# Jackrabbit Trail Access Control and Corridor Improvement Study

## Interstate -10 to Bell Road

## FINAL REPORT

## Volume 2

October 2008

DMJM HARRIS | AECOM

# Jackrabbit Trail
# Access Control and Corridor Improvement Study
# Interstate-10 to Bell Road

## APPENDICES

## VOLUME II

**Prepared for**

**Prepared by**

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**October 2008**

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# Appendix I
# Related Studies and Reports

## A. Completed Studies

### 1. Sun Valley Parkway Corridor Study

*Date Completed:* December 2006
*Lead Agency*: MCDOT
*Author*: Parsons Brinckerhoff (PB)

*Purpose of Study*: The purpose of this study was to establish the ultimate alignment and access control plan for the Sun Valley Parkway, including intersection spacing and median break locations, and to develop construction phasing plans.

*Study Area*: Sun Valley Parkway from I-10 to Bell Road/Jackrabbit Trail, plus a corridor from the existing "bend" in the parkway (near the Bell Road alignment) north to US-60.

*Recommendations Relevant to Study Area*: The preferred alternative will be considered in the Jackrabbit Trail study as the parkway forms the northern boundary of the study area. The access control plan will affect the Sun Valley Parkway connectivity with Jackrabbit Trail and other north-south arterials east of the White Tank Mountains. The study makes recommendations for the existing corridor, the northern extension and provides guidelines for right-of-way protection and access control. The recommended preferred concept is a six-lane facility, with the existing corridor divided into five sections, each of which has individual recommendations and implementation plans. The northern extension was divided into three one-half-mile wide corridors and the westernmost corridor was selected for further evaluation. The corridor starts at Sun Valley Parkway and 249th Avenue (extended), crosses the Central Arizona Project (CAP) Canal at right angles, swerves west, follows the 259th Avenue alignment from Lone Mountain Road, and continues north curving around Morristown Overpass to end at SR-74.

### 2. MAG RTP 2006 Update

*Date Completed*: March 2006
*Lead Agency*: MAG
*Author*: MAG Transportation Policy Committee

*Purpose of Study*: This study updates the RTP originally adopted in 2003. It summarizes revised revenue estimates and includes life cycle programs for freeways/highways, arterial streets, and transit projects.

*Study Area*: Maricopa County.

*Process*: The update was developed as an amendment to the RTP through a cooperative effort of government, business, public interest groups and the community.

*Recommendations Relevant to Study Area*: Additional projects planned within the Jackrabbit Trail study area include expansion of the arterial grid network west of SR-303L to four through lanes, and implementation of a regional freeway management system along I-10 and SR-303L.

### 3. Surprise Transportation Plan

*Date Completed*: December 2005
*Lead Agency*: City of Surprise
*Author*: Surprise Transportation Commission

*Purpose of Study*: This document is intended to plan for a safe, efficient, and effective multi-modal transportation system in Surprise. The plan's goals apply to transportation within Surprise and connections with regional systems.

*Study Area*: MPA of the City of Surprise.

*Process*: A General Plan Amendment outlined changes in the previous transportation plan. This amendment was adopted by the Surprise City Council and incorporated into the existing Surprise General Plan 2020.

*Recommendations Relevant to Study Area*: Recommendations include planning of Jackrabbit Trail as a six-lane, 200-foot-wide parkway to relieve anticipated congestion on nearby north/south arterials near SR-303L and 243rd Avenue; identification of several arterials such as Bell Road, Cactus Road, Waddell Road, Greenway Road, Peoria Avenue and Jackrabbit Trail as Strategic Intelligent Transportation Systems corridors; establishing the Sun Valley Parkway as a scenic parkway; and measures to achieve roadway service level "D" or better on all roadways. The plan also provides for the extension of transit service into the planning area and enhancement of infrastructure for alternative modes of transportation, such as bus rapid transit service along Bell Road and Sun Valley Parkway; local bus service along Jackrabbit Trail; multi-use paths; and regional trails along Bell Road and Jackrabbit Trail.

**4. Maricopa County Eye to the Future – Olive Avenue Scenic Corridor Guidelines**

*Date Completed:* December 2005
*Lead Agency*: Maricopa County
*Author*: Maricopa County Planning and Development Department

*Purpose of Study*: The objectives of the study were to guide and enhance development along the Olive Avenue corridor and to promote and preserve the area's inherent scenic characteristics. This route is the principal gateway to White Tank Mountain Regional Park.

*Study Area*: The corridor studied extends one-fourth mile on each side of Olive Avenue, from SR-303L to the eastern boundary of White Tank Mountain Regional Park.

*Recommendations Relevant to Study Area*: Landscaping policies favor preservation of sensitive natural habitats, the use of open space as a development buffer, and a general southwestern character to development. Building height, signage, lighting, and fencing are to be limited for all new residential development to protect views, and natural light should be available to surrounding property.

*Project Status*: A draft version of the report was published in March 2006.

**5. West Valley North Power Line and Substation Project**

*Date Completed*: May 2005
*Lead Agency*: APS
*Author*: URS Corporation

*Purpose of Study*: This study was an extension of the West Valley South Power Line and Substation Project, also seeking to expand electric services in the West Valley, while siting substations and power lines in locations that minimize impacts.

*Study Area*: The study area extends from approximately Jomax Road on the north to Northern Avenue on the south, and from Sun Valley Parkway on the west to Reems Road/US-60 on the east.

*Process*: A comprehensive and detailed inventory of existing and future land uses, scenic resources and other environmental factors was conducted. This environmental analysis was done in conjunction with aggressive community involvement. Each alternative substation site and power line route was then evaluated by resource specialists to assess its potential impact on land uses, scenic views, historic/archaeological sites and biological resources. All potential substation sites and power line routes were assessed and ranked by level of impact.

*Recommendations Relevant to Study Area*: The preferred system begins at Olive Avenue, heads north along SR-303L to Cactus Road, and then proceeds west to the 191st Avenue alignment. From there, the route continues north to approximately Beardsley Road, where it jogs west three-fourths of a mile, then north to Deer Valley Road, and west again to 243rd Avenue. Finally, it jogs north (following an existing fiber optic installation) to the CAP Canal, which it follows westerly to terminate at the proposed substation. A 4,000-foot corridor, extending 1,000 feet east and 3000 feet west of the 191st Avenue alignment from Cactus Road to Union Hills Drive, was approved by

the Arizona Corporation Commission. The Jackrabbit Trail section line is within this approved power line corridor.

6. **I-10 Corridor Profile Study (ADOT)**
   *Date Completed:* May 2005
   *Lead Agency:* ADOT
   *Author:* Parsons Brinckerhoff

   *Purpose of Study:* I-10 has been designated as a high priority corridor by the State of Arizona in their efforts to construct an effective strategy for statewide transportation planning. There were several goals to the I-10 Corridor Profile Study, including identification of any issues affecting performance, local land development, the environment, and statewide strategies. The study also aimed at enhancing the statewide goal toward development opportunities and increased mobility of people, goods, services as well as aiding the State in selecting priority projects.

   *Process:* The study used data on existing conditions to assemble an inventory and conduct an analysis of existing conditions along I-10. The inventory and analysis was then used to describe possible future conditions and deficiencies, identifying the needs for improvements. Study recommendations are based on these improvement needs. The study also looks at related transportation plans.

   *Study Area*: This study designated limits of 2 miles on either side of a 36-mile section of I-10 from the intersection of the SR-101L Traffic Interchange at Milepost 134 east to the Milepost 98 and the Wintersburg Traffic Interchange.

   *Recommendations Relevant to the Study Area*: The southern boundary of the Jackrabbit Trail Study Area overlaps with this study. The study contains hourly land volume data relevant to existing traffic conditions, finding that trucks currently make up a substantial portion of traffic volumes. It is predicted that future levels of congestion would be unacceptable and that a substantial widening, as well as additional traffic interchanges are ultimately needed. A traffic interchange at Perryville Road within the Jackrabbit Trail Study area is recommended. The Corridor Profile also recommends several changes to the Regional Transportation Plan for the I-10 West, mainly an increase in capacity. The stretch of I-10 between Perryville Road and SR-303L is recommended to be a 10-lane facility. In examining existing structures and pavement conditions, reconstruction and rehabilitation are recommended. Related roadways were also examined and recommended for an increase in capacity.

7. **Maricopa County Regional Trail System Plan**
   *Date Completed*: August 2004
   *Lead Agency*: Maricopa County
   *Author*: Maricopa County Trail Commission

   *Purpose of Study*: This study created a regional planning framework for a 1,521-mile trail network for pedestrians, equestrians, bicyclists, and other non-motorized trail users, expanding existing and planned trail systems and seeking to provide connections between municipalities, trails, parks, and neighborhoods, as well as to provide open space corridors to protect natural and cultural resources.

   *Study Area*: Maricopa County.

   *Process*: The Maricopa County Trail Commission was formed in February 2000 to help form a regional trail system, using established trail routes and identifying future trail corridors throughout Maricopa County. The 1,521 miles of the Maricopa County Regional Trail System are organized into segments and priorities that will serve as a guide for implementing the trail plan.

   *Recommendation Relevant to Study Area*: The Jackrabbit Trail study area contains portions of various proposed trail systems. The Priority 1 segments, including portions of the Beardsley Canal, are part of the Sun Circle Trail or the Maricopa Trail. Priority 2 segments are important regional corridors that connect to the Maricopa Trail and may provide connections to regional

park systems. Priority 3 segments are regional corridors that are not key components of the regional trail system at this time, but may become important future trails. Examples are the Roosevelt Irrigation District Canal, the Hassayampa River and the CAP Canal. Most Priority 4 trails are conceptual corridors in outlying areas of Maricopa County, and three of them lie within the study area, along Northern Avenue and Indian School Road and through White Tank Mountain Regional Park.

**8. West Valley South Power Line and Substation Project**

*Date Completed*: December 2003
*Lead Agency*: Arizona Public Service (APS)
*Author*: URS Corporation

*Purpose of Study*: This study sought to respond to the increasing demand for electricity in the West Valley by expanding electric services in Avondale, Buckeye, Glendale, Goodyear, Litchfield Park and Maricopa County. The goal of the project was to site substations and power lines in locations that minimize impacts to people and the environment.

*Study Area*: The area studied is bounded by approximately Thunderbird Road on the north, Baseline Road on the south, Oglesby Road (SR-85) on the west and 99th Avenue on the east.

*Process*: A comprehensive and detailed inventory of existing and future land uses, scenic resources, and other environmental factors was conducted for the study area. This environmental analysis was done in conjunction with an aggressive community involvement plan. Each alternative substation site and power line route was then evaluated by resource specialists to assess the potential impact of each alternative on land uses, scenic views, historic/archaeological sites and biological resources. All potential substation sites and power line routes were assessed and ranked by level of impact.

*Recommendations Relevant to Study Area*: The preferred system will allow APS to consolidate some 69kV and 230kV transmission lines on the same structures. The line will run north along Perryville Road from approximately Southern Avenue to Indian School Road, moving east to Citrus Road and veering northeast to Cotton Lane. The alignment then runs east on Bethany Home Road to SR-303L and then north to Olive Avenue. A 1,500 foot corridor jogs east and west of the proposed power line all along its length. This system contains three new power line substations.

**9. MAG Regional Transportation Plan (RTP)**

*Date Completed*: November 2003
*Lead Agency*: MAG
*Author*: URS; MAG Transportation Policy Committee

*Purpose of Study*: The RTP was developed and coordinated to provide a comprehensive blueprint for transportation investments in the region through the year 2026.

*Study Area*: Maricopa County.

*Process*: The MAG Transportation Policy Committee directed planning and spearheaded an extensive public involvement process.

*Recommendations Relevant to Study Area*: General recommendations include the development of a Life Cycle Certification Program, consideration of project acceleration and changes in costs of materials, and a re-evaluation of the RTP every five years. Specific recommendations regarding improvements to the arterial, freeway, and transit systems are outlined for the entire county. Programmed projects for the Jackrabbit Trail study area include a new freeway along SR-303L, interim corridor and right-of-way preservation for SR-801, and bus rapid transit routes on I-10, SR-303L, and US-60.

**10. Northwest Area Transportation Study**

*Date Completed*: September 2003
*Lead Agency:* MAG
*Author:* Parsons Brinckerhoff

*Purpose of Study*: This study was one of three sub-area transportation studies that became a part of the larger RTP for Maricopa County. The goal was to prioritize projects through an identification of the area's transportation needs.

*Study Area*: The study area is bounded by the I-17 on the east, I-10 on the south and the Maricopa county line on the west and north. The focus for recommendations is the developed and developing areas east of the CANAMEX Corridor.

*Process*: A database of existing and proposed transportation plans, programs and facilities within the study area was compiled by gathering data from municipalities and agencies. Demographic variables were examined to describe existing and future socioeconomic conditions. Current and future transportation facilities, conditions, options, and major issues were explored.

*Recommendations Relevant to Study Area*: Recommended projects include creation of "arterial roadway corridors," which are minimum four-lane facilities that operate as controlled access roadways; expressways; enhanced arterials; and possibly parkways. Creation of a new freeway parallel to I-10, widening of I-17 wherever possible, widening of SR-101L, and construction of SR-303L to expressway/parkway standards with sufficient right-of-way for a future freeway are other key recommendations.

**11. Southwest Area Transportation Study**

*Date Completed*: September 2003
*Lead Agency:* MAG
*Author:* Wilbur Smith Associates

*Purpose of Study*: This study was one of three sub-area transportation studies that became a part of the larger RTP for Maricopa County. The goal was to prioritize projects through an identification of the area's transportation needs.

*Study Area*: The study area is bounded by the Maricopa-Pinal County line on the east, the Maricopa-La Paz and Maricopa-Yuma County lines on the west, I-10 on the north, and I-8 on the south.

*Process*: A database of information regarding existing and proposed transportation plans, programs and facilities within the study area was compiled by gathering data from municipalities and agencies. Demographic variables were examined to describe existing and future socioeconomic conditions. Current and future transportation facilities, conditions, options, and major issues were explored.

*Recommendations Relevant to Study Area*: Recommended projects include expanding the arterial grid network in less developed areas, creating two new freeways including SR-801 and the SR-303L extension south of I-10, building a new traffic interchange on I-10 at Perryville Road, and widening I-10.

**12. High-Capacity Transit Study**

*Date Completed*: May 2003
*Lead Agency*: MAG
*Author*: IBI Group

*Purpose*: The goal of the study was to plan integrated, high-capacity transit corridors throughout Maricopa County.

*Study Area*: Greater Phoenix metropolitan area: SR-303L on the west to SR-202L on the east; SR-101L on the north to Pecos Road on the south.

*Process*: The study process was divided into six milestones that established the needs, opportunities, alternatives, and recommended plan for Maricopa County's transit network. Input was gathered from public and agency involvement as well as existing studies. Proven technologies and established transit systems in cities similar to Phoenix were studied.

*Recommendations Relevant to Study Area*: The study identified 29 corridors for possible inclusion in the transit network, some of which abut the eastern boundary of the Jackrabbit Trail study area. Specifically, a commuter rail corridor along SR-303L and light rail or bus rapid transit along Bell Road and Glendale Avenue were suggested. These corridors are all part of the plan's long-term (15- to 30-year) element.

**13. East-West Mobility Study**

*Date Completed*: May 2002
*Lead Agency*: MAG
*Author*: Entranco, Inc.

*Purpose*: This study explores current and future conditions of east-west traffic flow within the study area and presents strategies to improve mobility in an area that has no east-west freeways for a distance of approximately 15 miles, from SR-101L to I-10.

*Study Area:* The study area is bounded by Thunderbird Road /Waddell Road on the north, Northern Avenue on the south, SR-51 on the east and SR-303L on the west. The western boundary of this study coincides with the eastern limit of the Jackrabbit Trail study area.

*Process*: Strategy formulation was approached in an organizational hierarchy, first identifying actions that would decrease the need for vehicle trips, then replacing those trips with transit, non-auto and HOV modes. Upper level strategies maximized road capacity and system efficiency for single occupant vehicles. There was public and agency involvement throughout the project. Information was distributed and input solicited during the strategy formulation process.

*Recommendations Relevant to Study Area*: Along with the no-build option, three "strategy packages" were formulated as a result of this study. The first strategy emphasizes improving non-auto options, creating an intelligent transportation system, and enhancing signal coordination. The second entails improvements at 31 intersections, none of which are located in the Jackrabbit Trail study area. The third involves widening several east-west streets, with recommended lane additions to Waddell Road, Olive Avenue, and Northern Avenue from El Mirage Road to the western project limit.

**14. Buckeye Conceptual Planning**

*Date Completed*: June 2000
*Lead Agency*: Arizona State Land Department (ASLD)
*Author*: BRW, Inc.

*Purpose of Study*: This report outlined the needs of State Lands within the Buckeye MPA for the year 2020, based on population and employment projections.

*Study Area*: The MPA of the Town of Buckeye.

*Process*: The study used several allocation models to predict the amount of employment, residential dwelling units and population in 2020. The mapping and socioeconomic analyses were also used to estimate future conditions in the study area.

*Recommendations Relevant to Study Area*: The final conceptual plan outlines land use for approximately 19,900 acres of developable state land in Buckeye. It was estimated that there will be approximately 55,000 dwelling units accommodating a population of 128,000 people in 2020. This future development includes 1,936 acres of commercial and employment uses and areas for potential affordable housing.

**15. Maricopa County Eye to the Future – White Tank/Grand Avenue Area Plan**

*Date Completed*: 2000
*Lead Agency*: Maricopa County
*Author*: Maricopa County Planning and Development Department

*Purpose of Study*: This plan was compiled to provide one cohesive document in which regional growth and development conditions are addressed and analyzed. It is intended to prepare for growth over the next fifteen to twenty years.

*Study Area*: Boundaries of the planning area encompass 760 square miles and include all or part of Avondale, Buckeye, El Mirage, Glendale, Goodyear, Litchfield Park, Peoria, Surprise, Youngtown and unincorporated Sun City, Sun City West, Wittman, Circle City, and Morristown. The boundaries extend from approximately SR-74 on the north to the Gila River on the south, and from the eastern limit of Buckeye on the west to Lake Pleasant Road on the east.
*Process*: This study is an updated consolidation of two previous sub-area studies: the White Tank/Agua Fria Policy and Development Guide and the Grand Avenue Area Plan, published in 1982 and 1992. They were combined into one document so that regional considerations could be identified, analyzed and addressed.

*Recommendations Relevant to Study Area*: Goals formulated at the conclusion of the study include integration of land use development with transportation systems and the natural environment; promotion of public health, safety and welfare; roadway improvements to accommodate future needs; and encouragement to use transit and alternative transportation modes. Jackrabbit Trail is proposed to be a four-lane minor arterial, and Bell Road/Sun Valley Parkway an eight-lane principal arterial.

**16. MCDOT Bicycle System Plan**

*Date Completed*: May 19, 1999
*Lead Agency*: Maricopa County
*Author*: Maricopa County Department of Transportation

*Purpose of Study*: This plan, adopted in 1999, evaluated existing bicycle facilities throughout the unincorporated areas of Maricopa County and identified opportunities for linking existing and planned bike facilities of surrounding communities.

*Study Area*: Maricopa County

*Process*: This study reviews existing plans, policies, programs, design guidelines and laws, and assesses the provisions and recommendations for bikeway facilities in these documents. It then recommends a bicycle network and a Bicycle Improvement Program.

*Recommendations Relevant to Study Area*: Two segments lie in the Jackrabbit Trail study area: Bike Path #19 on Cotton Lane from MC-85 to Greenway Road, and Bike Path #20 on Olive Avenue from White Tank Mountain Regional Park to Cotton Lane. MCDOT is currently updating this plan.

**17. MAG I-10/Hassayampa Valley Roadway Framework Study**

*Lead Agency*: MAG
*Author*: DMJM Harris

*Purpose of Study*: The Hassayampa study will establish a framework for a future transportation network in the study area and provide feedback to local land use and transportation planners on how alternative development scenarios could be part of the regional transportation solution.

*Study Area*: This project encompasses over 1,400 square miles between SR-74 on the north, the Gila River on the south, 459th Avenue on the west, and SR-303L on the east.

*Recommendations Relevant to Study Area:* The Jackrabbit Trail is recommended as a parkway that goes along the 199th Avenue from Bell Road till Bethany Home Road and then swings east to 195th Avenue alignment and follows its won section-line for three miles. It then moves further east and connects to Interstate-10 at Perryville Road.

**18. Buckeye General Plan Update**

*Lead Agency*: Town of Buckeye
*Author*: Partners for Strategic Action

*Purpose of Study*: This study is an update of the Town of Buckeye's General Plan completed in 2001. The General Plan and the Town's Development Code are being completely rewritten to reflect recent and projected growth trends in the area, including the many entitled master-planned communities that are expected to make Buckeye one of Arizona's largest cities.

*Study Area*: Buckeye MPA.

*Recommendations Relevant to Study Area*: This study establishes a transportation plan and updates the current zoning plan within this MPA. The southwest quadrant of the Jackrabbit Trail study area lies within the Town of Buckeye MPA and the recommendations are consistent with the MAG I-10/Hassayampa Valley Roadway Framework Study.

## B. Studies Currently in Progress

**1. MAG Commuter Rail Study**

*Lead Agency*: MAG
*Author*: URS Corporation

*Purpose of Study*: This study will investigate conceptual commuter rail options along the Union Pacific and BNSF railroad lines throughout the Phoenix metropolitan area.

*Study Area*: Maricopa County and northwest Pinal County.
*Implications for the Jackrabbit Trail Study Area*: Commuter rail is being considered as a form of high-capacity transit to serve high-growth areas and to integrate with other travel modes.

*Project Status:* This project began in November 2006, with expected completion in the winter of 2007-2008.

**2. Northern Avenue Parkway DCR**

*Lead Agency*: MCDOT
*Author*: URS Corporation

*Purpose of Study*: This project begins preliminary engineering work to identify the preferred alignment and right-of-way needed to begin environmental clearances.

*Study Area*: Northern Avenue from SR-303L to US-60.

*Recommendations Relevant to Study Area*: While this corridor is not in the Jackrabbit Trail study area, the western boundary of the DCR coincides with the eastern limit of this study. Therefore, recommendations and designs for Northern Avenue will be considered and incorporated into planning efforts west of SR-303L.

*Project Status:* A revised preliminary draft DCR was submitted in March 2007 and the consultant is awaiting comments from ADOT on the EA. The DCR is expected to be completed by Fall 2007.

3. **West Side Study Area Conceptual Plan, White Tanks**
*Lead Agency*: Arizona State Land Department
*Author*: Arizona State Land Department

*Purpose of Study*: This study will illustrate a conceptual land use plan for state land holdings north and east of White Tank Mountain Regional Park. This plan is being prepared to help guide future development and auction of these lands.

*Study Area*: State land parcels adjacent to (the north and east sides of) White Tank Mountain Regional Park.

*Implications for the Jackrabbit Trail Study Area*: The recommended land use plan will eventually be incorporated into general plans for Maricopa County and the City of Surprise. Understanding the vision for these lands will help in assessing locations and determining classifications for future roadways in this area. The preliminary draft shows areas of high commercial development along Sun Valley Parkway/Bell Road, as well as commercial and high-density residential development along Northern Avenue, near the eastern edge of White Tank Mountain Regional Park and the northern border of the Jackrabbit Trail study area.

*Project Status*: Preliminary Conceptual Plan draft published in May 2006.

4. **Buckeye Sun Valley Parkway Area Drainage Master Study**
*Lead Agency*: Flood Control District of Maricopa County
*Author*: Flood Control District of Maricopa County

*Purpose of Study*: This Area Drainage Master Study will identify known and potential flooding and erosion hazards in the Buckeye/Sun Valley area. It will estimate flood potential for watersheds, map watercourses, identify existing and potential drainage problems, and develop preliminary solutions and standards for sound floodplain and storm water management.

*Study Area*: The watershed for the study area is generally bounded by Gates Road to the north, the White Tanks Mountains and the Dean Road alignment to the east, the Gila River to the south, and the Hassayampa River to the west, covering approximately 280 square miles.

*Recommendations Relevant to Study Area*: This study will identify areas of flooding and drainage concerns, especially relative to new development in the study area. After Phase 1, floodplain/floodway delineations of approximately 12.5 miles of tributaries to the Hassayampa River have been made. The Flood Control District of Maricopa County will offer both structural and nonstructural alternative solutions to reduce flooding and erosion hazards associated with the delineated floodplains. Upon completion of this study, an Area Drainage Master Plan will be developed to reduce flooding hazards.

*Project Status:* This project began in June 2003 and the data collection phase is complete.

5. **SR-303L Corridor/White Tanks Area Drainage Master Plan**
*Lead Agency*: Flood Control District of Maricopa County
*Author*: URS, Logan Simpson Design Inc.

*Purpose of Study*: This Area Drainage Master Plan will identify existing drainage issues and provide alternative stormwater management plans in a north/south regional drainage corridor. These plans will be coordinated with the development of SR-303L. This is an update to the White Tanks ADMP of the early 1990s.

*Study Area*: The study will include analysis of approximately 220 square miles of watershed from McMicken Dam south to the Gila River, and from the White Tank Mountains east to the Agua Fria River.

*Recommendations Relevant to Study Area*: The study will identify drainage problems, update the existing hydrology, and develop cost-effective solutions for a stormwater collection and disposal

system. It will also further identify potential outfall alternatives. The selected alternative proposes modified basins along Jackrabbit Trail and other roadways within and around the Jackrabbit Trail study area. Jackrabbit Channel is a proposed drainage feature that would start just west of Jackrabbit Trail and north of Bethany Home Road, extending south to McDowell Road.

*Project Status*: This alternative was selected in October 2003. It will use a series of channels and basins to convey flows to the Gila and Agua Fria Rivers by maximizing the use of existing flood control facilities. The project area adjacent to SR-303L will be modified to reflect the upgrade of SR-303L from a parkway to a freeway.

**6. Wittman Area Drainage Master Plan**

*Lead Agency*: Flood Control District of Maricopa County
*Author*: Entellus

*Purpose of Study*: The purpose of the Wittmann Area Drainage Master Plan is to identify potential solutions to mitigate existing flooding problems and anticipate future ones associated with impending development. The goal of this study is to keep ahead of development and identify mostly non-structural flood control solutions for the area ahead of future development.

*Study Area*: The study area consists of approximately 308 square miles in unincorporated Maricopa County, Peoria, Surprise and Buckeye, beginning at approximately Peoria Avenue on the south, extending north into Yavapai County, and generally following Douglas Ranch Road and the McMicken Dam as the western and eastern boundaries.

*Recommendations Relevant to Study Area*: This study will assess issues associated with McMicken Dam and the CAP Canal, anticipate future potential drainage problems, and generate "Rules of Development" with policies, standards, and guidelines to help guide general development in this area.

*Project Status*: This study began in March 2006 and is expected to take approximately 2.5 years to complete. Currently, alternative solutions such as compatible channels, basins and dams are being considered for the McMicken Dam project, which is part of the Wittmann Area Drainage Master Plan. Preliminary alternatives are scheduled to be published in late summer or fall of 2007.

**7. Maricopa County Eye to the Future – McMicken Dam Scenic Corridor Guidelines**

*Lead Agency*: Maricopa County Planning and Development Department
*Author*: Maricopa County Planning and Development Department

*Purpose of Study*: This study is intended to provide policies that will guide development along a scenic corridor, by maintaining the vision of the Maricopa County Regional Trail System and the character of the natural environment of washes, vegetation and wildlife.

*Study Area*: The scenic corridor extends southwest for 9.5 miles from US-60 to Peoria Avenue along the McMicken Dam. The project area encompasses land within one-fourth mile of the property owned by the Flood Control District of Maricopa County.

*Recommendations Relevant to Study Area*: Maricopa County policies favor leaving existing conditions intact. The guidelines favor preservation of sensitive natural habitats, the use of open space as a development buffer, and imparting a southwestern character to development. Building height, signage, lighting and fencing are to be limited.

*Project Status*: A draft version of the report was published in March 2006.

8. **White Tanks Flood Retarding Structure No. 3 Project**
*Lead Agency*: Flood Control District of Maricopa County
*Author*: Flood Control District of Maricopa County

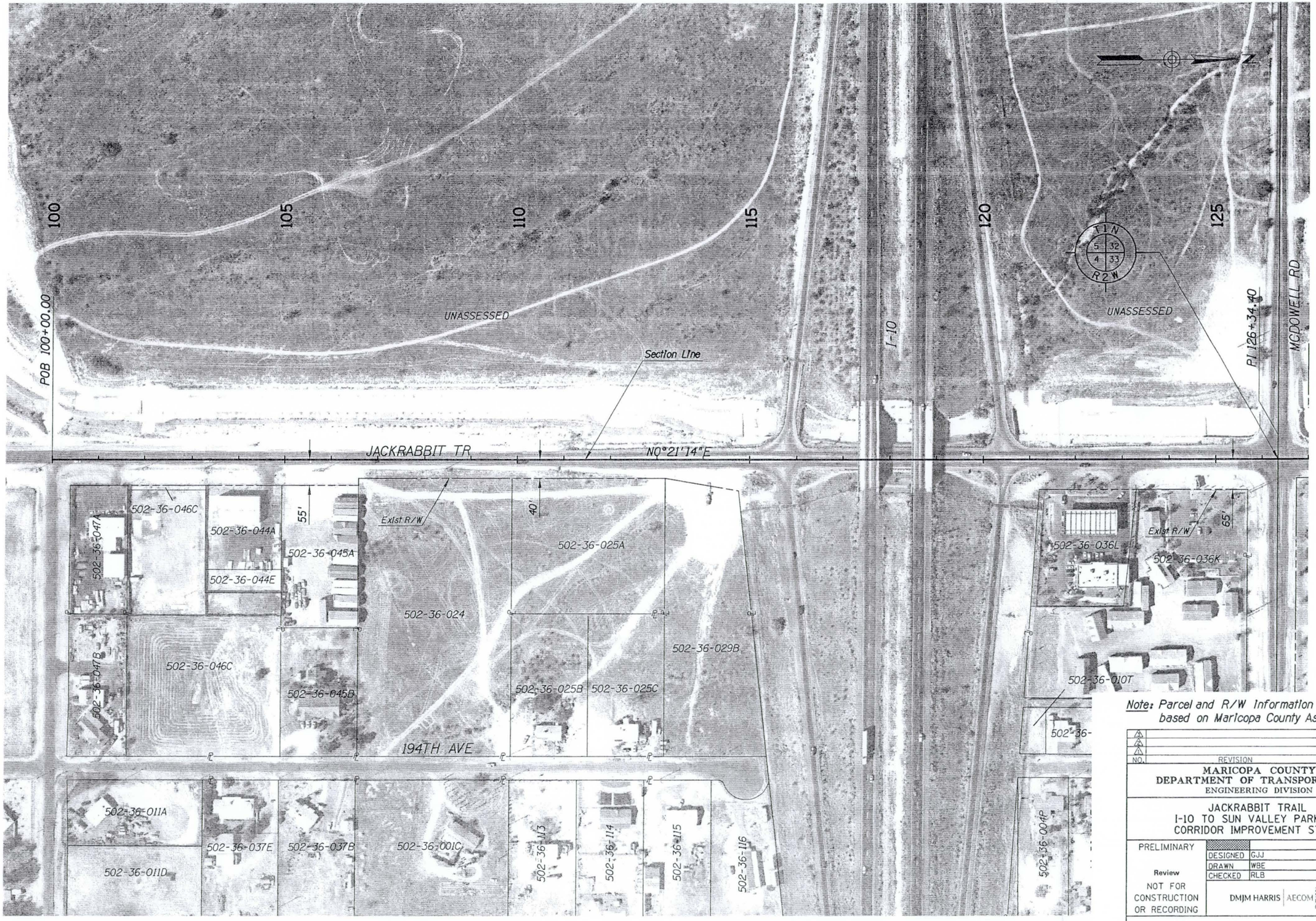
*Purpose of the Study*: Flood Control District of Maricopa County, in conjunction with the Natural Resources Conservation Service, is considering rehabilitating White Tanks Flood Retarding Structure No. 3 to extend its useful life and maintain flood control benefits to downstream properties. According to the Arizona Department of Water Resources, the dam does not meet certain state of Arizona dam safety requirements.

*Study Area*: The dam is located east of the White Tank Mountains, near Bethany Home Road and Jackrabbit Trail and west of the Beardsley Canal.

*Recommendations Relevant to Study Area*: The structure will provide 100-year flood protection. Alternatives being evaluated include a modified dam, a realigned dam, and a basin. Since the structure abuts the Jackrabbit Trail corridor, these alternatives will have implications for the alignment of any new or reconstructed roadway.

*Project Status:* The Natural Resources Conservation Service is developing a work plan that will result in federal assistance for this project. Phase 2, which includes a new channel along the eastern side of the Beardsley Canal from Olive Avenue to Northern Avenue, is currently under design, with construction programmed for fiscal year 2009.

# Appendix II
# Existing Conditions Plans




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

| NO. | REVISION | BY | DATE |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

| | | |
|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

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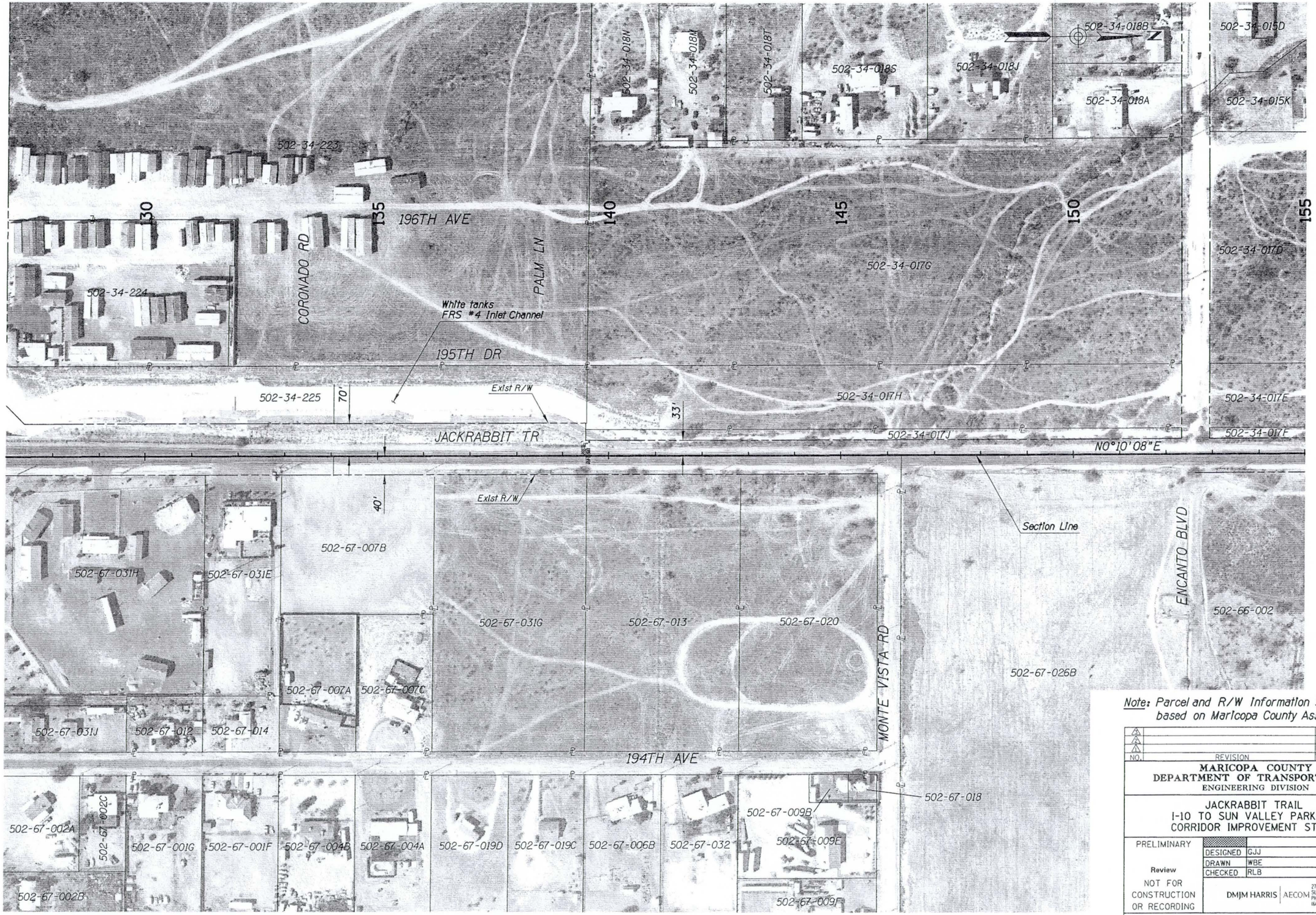
EXISTING CONDITIONS PLANS

SHEET 1 OF 24

English

N:\60021223\PROD\CIV\1223PL01.DGN 6/11/2007 9:15:27 AM

TRACS NO.




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

| NO. | REVISION | BY | DATE |
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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

| | | |
|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

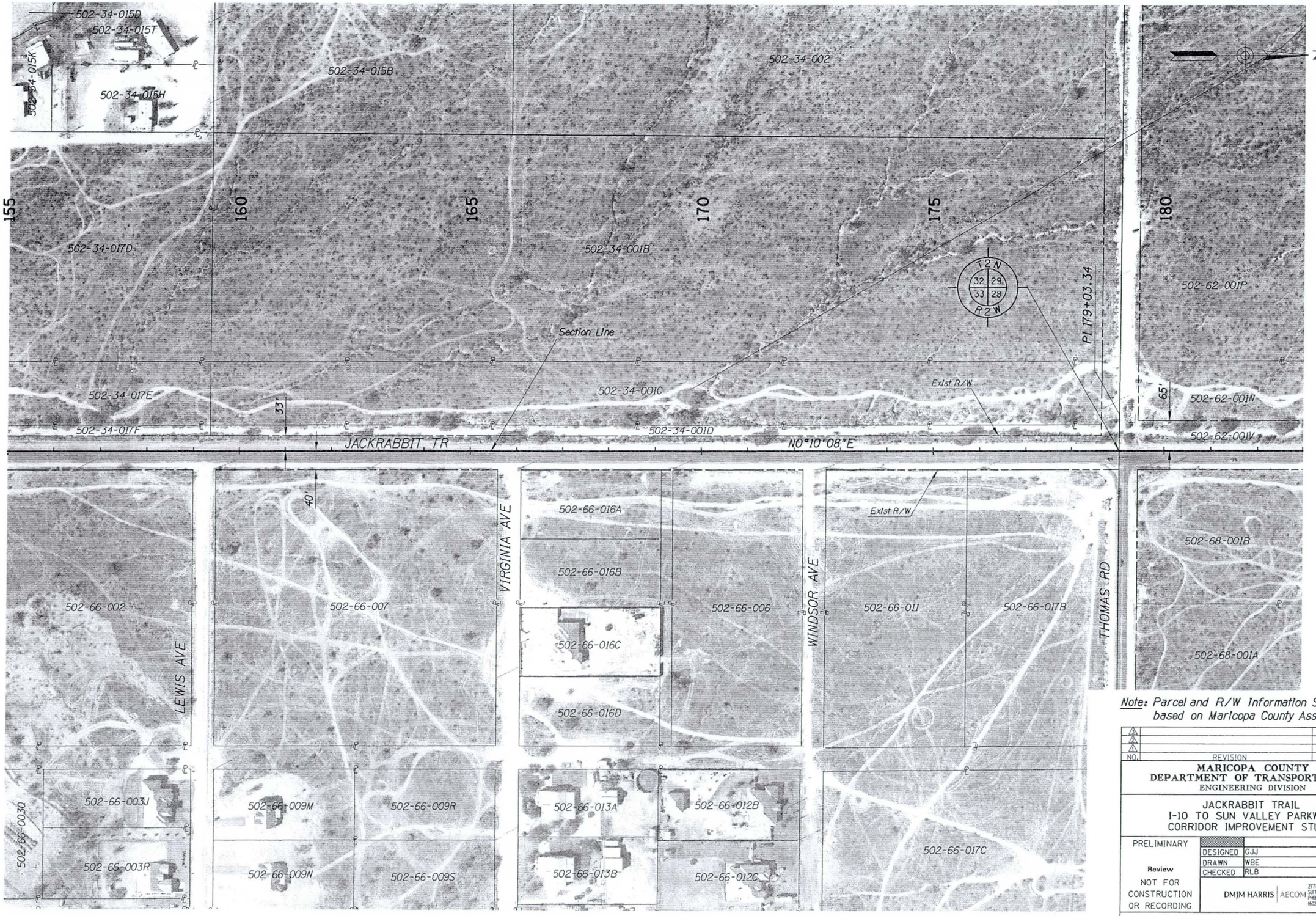
EXISTING CONDITIONS PLANS

SHEET 2 OF 24

English

N:\60021223\PROD\CIV\1223PL02.DGN 6/11/2007 9:17:28 AM

TRACS NO.




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 3 OF 24

TRACS NO.

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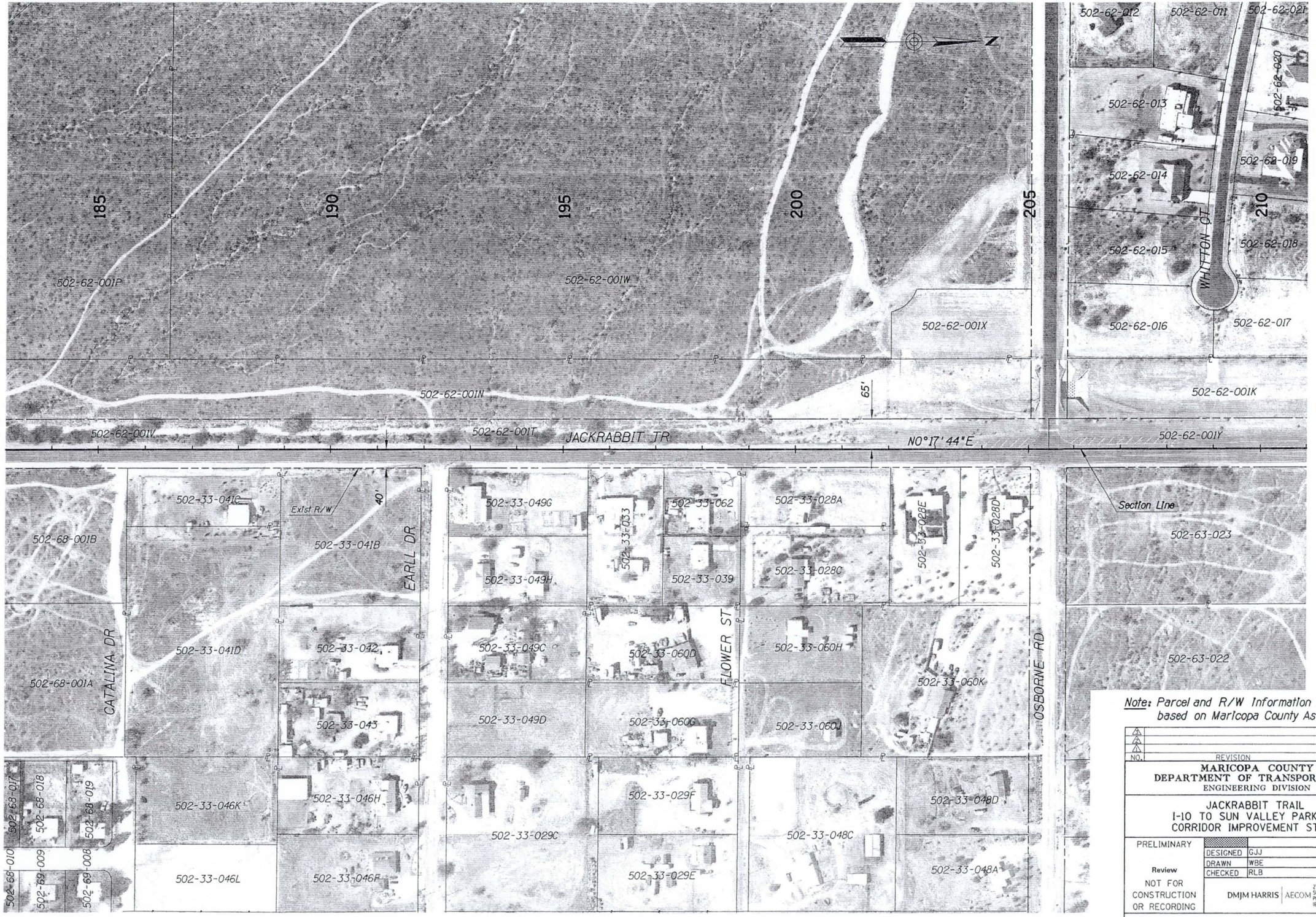


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 4 OF 24

TRACS NO.

N:\60021223\PROD\CIV\1223PL04.DGN 6/11/2007 9:22:39 AM

Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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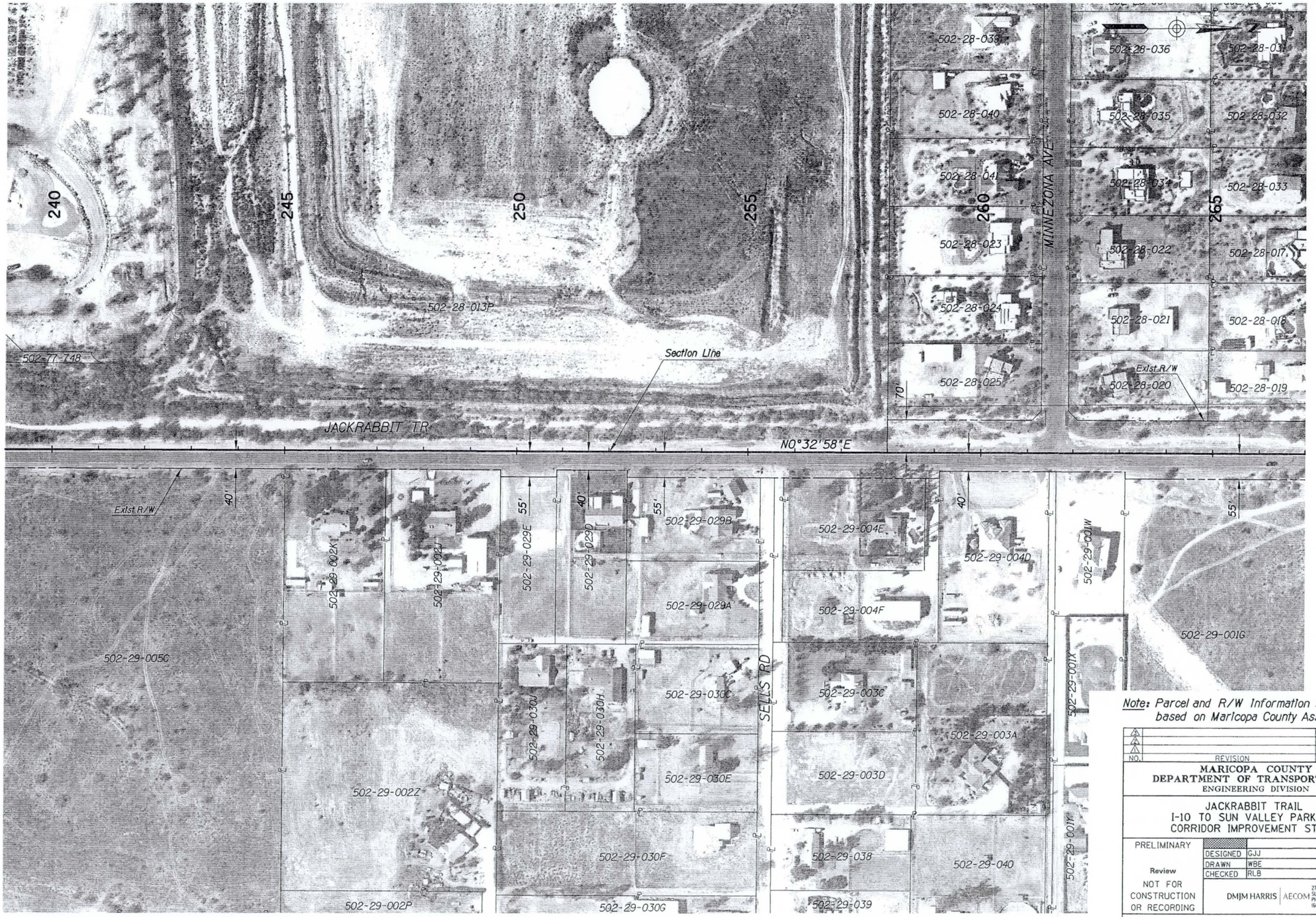
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 331-2777

EXISTING CONDITIONS PLANS

SHEET 5 OF 24

English




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 6 OF 24

TRACS NO.

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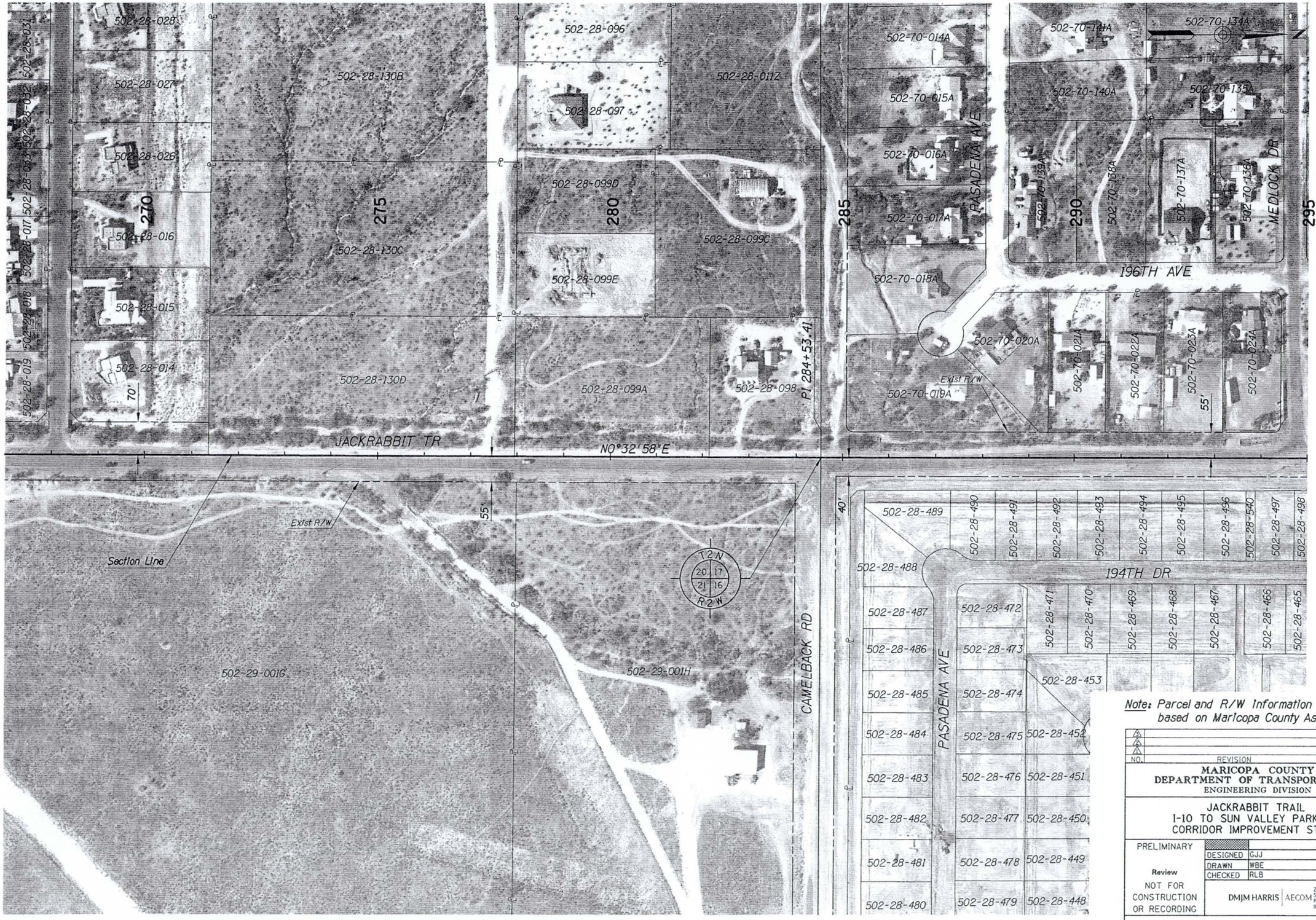
English




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 7 OF 24

TRACS NO.

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Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 8 OF 24

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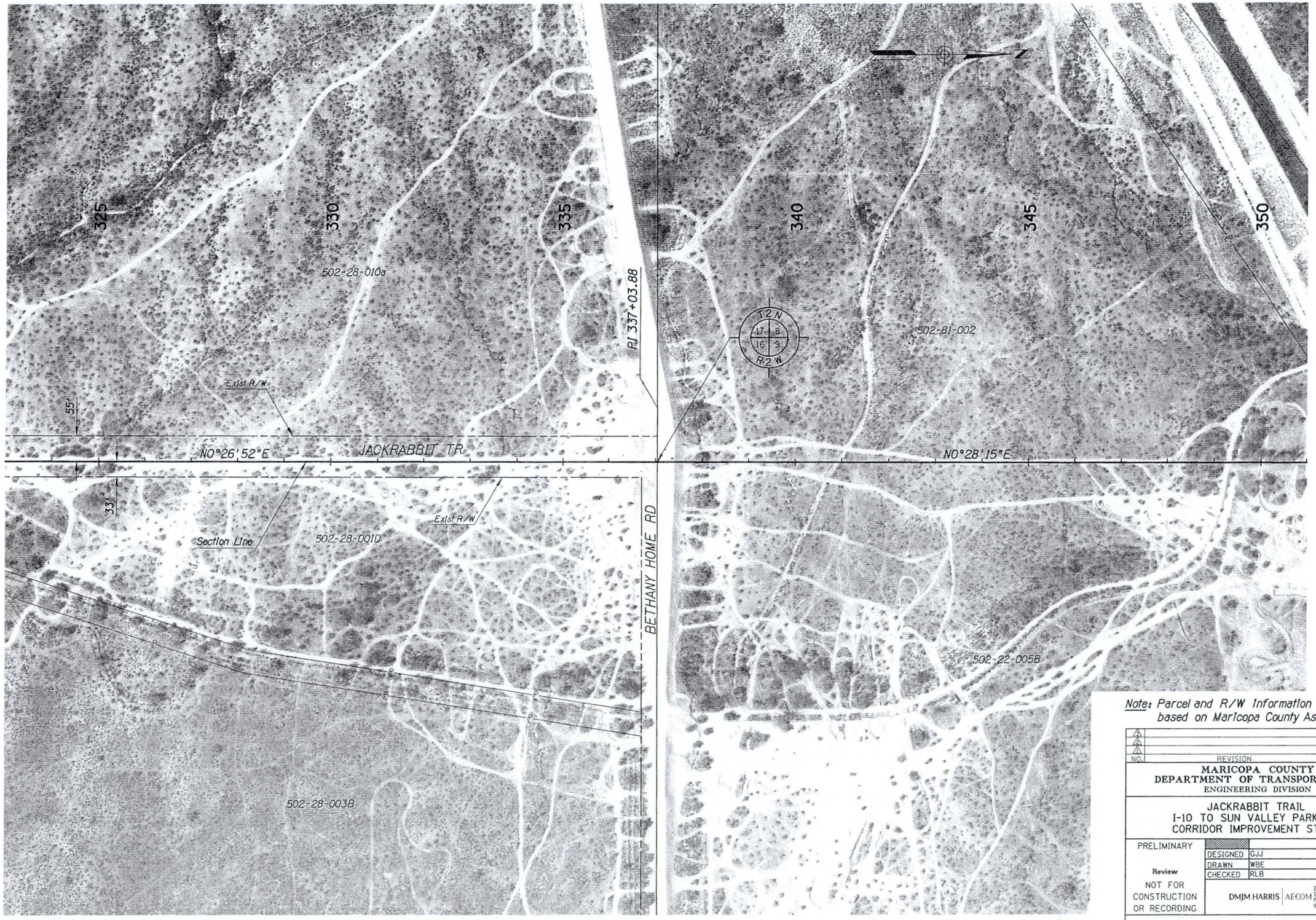
TRACS NO.

English




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 9 OF 24

English

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TRACS NO.

Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 10 OF 24

English

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TRACS NO.

Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 11 OF 24

English

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TRACS NO.

Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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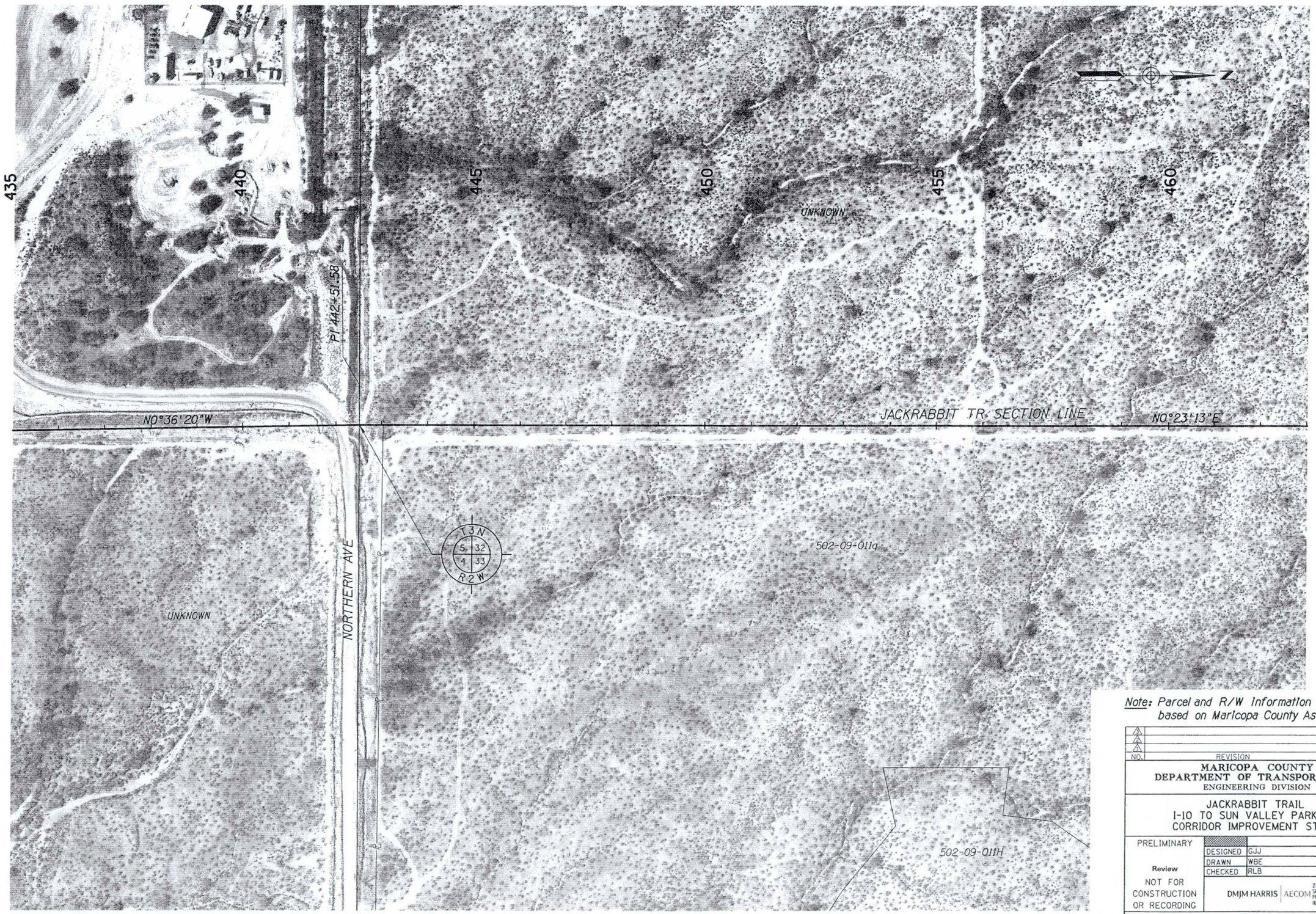
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 12 OF 24

TRACS NO.




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

| NO. | REVISION | BY | DATE |
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

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| PRELIMINARY | | | |
| | DESIGNED | GJJ | 05/07 |
| | DRAWN | WBE | 05/07 |
| Review | CHECKED | RLB | 05/07 |

NOT FOR CONSTRUCTION OR RECORDING

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 13 OF 24

TRACS NO.

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465
470
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480
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UNKNOWN
Exist R/W
70'
N0°23'13"E
JACKRABBIT TR SECTION LINE
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502-09-921
502-09-920
502-09-919
502-09-918
502-09-917
502-09-916
502-09-915
502-09-914
502-09-913
502-09-912
502-09-911
502-09-910
502-09-909
502-09-011J
502-09-944
502-09-038
502-09-037
502-09-036
502-09-011G
194TH DR
502-09-902
502-09-907
502-09-908
502-09-901
502-09-903
502-09-906
502-09-923
502-09-900
502-09-904
502-09-011K
502-09-924
502-09-899
502-09-905
502-09-925
502-09-898
502-09-945
502-09-123
502-09-122
502-09-121
502-09-120
502-09-119
502-09-118
502-09-117
502-09-116
502-09-115
502-09-926

Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

| NO. | REVISION | BY | DATE |
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 14 OF 24

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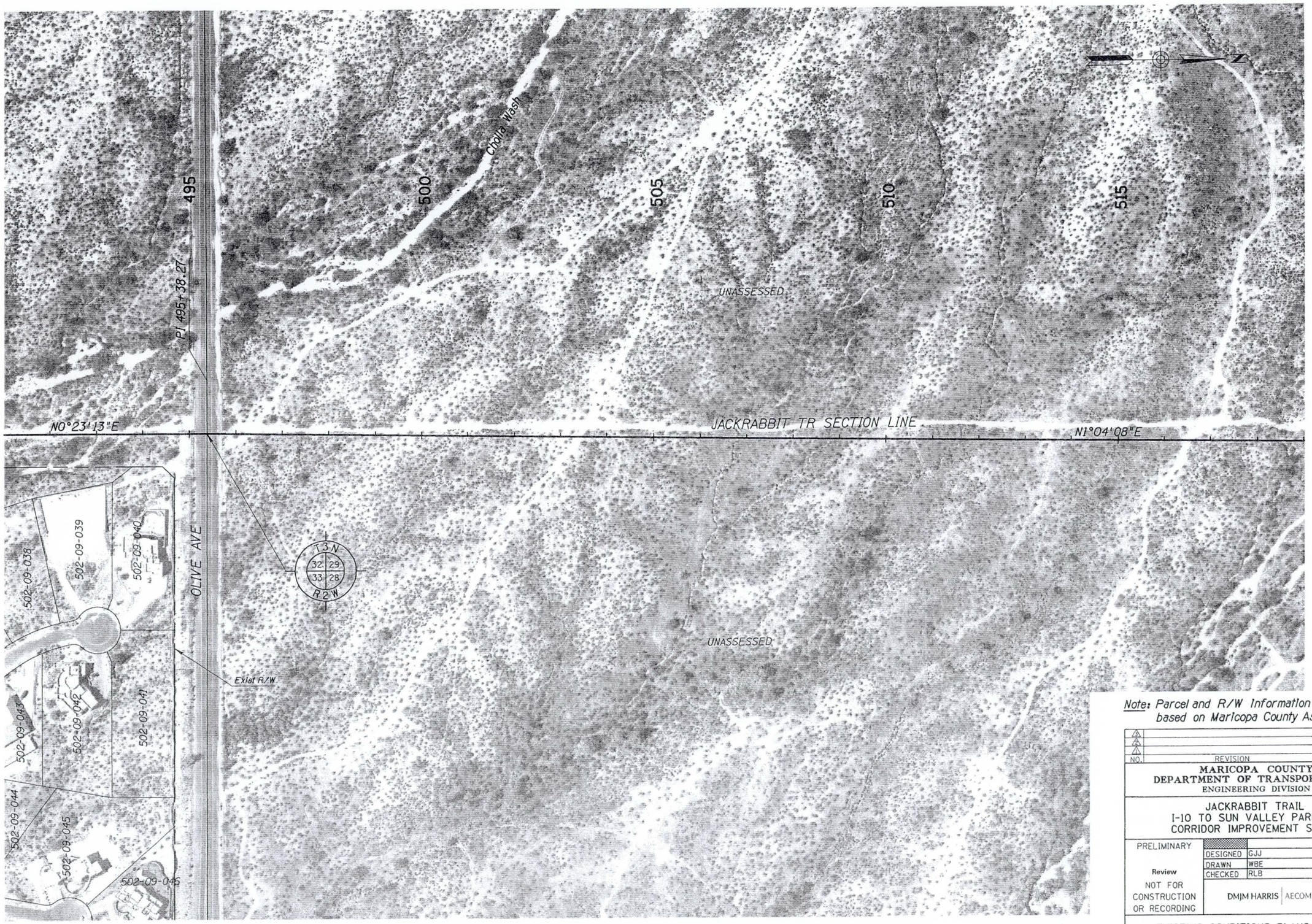
TRACS NO.




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

| NO. | REVISION | BY | DATE |
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 15 OF 24

TRACS NO.

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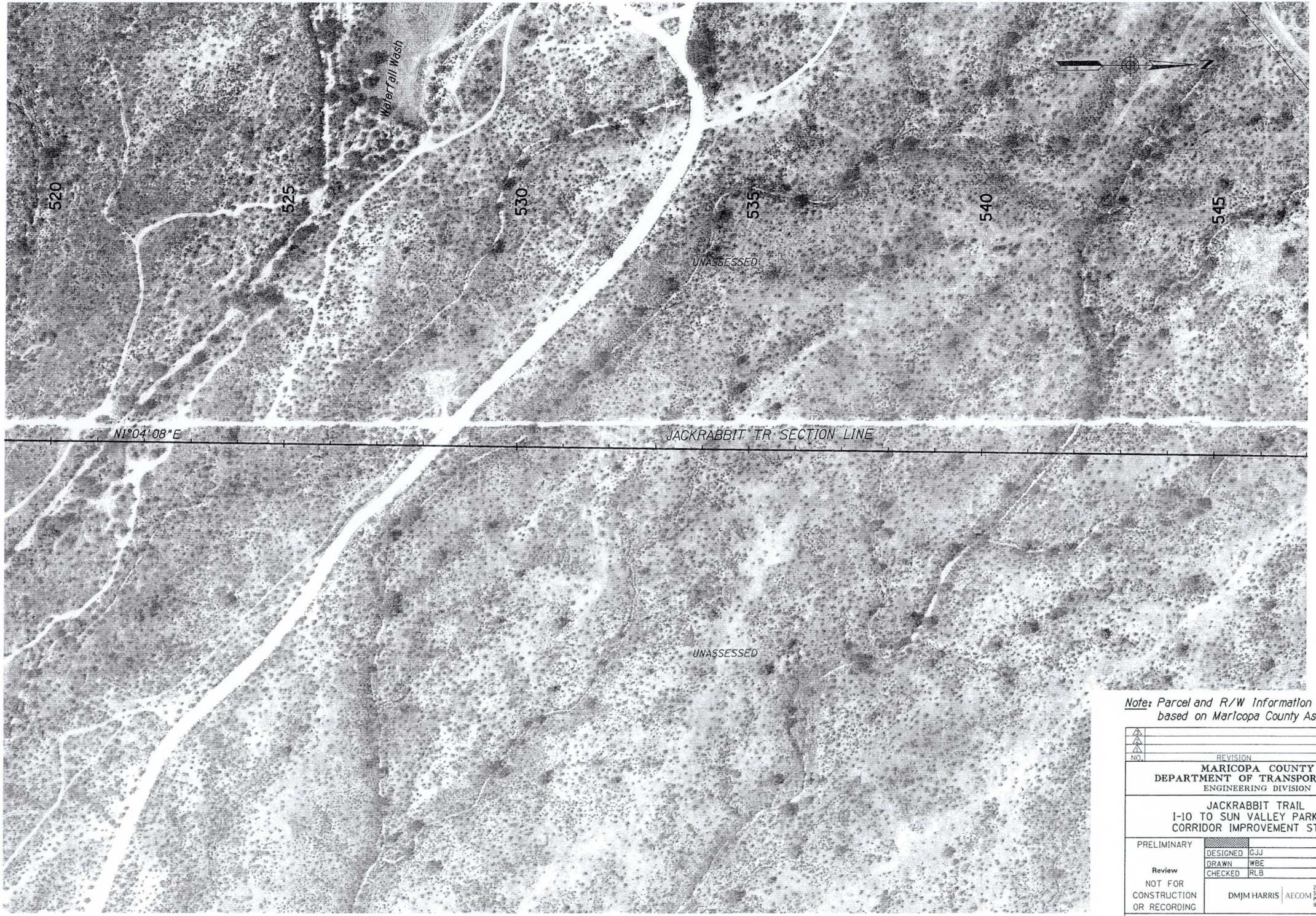


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 331-2777

EXISTING CONDITIONS PLANS

SHEET 16 OF 24

TRACS NO.

N:\60021223\PROD\CIV\1223PL16.DGN 6/11/2007 10:53:11 AM

Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review
NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 17 OF 24

TRACS NO.

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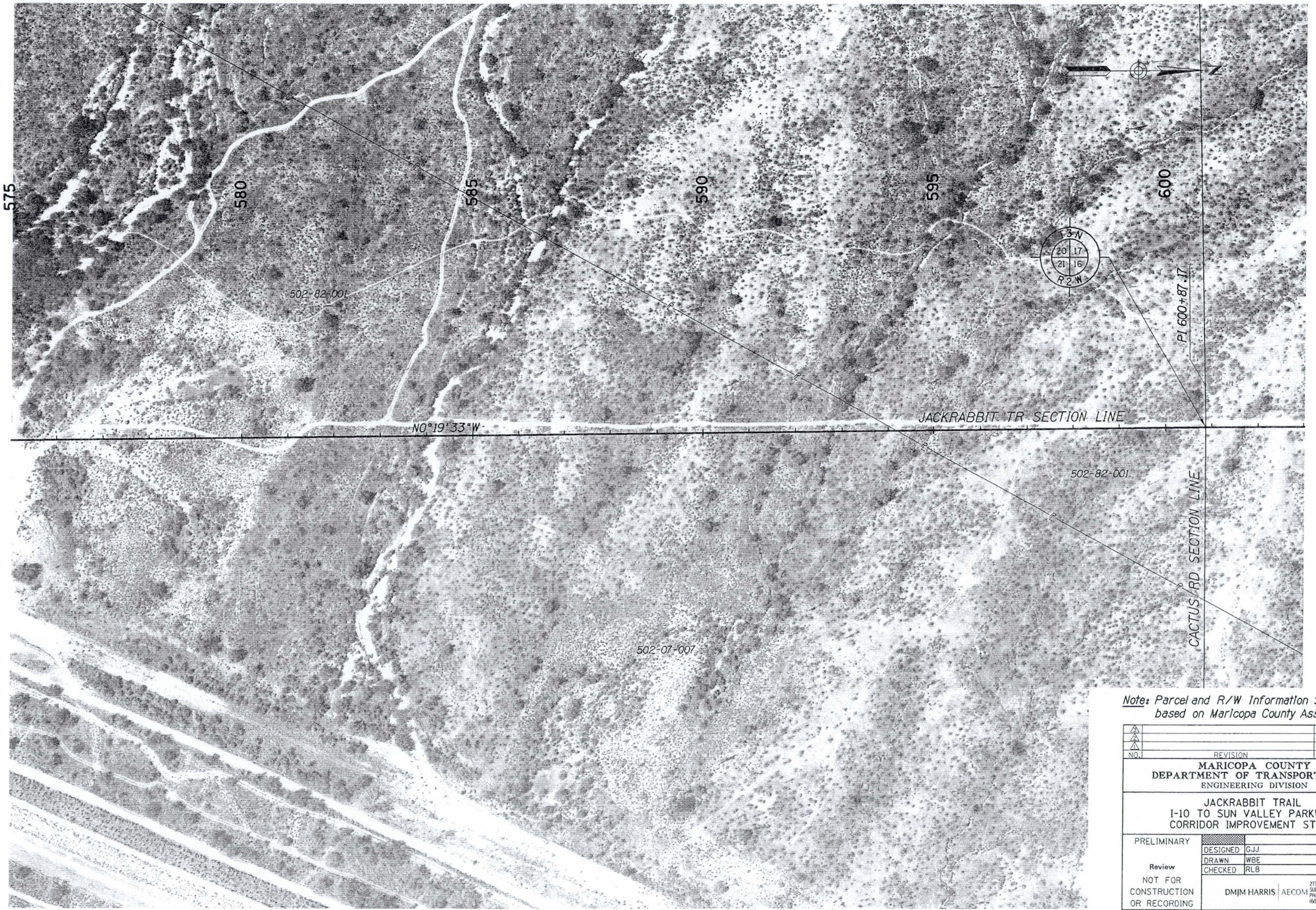
English




Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

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| DESIGNED | GJJ | 05/07 |
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| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 18 OF 24

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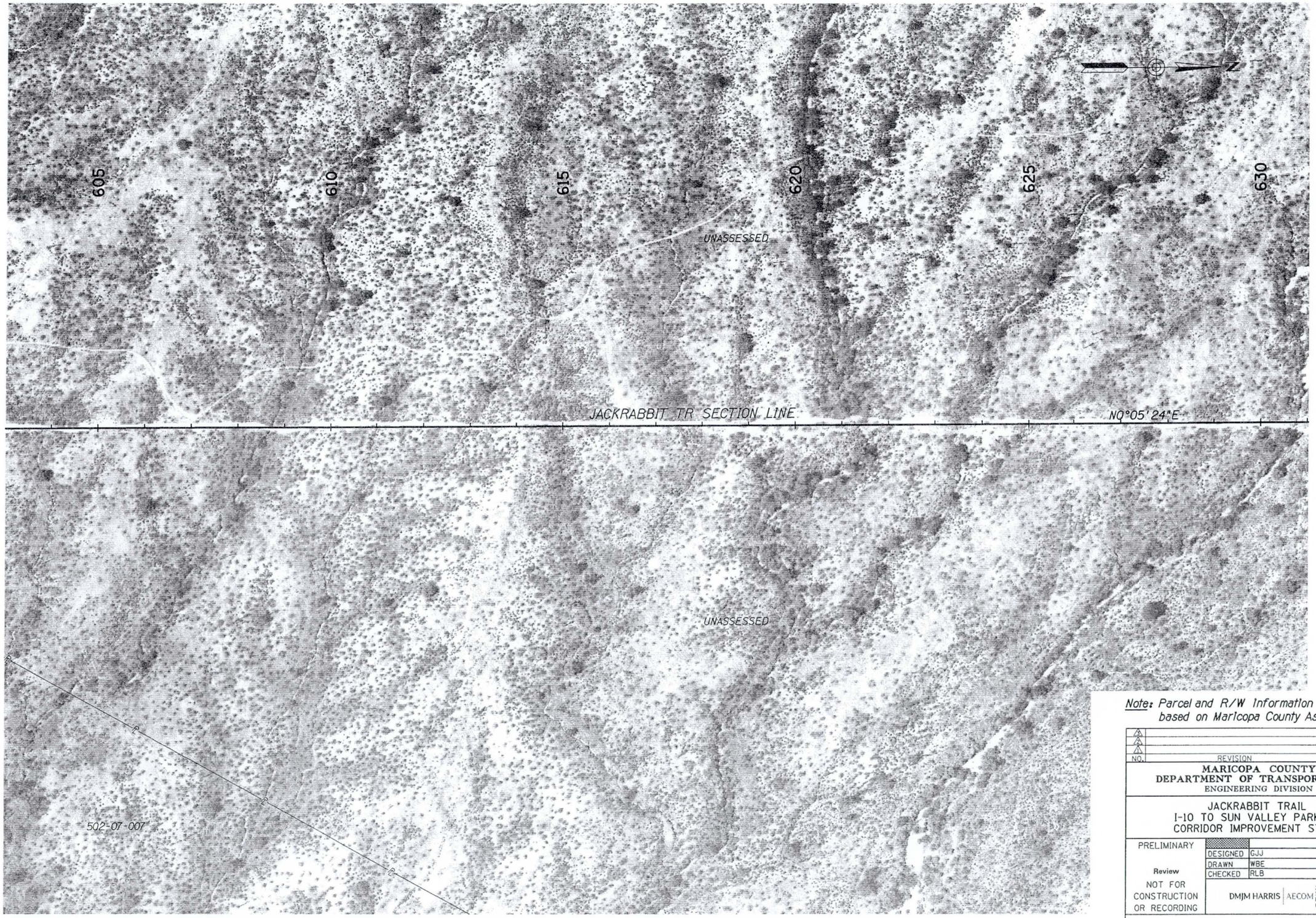


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

| NO. | REVISION | BY | DATE |
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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

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| DESIGNED | GJJ | 05/07 |
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| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 19 OF 24

English

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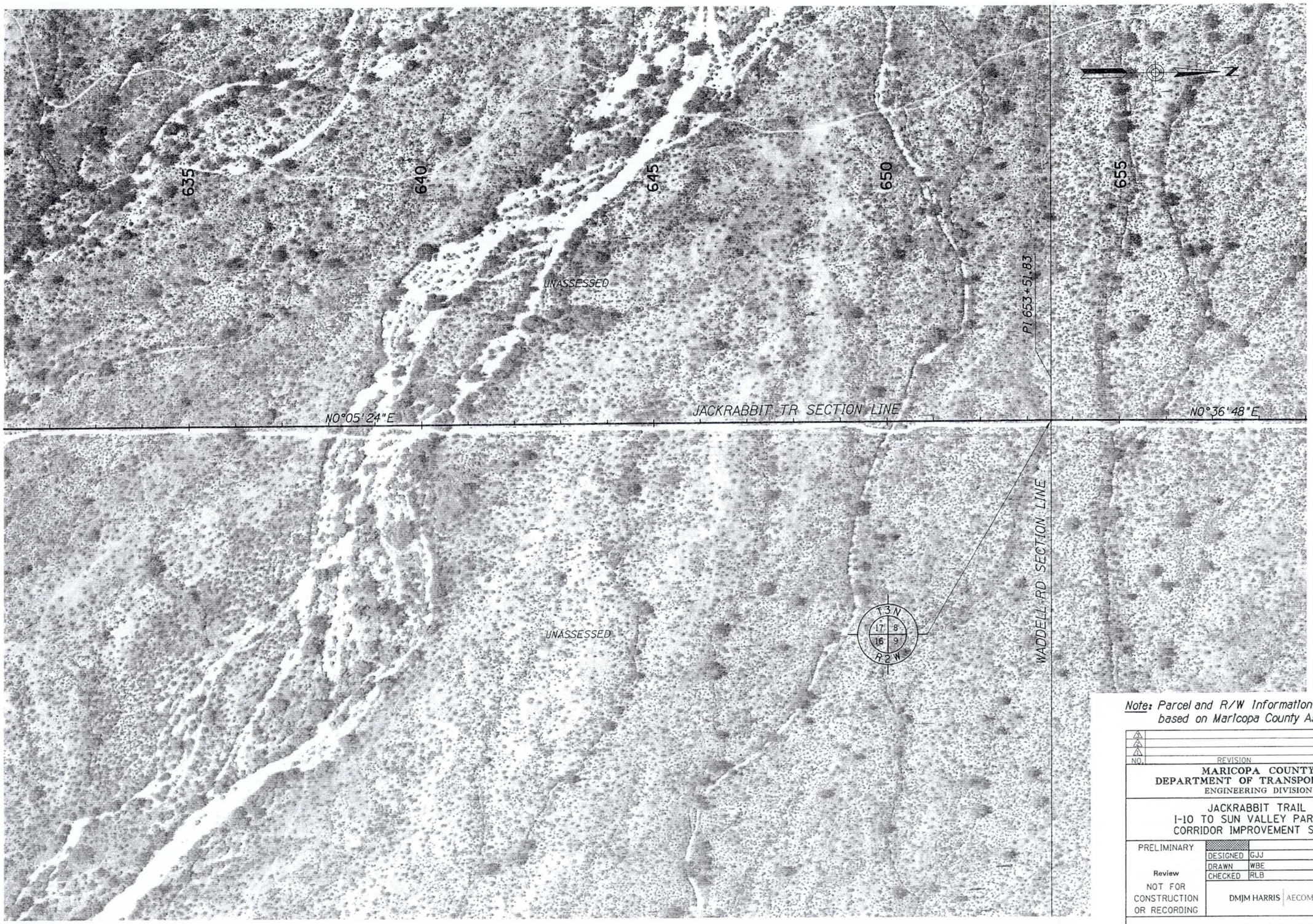


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

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| DESIGNED | GJJ | 05/07 |
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| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 20 OF 24

TRACS NO.

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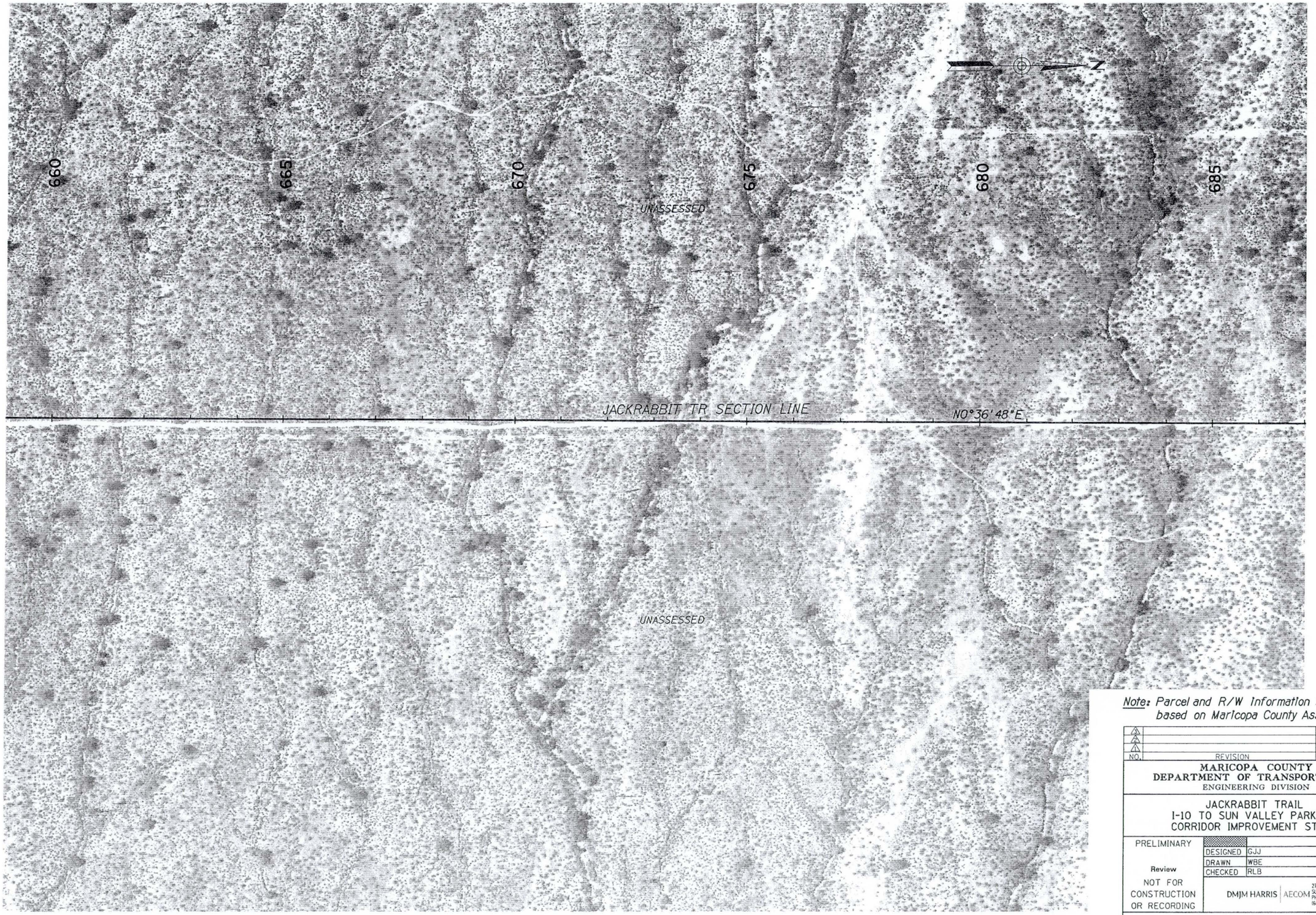


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review
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| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 21 OF 24

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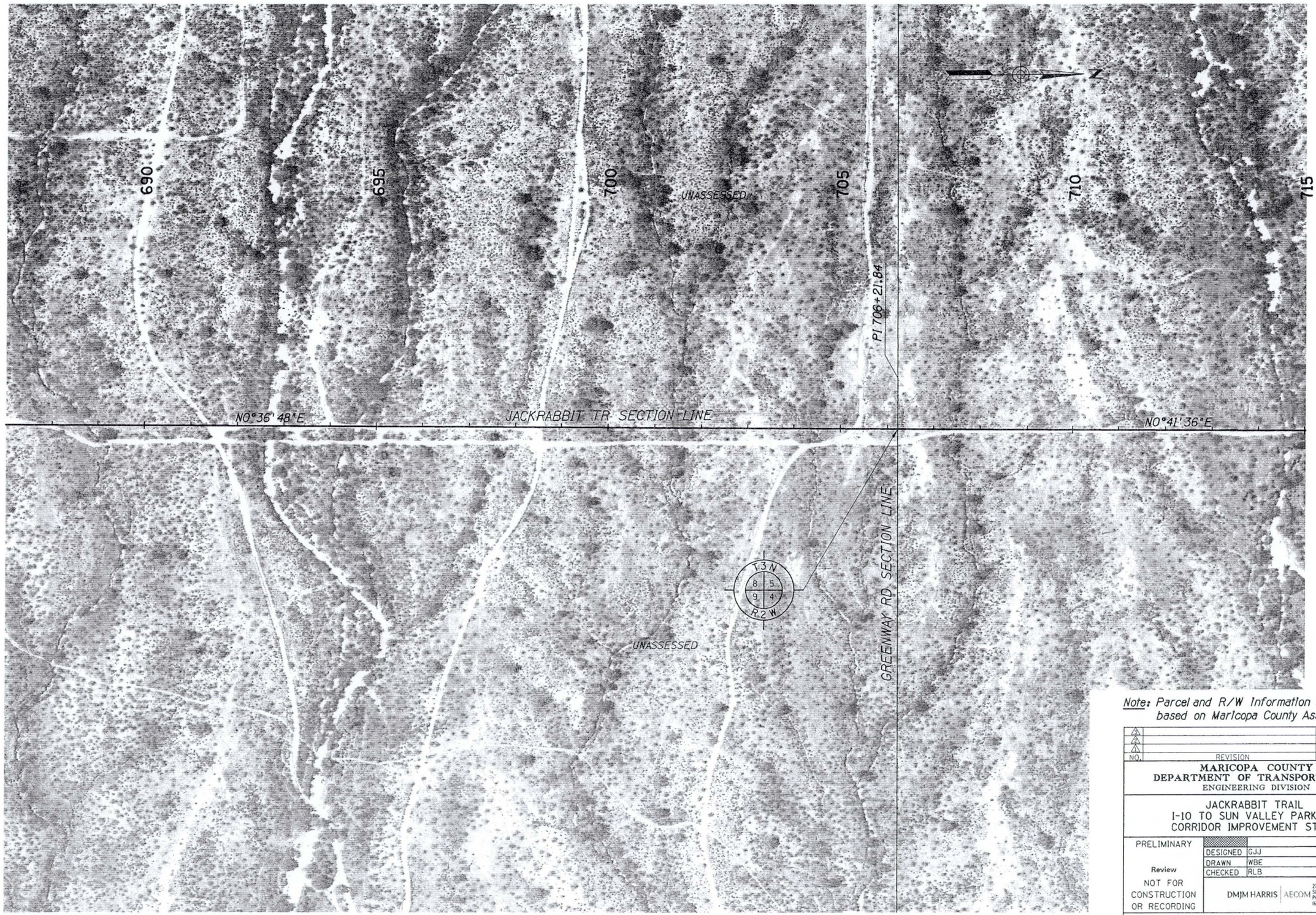


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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**MARICOPA COUNTY**
**DEPARTMENT OF TRANSPORTATION**
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review
NOT FOR CONSTRUCTION OR RECORDING

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|---|---|---|
| DESIGNED | GJJ | 05/07 |
| DRAWN | WBE | 05/07 |
| CHECKED | RLB | 05/07 |

DMJM HARRIS | AECOM
2777 E. CAMELBACK RD
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 22 OF 24

English

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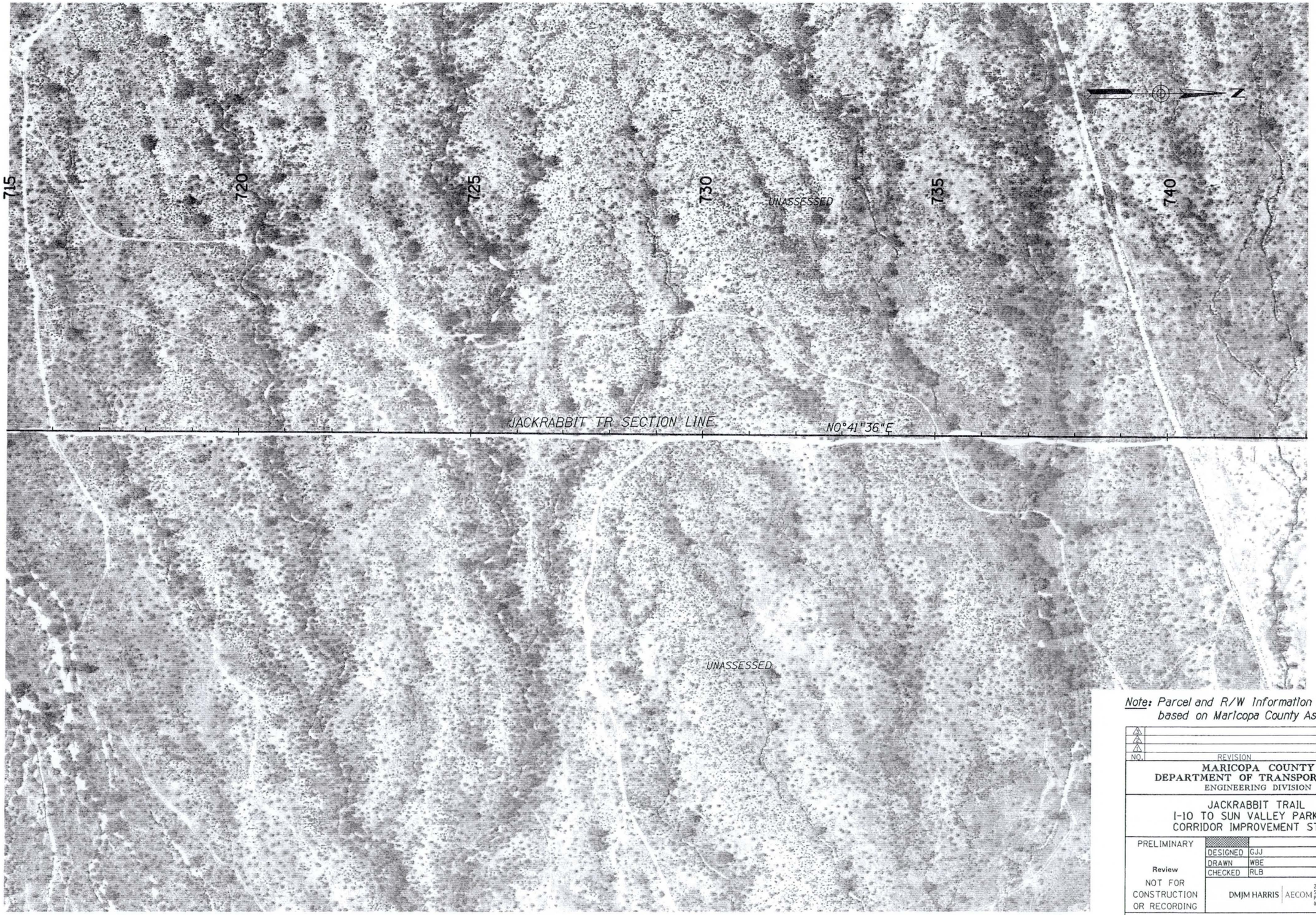


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

Review

NOT FOR CONSTRUCTION OR RECORDING

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| DESIGNED | GJJ | 05/07 |
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EXISTING CONDITIONS PLANS

SHEET 23 OF 24

English

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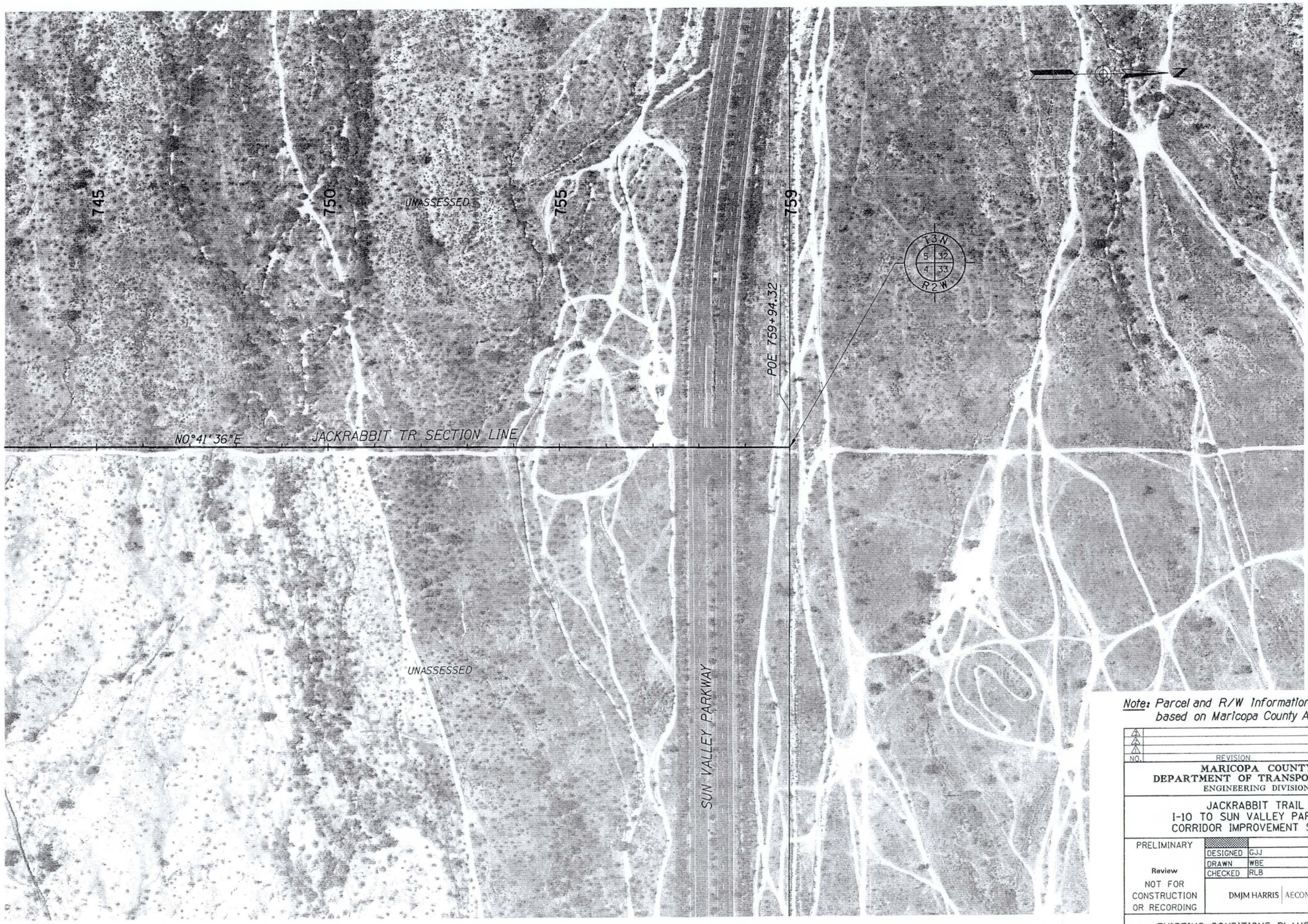


Note: Parcel and R/W Information Shown based on Maricopa County Assessor data.

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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

JACKRABBIT TRAIL
I-10 TO SUN VALLEY PARKWAY
CORRIDOR IMPROVEMENT STUDY

PRELIMINARY

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PHOENIX, AZ. 85016-4302
(602) 337-2777

EXISTING CONDITIONS PLANS

SHEET 24 OF 24

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# Appendix III
# Socioeconomic Data Forecast

Jackrabbit Trail Access Control and Corridor Improvement Study

# SOCIOECONOMIC DATA FORECASTS ADOPTED GENERAL PLAN(S) BUILDOUT CONDITION WHITE PAPER

Prepared for:
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Prepared by:
WILSON & COMPANY
9633 S. 48th Street
Suite 290
Phoenix, AZ 85044

April 24, 2007

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# 1.0 INTRODUCTION

## 1.1 Background

Over the past decade, a number of transportation system-related studies have been conducted in the vicinity of the Jackrabbit Trail Corridor, which extends from Interstate 10 to Bell Road. These studies include:

- Maricopa County Comprehensive Plan and Transportation System Plan (TSP) – 2006
- Maricopa Association of Governments (MAG) Regional Transportation Plan – 2003
- MAG Northwest Valley Transportation Study – 2002
- MAG Southwest Valley Transportation Study – 2003
- Maricopa County Department of Transportation (MCDOT) Northwest Valley Transportation Study – 2000
- MCDOT Southwest Valley Transportation Study – 1997
- Jackrabbit Trail/Tuthill Road – Germann Road to Indian School Road Access Control/Corridor Improvement Study

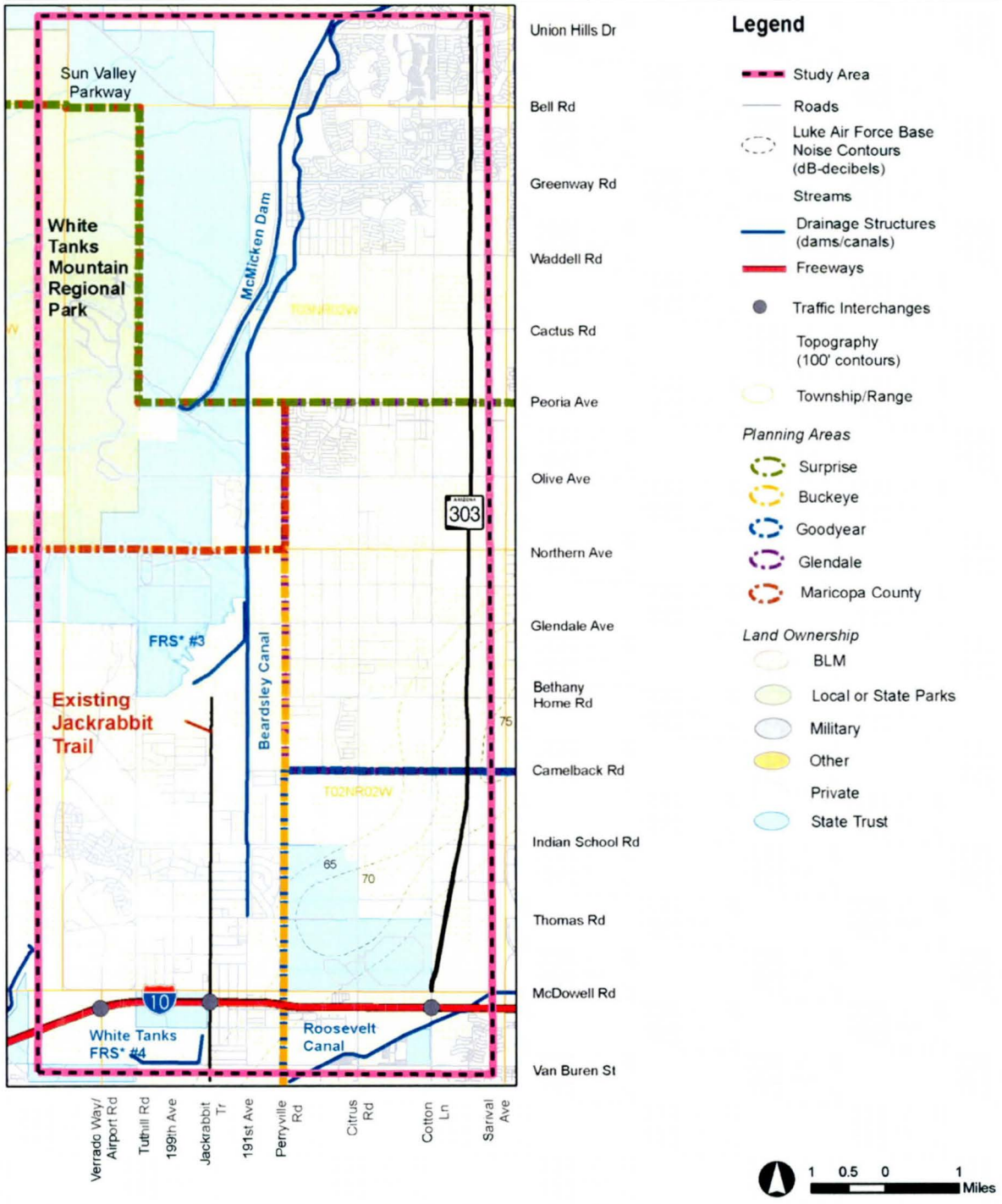
The MCDOT Jackrabbit Trail Access Control and Corridor Improvement Study represents the most recent effort to define interim and ultimate network improvements to accommodate forecast growth and development in this portion of the West Valley. This current study will provide MCDOT and other jurisdictions with a future functional classification designation and right-of-way/cross-section "footprint" for Jackrabbit Trail, along with the implementation timeframe and phasing of identified roadway improvements. Identified improvements will accommodate forecast travel demands and enhance the safety and mobility of the traveling public within the corridor.

This study area is bounded by Union Hills Drive to the north, Van Buren Street to the south, Sarival Avenue/163rd Avenue to the east and White Tank Mountain Regional Park to the west (**Figure 1.1**). This boundary represents the area of influence for the development of travel demand forecasts on the future roadway network in the study area.

## 1.2 Report Overview

The Jackrabbit Trail Access Control and Corridor Improvement Study is broken into two phases: planning and engineering. This White Paper documents the results of an important work element included within the planning phase of the study. This early work element involves development of socioeconomic data (SED) projections for interim and ultimate development conditions anticipated in the future. SED projections will serve as inputs to support development of travel demand forecasts for the future study area roadway network. All work in this

## Figure 1.1
## Study Area Base Map




*FRS stands for Flood Retardant Structure

**Source: Maricopa County Department of Transportation**

task will be coordinated with MCDOT, MAG, and staff representatives from the City of Surprise, Town of Buckeye, City of Glendale, and City of Goodyear.

### 1.3 White Paper Purpose

This White Paper documents existing, interim, and ultimate socioeconomic (i.e., population and employment) data forecasts for the Jackrabbit Trail Corridor study area. The purpose of this paper is to establish a well-defined socioeconomic database for the study area and enable MCDOT to prepare travel demand forecasts to be used in analyzing future roadway network performance. This White Paper also provides a context for developing recommended SED projections in relation to MCDOT's other ongoing Northwest Valley corridor studies. The vision for the Jackrabbit Trail Access Control and Corridor Improvement Study is to use SED projections developed for the corridor studies cited above and provide a direct linkage between those studies and this study.

This paper presents the 2005, 2030, and Buildout SED projections developed by MAG. It details how MCDOT will use these projections within the framework of the MAG regional travel demand model to develop travel forecasts for the study area. This paper also outlines the next steps in developing travel demand forecasts for the Jackrabbit Trail Access Control and Corridor Improvement Study.

### 1.4 White Paper Organization

This White Paper is organized in the following chapters:

1.0 Introduction

2.0 Data Source and Model Inputs

3.0 Socioeconomic Forecasts

4.0 Jackrabbit Trail Model Configuration Process

# 2.0 DATA SOURCE AND MODEL INPUTS

## 2.1 Model Development Background

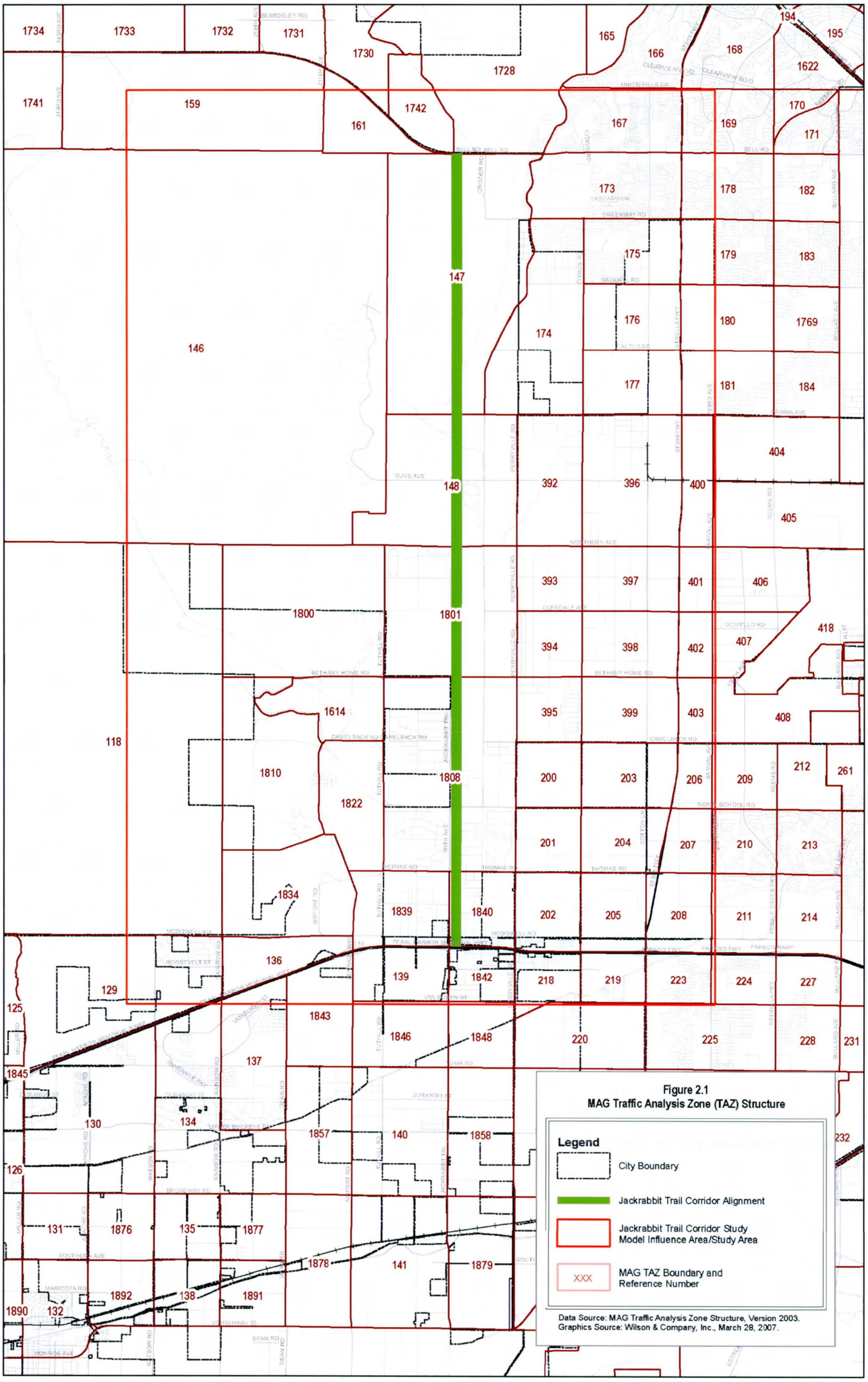
MAG operates and maintains a comprehensive regional travel demand model for the purpose of developing and testing the air quality conformity of regional transportation plans (RTPs) and transportation improvement programs (TIPs). The travel demand model and testing covers the MAG planning area, which includes all of Maricopa County. Currently, travel demand forecasting is based on year 2005 population and employment data and year 2030 forecasts adopted by MAG for each SAZ/TAZ comprising its regional planning area.

The MAG regional travel demand model has 1,864 Socioeconomic Analysis Zones (SAZs), including the 36 SAZs that comprise the Jackrabbit Trail study area. These are the smallest units for which MAG prepares socioeconomic projections. SAZ boundaries are defined using major streets and landmarks. When used for transportation modeling, the SAZs are also known as Traffic Analysis Zones (TAZs). **Figure 2.1** shows the TAZ structure for the Jackrabbit Trail Corridor study area. The study area encompasses approximately 77 square miles (less than one percent) of the 9,223 square-mile MAG planning area.

As part of MAG's update of its RTP, the regional planning body prepared revised population and employment projections for its entire planning region. The first step in preparing these projections was to establish Buildout conditions by estimating population and employment totals for TAZs forming the basis of the travel demand modeling process. "Buildout" forecasts are based on an amalgamation of (1) expected land development patterns and densities presented in local area General Plans and Comprehensive Plans, (2) approved development plans, and (3) planned or proposed development plans. Each of these sources provides a glimpse of the level of future development in the MAG planning region and, specifically, the density of development for all major land uses. As such, Buildout represents the best current understanding as to how the region will develop in the long term. There is no set timeframe within which Buildout will occur, but, generally, it is viewed as occurring in the next 50 years.

## 2.2 Modeling Basis/Methodology

MAG recently initiated development of an updated set of Buildout population and employment forecasts for the region. These new Buildout estimates were completed by MAG staff in September 2006 in consultation with representatives of local jurisdictions and agencies. Thus, the updated Buildout database incorporates the current General Plans and Comprehensive Plans of all MAG member agencies, including the following jurisdictions located within the Jackrabbit Trail Corridor study area: Buckeye, Surprise, Goodyear, Glendale, and Maricopa County. MAG's Buildout planning scenario provides a rationalized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1890
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Figure 2.1
MAG Traffic Analysis Zone (TAZ) Structure
Legend
City Boundary
Jackrabbit Trail Corridor Alignment
Jackrabbit Trail Corridor Study Model Influence Area/Study Area
XXX
MAG TAZ Boundary and Reference Number
Data Source: MAG Traffic Analysis Zone Structure, Version 2003.
Graphics Source: Wilson & Company, Inc., March 28, 2007.

basis for identifying for planning and programming purposes the ultimate transportation system for the region with specific attention to the roadway network.

The reader will note in data and graphics presented herein that Buildout projections for the Jackrabbit Trail Corridor study area SAZ/TAZ units may not be logical extensions of the 2030 projections. Socioeconomic data, specifically population and employment projections, for 2005 and 2030 were developed by MAG in 2003. To establish a growth scenario consistent with and sensitive to ongoing planning and development activities of member agencies, MAG developed the Buildout estimates in 2006. Buildout estimates were developed independently of the methodology adopted to develop the 2030 projections. Therefore, while the 2030 projections reflect standard planning practices for projecting future growth, such as trend analysis and extrapolation, Buildout projections reflect more subjective analysis of documented and apparent growth activity throughout the Valley.

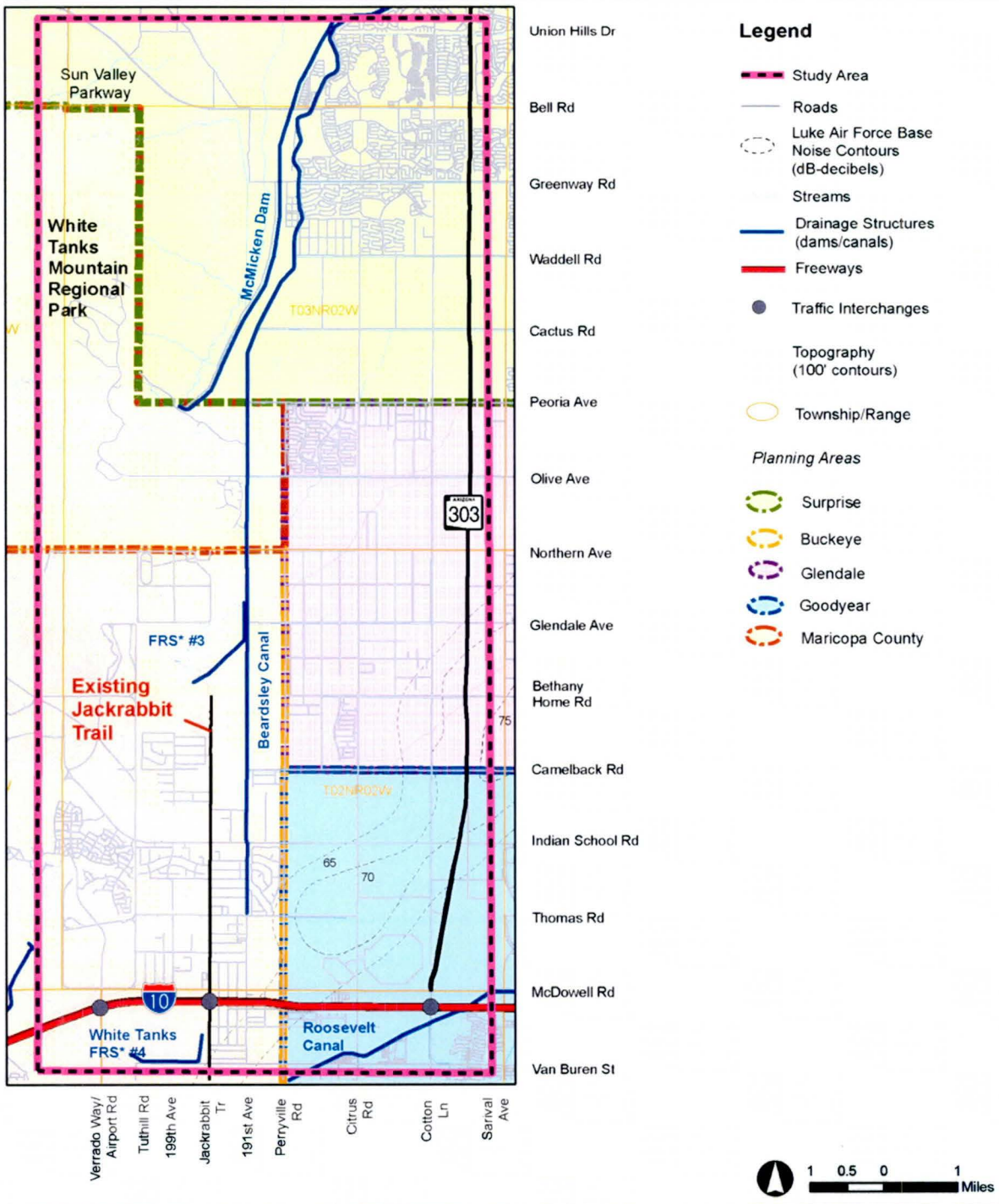
Buildout projections incorporate new facts on the ground, so to speak, and reveal a steady growth as anticipated by MAG's member agencies. It is not possible to say which projection would be the most reliable for transportation planning purposes. Thus, under the direction of MCDOT, a blended socioeconomic dataset has been developed for modeling purposes that considers the methods and assumptions associated with MAG's Buildout dataset. **Figure 2.2** depicts the Municipal Planning Area (MPA) boundary for each jurisdiction within the Jackrabbit Trail Corridor study area. As noted above, the population and employment estimates contained in adopted General Plans and Comprehensive Plans have been enhanced through examination of current land development plans and any known development information/trends.

Potential land development patterns for State Trust Lands also were considered. State Trust Lands cover a significant portion of the Jackrabbit Trail Corridor study area. The Arizona State Land Department (ASLD) holds these lands for eventual disposition by sale or lease to support Arizona public schools. ASLD works with the jurisdictions on conceptual development plans for state lands that each general plan reflects.

## 2.3 Jackrabbit Trail Modeling Vision

MCDOT is developing a custom-tailored travel demand model for the Northwest Valley to support the conduct of various corridor studies. It is recommended that the Jackrabbit Trail Corridor study area travel demand model be directly linked to MCDOT's refined Northwest Valley model. To date, the Northwest Valley model has focused on development of long-range travel demand forecasts based on the new Buildout socioeconomic database, reflecting full implementation of the MAG-adopted General Plan Land Use Elements. The new Jackrabbit Trail

## Figure 2.2
## Planning Areas




*FRS stands for Flood Retardant Structure

***Source: Maricopa County Department of Transportation***

Corridor model will rely on the same Buildout socioeconomic database as input for the TAZ structure within the Jackrabbit Trail Corridor study area.

In the near future, MCDOT is expected to develop interim year (2030) travel demand forecasts to support corridor studies in the Northwest Valley. Upon completion of this modeling effort for the Northwest Valley region, MCDOT also will produce an interim forecast for the Jackrabbit Trail Corridor, using an interim database directly linked to the Northwest Valley model.

# 3.0 SOCIOECONOMIC PROJECTIONS

## 3.1 Introduction

This chapter compares and contrasts MAG population and employment data/projections for existing (2005) conditions, interim year 2030, and Buildout.

## 3.2 Population Projections

**Table 3.1** summarizes the MAG population projections by SAZ for 2005, 2030, and Buildout for the Jackrabbit Trail Corridor study area (Detailed data for individual study area SAZs are presented in **Appendix A**). **Table 3.1** shows that the population in the study area is projected to be 5.6 times greater by the year 2030. By 2030, the study area is expected to be home to more than 180,000 residents, in contrast to approximately 33,000 in 2005. The projected average annual rate of increase in population is approximately 7.1 percent per year, resulting in a population density of approximately 2,400 persons per square mile. This compares to a population density of only 425 in the study area in 2005. The population of the Jackrabbit Trail Corridor study area is projected to increase an additional 30 percent between 2030 and Buildout to approximately 235,000 residents. For this same period, the overall population density is expected to increase from approximately 2,400 to 3,100 persons per square mile.

Table 3.1
Summary of Jackrabbit Trail Study Area Population Growth Projections

| | Year | | |
|---|---|---|---|
| | 2005 | 2030[1] | Buildout[2] |
| Total Population | 32,595 | 181,446 | 234,331 |
| Population Per Square Mile | 425 | 2,364 | 3,053 |
| Numerical Change | | | |
| Total Population | N/A | 148,851 | 52,885 |
| Population Per Square Mile | N/A | 1,939 | 689 |
| Percent Change | N/A | 357% | 29% |

Source: Maricopa Association of Governments: [1]July 2003; [2]September 2006

**Figures 3.1**, **3.2**, and **3.3** depict population per square mile for 2005, 2030, and Buildout, respectively, in the Jackrabbit Trail Corridor study area, which is coincident with the travel demand model influence area for purposes of future traffic forecasting. As shown in **Figure 3.1**, the vast majority of the study area was developed at a density of 0 to 1,500 persons per square mile in 2005. **Figure 3.2** indicates a notable increase in the density of development anticipated to occur between 2005 and 2030 in both the Jackrabbit Trail Corridor study area and surrounding areas. Densities exceeding 6,500 persons per square mile are

Figure 3.1
Year 2005 Population Density

Legend

City Boundary

Jackrabbit Trail Model Influence Area

MAG Year 2005 Population

Population per Square Mile

0 - 1,500

1,501 - 4,000

4,001 - 6,500

6,501 +

Data Source: MAG Buildout Housing Unit and Employment Data by SAZ03, July 2003;
Graphics Source: Wilson & Company, Inc., February 26, 2007.

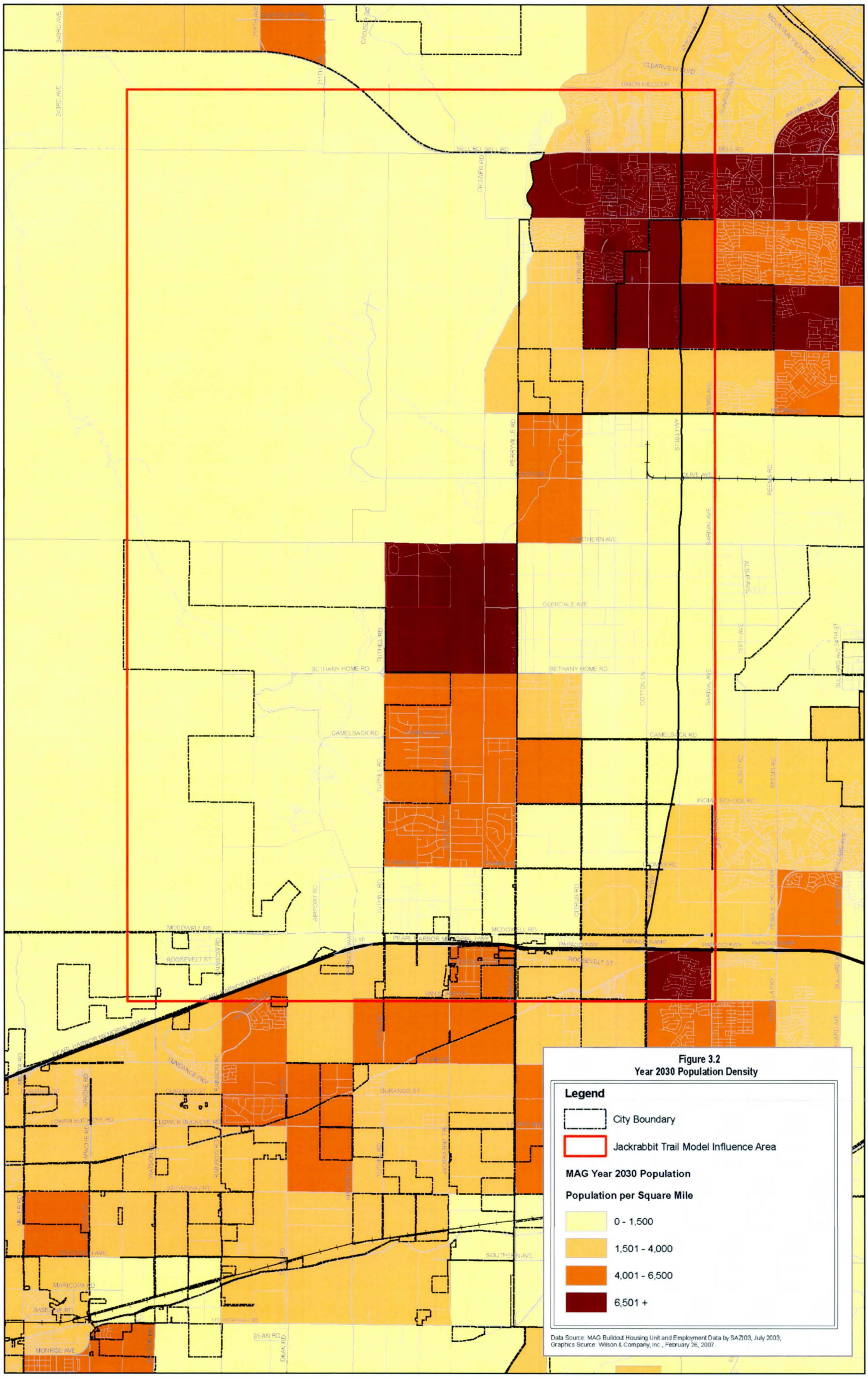


Figure 3.2
Year 2030 Population Density
Legend
City Boundary
Jackrabbit Trail Model Influence Area
MAG Year 2030 Population
Population per Square Mile
0 - 1,500
1,501 - 4,000
4,001 - 6,500
6,501 +
Data Source: MAG Buildout Housing Unit and Employment Data by SAZ03, July 2003;
Graphics Source: Wilson & Company, Inc., February 26, 2007.
249TH AVE
243RD AVE
219TH AVE
211TH AVE
CROZIER RD
BELL RD
CLEARVIEW BLVD
UNION HILLS DR
MOUNTAIN VIEW BLVD
REEMS BLVD
CITRUS RD
PERRYVILLE RD
ST303 FWY
OLIVE AVE
REEMS RD
NORTHERN AVE
SARIVAL AVE
GLENDALE AVE
59TH AVE
BULLARD AVE
24TH ST
BETHANY HOME RD
TUTHILL RD
COTTON LN
CAMELBACK RD
ALSUP RD
INDIAN SCHOOL RD
THOMAS RD
PEBBLE CREEK PKY
MCDOWELL RD
AIRPORT RD
ROOSEVELT ST
PEARL HARBOR MEMORIAL HWY
I-10
PAPAGO FWY
PAPAGO RAMP
RAINBOW RD
SUNDANCE PKY
DURANGO ST
LOWER BUCKEYE RD
APACHE RD
WATSON RD
JACKRABBIT TR
MILER RD
SOUTHERN AVE
MARICOPA RD
BASELINE RD
US HIGHWAY 85
DEAN RD
MONROE AVE

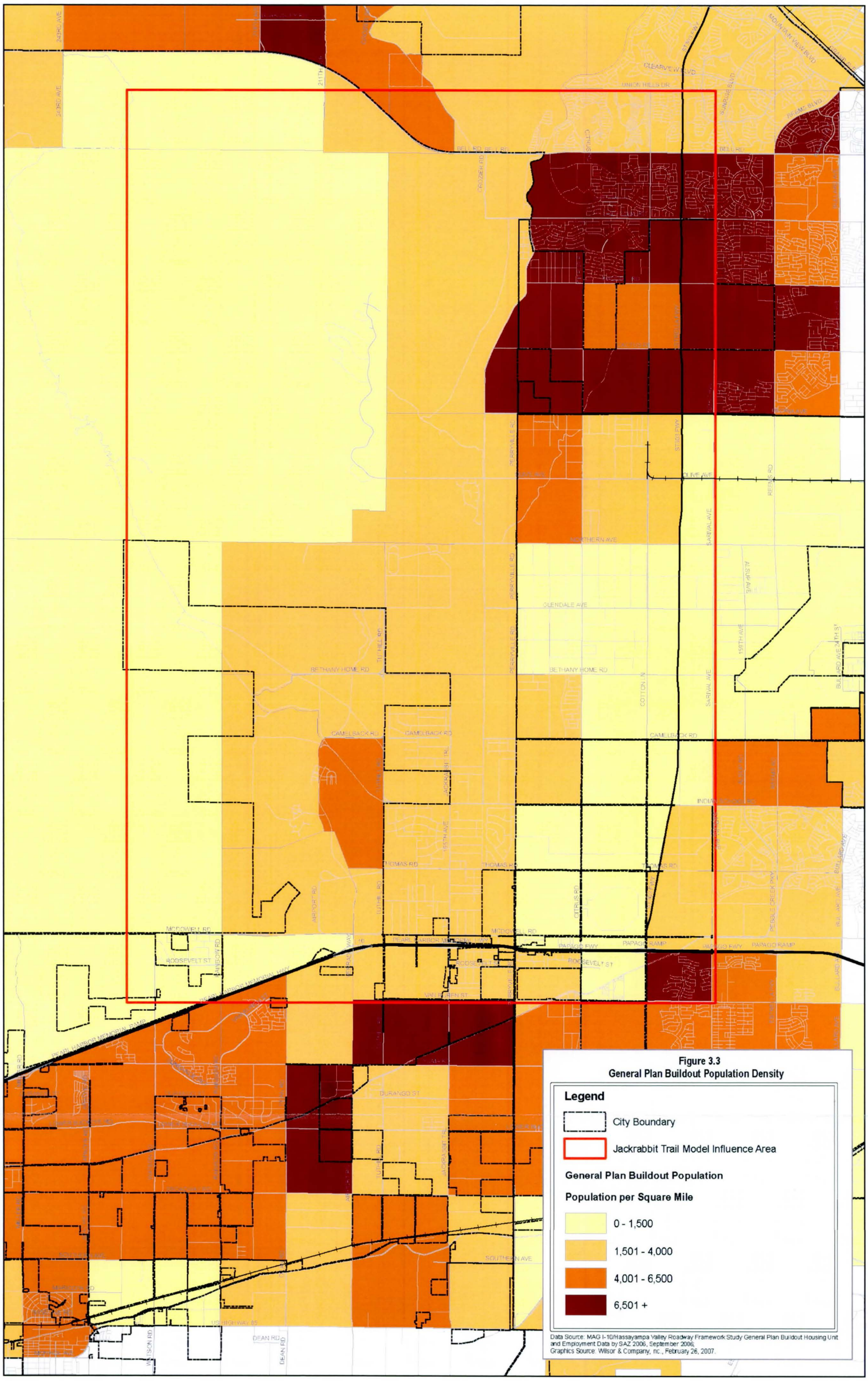



**Figure 3.3**
**General Plan Buildout Population Density**

**Legend**

- City Boundary
- Jackrabbit Trail Model Influence Area

**General Plan Buildout Population**

**Population per Square Mile**

- 0 - 1,500
- 1,501 - 4,000
- 4,001 - 6,500
- 6,501 +

Data Source: MAG I-10/Hassayampa Valley Roadway Framework Study General Plan Buildout Housing Unit and Employment Data by SAZ 2006, September 2006;
Graphics Source: Wilsor & Company, Inc., February 26, 2007.

expected to develop in the northeast corner of the study area and in the central portion. Under Buildout conditions (**Figure 3.3**), population density in the central portion of the study area is expected to more than double. Densities seen in the northeast corner of the study area are projected to expand to the west and south, based on projected development levels established for the City of Surprise and its MPA.

## 3.3 Employment Projections

**Table 3.2** summarizes the MAG employment projections by SAZ for 2005, 2030, and Buildout for the Jackrabbit Trail Corridor study area. (Detailed data for individual study area SAZs are presented in **Appendix B**). Employment in the study area is projected to have a slightly greater average annual growth rate than population from 2005 to 2030 (7.9 percent per year vs. 7.1 percent per year, respectively). Employment in the study area is expected to be 6.6 times greater by 2030, resulting in total employment growth between 2005 and 2030 of more than 59,000 employees. An additional 12,000 employees are projected for the study area from 2030 to Buildout, representing an increase of approximately 17 percent. Employment density in 2030 is projected to reach approximately 771 persons per square mile. This compares to a study area employment density of only 137 in 2005. Employment density in the study area is expected to increase to 1,065 employees per square mile under Buildout conditions.

Table 3.2
Summary of Jackrabbit Trail Study Area Employment Growth Projections

| | Year | | |
|---|---|---|---|
| | 2005 | 2030[1] | Buildout[2] |
| Total Employment | 10,495 | 69,654 | 81,727 |
| Employment Per Square Mile | 137 | 908 | 1,065 |
| Numerical Change | | | |
| Total Employment | N/A | 59,159 | 12,073 |
| Employment Per Square Mile | N/A | 771 | 157 |
| Percent Change | N/A | 463% | 17% |

Source: Maricopa Association of Governments: [1]July 2003; [2]September 2006

**Figures 3.4**, **3.5**, and **3.6** illustrate employment per square mile for 2005, 2030, and Buildout, respectively, in the Jackrabbit Trail Corridor study area. Currently, employment density in the majority of the study area is 0 to 500 employees per square mile. **Figure 3.4** shows three small areas where employment density exceeds 0 to 500 employees per square mile: between Bell and Greenway Roads in the City of Surprise; between the SR 303/Estrella Freeway and Sarival/163rd Avenue south of Peoria Avenue in the Cities of Litchfield Park and Waddell; and along Interstate 10 between Citrus Road and Cotton Lane.

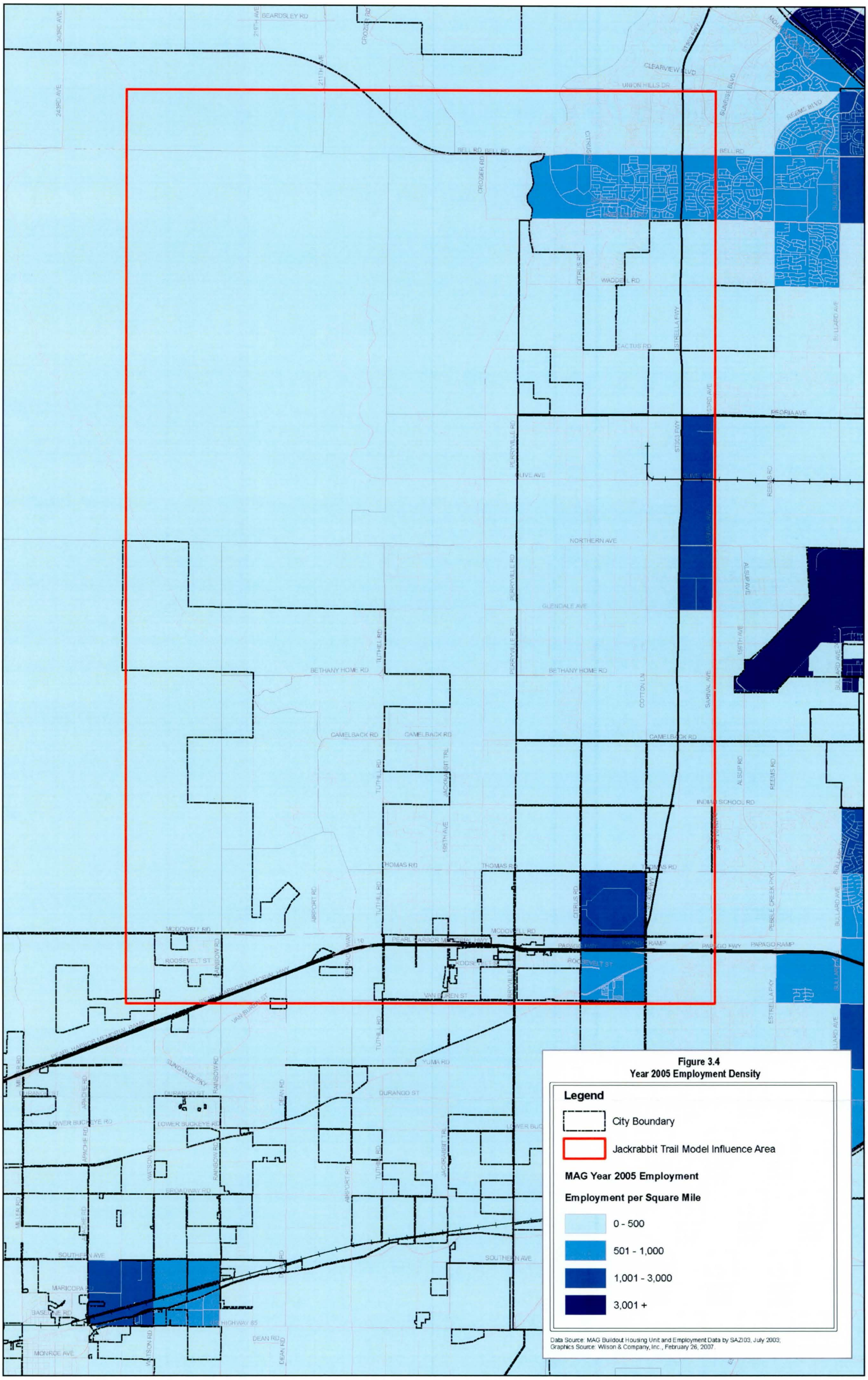


Figure 3.4
Year 2005 Employment Density
Legend
City Boundary
Jackrabbit Trail Model Influence Area
MAG Year 2005 Employment
Employment per Square Mile
0 - 500
501 - 1,000
1,001 - 3,000
3,001 +
Data Source: MAG Buildout Housing Unit and Employment Data by SAZI03, July 2003;
Graphics Source: Wilson & Company, Inc., February 26, 2007.
BELL RD
NORTHERN AVE
GLENDALE AVE
BETHANY HOME RD
CAMELBACK RD
INDIAN SCHOOL RD
THOMAS RD
MCDOWELL RD
VAN BUREN ST
PERRYVILLE RD
TUTHILL RD
COTTON LN
SARIVAL AVE
ESTRELLA FWY
PAPAGO FWY
OLIVE AVE
PEORIA AVE
SOUTHERN AVE
DURANGO ST
LOWER BUCKEYE RD
BROADWAY RD

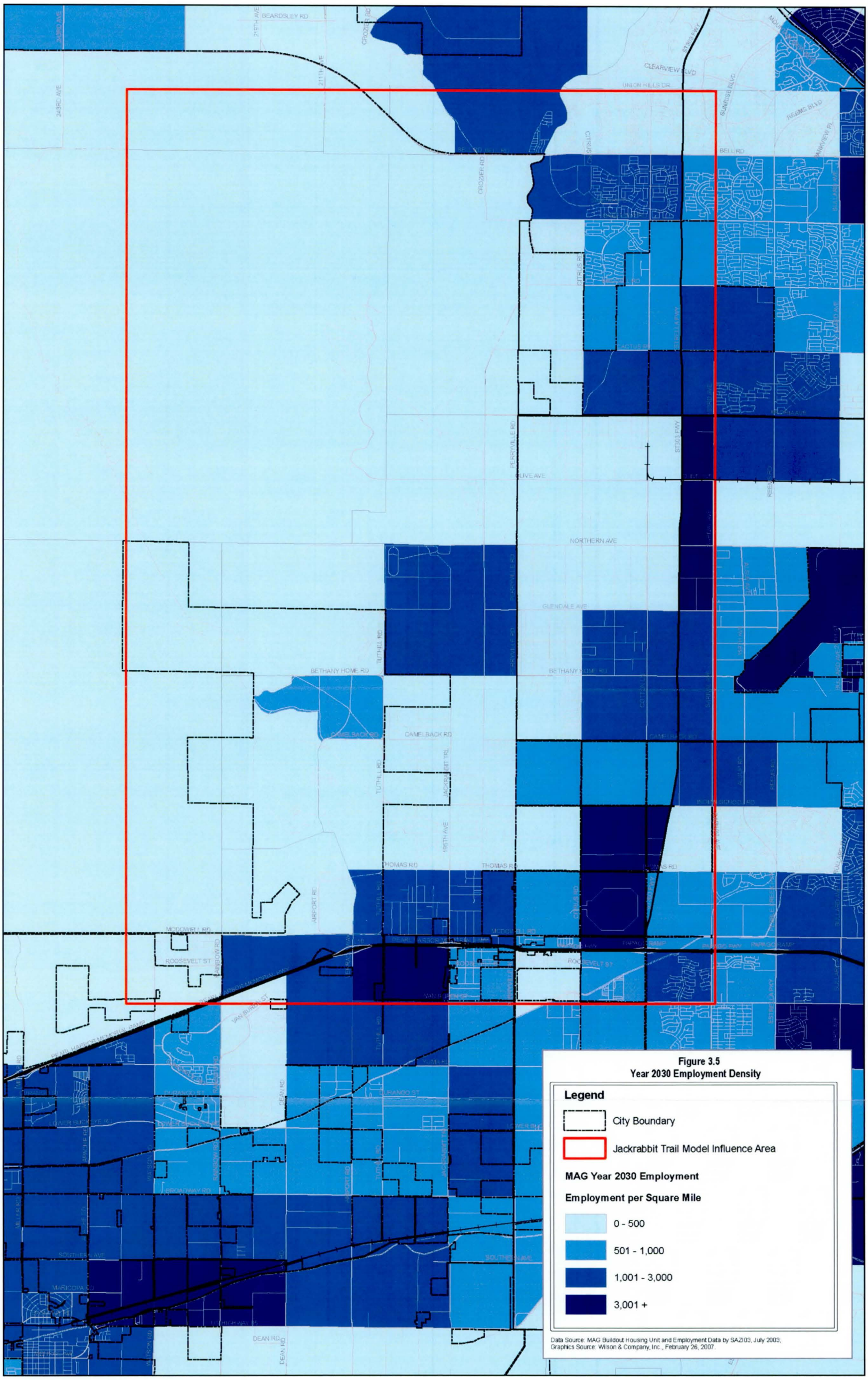
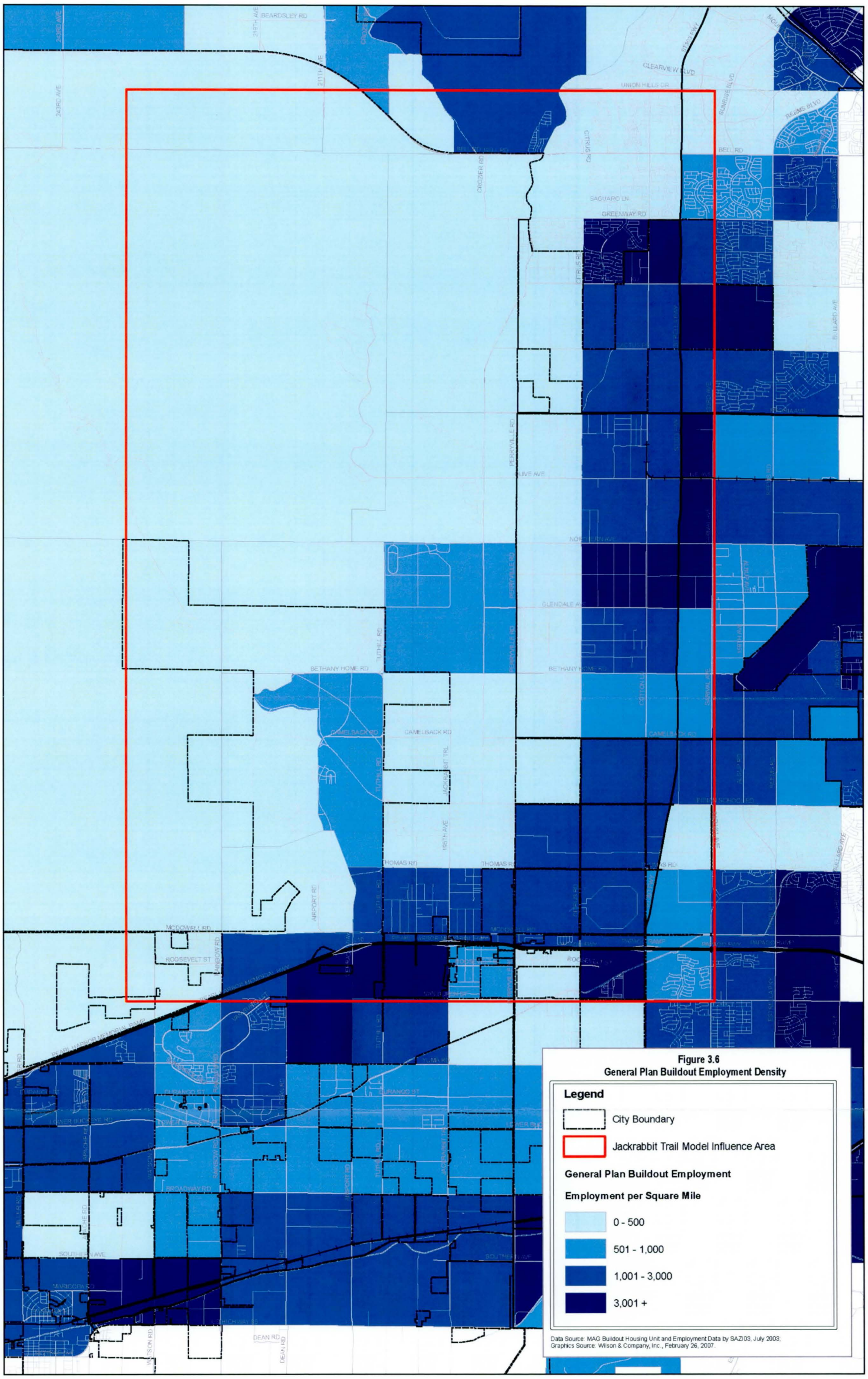



**Figure 3.5**
**Year 2030 Employment Density**

Data Source: MAG Buildout Housing Unit and Employment Data by SAZ103, July 2003;
Graphics Source: Wilson & Company, Inc., February 26, 2007.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OLIVE AVE
NORTHERN AVE
THOMAS RD
MCDOWELL RD
ROOSEVELT ST
BROADWAY RD
SOUTHERN AVE
MARIPOSA RD
DEAN RD
DURANGO ST
YUMA RD
LOWER BUCKEYE RD
CROZIER RD
TUTHILL RD
AIRPORT RD
PERRYVILLE RD
JACKRABBIT TRL
SUNRISE BLVD
REEMS BLVD
BULLARD AVE
SARIVAL AVE
243RD AVE
211TH AVE
195TH AVE
Figure 3.6
General Plan Buildout Employment Density
Legend
City Boundary
Jackrabbit Trail Model Influence Area
General Plan Buildout Employment
Employment per Square Mile
0 - 500
501 - 1,000
1,001 - 3,000
3,001 +
Data Source: MAG Buildout Housing Unit and Employment Data by SAZ103, July 2003;
Graphics Source: Wilson & Company, Inc., February 26, 2007.

Employment in the study area is projected to concentrate mostly along its eastern side and southern edge. Employment densities of 1,001 to greater than 3,000 employees per square mile will be prominent by 2030 (refer to **Figure 3.2**). Employment increases beyond 2030 are expected to occur in these same areas of the study area. **Figure 3.3** shows that, through the Buildout timeframe, employment densities in the remainder of the study area are projected to remain within a range similar to that which exists today (0 to 500 employees per square mile).

# 4.0 JACKRABBIT TRAIL MODEL CONFIGURATION PROCESS

## 4.1 Model Development Direction

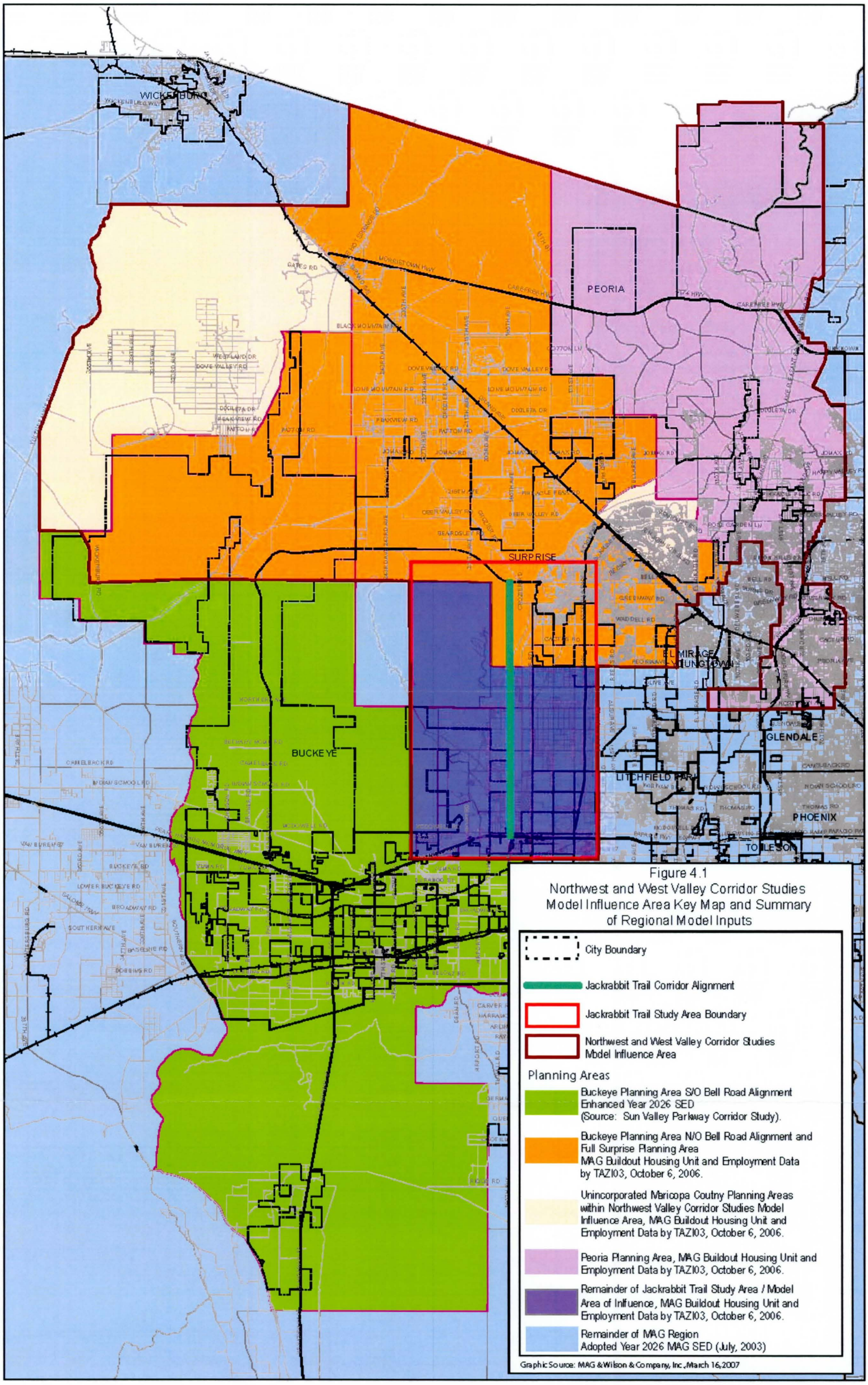
The Jackrabbit Trail Access Control and Corridor Improvement Study will utilize MAG Buildout socioeconomic data for the study area to generate long-range travel demand forecasts. Traffic volume projections from this model, custom-tailored for the Jackrabbit Trail Corridor, will be used to conduct traffic operations analyses on the future roadway network serving the study area. Interim year (2030) socioeconomic projections will be prepared, and the Jackrabbit Trail Corridor Travel Model will be modified to produce interim year travel demand forecasts.

The 2030 traffic forecasts then will be refined to reflect any significant development projects or traffic generators that were not accounted for in the MAG Buildout socioeconomic projections. Future traffic volumes, documented in related transportation studies, will be used as a reasonableness check for the Buildout traffic volume projections and to forecast intersection turning movement volumes.

## 4.2 Regional/Sub-Regional Model Configuration

As indicated previously, we propose to link the Jackrabbit Trail Corridor Travel Model directly to the Northwest Valley Corridor Studies Model that MCDOT recently developed. **Figure 4.1** graphically illustrates the sub-regional and regional socioeconomic input sources that MCDOT will use in the development of the Jackrabbit Trail Corridor Travel Model. Recently developed socioeconomic projections for Buildout conditions will serve as inputs to the model, which will be used to support future corridor studies in the Northwest Valley.

The new Jackrabbit Trail Corridor Travel Model will use the same MAG Buildout socioeconomic database as key inputs for all TAZs within the study area. Like the Northwest Valley Corridor Studies Model, this new Jackrabbit Trail Corridor Travel Model will use enhanced year 2026 socioeconomic data developed for the MCDOT Sun Valley Parkway Corridor Study for the portion of the Buckeye MPA south of the Bell Road alignment. Finally, for the rest of the MAG model region, 2026 socioeconomic data, the development of which was coordinated by MAG and later adopted in July of 2003, will be used as background model input.


WICKENBURG
PEORIA
SURPRISE
EL MIRAGE
YOUNGTOWN
GLENDALE
BUCKEYE
LITCHFIELD PARK
PHOENIX
TOLLESON
GATES RD
MORRISTOWN HWY
CAREFREE HWY
BLACK MOUNTAIN RD
DOVE VALLEY RD
PEAKVIEW RD
PATTON RD
JOMAX RD
DEER VALLEY RD
BEARDSLEY RD
GREENWAY RD
WADDELL RD
CACTUS RD
CAMELBACK RD
INDIAN SCHOOL RD
THOMAS RD
VAN BUREN ST
BUCKEYE RD
LOWER BUCKEYE RD
BROADWAY RD
SOUTHERN AVE
BASELINE RD
DOBBINS RD
YUMA RD
WESTLAND DR
DOVE VALLEY RD
Figure 4.1
Northwest and West Valley Corridor Studies
Model Influence Area Key Map and Summary
of Regional Model Inputs
City Boundary
Jackrabbit Trail Corridor Alignment
Jackrabbit Trail Study Area Boundary
Northwest and West Valley Corridor Studies
Model Influence Area
Planning Areas
Buckeye Planning Area S/O Bell Road Alignment
Enhanced Year 2026 SED
(Source: Sun Valley Parkway Corridor Study).
Buckeye Planning Area N/O Bell Road Alignment and
Full Surprise Planning Area
MAG Buildout Housing Unit and Employment Data
by TAZ103, October 6, 2006.
Unincorporated Maricopa Coutny Planning Areas
within Northwest Valley Corridor Studies Model
Influence Area, MAG Buildout Housing Unit and
Employment Data by TAZ103, October 6, 2006.
Peoria Planning Area, MAG Buildout Housing Unit and
Employment Data by TAZ103, October 6, 2006.
Remainder of Jackrabbit Trail Study Area / Model
Area of Influence, MAG Buildout Housing Unit and
Employment Data by TAZ103, October 6, 2006.
Remainder of MAG Region
Adopted Year 2026 MAG SED (July, 2003)
Graphic Source: MAG &Wilson & Company, Inc.,March 16,2007

# APPENDIX A
# POPULATION ESTIMATES
# JACKRABBIT TRAIL MODEL STUDY AREA

## Jackrabbit Trail Model Study Area Population Estimates (Continued)

| SAZ | ACRES | Square Miles | Population | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2005[1] | | 2030[1] | | | | Buildout[2] | | | |
| | | | Total | Per Square Mile | Total | Per Square Mile | Total Increase (2005-2030) | Average Annual Percent Increase (2005-2030) | Total | Per Square Mile | Total Increase (2030-Buildout) | Percent Increase (2030-Buildout) |
| 394 | 638 | 1 | 815 | 818 | 925 | 928 | 110 | 0.50% | 1277 | 1281 | 352 | 38.05 |
| 395 | 631 | 0.99 | 1311 | 1330 | 2788 | 2829 | 1477 | 3.10% | 2675 | 2715 | -113 | -4.05 |
| 396 | 1936 | 3.02 | 1974 | 653 | 3648 | 1206 | 1674 | 2.50% | 5985 | 1979 | 2337 | 64.06 |
| 397 | 944 | 1.47 | 1191 | 808 | 1578 | 1070 | 387 | 1.10% | 1085 | 736 | -493 | -31.24 |
| 398 | 944 | 1.47 | 712 | 483 | 1136 | 770 | 424 | 1.90% | 1234 | 837 | 98 | 8.63 |
| 399 | 948 | 1.48 | 411 | 277 | 896 | 605 | 485 | 3.20% | 953 | 643 | 57 | 6.36 |
| 1614 | 880 | 1.37 | 30 | 22 | 1943 | 1414 | 1913 | 18.20% | 3414 | 2484 | 1471 | 75.71 |
| 1728 | 3911 | 6.11 | 119 | 19 | 1601 | 262 | 1482 | 11.00% | 14593 | 2388 | 12992 | 811.49 |
| 1742 | 659 | 1.03 | 0 | 0 | 0 | 0 | 0 | | 5816 | 5645 | 5816 | |
| 1800 | 3197 | 5 | 1 | 0 | 4398 | 880 | 4397 | 39.90% | 12205 | 2443 | 7807 | 177.51 |
| 1801 | 2593 | 4.05 | 1047 | 258 | 30174 | 7447 | 29127 | 14.40% | 15420 | 3805 | -14754 | -48.9 |
| 1808 | 3854 | 6.02 | 2972 | 494 | 26919 | 4470 | 23947 | 9.20% | 21425 | 3558 | -5494 | -20.41 |
| 1822 | 1132 | 1.77 | 0 | 0 | 1672 | 945 | 1672 | | 8860 | 5007 | 7188 | 429.9 |
| 1839 | 1085 | 1.7 | 912 | 538 | 1870 | 1103 | 958 | 2.90% | 5678 | 3349 | 3808 | 203.64 |
| 1840 | 735 | 1.15 | 476 | 414 | 823 | 716 | 347 | 2.20% | 2973 | 2587 | 2150 | 261.24 |
| 1842 | 546 | 0.85 | 1132 | 1327 | 3530 | 4139 | 2398 | 4.70% | 3116 | 3654 | -414 | -11.73 |
| **Total** | | **76.74** | **32595** | **425** | **181446** | **2364** | **148851** | **7.10%** | **234331** | **3053** | **52885** | **29.15** |

Sources: [1]Maricopa Association of Governments, July 2003; [2]Maricopa Association of Governments, September 2006.

## Jackrabbit Trail Model Study Area Population Estimates

| SAZ | ACRES | Square Miles | Population | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2005[1] | | 2030[1] | | | | Buildout[2] | | | |
| | | | Total | Per Square Mile | Total | Per Square Mile | Total Increase (2005-2030) | Average Annual Percent Increase (2005-2030) | Total | Per Square Mile | Total Increase (2030-Buildout) | Percent Increase (2030-Buildout) |
| 139 | 799 | 1.25 | 102 | 82 | 2643 | 2117 | 2541 | 13.90% | 3187 | 2553 | 544 | 20.58 |
| 147 | 4964 | 7.76 | 344 | 44 | 6233 | 804 | 5889 | 12.30% | 15801 | 2037 | 9568 | 153.51 |
| 148 | 2720 | 4.25 | 15 | 4 | 5592 | 1316 | 5577 | 26.70% | 9137 | 2150 | 3545 | 63.39 |
| 161 | 741 | 1.16 | 0 | 0 | 0 | 0 | 0 | | 3211 | 2775 | 3211 | |
| 167 | 1220 | 1.91 | 3836 | 2012 | 6349 | 3330 | 2513 | 2.00% | 6936 | 3638 | 587 | 9.25 |
| 173 | 1467 | 2.29 | 4176 | 1822 | 15817 | 6901 | 11641 | 5.50% | 17559 | 7661 | 1742 | 11.01 |
| 174 | 2172 | 3.39 | 662 | 195 | 8141 | 2399 | 7479 | 10.60% | 22172 | 6532 | 14031 | 172.35 |
| 175 | 953 | 1.49 | 1106 | 743 | 10378 | 6971 | 9272 | 9.40% | 10269 | 6898 | -109 | -1.05 |
| 176 | 954 | 1.49 | 786 | 527 | 12094 | 8112 | 11308 | 11.60% | 7869 | 5278 | -4225 | -34.93 |
| 177 | 963 | 1.5 | 786 | 522 | 4088 | 2717 | 3302 | 6.80% | 13218 | 8784 | 9130 | 223.34 |
| 200 | 640 | 1 | 14 | 14 | 4445 | 4444 | 4431 | 25.90% | 2472 | 2472 | -1973 | -44.39 |
| 201 | 641 | 1 | 4 | 4 | 17 | 17 | 13 | 6.00% | 148 | 148 | 131 | 770.59 |
| 202 | 770 | 1.2 | 530 | 440 | 1779 | 1478 | 1249 | 5.00% | 474 | 394 | -1305 | -73.36 |
| 203 | 921 | 1.44 | 12 | 8 | 817 | 568 | 805 | 18.40% | 898 | 624 | 81 | 9.91 |
| 204 | 814 | 1.27 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | |
| 205 | 772 | 1.21 | 2374 | 1968 | 3527 | 2923 | 1153 | 1.60% | 0 | 0 | -3527 | -100 |
| 218 | 553 | 0.86 | 1204 | 1394 | 2756 | 3192 | 1552 | 3.40% | 2408 | 2789 | -348 | -12.63 |
| 219 | 507 | 0.79 | 740 | 935 | 2805 | 3543 | 2065 | 5.50% | 841 | 1062 | -1964 | -70.02 |
| 392 | 1276 | 1.99 | 2028 | 1017 | 9257 | 4643 | 7229 | 6.30% | 9963 | 4997 | 706 | 7.63 |
| 393 | 637 | 0.99 | 773 | 777 | 807 | 811 | 34 | 0.20% | 1059 | 1065 | 252 | 31.23 |

# APPENDIX B
# EMPLOYMENT ESTIMATES
# JACKRABBIT TRAIL MODEL STUDY AREA

## Jackrabbit Trail Model Study Area Employment Estimates

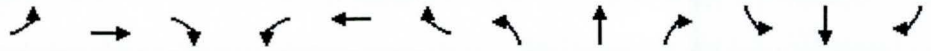
| SAZ | ACRES | Square Miles | Employment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2005[1] | | 2030[1] | | | | Buildout[2] | | | |
| | | | Total | Per Square Mile | Total | Per Square Mile | Total Increase (2005-2030) | Average Annual Percent Increase (2005-2030) | Total | Per Square Mile | Total Increase (2030-Buildout) | Percent Increase (2030-Buildout) |
| 139 | 799 | 1.25 | 276 | 221 | 9797 | 7847 | 9521 | 15.30% | 9915 | 7942 | 118 | 1.2 |
| 147 | 4964 | 7.76 | 180 | 23 | 1357 | 175 | 1177 | 8.40% | 164 | 21 | -1193 | -87.91 |
| 148 | 2720 | 4.25 | 4 | 1 | 881 | 207 | 877 | 24.10% | 228 | 54 | -653 | -74.12 |
| 161 | 741 | 1.16 | 2 | 2 | 19 | 16 | 17 | 9.40% | 0 | 0 | -19 | |
| 167 | 1220 | 1.91 | 549 | 288 | 777 | 408 | 228 | 1.40% | 649 | 340 | -128 | -16.47 |
| 173 | 1467 | 2.29 | 1206 | 526 | 2382 | 1039 | 1176 | 2.80% | 1063 | 464 | -1319 | -55.37 |
| 174 | 2172 | 3.39 | 197 | 58 | 763 | 225 | 566 | 5.60% | 877 | 258 | 114 | 14.94 |
| 175 | 953 | 1.49 | 139 | 93 | 1276 | 857 | 1137 | 9.30% | 5733 | 3851 | 4457 | 349.29 |
| 176 | 954 | 1.49 | 192 | 129 | 1069 | 717 | 877 | 7.10% | 3037 | 2037 | 1968 | 184.1 |
| 177 | 963 | 1.5 | 232 | 154 | 3492 | 2321 | 3260 | 11.50% | 1707 | 1134 | -1785 | -51.12 |
| 200 | 640 | 1 | 16 | 16 | 968 | 968 | 952 | 17.80% | 484 | 484 | -484 | -50 |
| 201 | 641 | 1 | 17 | 17 | 38 | 38 | 21 | 3.30% | 2209 | 2205 | 2171 | 5713.16 |
| 202 | 770 | 1.2 | 416 | 346 | 701 | 582 | 285 | 2.10% | 3250 | 2700 | 2549 | 363.62 |
| 203 | 921 | 1.44 | 263 | 183 | 853 | 593 | 590 | 4.80% | 2571 | 1787 | 1718 | 201.41 |
| 204 | 814 | 1.27 | 412 | 324 | 9129 | 7178 | 8717 | 13.20% | 3586 | 2820 | -5543 | |
| 205 | 772 | 1.21 | 2597 | 2152 | 5401 | 4476 | 2804 | 3.00% | 3180 | 2636 | -2221 | -41.12 |
| 218 | 553 | 0.86 | 99 | 115 | 272 | 315 | 173 | 4.10% | 184 | 213 | -88 | -32.35 |
| 219 | 507 | 0.79 | 494 | 624 | 564 | 712 | 70 | 0.50% | 4725 | 5969 | 4161 | 737.77 |
| 392 | 1276 | 1.99 | 484 | 243 | 821 | 412 | 337 | 2.10% | 745 | 374 | -76 | -9.26 |
| 393 | 637 | 0.99 | 10 | 10 | 7 | 7 | -3 | -1.40% | 5 | 5 | -2 | -28.57 |

## Jackrabbit Trail Model Study Area Employment Estimates (Continued)

| SAZ | ACRES | Square Miles | Employment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2005[1] | | 2030[1] | | | | Buildout[2] | | | |
| | | | Total | Per Square Mile | Total | Per Square Mile | Total Increase (2005-2030) | Average Annual Percent Increase (2005-2030) | Total | Per Square Mile | Total Increase (2030-Buildout) | Percent Increase (2030-Buildout) |
| 394 | 638 | 1 | 27 | 27 | 15 | 15 | -12 | -2.30% | 0 | 0 | -15 | -100 |
| 395 | 631 | 0.99 | 140 | 142 | 177 | 180 | 37 | 0.90% | 0 | 0 | -177 | -100 |
| 396 | 1936 | 3.02 | 198 | 65 | 879 | 291 | 681 | 6.10% | 5995 | 1982 | 5116 | 582.03 |
| 397 | 944 | 1.47 | 54 | 37 | 315 | 214 | 261 | 7.30% | 5216 | 3537 | 4901 | 1555.87 |
| 398 | 944 | 1.47 | 622 | 422 | 1475 | 1000 | 853 | 3.50% | 2061 | 1398 | 586 | 39.73 |
| 399 | 948 | 1.48 | 55 | 37 | 1722 | 1162 | 1667 | 14.80% | 795 | 537 | -927 | -53.83 |
| 1614 | 880 | 1.37 | 2 | 1 | 753 | 548 | 751 | 26.80% | 875 | 637 | 122 | 16.2 |
| 1728 | 3911 | 6.11 | 68 | 11 | 6751 | 1105 | 6683 | 20.20% | 7114 | 1164 | 363 | 5.38 |
| 1742 | 659 | 1.03 | 1 | 1 | 1 | 1 | 0 | 0.00% | 0 | 0 | -1 | |
| 1800 | 3197 | 5 | 4 | 1 | 2273 | 455 | 2269 | 28.90% | 1941 | 389 | -332 | -14.61 |
| 1801 | 2593 | 4.05 | 153 | 38 | 5031 | 1242 | 4878 | 15.00% | 2288 | 565 | -2743 | -54.52 |
| 1808 | 3854 | 6.02 | 370 | 61 | 2903 | 482 | 2533 | 8.60% | 2071 | 344 | -832 | -28.66 |
| 1822 | 1132 | 1.77 | 2 | 1 | 545 | 308 | 543 | 25.10% | 1439 | 813 | 894 | 164.04 |
| 1839 | 1085 | 1.7 | 370 | 218 | 3695 | 2179 | 3325 | 9.60% | 4805 | 2834 | 1110 | 30.04 |
| 1840 | 735 | 1.15 | 456 | 397 | 1896 | 1650 | 1440 | 5.90% | 2204 | 1918 | 308 | 16.24 |
| 1842 | 546 | 0.85 | 188 | 220 | 656 | 769 | 468 | 5.10% | 611 | 716 | -45 | -6.86 |
| **Total** | | **76.74** | **10495** | **137** | **69654** | **908** | **59159** | **7.90%** | **81727** | **1065** | **12073** | **17.33** |

Sources: [1]Maricopa Association of Governments, July 2003; [2]Maricopa Association of Governments, September 2006.

# Appendix IV
# Synchro Files



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 45 | 5 | 15 | 0 | 0 | 0 | 0 | 70 | 330 | 290 | 280 | 0 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 49 | 5 | 16 | 0 | 0 | 0 | 0 | 76 | 359 | 315 | 304 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1190 | 1370 | 304 | 1209 | 1190 | 255 | 304 | | | 435 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1190 | 1370 | 304 | 1209 | 1190 | 255 | 304 | | | 435 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 62 | 95 | 98 | 100 | 100 | 100 | 100 | | | 72 | | |
| cM capacity (veh/h) | 129 | 105 | 735 | 118 | 135 | 783 | 1256 | | | 1125 | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|
| Volume Total | 71 | 435 | 315 | 304 |
| Volume Left | 49 | 0 | 315 | 0 |
| Volume Right | 16 | 359 | 0 | 0 |
| cSH | 156 | 1700 | 1125 | 1700 |
| Volume to Capacity | 0.45 | 0.26 | 0.28 | 0.18 |
| Queue Length 95th (ft) | 52 | 0 | 29 | 0 |
| Control Delay (s) | 46.0 | 0.0 | 9.4 | 0.0 |
| Lane LOS | E | | A | |
| Approach Delay (s) | 46.0 | 0.0 | 4.8 | |
| Approach LOS | E | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 5.5 | | | |
| Intersection Capacity Utilization | 73.9% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 0 | 0 | 0 | 210 | 5 | 120 | 15 | 110 | 0 | 0 | 340 | 45 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 228 | 5 | 130 | 16 | 120 | 0 | 0 | 370 | 49 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 679 | 546 | 394 | 546 | 571 | 120 | 418 | | | 120 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 679 | 546 | 394 | 546 | 571 | 120 | 418 | | | 120 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 100 | 49 | 99 | 86 | 99 | | | 100 | | |
| cM capacity (veh/h) | 308 | 439 | 655 | 443 | 425 | 932 | 1141 | | | 1468 | | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 |
|---|---|---|---|---|
| Volume Total | 364 | 16 | 120 | 418 |
| Volume Left | 228 | 16 | 0 | 0 |
| Volume Right | 130 | 0 | 0 | 49 |
| cSH | 546 | 1141 | 1700 | 1700 |
| Volume to Capacity | 0.67 | 0.01 | 0.07 | 0.25 |
| Queue Length 95th (ft) | 124 | 1 | 0 | 0 |
| Control Delay (s) | 23.8 | 8.2 | 0.0 | 0.0 |
| Lane LOS | C | A | | |
| Approach Delay (s) | 23.8 | 1.0 | | 0.0 |
| Approach LOS | C | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 9.6 | | | |
| Intersection Capacity Utilization | 73.9% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 25 | 15 | 100 | 65 | 15 | 10 | 65 | 135 | 50 | 5 | 215 | 5 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 27 | 16 | 109 | 71 | 16 | 11 | 71 | 147 | 54 | 5 | 234 | 5 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 554 | 590 | 236 | 677 | 565 | 174 | 239 | | | 201 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 554 | 590 | 236 | 677 | 565 | 174 | 239 | | | 201 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 93 | 96 | 86 | 76 | 96 | 99 | 95 | | | 100 | | |
| cM capacity (veh/h) | 406 | 396 | 803 | 294 | 409 | 870 | 1328 | | | 1371 | | |

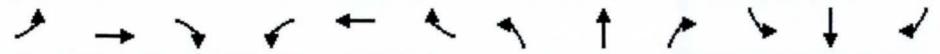
| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 27 | 125 | 71 | 27 | 71 | 201 | 5 | 239 |
| Volume Left | 27 | 0 | 71 | 0 | 71 | 0 | 5 | 0 |
| Volume Right | 0 | 109 | 0 | 11 | 0 | 54 | 0 | 5 |
| cSH | 406 | 708 | 294 | 519 | 1328 | 1700 | 1371 | 1700 |
| Volume to Capacity | 0.07 | 0.18 | 0.24 | 0.05 | 0.05 | 0.12 | 0.00 | 0.14 |
| Queue Length 95th (ft) | 5 | 16 | 23 | 4 | 4 | 0 | 0 | 0 |
| Control Delay (s) | 14.5 | 11.2 | 21.1 | 12.3 | 7.9 | 0.0 | 7.6 | 0.0 |
| Lane LOS | B | B | C | B | A | | A | |
| Approach Delay (s) | 11.8 | | 18.6 | | 2.0 | | 0.2 | |
| Approach LOS | B | | C | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 5.5 | | | |
| Intersection Capacity Utilization | 35.5% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 30 | 10 | 130 | 40 | 25 | 180 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 33 | 11 | 141 | 43 | 27 | 196 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 413 | 163 | | | 185 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 413 | 163 | | | 185 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 94 | 99 | | | 98 | |
| cM capacity (veh/h) | 584 | 882 | | | 1390 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 43 | 185 | 223 |
| Volume Left | 33 | 0 | 27 |
| Volume Right | 11 | 43 | 0 |
| cSH | 638 | 1700 | 1390 |
| Volume to Capacity | 0.07 | 0.11 | 0.02 |
| Queue Length 95th (ft) | 5 | 0 | 1 |
| Control Delay (s) | 11.1 | 0.0 | 1.1 |
| Lane LOS | B | | A |
| Approach Delay (s) | 11.1 | 0.0 | 1.1 |
| Approach LOS | B | | |

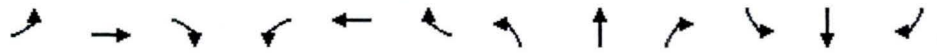
| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | | 1.6 | |
| Intersection Capacity Utilization | | 33.5% | ICU Level of Service A |
| Analysis Period (min) | | 15 | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 35 | 5 | 25 | 0 | 0 | 0 | 0 | 165 | 315 | 220 | 405 | 0 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 38 | 5 | 27 | 0 | 0 | 0 | 0 | 179 | 342 | 239 | 440 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 1269 | 1440 | 440 | 1299 | 1269 | 351 | 440 | | | 522 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 1269 | 1440 | 440 | 1299 | 1269 | 351 | 440 | | | 522 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 68 | 95 | 96 | 100 | 100 | 100 | 100 | | | 77 | | |
| cM capacity (veh/h) | 120 | 102 | 617 | 105 | 130 | 693 | 1120 | | | 1045 | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|
| Volume Total | 71 | 522 | 239 | 440 |
| Volume Left | 38 | 0 | 239 | 0 |
| Volume Right | 27 | 342 | 0 | 0 |
| cSH | 170 | 1700 | 1045 | 1700 |
| Volume to Capacity | 0.42 | 0.31 | 0.23 | 0.26 |
| Queue Length 95th (ft) | 46 | 0 | 22 | 0 |
| Control Delay (s) | 40.4 | 0.0 | 9.5 | 0.0 |
| Lane LOS | E | | A | |
| Approach Delay (s) | 40.4 | 0.0 | 3.3 | |
| Approach LOS | E | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 4.0 | | | |
| Intersection Capacity Utilization | 92.4% | ICU Level of Service | F | |
| Analysis Period (min) | 15 | | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 0 | 0 | 0 | 300 | 10 | 260 | 25 | 170 | 0 | 0 | 330 | 65 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 326 | 11 | 283 | 27 | 185 | 0 | 0 | 359 | 71 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 921 | 633 | 394 | 633 | 668 | 185 | 429 | | | 185 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 921 | 633 | 394 | 633 | 668 | 185 | 429 | | | 185 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 100 | 100 | 100 | 15 | 97 | 67 | 98 | | | 100 | | |
| cM capacity (veh/h) | 161 | 387 | 655 | 385 | 370 | 857 | 1130 | | | 1390 | | |

| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 |
|---|---|---|---|---|
| Volume Total | 620 | 27 | 185 | 429 |
| Volume Left | 326 | 27 | 0 | 0 |
| Volume Right | 283 | 0 | 0 | 71 |
| cSH | 514 | 1130 | 1700 | 1700 |
| Volume to Capacity | 1.21 | 0.02 | 0.11 | 0.25 |
| Queue Length 95th (ft) | 581 | 2 | 0 | 0 |
| Control Delay (s) | 135.4 | 8.3 | 0.0 | 0.0 |
| Lane LOS | F | A | | |
| Approach Delay (s) | 135.4 | 1.1 | | 0.0 |
| Approach LOS | F | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 66.7 | | |
| Intersection Capacity Utilization | 92.4% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 15 | 25 | 95 | 50 | 15 | 5 | 100 | 165 | 70 | 5 | 255 | 20 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 16 | 27 | 103 | 54 | 16 | 5 | 109 | 179 | 76 | 5 | 277 | 22 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 709 | 772 | 288 | 840 | 745 | 217 | 299 | | | 255 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 709 | 772 | 288 | 840 | 745 | 217 | 299 | | | 255 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 95 | 91 | 86 | 75 | 95 | 99 | 91 | | | 100 | | |
| cM capacity (veh/h) | 310 | 301 | 751 | 213 | 312 | 822 | 1262 | | | 1310 | | |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 16 | 130 | 54 | 22 | 109 | 255 | 5 | 299 |
| Volume Left | 16 | 0 | 54 | 0 | 109 | 0 | 5 | 0 |
| Volume Right | 0 | 103 | 0 | 5 | 0 | 76 | 0 | 22 |
| cSH | 310 | 572 | 213 | 369 | 1262 | 1700 | 1310 | 1700 |
| Volume to Capacity | 0.05 | 0.23 | 0.25 | 0.06 | 0.09 | 0.15 | 0.00 | 0.18 |
| Queue Length 95th (ft) | 4 | 22 | 24 | 5 | 7 | 0 | 0 | 0 |
| Control Delay (s) | 17.3 | 13.1 | 27.6 | 15.4 | 8.1 | 0.0 | 7.8 | 0.0 |
| Lane LOS | C | B | D | C | A | | A | |
| Approach Delay (s) | 13.6 | | 24.1 | | 2.4 | | 0.1 | |
| Approach LOS | B | | C | | | | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 5.3 | | | |
| Intersection Capacity Utilization | 39.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 25 | 5 | 150 | 20 | 5 | 240 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 27 | 5 | 163 | 22 | 5 | 261 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 446 | 174 | | | 185 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 446 | 174 | | | 185 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 95 | 99 | | | 100 | |
| cM capacity (veh/h) | 568 | 870 | | | 1390 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 33 | 185 | 266 |
| Volume Left | 27 | 0 | 5 |
| Volume Right | 5 | 22 | 0 |
| cSH | 603 | 1700 | 1390 |
| Volume to Capacity | 0.05 | 0.11 | 0.00 |
| Queue Length 95th (ft) | 4 | 0 | 0 |
| Control Delay (s) | 11.3 | 0.0 | 0.2 |
| Lane LOS | B | | A |
| Approach Delay (s) | 11.3 | 0.0 | 0.2 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | | 0.9 | |
| Intersection Capacity Utilization | | 26.6% | ICU Level of Service A |
| Analysis Period (min) | | 15 | |

# Appendix V
# Crash Data

**Incidents**

| MICROFILM | ROADNAME | LOCATION | DISTANCE | MONTH | YR | TIME | FIRST_HARM | TOTAL UNIT | TOTAL INJURY | TOTAL FATAL | COLLISION MANNER | DAYLIGHT | WEATHER | TRAFFIC WAY | RUN OFF ROAD | INJURY SEVERITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11252677 | Jackrabbit Trl | McDowell Rd | -97 | 2 | 2003 | 6:56:00 PM | Collision with other Motor Vehicle | 2 | 1 | 0 | Angle | Darkness | Clear | Roadway/Alley | 0 | Incapacitating Injury |
| 11261610 | Jackrabbit Trl | I 0010121c | 0 | 2 | 2003 | 12:37:00 PM | Collision with other Motor Vehicle | 2 | 2 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | Non-Incapacitating Injury |
| 11390281 | Jackrabbit Trl | Encanto Blvd | 3 | 3 | 2003 | 11:17:00 AM | Collision with Traffic Barricade | 1 | 2 | 0 | Single Vehicle | Daylight | Snow | Roadside | -1 | Possible Injury |
| 11391226 | Jackrabbit Trl | I 0010121c | 0 | 3 | 2003 | 12:25:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 11473346 | Jackrabbit Trl | I 0010121j | 76 | 4 | 2003 | 9:52:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Rear-End | Dawn or Dusk | Clear | Roadway/Alley | 0 | No Injury |
| 11912685 | Jackrabbit Trl | Monte Vista Rd | 182 | 8 | 2003 | 4:53:00 AM | Collision with other Motor Vehicle | 2 | 0 | 0 | Sideswipe (opposite) | Dawn or Dusk | Clear | Roadway/Alley | 0 | No Injury |
| 12492433 | Jackrabbit Trl | I 0010121c | 0 | 1 | 2004 | 4:00:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Left Turn | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 12962224 | Jackrabbit Trl | Lewis Av | -197 | 4 | 2004 | 7:09:00 AM | Collision with Other Fixed Object | 1 | 2 | 0 | Single Vehicle | Daylight | Clear | Roadside | -1 | Non-Incapacitating Injury |
| 13130734 | Jackrabbit Trl | I 0010121c | 3 | 5 | 2004 | 6:34:00 AM | Collision with other Motor Vehicle | 2 | 1 | 0 | Left Turn | Daylight | Clear | Roadway/Alley | 0 | Possible Injury |
| 13141551 | Jackrabbit Trl | McDowell Rd | 0 | 7 | 2004 | 4:44:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 13151203 | Jackrabbit Trl | McDowell Rd | -249 | 7 | 2004 | 1:34:00 PM | Collision with other Motor Vehicle | 2 | 2 | 0 | Left Turn | Daylight | Clear | Roadway/Alley | 0 | Possible Injury |
| 13271638 | Jackrabbit Trl | I 0010121a | -98 | 8 | 2004 | 8:03:00 PM | Collision with other Motor Vehicle | 2 | 1 | 0 | Left Turn | Darkness | Clear | Roadway/Alley | 0 | Possible Injury |
| 13292315 | Jackrabbit Trl | I 0010121c | 0 | 8 | 2004 | 11:14:00 AM | Collision with other Motor Vehicle | 2 | 2 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | Possible Injury |
| 13550914 | Jackrabbit Trl | McDowell Rd | 0 | 10 | 2004 | 12:26:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 13651419 | 195th Av | McDowell Rd | 0 | 11 | 2004 | 2:46:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 13771046 | Jackrabbit Trl | I 0010121c | 0 | 12 | 2004 | 11:40:00 AM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 14622863 | 195th Av | Monte Vista Rd | 0 | 7 | 2005 | 5:00:00 PM | Collision with Utility Pole | 1 | 1 | 0 | Single Vehicle | Daylight | Clear | Roadside | -1 | Incapacitating Injury |
| 14700783 | Jackrabbit Trl | McDowell Rd | 0 | 7 | 2005 | 4:43:00 AM | Collision with other Motor Vehicle | 2 | 0 | 0 | U-Turn | Dawn or Dusk | Clear | Roadway/Alley | -1 | No Injury |
| 14722396 | Jackrabbit Trl | I 0010121a | 0 | 8 | 2005 | 5:13:00 AM | Collision with other Motor Vehicle | 2 | 1 | 0 | Left Turn | Dawn or Dusk | Clear | Roadway/Alley | 0 | Non-Incapacitating Injury |
| 15002298 | 195th Av | McDowell Rd | 0 | 10 | 2005 | 3:36:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 15010264 | Jackrabbit Trl | I 0010121j | 0 | 8 | 2005 | 8:00:00 PM | Collision with other Motor Vehicle | 2 | 2 | 0 | Rear-End | Darkness | Clear | Roadway/Alley | 0 | Incapacitating Injury |
| 15250897 | Jackrabbit Trl | I 0010121c | 0 | 12 | 2005 | 6:46:00 AM | Collision with other Motor Vehicle | 2 | 0 | 0 | Angle | Dawn or Dusk | Clear | Roadway/Alley | 0 | No Injury |
| 11222845 | Jackrabbit Trl | Indian School Rd | 402 | 2 | 2003 | 9:54:00 PM | All Other Non-Collision | 1 | 0 | 0 | Single Vehicle | Darkness | Snow | Roadway/Alley | 0 | No Injury |
| 11361270 | Jackrabbit Trl | Flower St | 0 | 2 | 2003 | 9:50:00 PM | Collision with other Motor Vehicle | 2 | 2 | 1 | Head-On | Darkness | Clear | Roadway/Alley | 0 | Fatal |
| 12591772 | Jackrabbit Trl | Medlock Dr | 1319 | 2 | 2004 | 7:41:00 PM | Overturning | 1 | 1 | 0 | Single Vehicle | Daylight | Clear | Roadside | -1 | Incapacitating Injury |
| 13662197 | Jackrabbit Trl | Osborn Rd | -39 | 11 | 2004 | 5:35:00 AM | Overturning | 1 | 0 | 0 | Single Vehicle | Darkness | Clear | Roadside | -1 | No Injury |
| 14382193 | Jackrabbit Trl | Indian School Rd | -30 | 5 | 2005 | 4:00:00 PM | Collision with other Motor Vehicle | 2 | 0 | 0 | Rear-End | Daylight | Clear | Roadway/Alley | 0 | No Injury |
| 14511498 | 195th Av | Indian School Rd | 0 | 6 | 2005 | 2:45:00 PM | Collision with other Motor Vehicle | 2 | 1 | 0 | Angle | Daylight | Clear | Roadway/Alley | 0 | Possible Injury |
| 14612076 | Jackrabbit Trl | Indian School Rd | 0 | 7 | 2005 | 10:59:00 AM | Collision with other Motor Vehicle | 2 | 0 | 0 | Left Turn | Daylight | Clear | Roadway/Alley | 0 | No Injury |

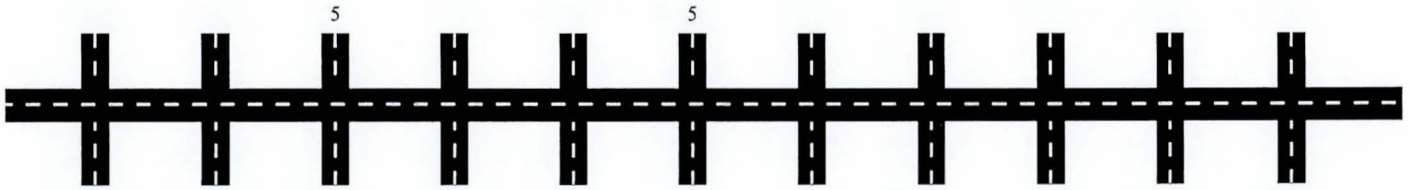
# Accidents by Collision Manner - 2003 through 2005

## Road: Jackrabbit Trl

I 0010 | I 0010121c | I 0010121j | Monte Vista Rd | Lewis Av | Thomas Rd

I 0010121a | I 0010121e | Mcdowell Rd | Encanto Blvd | Virginia Av | Total

### Angle

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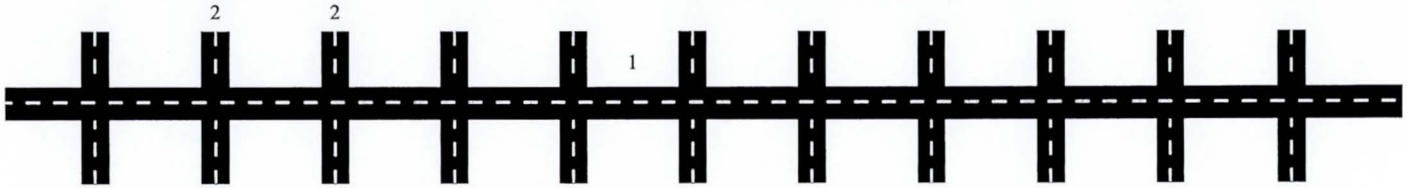
### Left Turn



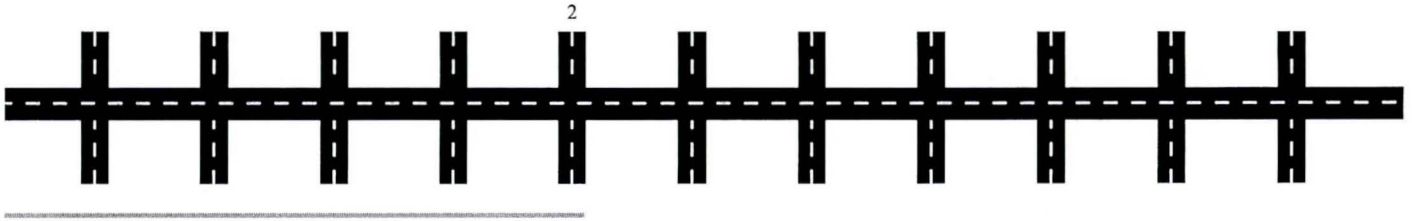

5

# Road: Jackrabbit Trl

I 0010 | I 0010121c | I 0010121j | Monte Vista Rd | Lewis Av | Thomas Rd

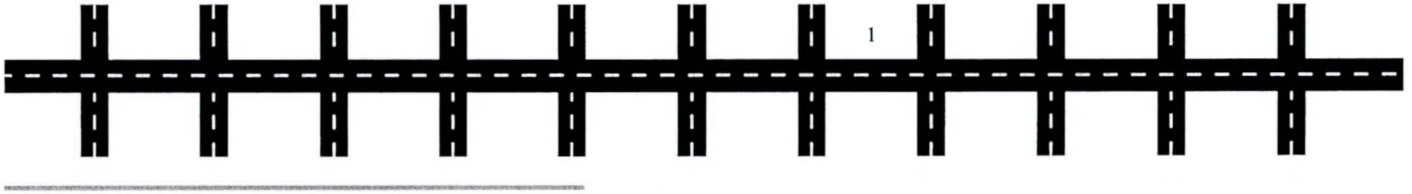
I 0010121a | I 0010121e | Mcdowell Rd | Encanto Blvd | Virginia Av | Total

## Rear-End



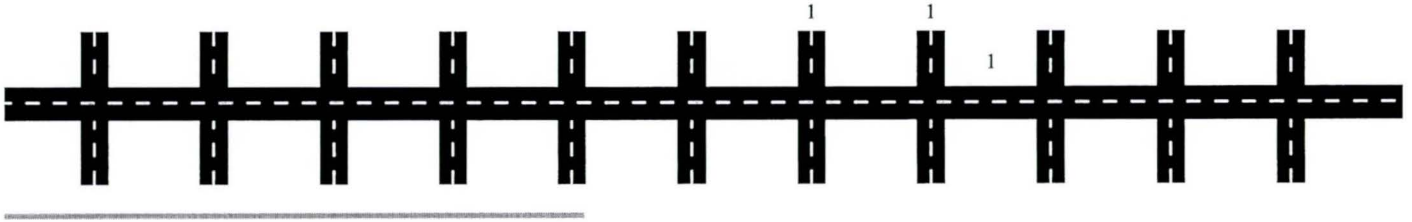

2

## Sideswipe (opposite)




1

## Single Vehicle




3

## Road: Jackrabbit Trl

| I 0010 | | I 0010121c | | I 0010121j | Monte Vista Rd | Lewis Av | | Thomas Rd | |
|---|---|---|---|---|---|---|---|---|---|
| | I 0010121a | | I 0010121e | | Mcdowell Rd | | Encanto Blvd | | Virginia Av | Total |
| **U-Turn** | | | | | | | | | | |
| | | | | | 1 | | | | | |
| | | | | | | | | | | 1 |
| | 2 | 7 | | 2 | 1 | 6 | 1 | 1 | 1 | 1 | 22 |

**Intersection Method:** Distance From Intersection **Intersection Radius:** 100 feet

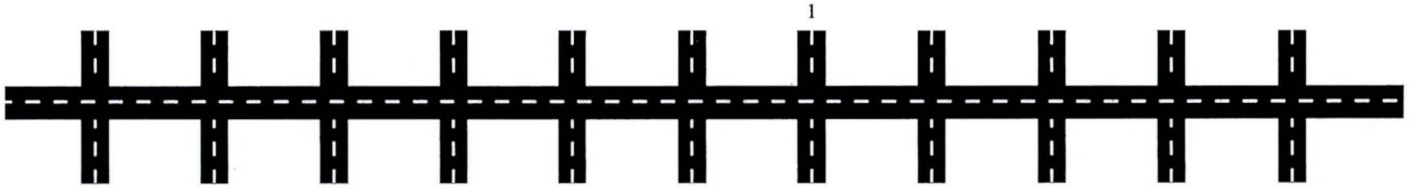
**Distance From First Intersection:** -100 feet **Distance From Second Intersection:** 1000 feet

# Accidents by Collision Manner - 2003 through 2005

## Road: Jackrabbit Trl

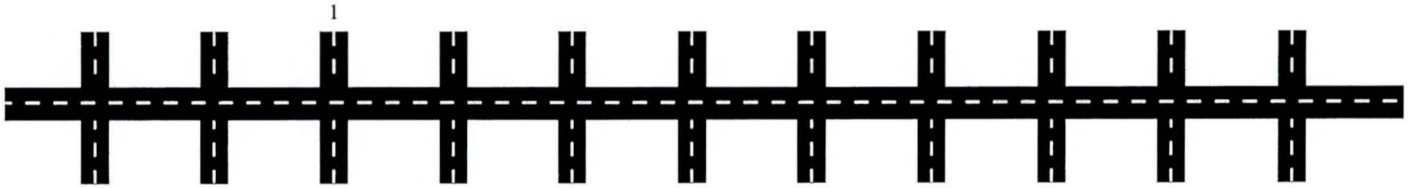
Catalina Dr | Earll Dr | Flower St | Osborn Rd | Whitton Av | Clarendon Av | Indian School Rd | Sells Rd | Minnezona Av | Meadowbrook Av | Medlock Dr | Total

### Angle




1

### Head-On



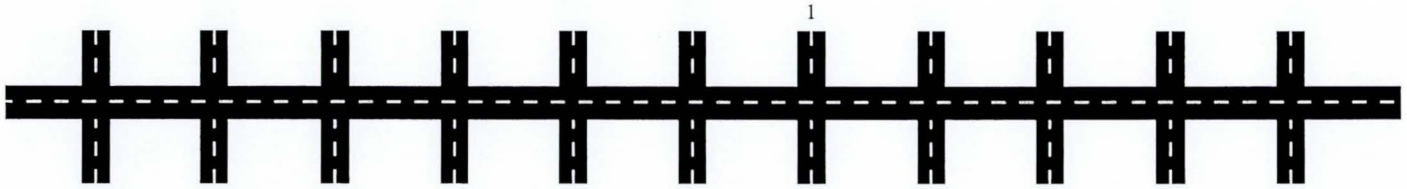

1

## Road: Jackrabbit Trl

Catalina Dr | Flower St | Whitton Av | Indian School Rd | Minnezona Av | Medlock Dr

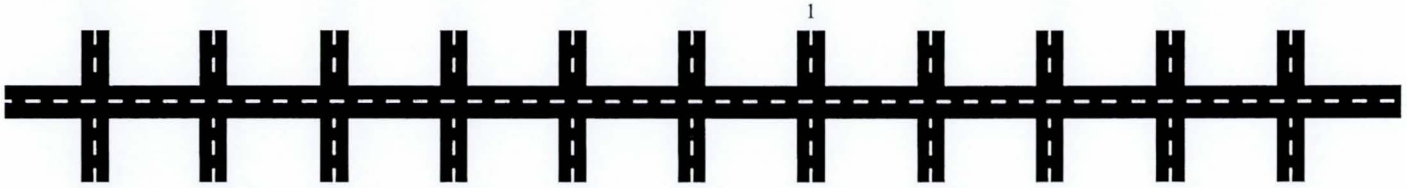
Earll Dr | Osborn Rd | Clarendon Av | Sells Rd | Meadowbrook Av | Total

### Left Turn




1

### Rear-End




1

### Single Vehicle

3

## Road: Jackrabbit Trl

| Catalina Dr | Flower St | Whitton Av | Indian School Rd | Minnezona Av | Medlock Dr | |
|---|---|---|---|---|---|---|
| Earll Dr | Osborn Rd | Clarendon Av | Sells Rd | Meadowbrook Av | | Total |
| 1 | 1 | 3 | 1 | 1 | | 7 |

**Intersection Method:** Distance From Intersection **Intersection Radius:** 100 feet

**Distance From First Intersection:** -1000 feet **Distance From Second Intersection:** 5000 feet

# Accidents by Injury Severity - 2003 through 2005

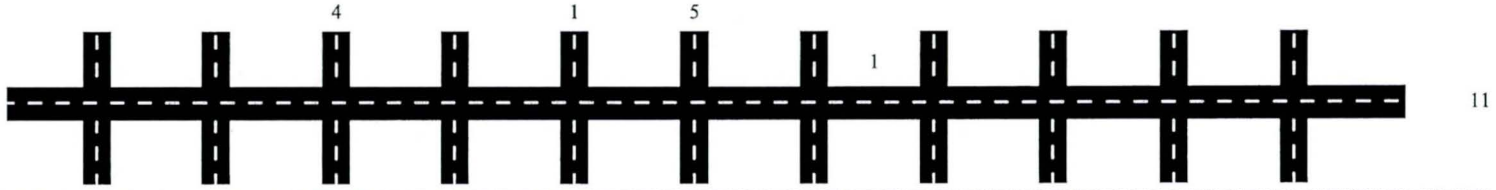
## Road: Jackrabbit Trl

| I 0010 | I 0010121a | I 0010121c | I 0010121e | I 0010121j | Mcdowell Rd | Monte Vista Rd | Encanto Blvd | Lewis Av | Virginia Av | Thomas Rd | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Incapacitating Injury** | | | | | | | | | | | |
| | | | | 1 | 1 | 1 | | | | | 3 |
| **Non-Incapacitating Injury** | | | | | | | | | | | |
| | 1 | 1 | | | | | 1 | | | | 3 |
| **Possible Injury** | | | | | | | | | | | |
| | 1 | 2 | | 1 | | 1 | | | | | 5 |

## Road: Jackrabbit Trl

I 0010 | I 0010121a | I 0010121c | I 0010121e | I 0010121j | Mcdowell Rd | Monte Vista Rd | Encanto Blvd | Lewis Av | Virginia Av | Thomas Rd | Total

**No Injury**




**Intersection Method:** Distance From Intersection **Intersection Radius:** 100 feet

**Distance From First Intersection:** -100 feet **Distance From Last Intersection:** 1000 feet

# Accidents by Injury Severity - 2003 through 2005

## Road: Jackrabbit Trl

Catalina Dr | Earll Dr | Flower St | Osborn Rd | Whitton Av | Clarendon Av | Indian School Rd | Sells Rd | Minnezona Av | Meadowbrook Av | Medlock Dr | Total

### Fatal

1

### Incapacitating Injury

1

### Possible Injury

1

## Road: Jackrabbit Trl

| Catalina Dr | Earll Dr | Flower St | Osborn Rd | Whitton Av | Clarendon Av | Indian School Rd | Sells Rd | Minnezona Av | Meadowbrook Av | Medlock Dr | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **No Injury** | | | | | | | | | | | |
| | | 1 | 1 | | | 2 | 1 | | | | 4 |
| | | 1 | 1 | | | 3 | 1 | | | 1 | 7 |

**Intersection Method:** Distance From Intersection **Intersection Radius:** 100 feet

**Distance From First Intersection:** -1000 feet **Distance From Last Intersection:** 5000 feet

# Appendix VI
# ADOT Priority Weeds List

# ARIZONA DEPARTMENT OF TRANSPORTATION

## Natural Resources Management Section
## Priority Weeds List

- *Acroptilon repens* (L.) DC. -- Russian knapweed
- *Ailanthus altissima* -- Tree of heaven
- *Alhagi pseudalhagi* (Bieb.) Desv. -- Camelthorn
- *Asphodelus fistulosus* -- Onion weed
- *Brassica tournifortii* -- Sahara mustard
- *Carduus nutans* -- Musk thistle
- *Centaurea diffusa* L. -- Diffuse knapweed
- *Centaurea maculosa* L. -- Spotted knapweed
- *Centaurea melitensis* -- Malta starthistle
- *Centaurea solsitialis* -- Yellow starthistle
- *Cirsium vulgare* -- Bull thistle
- *Eragrostis curvula* -- Weeping lovegrass
- *Euryops subcarnosa* -- Sweet resinbush
- *Heterotheca subaxilaris* -- Camphorweed
- *Kochia scoparia* -- Kochia
- *Linaria genistifolia* var. -- dalmatica - Dalmation toadflax
- *Melilotus officinalis* -- Yellow sweet clover
- *Onopordum acanthium* L. -- Scotch thistle
- *Parkinsonia aculeata* -- Mexican palo verde
- *Pennisetum ciliare* -- Buffelgrass
- *Pennisetum setaceum* -- Fountaingrass
- *Salsola kali* – Tumbleweed
- *Salvia aethiopis* -- Mediterranean sage
- *Sorghum halepense* -- Johnson grass
- *Tamarix spp* -- Salt Cedar
- *Verbascum thapsus* -- Mullein

For additional information, please visit: http://www.usgs.nau.edu/swepic

Some of the plants listed are prohibited from entry into Arizona unless accompanied by the appropriate federal and state permits. Additional weed species are regulated by the federal government and may not be transported without specific permit. Please visit the Arizona Noxious Weeds List at the Arizona Department of Argriculture: http://azda.gov/PSD/quarantine5.htm. Arizona is also under the jurisdiction of the federal noxious weed list http://www.aphis.usda.gov/ppq/weeds.

# Appendix VII
# AzDA Noxious Weeds List

# ARIZONA DEPARTMENT OF AGRICULTURE

# PROHIBITED, REGULATED AND RESTRICTED NOXIOUS WEEDS

## PROHIBITED:

The following noxious weeds (includes, plants, stolons, rhizomes, cuttings and seed) are prohibited from entry into the state.

Acroptilon repens (L.) DC. -- Russian knapweed,
Aegilops cylindrica Host. -- Jointed goatgrass,
Alhagi pseudalhagi (Bieb.) Desv. -- Camelthorn,
Alternanthera philoxeroides (Mart.) Griseb. -- Alligator weed,
Cardaria pubescens (C.A. Mey) Jarmolenko -- Hairy whitetop,
Cardaria chalepensis (L.) Hand-Muzz -- Lens podded hoary cress,
Cardaria draba (L.) Desv. -- Globed-podded hoary cress (Whitetop),
Carduus acanthoides L. -- Plumeless thistle,
Cenchrus echinatus L. -- Southern sandbur,
Cenchrus incertus M.A. Curtis -- Field sandbur,
Centaurea calcitrapa L. -- Purple starthistle,
Centaurea iberica Trev. ex Spreng. -- Iberian starthistle,
Centaurea squarrosa Willd. -- Squarrose knapweed,
Centaurea sulphurea L. -- Sicilian starthistle,
Centaurea solstitialis L. -- Yellow starthistle (St. Barnaby's thistle),
Centaurea diffusa L. -- Diffuse knapweed,
Centaurea maculosa L. -- Spotted knapweed,
Chondrilla juncea L. -- Rush skeletonweed,
Cirsium arvense L. Scop. -- Canada thistle,
Convolvulus arvensis L. -- Field bindweed,
Coronopus squamatus (Forskal) Ascherson -- Creeping wartcress (Coronopus),
Cucumis melo L. var. Dudaim Naudin -- Dudaim melon (Queen Anne's melon),
Cuscuta spp. -- Dodder,
Drymaria arenarioides H.B.K. -- Alfombrilla (Lightningweed),
Eichhornia crassipes (Mart.) Solms – Floating water hyacinth,
Eichhornia azurea (SW) Kunth. -- Anchored water hyacinth,
Elytrigia repens (L.) Nevski -- Quackgrass,
Euphorbia esula L. -- Leafy spurge,
Halogeton glomeratus (M. Bieb.) C.A. Mey -- Halogeton,
Helianthus ciliaris DC. -- Texas blueweed,
Hydrilla verticillata Royale -- Hydrilla (Florida-elodea),
Ipomoea spp. -- Morning glory. All species except Ipomoea carnea, Mexican bush morning glory; Ipomoea triloba, three-lobed morning glory (which is considered a restricted pest); and Ipomoea aborescens, morning glory tree,
Ipomoea triloba L. – Three-lobed morning glory,
Isatis tinctoria L. – Dyers woad,
Linaria genistifolia var. dalmatica – Dalmation toadflax,
Lythrum salicaria L. – Purple loosestrife,
Medicago polymorpha L. -- Burclover,
Nassella trichotoma(Nees.) Hack. -- Serrated tussock,
Onopordum acanthium L. -- Scotch thistle,
Orobanche ramosa L. -- Branched broomrape,
Panicum repens L. -- Torpedo grass,
Peganum harmala L. -- African rue (Syrian rue),
Pennisetum ciliare (L.) Link – buffelgrass,
Portulaca oleracea L. -- Common purslane,
Rorippa austriaca (Crantz.) Bess. -- Austrian fieldcress,
Salvinia molesta – Giant salvina

Senecio jacobaea L. -- Tansy ragwort,
Solanum carolinense L. -- Carolina horsenettle,
Sonchus arvensis L. -- Perennial sowthistle,
Solanum viarum Dunal -- Tropical Soda Apple,
Stipa brachychaeta Godr. -- Puna grass,
Striga spp. -- Witchweed,
Trapa natans L. -- Water-chestnut,
Tribulus terrestris L. -- Puncturevine.

## REGULATED:

The following noxious weeds are regulated (includes plants, stolons, rhizomes, cuttings and seed) and if found within the state may be controlled or quarantined to prevent further infestation or contamination.

Cenchrus echinatus L. -- Southern sandbur,
Cenchrus incertus M.A. Curtis -- Field sandbur,
Convolvulus arvensis L. -- Field bindweed,
Eichhornia crassipes (Mart.) Solms -- Floating water hyacinth,
Medicago polymorpha L. -- Burclover,
Pennisetum ciliare (L.) Link – buffelgrass,
Portulaca oleracea L. -- Common purslane,
Salvinia molesta– Giant Salvinia *
Tribulus terrestris L. -- Puncturevine.

* Added by Director's Administrative Order DAO 99-03 on 8/25/99

## RESTRICTED:

The following noxious weeds are restricted (includes plants, stolons, rhizomes, cuttings and seed) and if found within the state shall be quarantined to prevent further infestation or contamination.

Acroptilon repens (L.) DC. -- Russian knapweed,
Aegilops cylindrica Host. -- Jointed goatgrass,
Alhagi pseudalhagi Bieb.) Desv. -- Camelthorn,
Cardaria draba (L.) Desv. -- Globed-podded hoary cress (Whitetop),
Centaurea diffusa L. -- Diffuse knapweed,
Centaurea maculosa L. -- Spotted knapweed,
Centaurea solstitialis L. -- Yellow starthistle (St. Barnaby's thistle),
Cuscuta spp. -- Dodder,
Eichhornia crassipes (Mart.) Solms – Floating water hyacinth
Elytrigia repens (L.) Nevski -- Quackgrass,
Euryops sunbcarnosus subsp. vulgaris – Sweet resinbush,
Halogeton glomeratus (M. Bieb.) C.A. Mey -- Halogeton,
Helianthus ciliaris DC. -- Texas blueweed,
Ipomoea triloba L. -- Three-lobed morning glory,
Linaria genistifolia var. dalmatica -- Dalmation toadflax,
Onopordum acanthium L. -- Scotch thistle.

## The following commodities are hosts or carriers of the prohibited, regulated or restricted plants:

1. All plants other than those categorized as a regulated or restricted pest;
2. Forage, straw and feed grains;
3. Live and dead flower arrangements
4. Ornamental displays; and
5. Any appliance, construction or dredging equipment, boat, boat trailer or related equipment, or any other vehicle with soil attached or carrying plant debris.

Additional weed species are regulated by the federal government and may not be transported without specific permit. The federal noxious weed list may be obtained at the following web site http://www.aphis.usda.gov/ppq/weeds/

# Appendix VIII
# AZGFD

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
2221 WEST GREENWAY ROAD
PHOENIX, AZ 85023-4399
(602) 942-3000 • AZGFD.GOV

GOVERNOR
JANET NAPOLITANO
COMMISSIONERS
CHAIRMAN, MICHAEL M. GOUGHTLY, FLAGSTAFF
WILLIAM H. MCLEAN, GOLD CANYON
BOB HERNBRODE, TUCSON
JENNIFER L. MARTIN, PHOENIX
JOE MELTON, YUMA
DIRECTOR
DUANE L. SHROUFE
DEPUTY DIRECTOR
STEVE K. FERRELL

RECEIVED
FEB 21 2007

February 16, 2007

Mr. Michael Zorba
A Dye Design Inc.
99 E. Virginia, #175
Phoenix, Arizona 85004

Re: Jackrabbit Trail from Interstate 10 North to Bell Road

Dear Mr. Zorba:

The Arizona Game and Fish Department (Department) has reviewed the letter dated February 05, 2007, regarding the proposed Jackrabbit Trail Access Control and Corridor Improvement Study, in Maricopa County, Arizona. The Department understands the proposed project may include widening of the roadway up to 6 lanes (divided), intersection and traffic light upgrades, culverts, bridge widening or new bridge construction. Per your request, the Department's Heritage Data Management System (HDMS) has been accessed and current records show that the special status species listed on the attachment have been documented as occurring in the project vicinity (3-mile buffer). In addition, this project does not occur within Designated Critical Habitat. The Department is also enclosing handling guidelines for the Sonoran Desert tortoise, and the Western Burrowing Owl. We offer the following comments for your consideration.

The Department's HDMS data are not intended to include potential distribution of special status species. Arizona is large and diverse with plants, animals, and environmental conditions that are ever changing. Consequently, many areas may contain species that biologists do not know about or species previously noted in a particular area may no longer occur there. Not all of Arizona has been surveyed for special status species, and surveys that have been conducted have varied greatly in scope and intensity.

The Department understands Arizona's increasing human population has necessitated more roads, wider highways, and urban development across the state. However, the associated infrastructure can create barriers and prevent the movement of terrestrial and aquatic animals. These barriers isolate wildlife and their habitat, increase the likelihood of species mortality, and restrict the ability of animals to move between important undeveloped regions of the state.

The Department has undertaken a joint effort with the Arizona Department of Transportation (ADOT), the Federal Highway Administration (FHWA) and the U.S. Forest Service (USFS), along with representatives from other agencies and non-profit groups to identify wildlife linkages across the state that need to be maintained to ensure wildlife permeability. The Department is

interested in maintaining wildlife connectivity in this region and in the broader context of future development and in relation to the roadway itself. Please contact Ray Schweinsburg, Research, Arizona Game and Fish Department at (602) 789-3251, for further information pertaining to current research, and the Department's interest in maintaining wildlife connectivity and permeability and specific design recommendations (culverts, etc.). Although specific areas for wildlife connectivity within the project study area have not yet been identified, it's important to note that large and small washes are considered important connectivity areas. The riparian areas along washes are critical to biological community diversity and provide linear corridors important to migratory species. The Department has created guidelines for culverts and bridges; these can be found at http://www.azgfd.gov/hgis/.

The Department appreciates the opportunity to provide preliminary comments on this project. In addition, the Department would like to continue this coordinated effort along with the opportunity to provide an evaluation of impacts to wildlife or wildlife habitats associated with project development when more information becomes available. If you have any questions regarding this letter, please contact me at (602) 789-3486.

Sincerely,

Alicia Sweezer
Project Evaluation Specialist

cc: Russ Haughey, Habitat Program Manager, Region VI, AGFD
AGFD#- M07-02091505

**Special Status Species within 3 Miles of Jackrabbit Corridor Study: T1.0N, R2.0W, SEC 2-5; T2.0N, R2.0W, SEC 1-5, 8-12, 13-17, 20-24, 25-29, 32-36; T3.0N, R2.0W, SEC 1-5, 8-12, 13-17, 20-24, 25-29, 32-36.**

| NAME | COMMON NAME | ESA | USFS | BLM | STATE |
|---|---|---|---|---|---|
| *Athene cunicularia hypugaea* | Western Burrowing Owl | SC | | S | |
| *Gopherus agassizii (Sonoran Population)* | Sonoran Desert Tortoise | SC | | | WSC |
| *Opuntia engelmannii var. flavispina* | | | | | SR |
| *Rana yavapaiensis* | Lowland Leopard Frog | SC | S | | WSC |

No Critical Habitats in project area. AGFD # M07-02091505. Jackrabbit Corridor Study.

Arizona Game and Fish Department. Heritage Data Management System, February 16, 2006. Project Evaluation Program.

# GUIDELINES FOR HANDLING SONORAN DESERT TORTOISES ENCOUNTERED ON DEVELOPMENT PROJECTS

Arizona Game and Fish Department

Revised January 17, 1997

The Arizona Game and Fish Department (Department) has developed the following guidelines to reduce potential impacts to desert tortoises, and to promote the continued existence of tortoises throughout the state. These guidelines apply to short-term and/or small-scale projects, depending on the number of affected tortoises and specific type of project.

Desert tortoises of the Sonoran population are those occurring south and east of the Colorado River. Tortoises encountered in the open should be moved out of harm's way to adjacent appropriate habitat. If an occupied burrow is determined to be in jeopardy of destruction, the tortoise should be relocated to the nearest appropriate alternate burrow or other appropriate shelter, as determined by a qualified biologist. Tortoises should be moved less than 48 hours in advance of the habitat disturbance so they do not return to the area in the interim. Tortoises should be moved quickly, kept in an upright position at all times and placed in the shade. Separate disposable gloves should be worn for each tortoise handled to avoid potential transfer of disease between tortoises. Tortoises must not be moved if the ambient air temperature exceeds 105 degrees Fahrenheit unless an alternate burrow is available or the tortoise is in imminent danger.

A tortoise may be moved up to two miles, but no further than necessary from its original location. If a release site, or alternate burrow, is unavailable within this distance, and ambient air temperature exceeds 105 degrees Fahrenheit, the Department should be contacted to place the tortoise into a Department-regulated desert tortoise adoption program. Tortoises salvaged from projects which result in substantial permanent habitat loss (e.g. housing and highway projects), or those requiring removal during long-term (longer than one week) construction projects, will also be placed in desert tortoise adoption programs. *Managers of projects likely to affect desert tortoises should obtain a scientific collecting permit from the Department to facilitate temporary possession of tortoises.* Likewise, if large numbers of tortoises (>5) are expected to be displaced by a project, the project manager should contact the Department for guidance and/or assistance.

Please keep in mind the following points:

- These guidelines do not apply to the Mohave population of desert tortoises (north and west of the Colorado River). Mohave desert tortoises are specifically protected under the Endangered Species Act, as administered by the U.S. Fish and Wildlife Service.

- These guidelines are subject to revision at the discretion of the Department. We recommend that the Department be contacted during the planning stages of any project that may affect desert tortoises.

- Take, possession, or harassment of wild desert tortoises is prohibited by state law. Unless specifically authorized by the Department, or as noted above, project personnel should avoid disturbing any tortoise.

RAC:NLO:rc

# Appendix IX
# USFWS Maricopa TE Species

# Maricopa County

| COMMON NAME | SCIENTIFIC NAME | STATUS | DESCRIPTION | COUNTY | ELEVATION | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| Arizona cliffrose | *Purshia subintegra* | Endangered | Evergreen shrub of the rose family (Roseaceae). Bark pale shreddy. Young twigs with dense hairs. Leaves 1-5 lobes and edges curl downward (revolute). Flowers: 5 white or yellow petals <0.5 inches long. | Graham, Maricopa, Mohave, Yavapai | < 4,000 ft | Characteristic white soils of tertiary limestone lakebed deposits. | White soils of teritiary limestone lakebed deposits can be seen from a distance. |
| Bald eagle | *Haliaeetus leucocephalus* | Threatened | Large, adults have white head and tail. Height 28-38 inches; wingspan 66-96 inches. Dark with varying degrees of mottled brown plumage. Feet bare of feathers. | Apache, Cochise, Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma | Varies | Large trees or cliffs near water (reservoirs, rivers, and streams) with abundant prey. | Some birds are nesting residents while a larger number winters along rivers and reservoirs. An estimated 200 to 300 birds winter in Arizona. Once endangered (32 FR 4001, 03-11-1967; 43 FR 6233, 02-14-78) because of reproductive failures from pesticide poisoning and loss of habitat, this species was down listed to threatened on August 11, 1995. Illegal shooting, disturbance, and loss of habitat continues to be a problem. Species has been proposed for delisting (64 FR 36454) but still receives full protection under the ESA. |
| California Brown pelican | *Pelecanus occidentalis californicus* | Endangered | Large dark gray-brown water bird with a pouch underneath long bill and webbed feet. Adults have a white head and neck, brownish black breast, and silver gray upper parts. | Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma | Varies | Coastal land and islands; species found around many Arizona lakes and rivers. | Subspecies is found on Pacific Coast and is endangered due to pesticides. It is an uncommon transient in Arizona on many Arizona lakes and rivers. Individuals wander up from Mexico in summer and fall. No breeding records in Arizona. |
| Desert pupfish | *Cyprinodon macularius* | Endangered | Small (2 inches) smoothly rounded body shape with narrow vertical bars on the sides. Breeding males blue on head and sides with yellow on tail. Females and juveniles tan to olive colored back and silvery sides. | Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai | < 5,000 ft | Shallow springs, small streams, and marshes. Tolerates saline and warm water. | Critical habitat includes Quitobaquito Springs, Pima County, portions of San Felipe Creek, Carrizo Wash, and Fish Creek Wash, Imperial County, California. Two subspeices are recognized: Desert Pupfish (C.m.macularis) and Quitobaquito Pupfish (C.m.eremus). |

| COMMON NAME | SCIENTIFIC NAME | STATUS | DESCRIPTION | COUNTY | ELEVATION | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| Gila chub | *Gila intermedia* | Endangered | Deep compressed body, flat head. Dark olive-gray color above, silver sides. Endemic to Gila River Basin. | Cochise, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yavapai | 2,000 - 5,500 ft | Pools, springs, cienegas, and streams. | Found on multiple private lands, including the Nature Conservancy, the Audubon Society, and others. Also occurs on Federal and state lands and in Sonora, Mexico. Critical habitat occurs in Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz and Yavapai counties. |
| Gila topminnow | *Poeciliopsis occidentalis occidentalis* | Endangered | Small (2 inches), guppy-like, live bearing, lacks dark spots on its fins. Breeding males are jet black with yellow fins. | Gila, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai | < 4,500 ft | Small streams, springs, and cienegas vegetated shallows. | Species historically occurred in backwaters of large rivers but is currently isolated to small streams and springs. |
| Lesser long-nosed bat | *Leptonycteris curasoae yerbabuenae* | Endangered | Elongated muzzle, small leaf nose, and long tongue. Yellowish brown or gray above and cinnamon brown below. Tail minute and appears to be lacking. Easily disturbed. | Cochise, Gila, Graham, Greenlee, Pima, Pinal, Maricopa, Santa Cruz | < 6000 ft | Desert scrub habitat with agave and columnar cacti present as food plants. | Day roosts in caves and abandoned tunnels. Forages at night on nectar, pollen, and fruit of paniculate agaves and columnar cacti. This species is migratory and is present in Arizona usually from April to September and south of the border the remainder of the year. |
| Mexican spotted owl | *Strix occidentalis lucida* | Threatened | Medium sized with dark eyes and no ear tufts. Brownish and heavily spotted with white or beige. | Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai | 4100-9000 ft | Nests in canyons and dense forests with multi-layered foliage structure. | Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type, in canyons, and use variety of habitats for foraging. Sites with cool microclimates appear to be of importance or are preferred. Critical habitat was finalized on August 31, 2004 (69 FR 53182). Critical habitat in Arizona occurs in Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz, and Yavapai counties. |
| Razorback sucker | *Xyrauchen texanus* | Endangered | Large, up to 3 feet long and up to 6 lbs, high sharp-edged keel-like hump behind the head. Head flattened on top. Olive-brown above to yellowish below. | Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Pinal, Yavapai, Yuma | < 6000 ft | Riverine and lacustrine areas, generally not in fast moving water and may use backwaters. | Species is also found in Horseshoe reservoir (Maricopa County). Critical habitat includes the 100-year floodplain of the river through the Grand Canyon from confluence with Paria River to Hoover Dam; Hoover Dam to Davis Dam; Parker Dam to Imperial Dam. Also Gila River from Arizon/New Mexico border to Coolidge Dam; and Salt River from Hwy 60/SR77 Bridge to Roosevelt Dam; Verde River from FS boundary to Horseshoe Lake. |

| COMMON NAME | SCIENTIFIC NAME | STATUS | DESCRIPTION | COUNTY | ELEVATION | HABITAT | COMMENTS |
|---|---|---|---|---|---|---|---|
| Sonoran pronghorn | *Antilocapra americana sonoriensis* | Endangered | Buff on back and white below, hoofed with slightly curved black horns having a single prong. Smallest and palest of the pronghorn subspecies | Maricopa, Pima, Yuma | 500 - 2,000 ft | Broad intermountain alluvial valleys with creosote-bursage and palo verde-mixed cacti associations. | Typically, bajadas are used as fawning areas and sandy dune areas provide food seasonally. Historical range was probably larger than exists today. This subspecies also occurs in Mexico. |
| Southwestern willow flycatcher | *Empidonax traillii extimus* | Endangered | Small passerine (about 6 inches) grayish-green back and wings, whitish throat, light olive-gray breast and pale yellowish belly. Two wingbars visible. Eye-ring faint or absent. | Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma | <8500 ft | Cottonwood/willow and tamarisk vegetation communities along rivers and streams. | Migratory riparian-obligate species that occupies breeding habitat from late April to September. Distribution within its range is restricted to riparian corridors. Difficult to distinguish from other members of the Empidonax complex by sight alone. Training seminar required for those conducting flycatcher surveys. Critical habitat was finalized on October 19, 2005 (50 CFR 60886) and can be viewed at http://arizonaes.fws.gov. In Arizona there are critical habitat segments in Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, and Yavapai counties. |
| Yuma clapper rail | *Rallus longirostris yumanensis* | Endangered | Water bird with long legs and short tail. Long, slender decurved bill. Mottled brown or gray on its rump. Flanks and undersides are dark gray with narrow vertical stripes producing a barring effect. | Gila, La Paz, Maricopa, Mohave, Pinal, Yuma | < 4,500 ft | Fresh water and brackish marshes. | Species is associated with dense emergent riparian vegetation. Requires wet substrate (mudflat, sandbar) with dense herbaceous or woody vegetation for nesting and foraging. Channelization and marsh destruction are primary sources of habitat loss. |
| Yellow-billed cuckoo | *Coccyzus americanus* | Candidate | Medium-sized bird with a slender, long-tailed profile, slightly down-curved bill, which is blue-black with yellow on the lower half of the bill. Plumage is grayish-brown above and white below, with rufous primary flight feathers. | Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma | < 6,500 ft | Large blocks of riparain woodlands (cottonwood, willow, or tamarisk galleries). | Listing was found warranted, but precluded as a distinct vertebrate population segment in the western U.S. on July 25, 2001. This finding indicates that the Service has sufficient information to list the bird, but other, higher priority listing actions prevent the Service from addressing the listing of the cuckoo at this time. |

# Appendix X
# Correspondence from Arizona State Museum

Arizona State Museum
P.O. Box 210026
Tucson, AZ 85721-0026
(520) 621-6302
FAX: (520) 621-2976

THE UNIVERSITY OF
ARIZONA®
TUCSON ARIZONA

# Archaeological Records Check Form

E-mail **Request Received:** 3/23/2007 **Check Completed:** 3/30/2007

**Requester Name and Title:** Mr. Michael Zorba, Environmental Scientist
**Company:** A Dye Design, Inc.
**Address:** 99 E. Virginia, #175
**City, State, Zip Code:** Phoenix, Arizona 85004
**Phone/Fax/or E-mail:** (602) 234-2111

**Project Name and/or Number**
Jackrabbit Trail Access Control Study

**Project Description**
Phase 1 Environmental Assessment

**Project Area Location:** N of I-10, W of Sarival Road, S of Union Hills Drive, E of Tuthill Road, Maricopa County, Arizona.

**Legal Description:** portions of S32-36, T4N, R2W; portions of S1-5, 8-17, 20-29, and 32-36, T3N, R2W; portions of S1-5, 8-17, 20-29, and 32-36, T2N, R2W; and portions of S1-5, T1N, R2W, G&SRB&M, Maricopa County, Arizona.

**Search Results:** According to a records search of the Arizona archaeological site files, the project area has been archaeologically surveyed with a patchwork of cultural resources inventories. Not one section within the proposed area of potential effects (APE) (see the legal description previously described) has been completely scrutinized with a Class III cultural resources investigation. At least 40 archaeological inventories have been completed across the APE between 1977 and 2004. At least 40 cultural resources have been identified within the APE as well. At least one other site has been identified within a mile of the APE. A map of the project area is enclosed with this letter. If using a higher resolution, the Maricopa County GIS Portal depicts aerial orthophotographs of the proposed APE, showing native vegetation growing upon unmodified ground surfaces within some of the sections being considered for use in this project. Other portions are completely developed. Some cultural resources are linear sites that transverse numerous township sections.

**Sites in Project Area:** At least 40.

**Recommendations:** As a result of a file search of Arizona State Museum's (ASM) archaeological site records, ASM staff found 40 sites and a patchwork of archaeological surveys across the broad APE. Consequently, ASM staff recommends that the final right of way for the proposed Jackrabbit Trail Access Control and Corridor Improvements be subjected to an intensive Class III cultural resources inventory in advance of any ground-disturbing activities.

The ASM maintains a list of qualified archaeological consultants on its website at http://www.statemuseum.arizona.edu/crservices/permits/permittees.shtml. A professional consultant will perform the necessary records checks once A Dye Design has a refined/narrowed right of way for the proposed project. From the current records check, it is obvious that a professional archaeologist will have to be consulted as, no matter which path Jackrabbit Trail is projected, it will proceed across archaeologically unexamined land and possibly may impact a cultural resource. An archaeological contractor needs to be consulted for this project to help plan a construction model with the fewest and least harmful impacts to cultural resources.

If you have any additional questions, comments, or concerns about this records check, please contact me at the letterhead address above or at the phone number or E-mail address that follows. Thank you for your interest in preserving and protecting Arizona's cultural heritage.

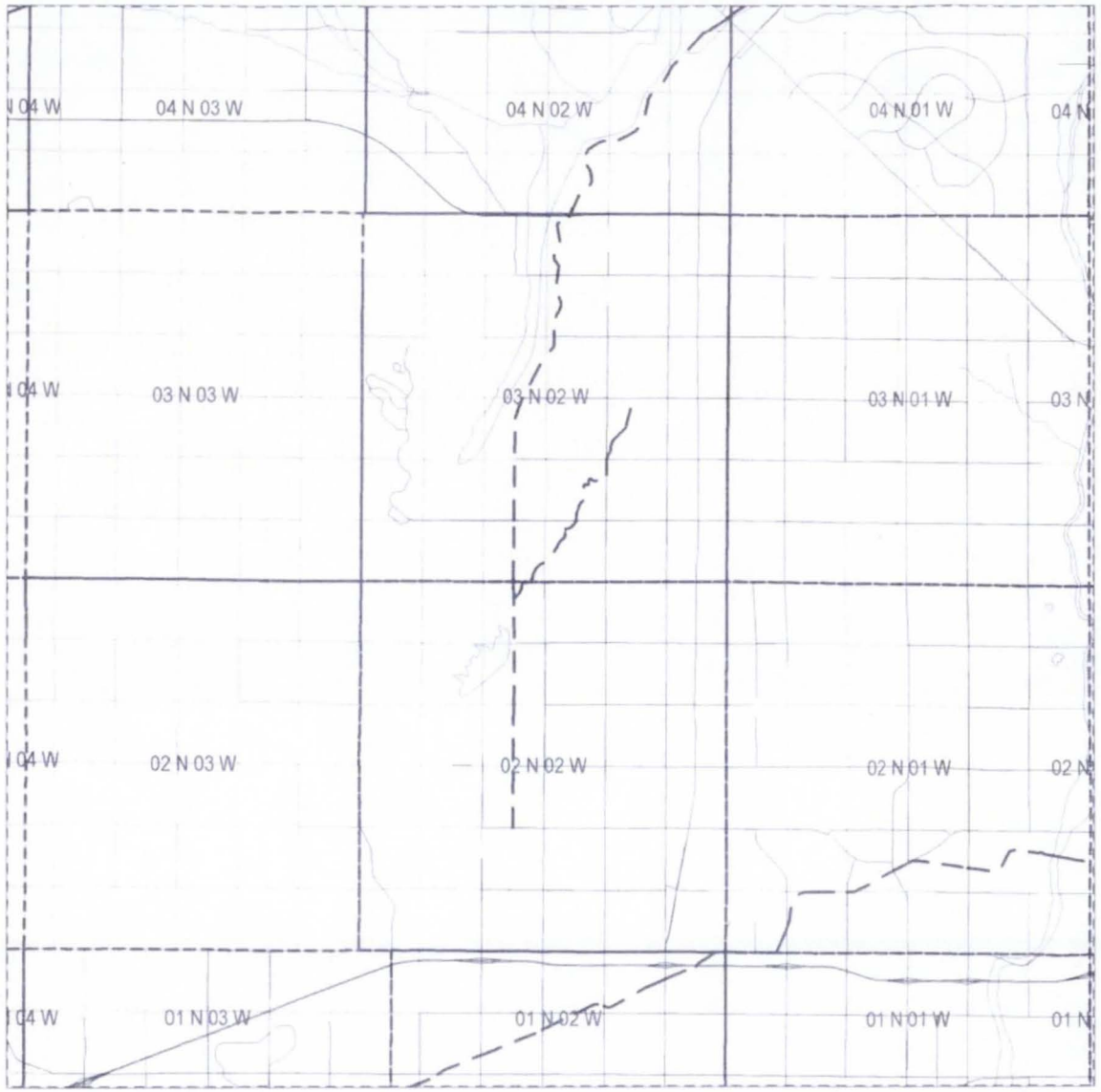
Sincerely,

Nancy E Pearson

Nancy E. Pearson
Assistant Permits Administrator
Arizona State Museum
(520) 621-2096 Phone and Fax
nepearso@email.arizona.edu

You may wish to contact Brian Kenny,
Maricopa County Archaeologist at (602) 506-8082.

# AdyeDESIGN: JackrabbitMARICOPA




SCALE 1 : 170,802

2 0 2 4 6

MILES

N

http://www.maricopa.gov/Assessor/GIS/Maps/assessor.mwf

Friday, March 30, 2007 1:47 PM

# Appendix XI
# FRS 3 Detailed Report

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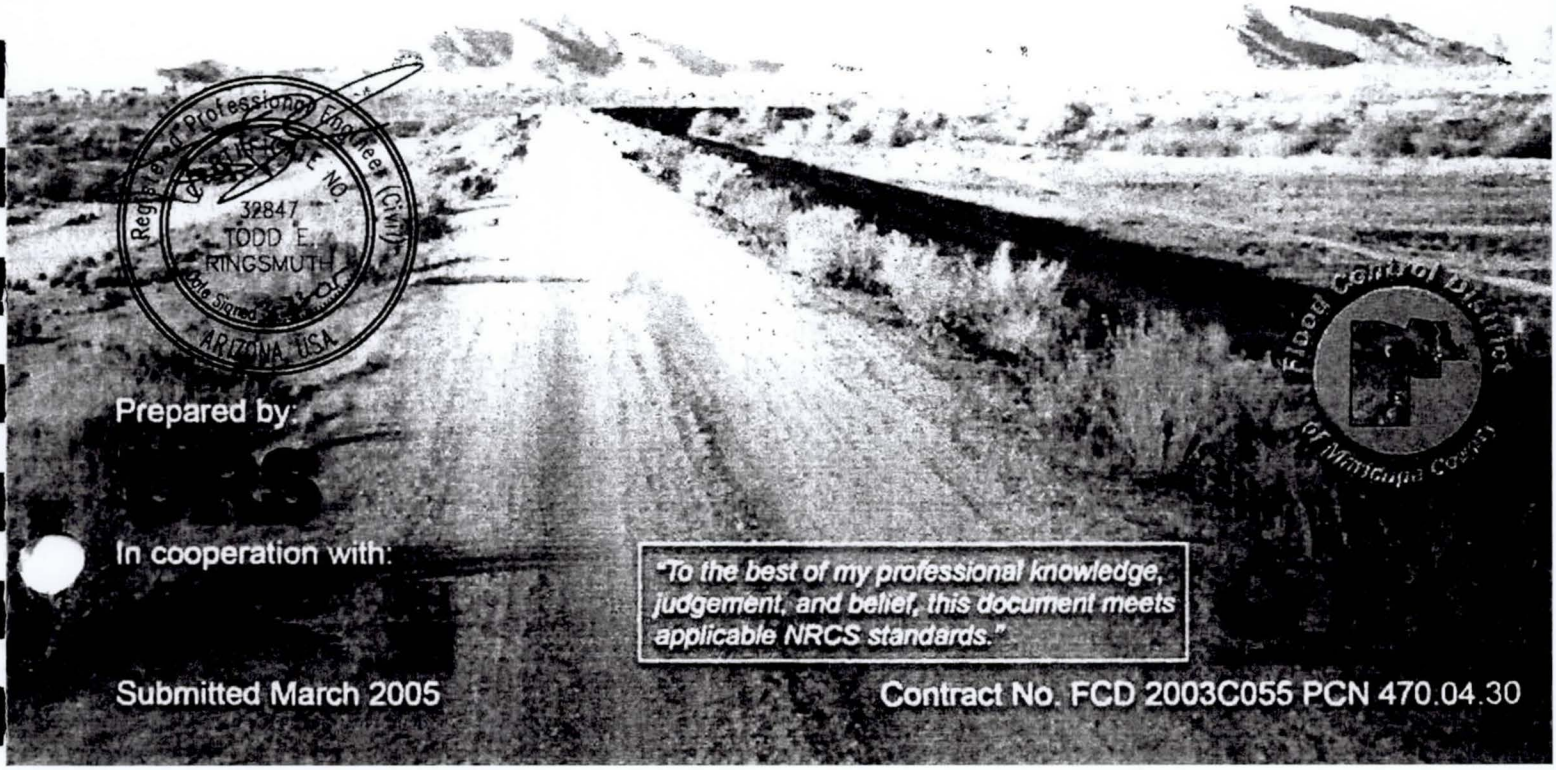
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

WHITE TANKS FRS #3

# DESIGN REPORT VOLUME 1

## WHITE TANKS FRS NO. 3 REMEDIATION PROJECT - PHASE 1




Prepared by:

In cooperation with:

*"To the best of my professional knowledge, judgement, and belief, this document meets applicable NRCS standards."*

Submitted March 2005

Contract No. FCD 2003C055 PCN 470.04.30

# 3.0 FACILITY DESCRIPTION

White Tanks FRS No. 3 was constructed in 1954 by the NRCS to protect farmland and irrigation facilities from runoff collected off the White Tank Mountains. The dam is located on alluvial fan deposits east of the White Tank Mountains, approximately 20 miles west of Phoenix. The northern end of the embankment is approximately 1 mile south of the intersection of Northern Avenue and the Beardsley Canal in Maricopa County. The dam is a homogeneous earth embankment. The dam is currently maintained and operated by the District.

## 3.1 ORIGINAL CONFIGURATION

### 3.1.1 Embankment

The embankment is approximately 7,700 feet long, and was constructed using soils borrowed from the reservoir area. At its maximum section, the embankment is approximately 27 feet high. The crest width varies between 10 and 11 feet. The upstream and downstream faces are sloped at 2.5:1 (horizontal to vertical) and 2:1, respectively. The embankment soils are predominantly clayey sands with lesser amounts of sandy clays present.

#### *3.1.1.1 Foundation Preparation*

The foundation footprint was cleared and grubbed. There appears to have been no attempt to overexcavate and recompact the near-surface soils, or to remove granular channels that intersected the alignment. The soils underlying the embankment are predominantly silty and clayey sands with lesser amounts of sandy clays, and occasional layers of relatively clean sands.

### 3.1.2 Watershed

White Tanks FRS No. 3 was originally designed to impound runoff from a drainage area of approximately 24 square miles. A Phase II flood study performed by the District (1984) noted that portions of the watershed had been removed due to the breaching of training dikes and diversion channels north of Northern Avenue and the redirection of flows from the Caterpillar Test grounds. These changes reduced the tributary area of the structure to approximately 20.5 square miles, a reduction of 3.5 square miles (District 1984). The elevation of the watershed ranges from over 4,000 ft (NGCD 29) to the outlet works inlet elevation of approximately 1,188 ft (NGVD 29).

### 3.1.3 Flood Pool

The capacity of the reservoir at the time of construction was 2,655 ac-ft below the emergency spillway crest. The emergency spillway crest elevation was 1,210.0 feet (NGVD 29), or 1,211.87 feet (NAVD 88). The surface area of the flood pool at the emergency spillway crest was 280.6 acres.

### 3.1.4 North Inlet Channel

The north inlet channel runs for approximately 2 miles from north of Olive Avenue to the north end of the White Tanks FRS #3 embankment. The channel crosses Olive and Northern Avenues. The channel runs parallel to and on the west side of the Beardsley Canal. It is not clear when the channel was constructed. However, the channel serves to capture areas of the watershed that were included in the original design. The channel significantly increases the size of the watershed contained by White Tanks FRS #3: with the channel, the watershed is 20.49 square miles; without the channel, the watershed would be 9.72 square miles (NRCS 1998).

Historic subsidence has occurred at the north end of the dam, and along the North Inlet Channel, requiring that the dam be extended north to contain the design flood pool. The dam extension will be parallel to the channel and potentially require erosion protection along the upstream face of the dam.

### 3.1.5 Sediment Pool

The NRCS design incorporated sediment pool of 500 acre-feet (NRCS 1996) corresponding to a 100-year design life. The 500 ac-ft allowance for sediment accumulation corresponds to an elevation of 1,197 ft (NGVD 29), or a maximum of 21 ft above the current lowest surface behind the dam, as estimated from the elevation-capacity relationship shown on Figure 4-1. The upstream inverts of the existing North, Central, and South gated outlet pipes are at elevations of 1,190, 1,188, and 1,190 ft, respectively (NGVD 29).

### 3.1.6 Emergency Spillway

The emergency spillway is cut into natural ground at the south abutment of the dam. ADWR's inspection report (2002) indicates that the emergency spillway crest elevation is approximately 1,211.92 feet (NGVD 29). The unlined spillway was constructed 800-ft-wide for a design peak flow of 11,750 cubic feet per second (cfs).

Dames & Moore (1998) estimated that during discharge under the full probable maximum flood (PMF) conditions, the flow depths and velocities at the crest of the spillway were 4 feet and 6 feet per second (fps), respectively. Based on these depths and flow velocities, Dames & Moore (1998) predicted scour and head cutting at the emergency spillway.

### 3.1.7 Bethany Home Road Dike

The Bethany Home Road Dike begins at the south edge of the emergency spillway and runs eastward to the Beardsley Canal. The purpose of the dike appears to be for directing flows that pass through the spillway to a siphon crossing in the canal. The existing dike is located mostly off District property. Review of the design drawings suggests that the dike was intended to be constructed at heights ranging from 5 to 7 feet above the existing grade.

### 3.1.8 Principal Outlets

Three corrugated metal pipes (CMPs) serve as the principal outlets for the dam. These CMPs are located at stations 29+00, 46+00, and 63+80 (based on existing stationing). The two pipes at stations 29+00 and 46+00 are 48 inches in diameter, while the third outlet is 24 inches in diameter. One of the 48-inch outlets is connected to the Beardsley Canal via a concrete-lined channel, while the other two outlets discharge at the downstream toe of the dam. All three outlet pipes are provided with steel seepage collars. According to construction drawings, the collars are spaced at 20-ft centers and extend for a distance equal to the diameter of the pipe beyond the outlets. The outlets are provided with a protective asbestos-containing coating on inside and outside. The three outlets are regulated by control gates at the upstream end. The gates are manually operated and are fitted with stems, which extend to the crest of the embankment.

## 3.2 DAM MODIFICATIONS

Since the original construction of White Tanks FRS No. 3, the facility has been modified to address dam safety issues that have arisen, and to improve the overall performance and safety of the dam. These modifications are discussed below. Additional details of previous modifications to the dam are provided in Section 4.0.

### 3.2.1 Central Filter and Outlet Drains

The NRCS designed and installed a granular filter along the centerline of the embankment to mitigate the impacts of the transverse cracking. The filter was installed for the entire length of the embankment and is approximately 30 inches wide. The center filter trench was backfilled with a medium to coarse sand. The filter does not extend to the foundation soils. However, it

appears that outlets were installed at all locations where the transverse cracks extended below the bottom of the center filter trench. A total of about 68 outlets were installed. Each outlet includes a 2-foot by 2-foot section of open graded gravel to increase flow capacity. Additional information concerning the construction of the central filter and outlet drains is provided in Section 4.2 of this report.

### 3.2.2 Diaphragm Filters

In 2000, the District retained URS to design interim dam safety measures, which included installation of diaphragm filters around the three existing outlet pipes. The existing outlet pipes consist of corrugated metal pipes (CMPs) The diaphragm filters were designed and constructed in general accordance with NRCS guidelines. Details of the project are provided in a design report prepared by URS (2001).

All three conduits were extended. The extensions were encased in concrete to the spring-line. Sand diaphragms were constructed directly downstream of the embankment. The sand diaphragms were weighted down with buttress fill in order to counter potential hydrostatic pressures caused by a full reservoir. The design also included the design and installation of trash racks on the upstream end of the conduits.

### 3.2.3 Emergency Spillway Modifications

In 2000, the District retained URS to design interim dam safety measures, which included excavating a notch through the emergency spillway and provided erosion protection along the downstream toe of the embankment. The notch was excavated 75 feet wide and lowered the spillway crest to an elevation of 1,207.0 ft (NGVD 29). The notch elevation was set at this elevation to provide a minimum of 4 feet of dry freeboard below the lowest dam crest elevation of 1,211.39 ft (NGVD 29). The design notch elevation accounted for future potential lowering of the dam crest of 0.266 ft due to subsidence. The material excavated from the notch was used to construct the buttresses placed over the diaphragm filters at the outlets.

## 3.3 INTERIM OPERATIONAL PLAN

The District implemented an interim operational plan for the outlets following modification of the dam under the Interim Dam Safety Project (See Section 4.3). These modifications included constructing a notch lowering the emergency spillway crest, installing diaphragm filters near the downstream end of the outlets, and installing trash racks over the upstream end of the outlets. ADWR required that an interim operational plan be developed for permit approval of the interim design.

The Interim Operational Plan developed by the District details operational requirements that must be undertaken by the District during a reservoir-filling event (FCDMC 2001). The Plan included the following requirements:

- The District's Operation & Maintenance Division (O&M) is notified by the District's ALERT staff and sent to the dam for around-the-clock watch when the reservoir is 25 percent full. The percentage full is measured as a volume of storage available below the emergency spillway crest. The Maricopa County Department of Emergency Management is also notified.
- When the volume reaches 50 percent full (a reading of 12 ft on the staff gage) the gate on the 48-inch Central Outlet is to be opened.

# Appendix XII
# Peak Flows

**ANDES**

*ENGINEERING*

# CALCULATION SHEET

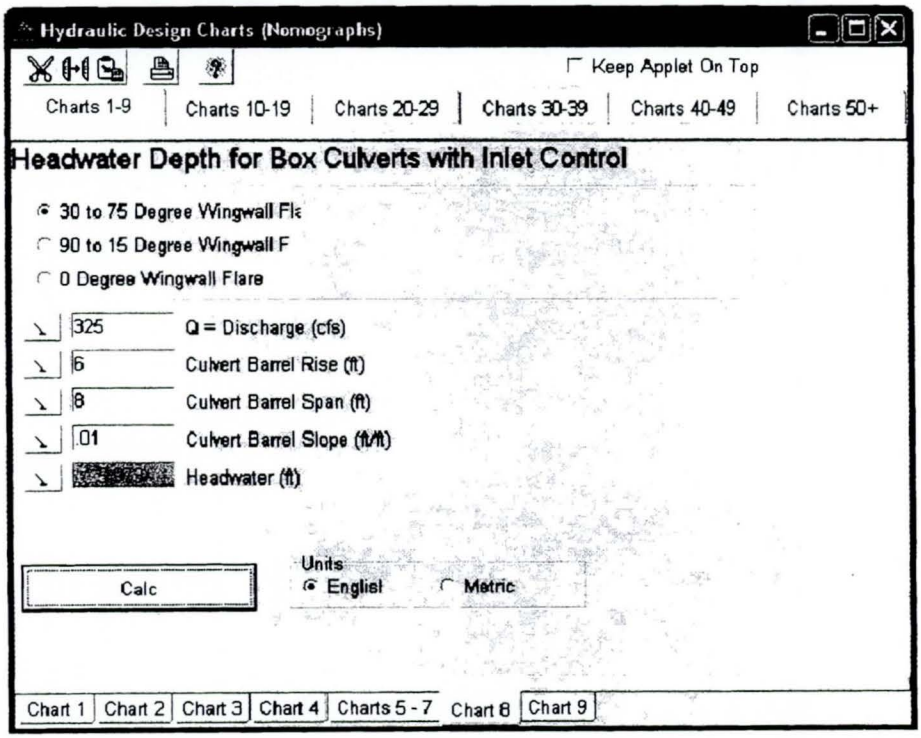
| | | | |
|---|---|---|---|
| **Project Name:** | Jackrabbit Trail CIS | **Number:** | 0606D |
| **By:** | K. Ponnapalli | **Date:** | 08/17/07 |
| **Checked:** | JDG | **Date:** | 8/17/07 |

INLET CONTROL CAPACITY FOR 8'x6' CBC WITH HEADWATER AT BOX CROWN

Headwater is 6', at box crown.

Used HY8 Calculator to determine flow capacity for headwater equal to 6'.

Capacity is 325 cfs for single barrel.




*11811 North Tatum Boulevard, Suite3090 Phoenix, Arizona 85028*
*Phone: (602)374-7119 · Fax: (602)374-7699*

Andes Engineering

**JACKRABBIT TRAIL CIS**
**I-10 to Bell Road**
**Peak Flows at Preferred Alternative Crossings**

**4/18/2008**

| Basin | | | | Crossing ID | Sub Basin | | | | Upstream CP | | | Flows at Crossing (cfs) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Area (sq.mi) | Flows (cfs) 100-Year | Flows (cfs) 50-Year | | Area (sq.ft.) | Area (sq.mi) | Flows (cfs) 100-Year | Flows (cfs) 50-Year | ID | Flows (cfs) 100-Year | Flows (cfs) 50-Year | 100-Year | 50-Year |
| 16 | 1.13 | 1,206 | 1,011 | 1 | 5008110 | 0.18 | 192 | 161 | | | | 363 | 303 |
| 17 | 1.07 | 1,168 | 973 | | 4369003 | 0.16 | 171 | 143 | | | | | |
| | | | | 2 | | | | | CP15 | 2,629 | 2,155 | 2,629 | 2,155 |
| 13 | 1.30 | 1,223 | 1,096 | 3 | 19383160 | 0.70 | 654 | 586 | | | | 654 | 586 |
| 13 | 1.30 | 1,223 | 1,096 | 4 | 3202494 | 0.11 | 108 | 97 | RCP11 | 1,315 | 1,078 | 1,423 | 1,175 |
| 12 | 1.38 | 1,230 | 1,024 | 5 | 20317006 | 0.73 | 650 | 541 | | | | 650 | 541 |
| 12 | 1.38 | 1,230 | 1,024 | 6 | 4675565 | 0.17 | 149 | 124 | | | | 149 | 124 |
| 10 | 2.02 | 1,362 | 1,122 | 7 | 3988763 | 0.14 | 96 | 79 | | | | 96 | 79 |
| 10 | 2.02 | 1,362 | 1,122 | 8 | 5281969 | 0.19 | 128 | 105 | | | | 128 | 105 |
| 10 | 2.02 | 1,362 | 1,122 | 9 | 14293364 | 0.51 | 346 | 285 | CP 9 | 3,963 | 3,156 | 4,309 | 3,441 |
| 2 | 1.82 | 1,339 | 1,114 | 10 | 11969832 | 0.43 | 316 | 263 | | | | 316 | 263 |
| 2 | 1.82 | 1,339 | 1,114 | 11 | 19164188 | 0.69 | 506 | 421 | | | | 506 | 421 |
| 2 | 1.82 | 1,339 | 1,114 | 12 | 26730793 | 0.96 | 705 | 587 | RCP1 | 1,386 | 1,090 | 2,091 | 1,677 |
| WT130 | 2.57 | 1,936 | 1,643 | 13 | 1375250 | 0.05 | 37 | 32 | | | | 37 | 32 |
| WT130 | 2.57 | 1,936 | 1,643 | 14 | 2138043 | 0.08 | 58 | 49 | | | | 58 | 49 |
| WT130 | 2.57 | 1,936 | 1,643 | 15 | 3185292 | 0.11 | 86 | 73 | | | | 86 | 73 |
| WT130 | 2.57 | 1,936 | 1,643 | 16 | 51984086 | 1.86 | 1,405 | 1,192 | | | | 1,405 | 1,192 |
| WT130 | 2.57 | 1,936 | 1,643 | 17 | 9822376 | 0.35 | 265 | 225 | RWT140 | 1,981 | 1,682 | 2,246 | 1,907 |
| WT120 | 2.80 | 1,889 | 1,597 | 18 | 30176143 | 1.08 | 729 | 617 | RWT160 | 409 | 321 | 1,138 | 938 |
| WT120 | 2.80 | 1,889 | 1,597 | 19 | 5185305 | 0.19 | 125 | 106 | | | | 125 | 106 |
| WT120 | 2.80 | 1,889 | 1,597 | 20 | 15501770 | 0.56 | 375 | 317 | | | | 375 | 317 |
| WT120 | 2.80 | 1,889 | 1,597 | 21 | 8351620 | 0.30 | 202 | 171 | CWT150 | 3,269 | 2,460 | 3,471 | 2,631 |
| WT110 | 2.90 | 2,523 | 2,139 | 22 | 6448150 | 0.23 | 202 | 171 | | | | 202 | 171 |
| WT110 | 2.90 | 2,523 | 2,139 | 23 | 11670410 | 0.42 | 365 | 309 | | | | 365 | 309 |
| WT110 | 2.90 | 2,523 | 2,139 | 24 | 46095934 | 1.65 | 1,441 | 1,221 | | | | 1,441 | 1,221 |
| WT100 | 3.85 | 3,045 | 2,597 | 25 | 5417275 | 0.19 | 154 | 131 | | | | 154 | 131 |
| WT100 | 3.85 | 3,045 | 2,597 | 26 | 32036902 | 1.15 | 909 | 776 | | | | 909 | 776 |
| WT100 | 3.85 | 3,045 | 2,597 | 27 | 8249170 | 0.30 | 234 | 200 | | | | 234 | 200 |
| WT100 | 3.85 | 3,045 | 2,597 | 28 | 43296166 | 1.55 | 1,229 | 1,048 | | | | 1,229 | 1,048 |

100-Year data taken from HEC-1 models developed for the White Tanks ADMPU and Wittmann ADMSU. Models were modified for the 50-Year event by plugging precipitation data for the 50-Year storm to the original model.

# Appendix XIII
# Modified Hydrologic Models

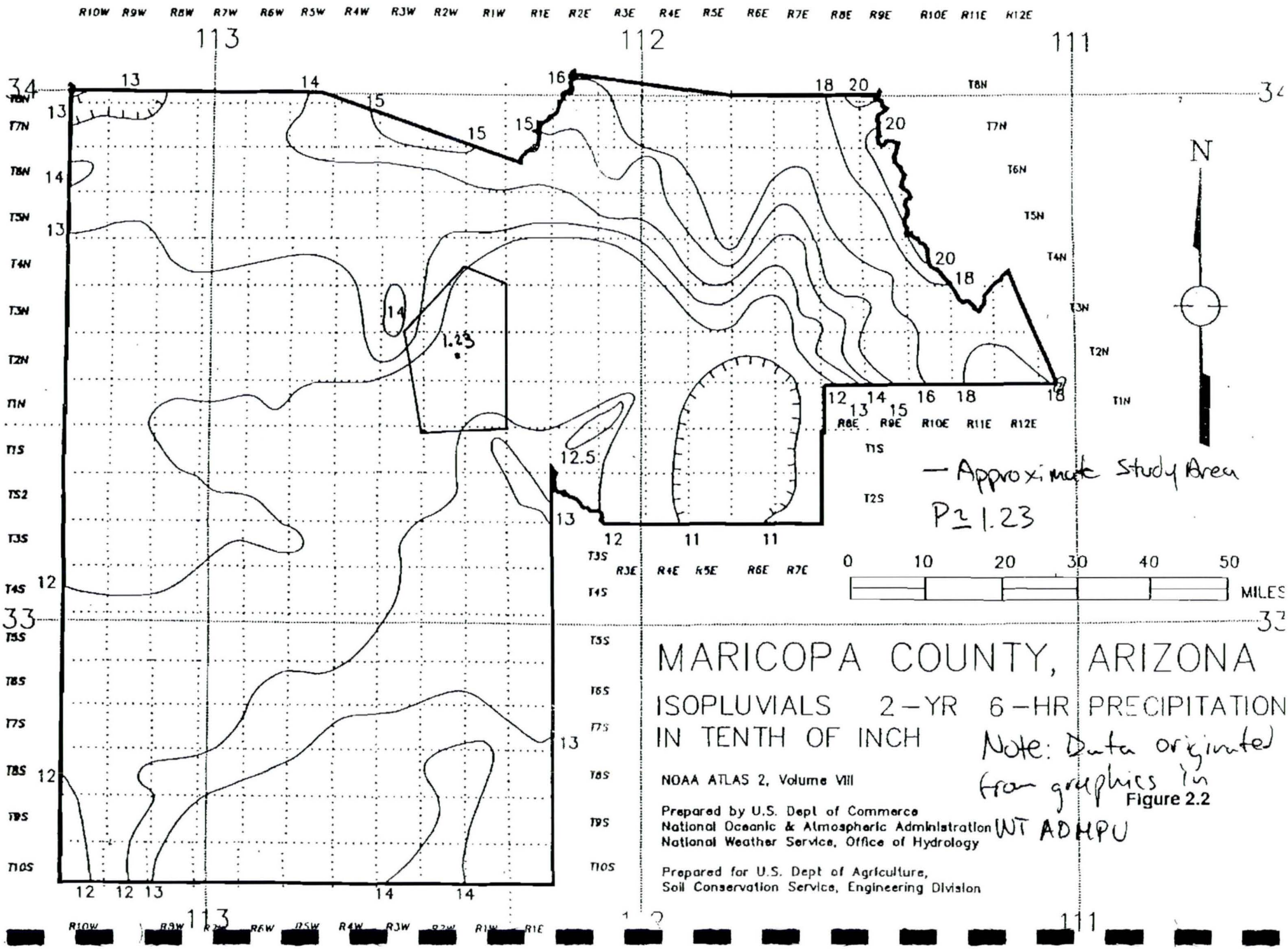
# Rainfall Data



Primary Zone Number: 7 Latitude: 0.0 Elevation: 0

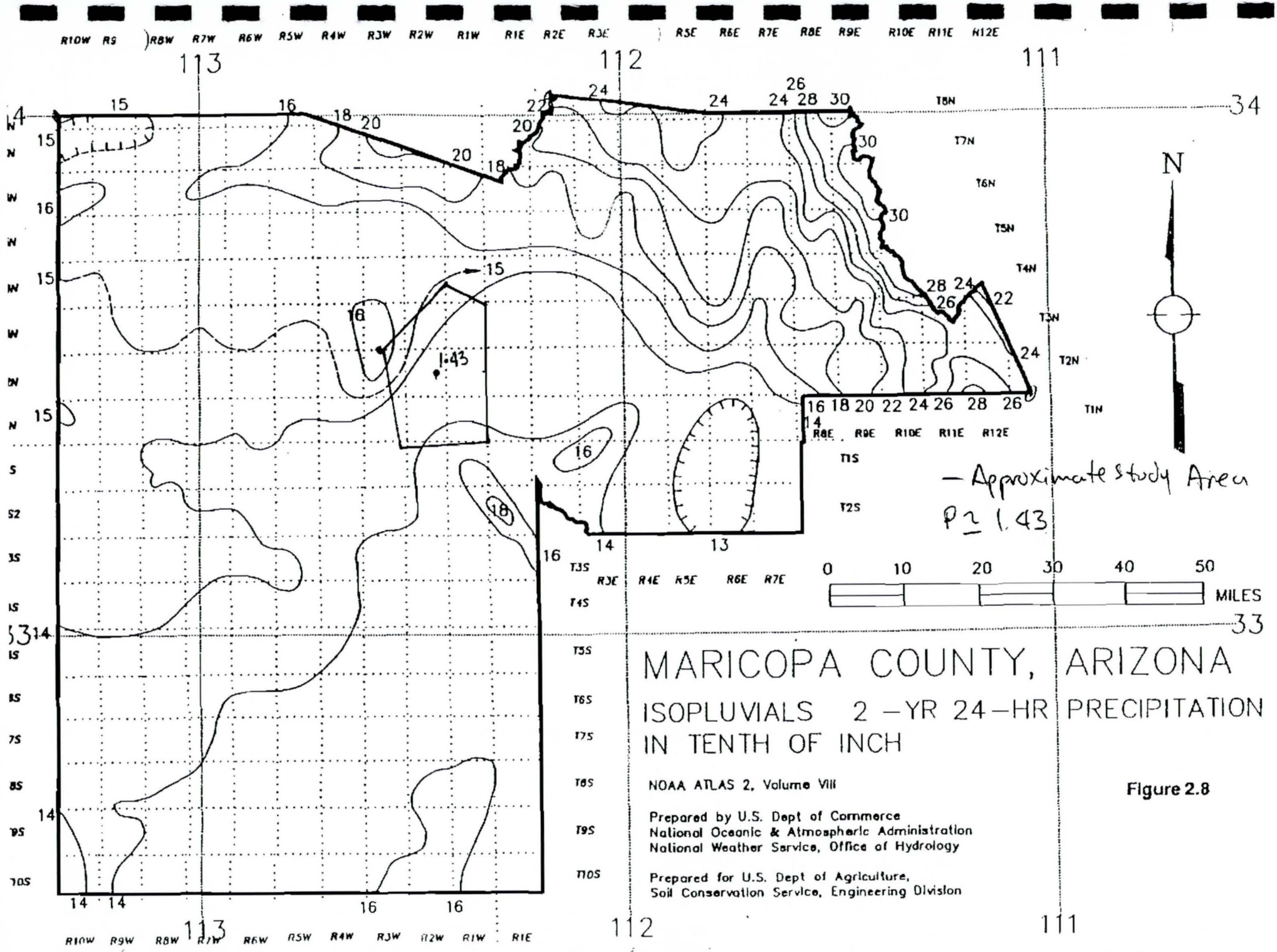
Short Duration Zone Number: 8 Longitude: 0.0

| | Point Values (in) | | | | | |
|---|---|---|---|---|---|---|
| Duration | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
| 5 MIN | 0.34 | 0.43 | 0.49 | 0.58 | 0.65 | 0.72 |
| 10 MIN | 0.50 | 0.65 | 0.75 | 0.89 | 1.00 | 1.11 |
| 15 MIN | 0.61 | 0.81 | 0.94 | 1.13 | 1.28 | 1.42 |
| 30 MIN | 0.81 | 1.08 | 1.27 | 1.53 | 1.73 | 1.93 |
| 1 HOUR | 0.99 | 1.34 | 1.57 | 1.90 | 2.16 | 2.41 |
| 2 HOUR | 1.07 | 1.47 | 1.74 | 2.11 | 2.39 | 2.68 |
| 3 HOUR | 1.12 | 1.55 | 1.84 | 2.24 | 2.55 | 2.86 |
| 6 HOUR | 1.23 | 1.72 | 2.05 | 2.50 | 2.85 | 3.20 |
| 12 HOUR | 1.33 | 1.90 | 2.28 | 2.81 | 3.21 | 3.62 |
| 24 HOUR | 1.43 | 2.09 | 2.52 | 3.11 | 3.57 | 4.03 |




Note: Data originated from graphics in WT ADHPU

Figure 2.2




# MARICOPA COUNTY, ARIZONA

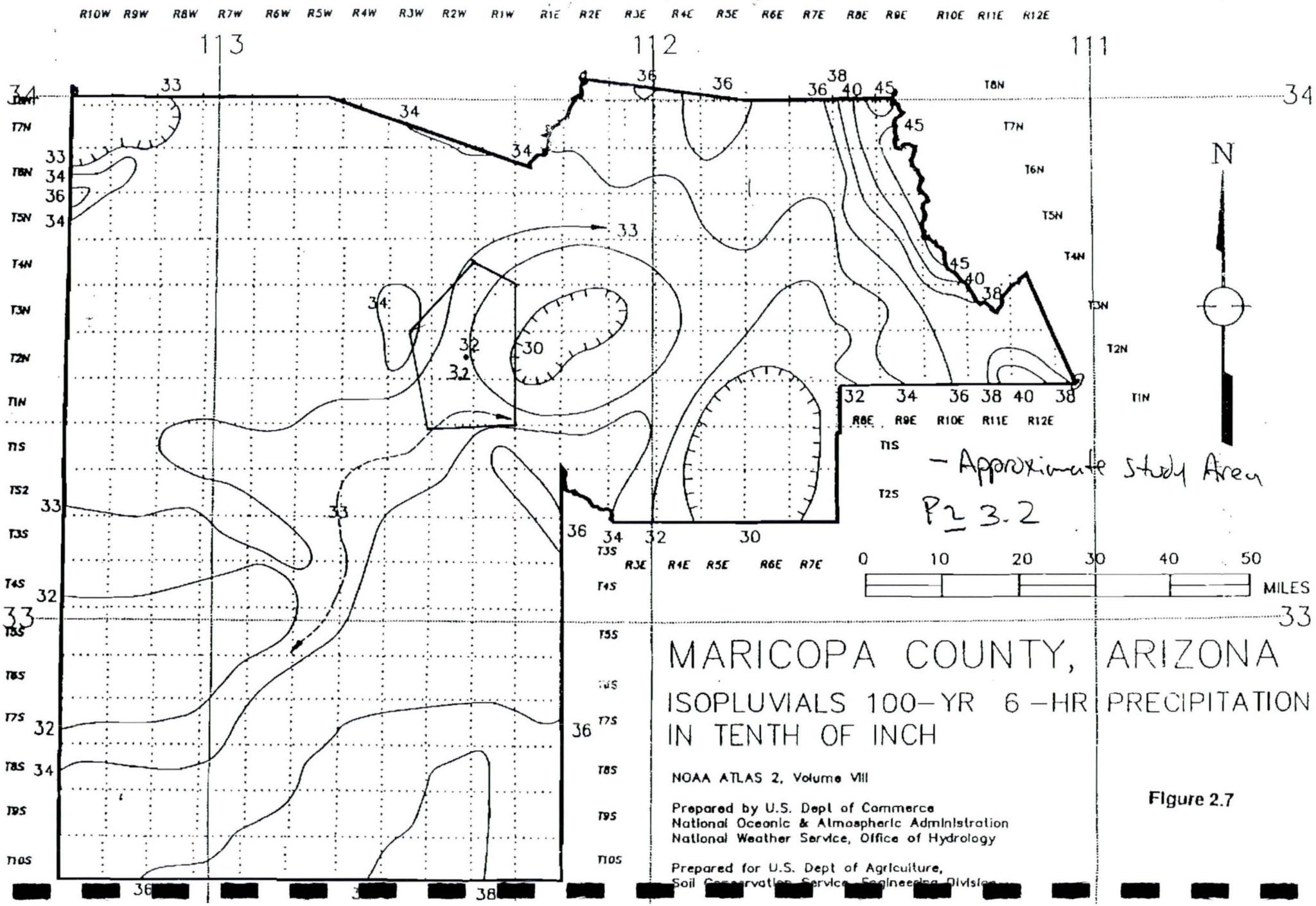
## ISOPLUVIALS 2 – YR 24 – HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

**Figure 2.8**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112
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T6S
T7S
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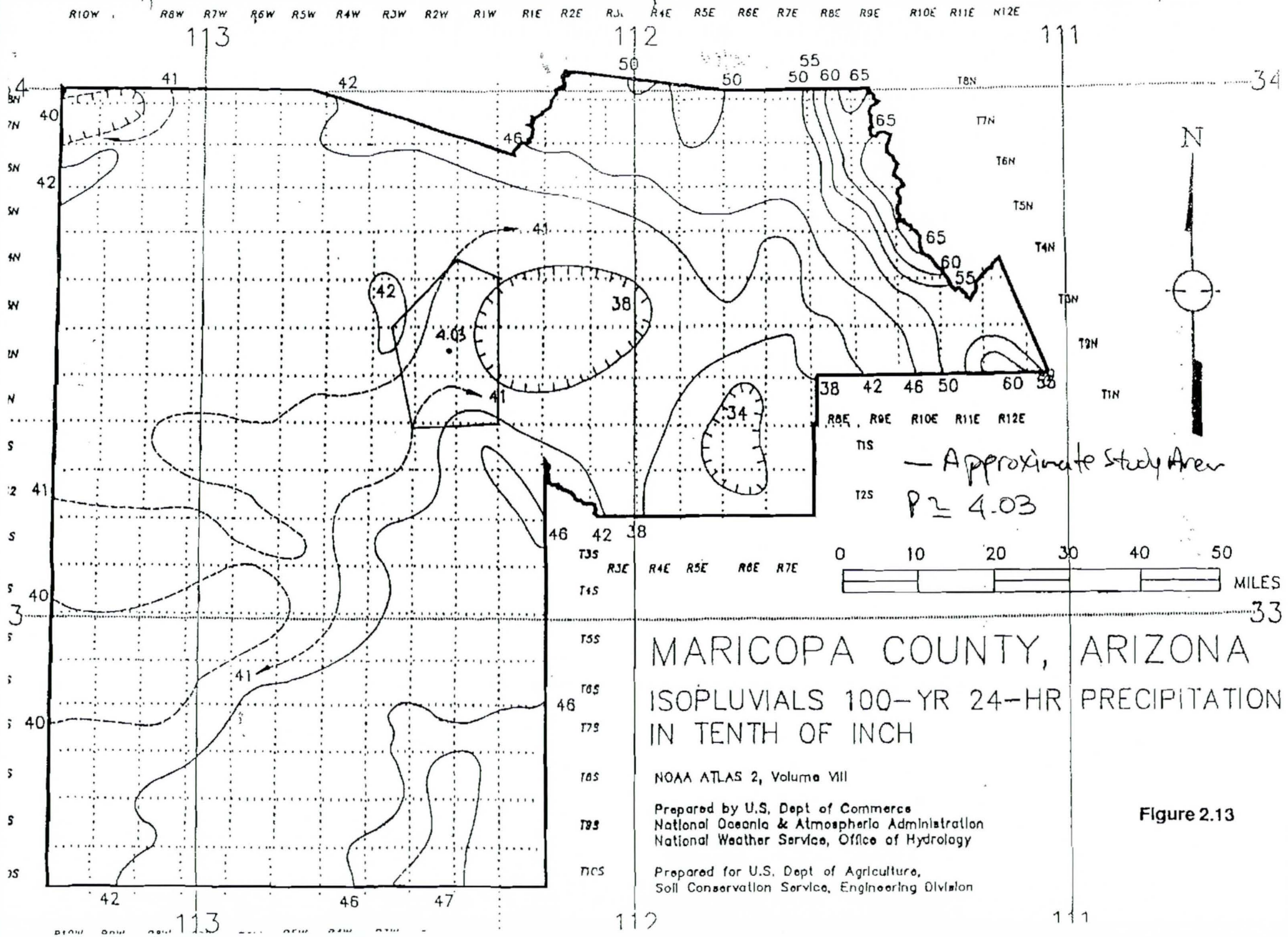
T9S
T10S
N
- Approximate Study Area
P2 3.2
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.7


R10W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
113
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N
— Approximate Study Area
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MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.13

# Rainfall Data



Primary Zone Number: 7 Latitude: 0.0 Elevation: 0

Short Duration Zone Number: 8 Longitude: 0.0

| Duration | Point Values (in) 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| 5 MIN | 0.39 | 0.48 | 0.54 | 0.63 | 0.70 | 0.77 |
| 10 MIN | 0.58 | 0.72 | 0.82 | 0.97 | 1.08 | 1.19 |
| 15 MIN | 0.71 | 0.90 | 1.04 | 1.23 | 1.38 | 1.52 |
| 30 MIN | 0.94 | 1.21 | 1.39 | 1.66 | 1.86 | 2.07 |
| 1 HOUR | 1.14 | 1.49 | 1.73 | 2.06 | 2.32 | 2.58 |
| 2 HOUR | 1.23 | 1.63 | 1.90 | 2.27 | 2.57 | 2.86 |
| 3 HOUR | 1.29 | 1.72 | 2.01 | 2.42 | 2.73 | 3.05 |
| 6 HOUR | 1.40 | 1.89 | 2.22 | 2.68 | 3.04 | 3.40 |
| 12 HOUR | 1.50 | 2.07 | 2.45 | 2.97 | 3.38 | 3.79 |
| 24 HOUR | 1.60 | 2.24 | 2.67 | 3.26 | 3.72 | 4.18 |

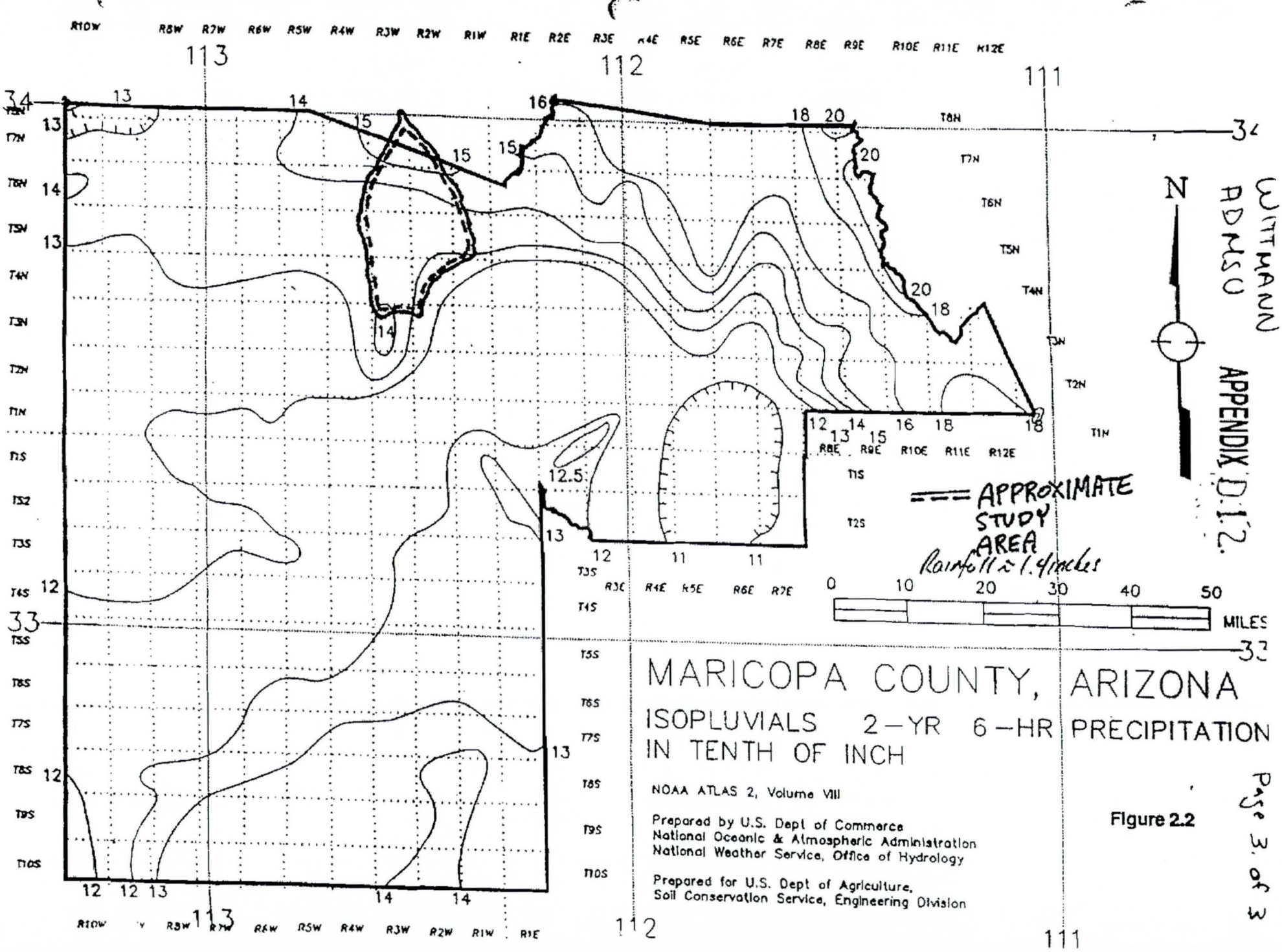
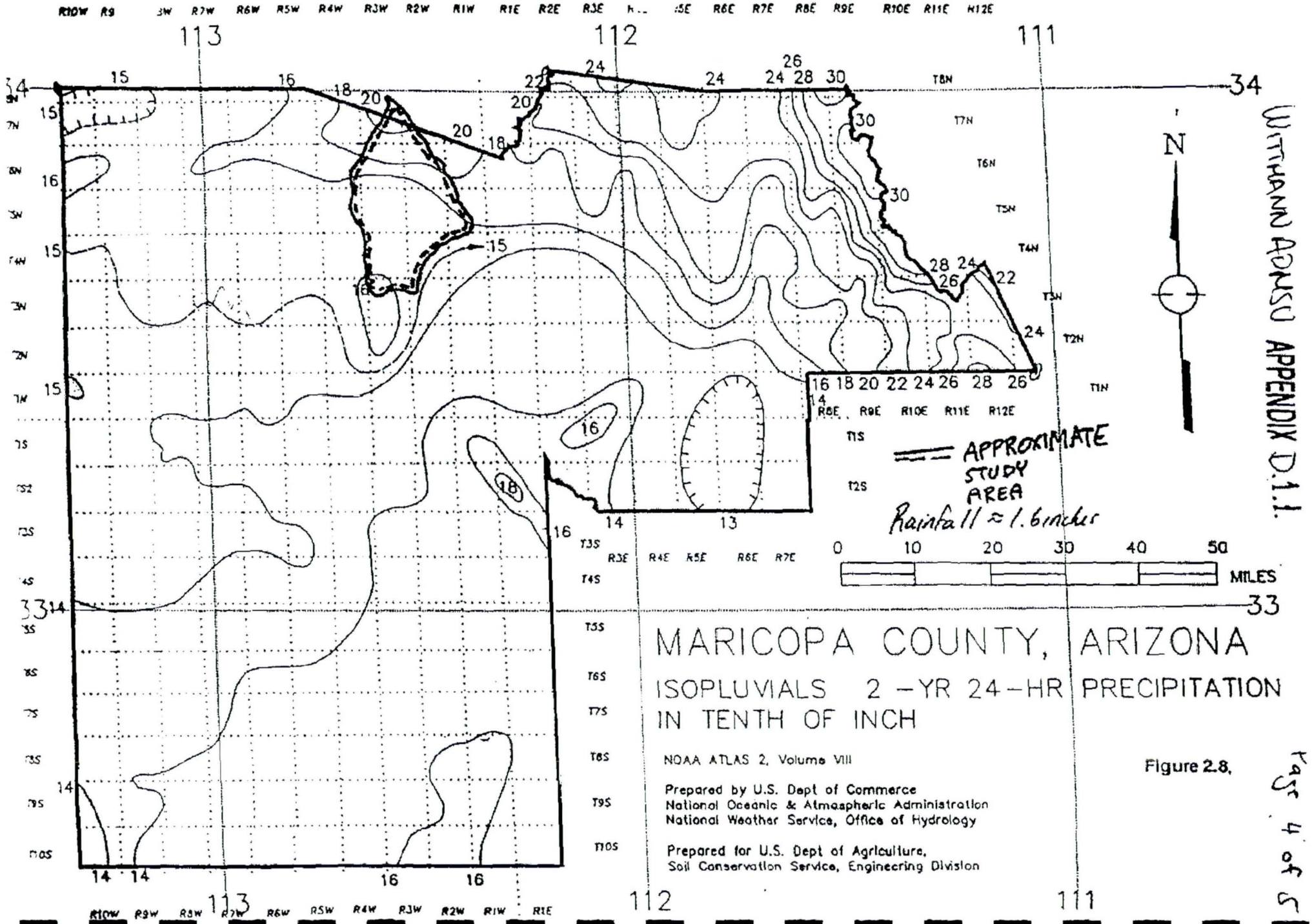



Figure 2.2

WITTMAN ADMSO APPENDIX D.1.2.

Page 3 of 3




# MARICOPA COUNTY, ARIZONA

## ISOPLUVIALS 2 – YR 24 – HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

**Figure 2.8.**

WITTMANN ADMSU APPENDIX D.1.1.

Page 4 of 5

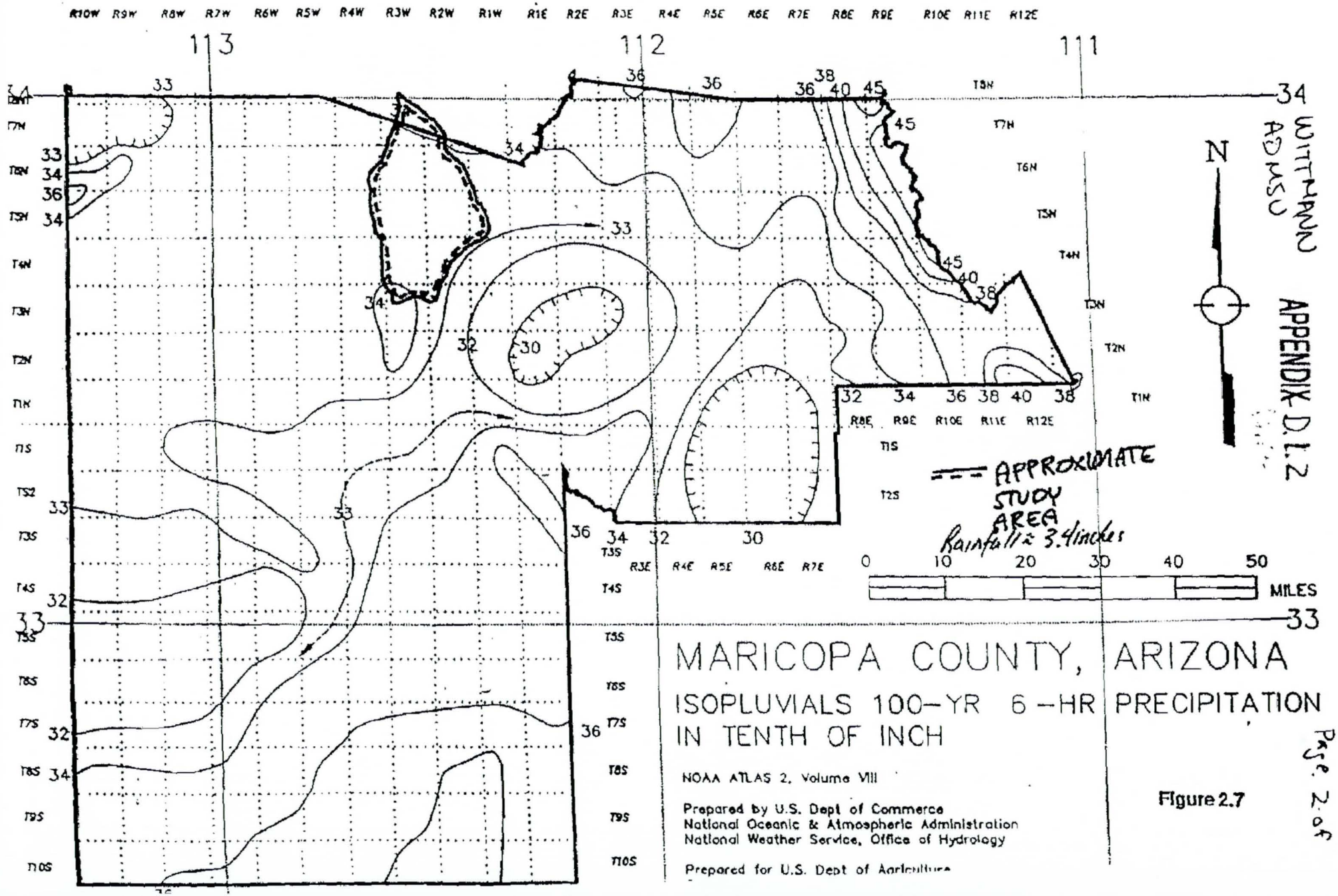
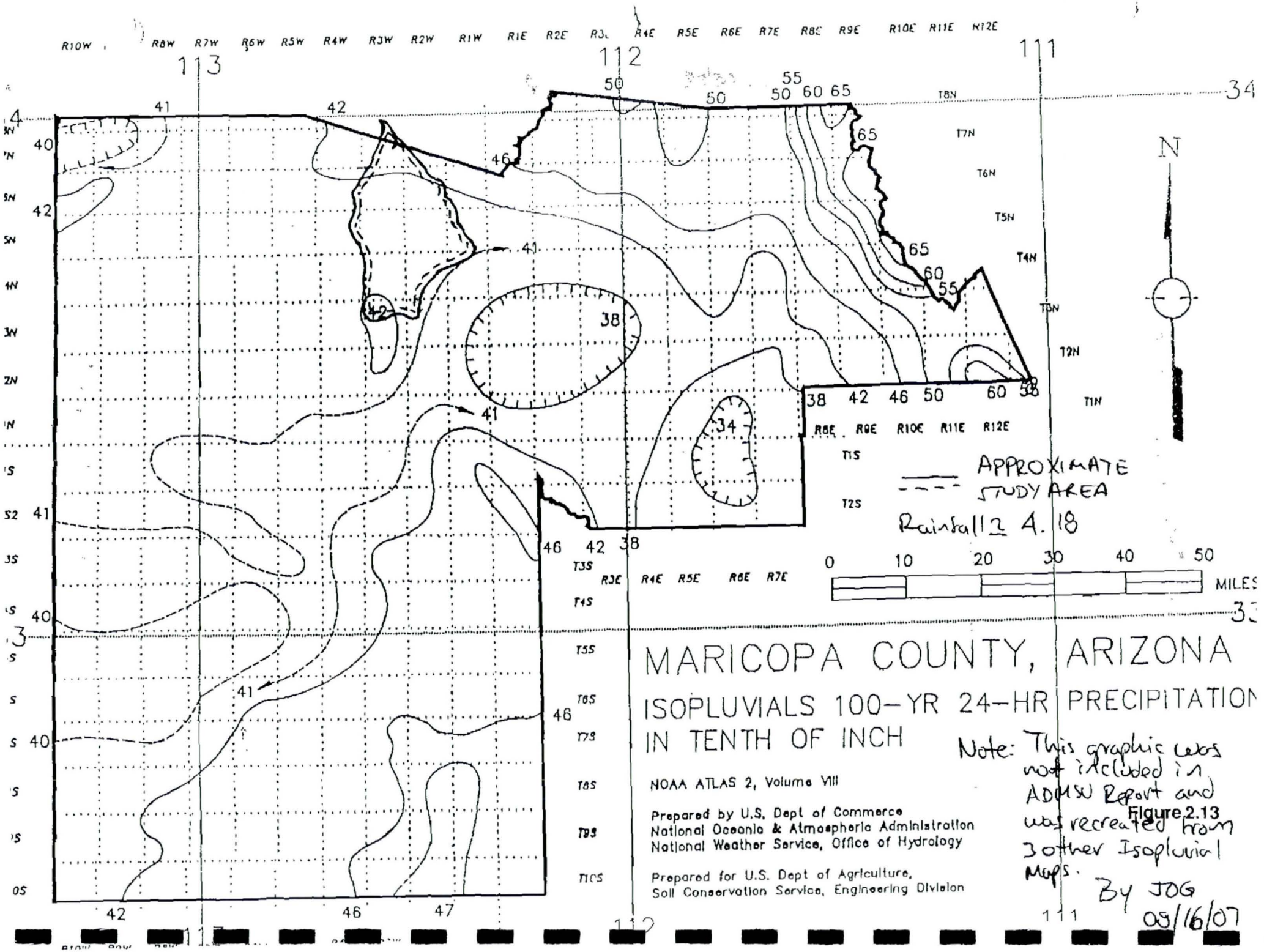

R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
113
112
111
T7N
T6N
T5N
T4N
T3N
T2N
T1N
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
T10S
N
WITTMANN AD MSU
APPENDIX D.L.2
APPROXIMATE STUDY AREA
Rainfall ≥ 3.4 inches
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture

Figure 2.7




Note: This graphic was not included in ADMS Report and was recreated from 3 other Isopluvial Maps.

By JOG 05/16/07

Figure 2.13

DEPTH-AREA REDUCTION FACTORS AND DEPTHS FOR 24-HOUR DURATION RAINFALL

BY: JOG - 08/10/07

WHITE TANKS ADMPU

P50 3.57 INCHES

| Area | Factor | P50 |
|---|---|---|
| 0.001 | 1 | 3.57 |
| 10 | 0.94 | 3.36 |
| 50 | 0.87 | 3.11 |
| 100 | 0.842 | 3.01 |
| 200 | 0.817 | 2.92 |

WITTMANN ADMSU

P50 3.72 INCHES

| Area | Factor | P50 |
|---|---|---|
| 0.001 | 1 | 3.720 |
| 10 | 0.94 | 3.497 |
| 20 | 0.91 | 3.385 |
| 40 | 0.88 | 3.274 |
| 80 | 0.855 | 3.181 |
| 120 | 0.834 | 3.102 |
| 200 | 0.817 | 3.039 |
| 300 | 0.8 | 2.976 |
| 500 | 0.78 | 2.902 |

```
1****************************************
**************************************
 *                                    *                                    *
                *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                    *    U.S. ARMY CORPS
OF ENGINEERS     *
 *              JUN   1998              *                                    *    HYDROLOGIC
ENGINEERING CENTER    *
 *           VERSION 4.1                *                                    *         609 SECOND
STREET           *
 *                                      *                                    *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   20AUG07  TIME  16:13:15   *                                    *          (916)
756-1104            *
 *                                      *                                    *
                *
 ************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL  LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT
PAGE 1

```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            1           ID   ----------------------------------------------------------------------------
            2           ID   08-16-2007
            3           ID   Model modified by Andes Engineering for the estimation of 50-year flows for
            4           ID   the Jackrabbit Trail Corridor Improvement Study. Model should be used only
            5           ID   for this purpose.
            6           ID
            7           ID   1. Replaced 100-year Rainfall Depth values in JD cards with 50-year values
            8           ID   derived from Isopluvial Maps in FCDMC's 1995 Hydrology Manual(NOAA Atlas 2).
            9           ID   ----------------------------------------------------------------------------
           10           ID
           11           ID   ----------------------------------------------------------------------------
           12           ID   ****************************************************************************
           13           ID   ****************************************************************************
           14           ID   **                                                                        **
           15           ID   **    WITTMANN AREA DRAINAGE MASTER STUDY UPDATE-HYDROLOGY MODEL 2004      **
           16           ID   **                                                                        **
           17           ID   ****************************************************************************
           18           ID   ****************************************************************************
           19           ID
           20           ID   PROJECT:                Wittmann ADMS Update
           21           ID   CLIENT:                 Flood Control District of Maricopa County
           22           ID   PREPARED BY:            Entellus, Inc.
           23           ID   PROJECT No:               FCD 2002C029              Entellus 310.032
           24           ID   FILE NAME: WTFC24.hc1                    CREATED DATE: FEB 01, 2004
           25           ID                                          MODIFIED DATE: OCT 22, 2004
           26           ID
           27           ID   STORM:
           28           ID                           100-year 24-hour Storm
           29           ID
           30           ID   DEVELOPMENT CONDITIONS:
           31           ID                           Future Conditions
           32           ID
           33           ID   MODELING ASSUMPTIONS:
           34           ID                           It was assumed that the US60 did not have adequate
           35           ID                           storage to cause any significant attenuation.
           36           ID
           37           ID                           The assumption was made that the CAP Canal embankment
           38           ID                           would not be breached under a large flood event.
           39           ID
           40           ID                           The assumption was made that the Beardsley Canal would
           41           ID                           not fail under a large storm event (Per District
           42           ID                           Instruction).  In addition, the berm north of the
           43           ID                           Beardsley canal and east of US60 was assumed to fail
           44           ID                           (per district Instruction).
           45           ID
           46           ID                           For both the CAP and Beardsley Canals, once the berm
           47           ID                           elevation was reached weir flow was assumed.  It was
           48           ID                           also assumed that any weir flow over the canal that
           49           ID                           might enter the canal and be diverted out of the study
           50           ID                           area was insignificant, and thus was ignored.  In other
           51           ID                           words all weir flow over the canal embankment reaches
           52           ID                           the downstream concentration point.
           53           ID
           54           ID                           Typical X-sects were developed, and it was assumed
```

```
          55          ID                        that a typical x-sect could adequately represent
1                                                   HEC-1 INPUT
PAGE  2

          LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          56          ID                        various reaches.
          57          ID
          58          ID                        Time-Area Relations were used base on the District's
          59          ID                        Hydrology Manual criteria.  Two Time-Area Relation
          60          ID                        Curves were utilized:
          61          ID                                -Urban
          62          ID                                -Natural
          63          ID                        The Time-Area Relation Curves were taken directly
          64          ID                        from the manual
          65          ID
          66          ID   MODELING METHODS:
          67          ID                        This model utilizes QI cards to input the Padelford
          68          ID                        hydrographs from the A-N West Inc. Padelford Wash
          69          ID                        Floodplain Delineation Study.  The hydrograph was
          70          ID                        altered from its original form (2 minute interval to
          71          ID                        5-minute interval) through simple interpolation.
          72          ID
          73          ID                        Clark Unit Hydrographs were used for all subbasins
          74          ID                        except the two subbasins directly upstream of the
          75          ID                        Bonita Dam (PD726B and PD740 use S-graphs).  The UC
          76          ID                        parameters were calculated using the WMS7.0 software.
          77          ID
          78          ID                        For Basins PD726B and PD740 S-Graphs were utilized per
          79          ID                        the request of the FCDMC.  Limited details regarding
          80          ID                        the calculations of the S-graphs can be found in the
          81          ID                        model by the basin KK card.  For full details of the
          82          ID                        S-graph calculations refer to the Appendix.
          83          ID
          84          ID                        Normal Depth routing was used for all routing reaches.
          85          ID
          86          ID                        Hard coding was used to account for the percentage of
          87          ID                        area associated with a diversion.  Because of the use
          88          ID                        of JD cards and aereal reduction, hard coding was
          89          ID                        necessary to properly account for area.  For a given
          90          ID                        diversion a percentage of the flow is routed to two
          91          ID                        different locations.  The same percentage of area
          92          ID                        follows that diverted flow.  In addition the area
          93          ID                        downstream of the main path is reduced or increased and
          94          ID                        is hard coded to account for the loss or gain of area.
          95          ID                        Hard coding was performed based on the 24-hour existing
          96          ID                        conditions model.
          97          ID
          98          ID                        Stage-storage was developed for all the structures
          99          ID                        along the CAP Canal, as well as along the Beardsley
         100          ID                        Canal.  In addition several stage-storage locations
         101          ID                        were developed for areas with significant storage
         102          ID                        along the SR74.  No storage was modeled along the US60
         103          ID                        and railroad, but the culverts were analyzed for
         104          ID                        diversion potential.  Diversions were placed in the
         105          ID                        model where deemed appropriate.  See appendix for
         106          ID                        details.
         107          ID
         108          ID                        FLO-2D was utilized to calculate the split flows at
         109          ID                        concentration points CIW351. CIW357, CIW363 and CWI576.
         110          ID                        See appendix for modeling details.
1                                                   HEC-1 INPUT
PAGE  3

          LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

         111          ID
         112          ID   ********************************************************************************
         113          ID   ********************************************************************************
         114          ID
                      *DIAGRAM
         115          IT       5                0    1500
         116          IO       5
         117          IN      15                0
         118          JD    3.72     0.01
                      * 24-hour distribution
         119          PC     0.0    0.002    0.005    0.008    0.011    0.014    0.017     0.02    0.023    0.026
         120          PC   0.029    0.032    0.035    0.038    0.041    0.044    0.048    0.052    0.056     0.06
         121          PC   0.064    0.068    0.072    0.076     0.08    0.085     0.09    0.095      0.1    0.105
         122          PC    0.11    0.115     0.12    0.126    0.133     0.14    0.147    0.155    0.163    0.172
         123          PC   0.181    0.191    0.203    0.218    0.236    0.257    0.283    0.387    0.663    0.707
         124          PC   0.735    0.758    0.776    0.791    0.804    0.815    0.825    0.834    0.842    0.849
         125          PC   0.856    0.863    0.869    0.875    0.881    0.887    0.893    0.898    0.903    0.908
         126          PC   0.913    0.918    0.922    0.926     0.93    0.934    0.938    0.942    0.946     0.95
         127          PC   0.953    0.956    0.959    0.962    0.965    0.968    0.971    0.974    0.977     0.98
         128          PC   0.983    0.986    0.989    0.992    0.995    0.998      1.0
         129          JD   3.497     10.0
         130          JD   3.385     20.0
         131          JD   3.274     40.0
         132          JD   3.181     80.0
         133          JD   3.102    120.0
         134          JD   3.039    200.0
         135          JD   2.976    300.0
         136          JD   2.902    500.0
                      *
                      *
                      *
                      *
                      * WESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWEST *
                      * WESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWEST *
                      * WESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWEST *
                      * ******************************************************************************** *
                      * ************ BEGINNING OF WEST PORTION OF DETAILED MODEL ******************** *
                      * ******************************************************************************** *
                      * WESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWEST *
                      * WESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWESTWEST *
```

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

| | OPERATION | STATION | PEAK FLOW | TIME OF PEAK | AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR | 24-HOUR | 72-HOUR | BASIN AREA | MAXIMUM STAGE | TIME OF MAX STAGE |
|---|---|---|---|---|---|---|---|---|---|---|
| + | HYDROGRAPH AT | WT140 | 1785. | 13.00 | 534. | 160. | 53. | 3.79 | | |
| + | ROUTED TO | RWT140 | 1682. | 13.33 | 533. | 159. | 53. | 3.79 | | |
| + | HYDROGRAPH AT | WT130 | 1643. | 12.67 | 343. | 97. | 32. | 2.57 | | |
| + | 2 COMBINED AT | CWT130 | 2449. | 13.25 | 865. | 254. | 85. | 6.36 | | |
| + | ROUTED TO | RWT130 | 2265. | 13.75 | 863. | 254. | 85. | 6.36 | | |
| + | HYDROGRAPH AT | WT160 | 524. | 12.58 | 117. | 34. | 11. | 0.81 | | |
| + | ROUTED TO | RWT160 | 352. | 14.25 | 116. | 34. | 11. | 0.81 | | |
| + | HYDROGRAPH AT | WT150A | 2593. | 12.92 | 673. | 201. | 67. | 4.75 | | |
| + | ROUTED TO | R150A | 2428. | 13.17 | 672. | 201. | 67. | 4.75 | | |
| + | HYDROGRAPH AT | WT150 | 828. | 12.50 | 154. | 45. | 15. | 1.09 | | |
| + | 2 COMBINED AT | CWT150 | 2769. | 13.08 | 820. | 244. | 82. | 5.84 | | |
| + | ROUTED TO | RWT150 | 2688. | 13.50 | 819. | 243. | 82. | 5.84 | | |
| + | HYDROGRAPH AT | WT120 | 1597. | 12.75 | 351. | 95. | 32. | 2.80 | | |
| + | 4 COMBINED AT | CWT120 | 5487. | 13.58 | 2061. | 602. | 202. | 15.81 | | |
| + | ROUTED TO | RWT120 | 5261. | 14.08 | 2059. | 602. | 202. | 15.81 | | |
| + | HYDROGRAPH AT | WT110 | 2139. | 12.58 | 374. | 104. | 35. | 2.90 | | |
| + | 2 COMBINED AT | CWT110 | 5393. | 14.08 | 2374. | 693. | 233. | 18.71 | | |
| + | ROUTED TO | RWT110 | 5035. | 14.75 | 2368. | 692. | 233. | 18.71 | | |
| + | HYDROGRAPH AT | WT100 | 2597. | 12.67 | 552. | 163. | 55. | 3.85 | | |
| + | 2 COMBINED AT | CWT100 | 5162. | 14.75 | 2830. | 834. | 281. | 22.55 | | |
| + | ROUTED TO | RWT100 | 4804. | 15.17 | 2815. | 833. | 281. | 22.55 | | |
| + | HYDROGRAPH AT | TW406 | 329. | 12.08 | 24. | 7. | 2. | 0.16 | | |
| + | ROUTED TO | RTW406 | 26. | 16.75 | 20. | 7. | 2. | 0.16 | | |
| + | HYDROGRAPH AT | TW408 | 373. | 12.83 | 129. | 39. | 13. | 0.91 | | |
| + | ROUTED TO | RTW408 | 187. | 16.17 | 109. | 39. | 13. | 0.91 | | |
| + | HYDROGRAPH AT | TW404 | 2151. | 12.25 | 319. | 95. | 32. | 2.09 | | |
| + | 4 COMBINED AT | CTW404 | 4852. | 15.17 | 3124. | 953. | 323. | 25.72 | | |
| + | ROUTED TO | RTW404 | 4793. | 15.42 | 3113. | 953. | 323. | 25.72 | | |
| + | HYDROGRAPH AT | IW371 | 53. | 12.17 | 6. | 2. | 1. | 0.05 | | |
| + | DIVERSION TO | DO371 | 33. | 12.17 | 2. | 1. | 0. | 0.05 | | |
| + | HYDROGRAPH AT | D371 | 20. | 12.17 | 4. | 1. | 0. | 0.05 | | |
| | ROUTED TO | | | | | | | | | |

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1****************************************
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 *                                      *                                      *
                *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *    U.S. ARMY CORPS
OF ENGINEERS     *
 *              JUN   1998              *                                      *    HYDROLOGIC
ENGINEERING CENTER    *
 *            VERSION 4.1               *                                      *          609 SECOND
STREET           *
 *                                      *                                      *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   10AUG07  TIME  14:33:09  *                                      *            (916)
756-1104            *
 *                                      *                                      *
                *
 ****************************************
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
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NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL  LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT
PAGE 1

```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            1           ID         MODEL MODIFIED BY ANDES ENGINEERING FOR JACKRABBIT TRAIL CIS
            2           ID         50-YEAR PRECIPITATION VALUES REPLACE 100-YEAR IN JD CARD
            3           ID         DATE: AUGUST 2007
            4           ID
            5           ID         FUTURE CONDITION HDYROLOGY MODEL WITH PROJECTS - LEVEL III
            6           ID
            7           ID         WHITE TANKS AREA DRAINAGE MASTER STUDY *UPDATE*
            8           ID         Original MODEL BY THE WLB Group for FCDMC AS PART OF THE WHITE
            9           ID         TANKS/AGUA FRIA ADMS, Date: October 1991
           10           ID
           11           ID         ***REMOVED RETENTION AT SUPER BASIN #5 SUB BASINS 297, 315, ***
           12           ID         ***334, 335A, 335, 316 TO REFLECT RELAXED RETENTION REQUIRE-***
           13           ID         ***MENTS ADJACENT TO THE BULLARD CHANNEL S. OF I-10.        ***
           14           ID
           15           ID        * URS REVISED RTIMP PERCENT IMPERVIOUS VALUES *
           16           ID        * AS PER FCDMC GIS DATA - 6-27-01 *
           17           ID
           18           ID         REVISED HYDROLOGY HEC-1 RUN FOR WHITE TANKS ADMS
           19           ID         100-YEAR, 24-HOUR STORM                  original file: WTADMS.24
           20           ID
           21           ID         FUTURE CASE WITH RETENTION VOLUME DIVERTS
           22           ID
           23           ID                                          REVISED BY URS     DATE: 01-14-04
           24           ID                                                             FILE: L33PF6D.DAT
           25           ID
           26           ID        NOTES:
           27           ID        1. THIS HEC-1 MODEL CONTAINS THE FOLLOWING SUPER BASINS: WHITE TANKS 3,
           28           ID           2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 2 & 3, 4 THRU 26.
           29           ID        2. REVISED TO REFLECT UPDATED SOILS MAPS AND NEW DEVELOPMENT.
           30           ID        3. AVERAGE XKSAT VALUES FOR EACH SUBBASIN WAS RECEIVED FROM FCDMC
           31           ID           GIS DATA AND THEN ADJUSTED FOR VEGETATION, OR LEFT AS ORIGINALLY IN
           32           ID           THE WLB MODEL.
           33           ID        4. FOR NEW DEVELOPMENTS ONLY 80% OF REPORTED PROVIDED RETENTION
           34           ID           WAS INCLUDED IN THIS MODEL (AS A CONSERVATIVE ESTIMATE). RETENTION
           35           ID           CAPACITIES WERE ESTIMATED BY EEC FOR DEVELOPMENTS WITH NO
           36           ID           DRAINAGE REPORTS.
           37           ID        5. REVISED DRAINAGE BOUNDARIES BASED UPON FIELD INSPECTION OF SUN CITY.
           38           ID           GRAND.  COMBINED SEVERAL BASINS TOGETHER TO MAKE NEW BASINS 114 &115.
           39           ID           ALSO REROUTED SUBBASINS 100A, 101, 102A AND 106 TO THE SOUTH TO 113A.
           40           ID        6. CHANNEL ROUTE ALONG REEMS ROAD UPDATED TO REFLECT NEW CONSTRUCTION.
           41           ID        7. REVISED SCS TYPE II RAINFALL DISTRIBUTION FOR THE 24-HOUR GENERAL
           42           ID           STORM.
           43           ID        8. REVISED RAINFALL DEPTH-AREA REDUCTION FACTORS.
           44           ID        9. PSIF WERE ADJUSTED BASED ON THE VALUES OF XKSAT AND WERE EDITED INTO
           45           ID           THE DATA FILE BY THE FCDMC.
           46           ID       10. AVERAGE XKSAT VALUES FOR SUBBASINS WITH BORROW PITS (WHITE TANKS
           47           ID           AREAS #3 & #4) WERE ESTIMATED BY EEC.
           48           ID
                        *DIAGRAM
           49           IT       5                    1000
           50           IO       5
           51           IN      15
           52           JD    3.57    .001
           53           PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
```

```
                                                01-50
          54          PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
1                                                HEC-1 INPUT
PAGE  2

          LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          55          PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
          56          PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
          57          PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
          58          PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
          59          PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
          60          PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
          61          PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
          62          PC    .983    .986    .989    .992    .995    .998   1.00   1.000   1.000   1.000
          63          JD    3.36      10
          64          JD    3.11      50
          65          JD    3.01     100
          66          JD    2.92     200
                      * ***************************************************************************
                      * *************THE FOLLOWING SECTION IS WHITE TANKS 3**********************
                      * ***************************************************************************
                      * ******TRANSMISSION LOSSES REMOVED - 4/25/00 - ERE*************************
                      * ***************************************************************************
                      *
                      * SUB BASIN LG AND UI RECORDS UPDATED PER SLOPE CHANGE TO SUB BASIN 1
                      * AT REQUEST OF FCDMC ON 01-14-04
                      *

          67          KK       1
          68          KM   SUB BASIN 1
          69          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
          70          KM    L=      3.5  Lca=      1.5   S=  527.2  Kn= .050  LAG=  40.7
          71          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
          72          BA    1.94
          73          LG     .20     .35    4.00     .52   10.00
          74          UI    160.    207.    585.    790.    939.   1135.   1427.   1996.   1720.   1386.
          75          UI   1159.    946.    776.    535.    307.    267.    194.    160.     72.     49.
          76          UI     49.     49.     49.     49.      0.      0.      0.      0.      0.      0.
          77          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

          78          KK    RCP1
          79          KM        ROUTE FLOW FROM CP1 TO CP2.
          80          RS       5              -1       0
          81          RC     .06     .04     .06   17800   .0469
          82          RX    1000    1125    1300    1390    1405    1490    1590    1750
          83          RY    1440    1439    1437    1428    1428    1439    1442    1444
                      *

          84          KK       2
          85          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
          86          BA    1.82
                      *     LG    0.35   0.154   6.959   0.119  21.855
          87          LG     .18     .35    4.55     .37   12.00
          88          UI    115.    115.    259.    443.    557.    643.    728.    849.   1014.   1348.
          89          UI   1418.   1145.    985.    864.    735.    634.    545.    404.    268.    202.
          90          UI    189.    143.    115.    102.     35.     35.     35.     35.     35.     35.
          91          UI     35.      0.      0.      0.      0.      0.      0.      0.      0.      0.
          92          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1                                                HEC-1 INPUT
PAGE  3

          LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          93          KK    2OUT
          94          KM        DIVERSION-RETENTION
          95          DT    2RET    3.48
          96          DI       0   10000
          97          DQ       0   10000

          98          KK     CP2
          99          KM        ADD HYDROGRAPHS AT CP2.
         100          HC       2    3.76

         101          KK    RCP2
         102          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
         103          RS       2              -1       0
         104          RC     .06    .035     .06    4500   .0111
         105          RX    1000    1100    1350    1705    1735    1780    1850    2000
         106          RY    1304    1302    1302    1298    1298    1303    1302    1305
                      *

         107          KK      3A
         108          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 3A
         109          BA     .29
         110          LG     .15     .35    4.30     .42     0.4
         111          UI     34.     90.    165.    213.    289.    411.    312.    240.    181.    121.
         112          UI     60.     47.     32.     10.     10.     10.     10.      0.      0.      0.
         113          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                      * KK 3AOUT

         114          KK    !BC1
         115          KM        DIVERSION-RETENTION
         116          DT   3ARET    0.56
         117          DI       0   10000
         118          DQ       0   10000
                      *
                      * MODIFY PER LEVEL III
                      *
                      * KK RCP3A

         119          KK    RBC1
         120          KM   ROUTE BC1 TO BC2
         121          RS     2.0            -1.0     0.0
         122          RC   0.030   0.030   0.030    3550  0.0031
         123          RX       0    35.4    55.4    75.4    95.4   115.4   135.4   170.8
                                              Page 2
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| TIME OF MAX STAGE | OPERATION | STATION | PEAK FLOW | TIME OF PEAK | AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR | 24-HOUR | 72-HOUR | BASIN AREA | MAXIMUM STAGE |
|---|---|---|---|---|---|---|---|---|---|
| + | HYDROGRAPH AT | 1 | 1273. | 12.50 | 179. | 50. | 17. | 1.94 | |
| + | ROUTED TO | RCP1 | 1090. | 12.83 | 179. | 50. | 17. | 1.94 | |
| + | HYDROGRAPH AT | 2 | 1114. | 12.75 | 197. | 55. | 18. | 1.82 | |
| + | DIVERSION TO | 2RET | 9. | 7.00 | 7. | 2. | 1. | 1.82 | |
| + | HYDROGRAPH AT | 2OUT | 1114. | 12.75 | 197. | 53. | 18. | 1.82 | |
| + | 2 COMBINED AT | CP2 | 2104. | 12.75 | 372. | 102. | 34. | 3.76 | |
| + | ROUTED TO | RCP2 | 1944. | 13.00 | 372. | 102. | 34. | 3.76 | |
| + | HYDROGRAPH AT | 3A | 258. | 12.33 | 25. | 6. | 2. | 0.29 | |
| + | DIVERSION TO | 3ARET | 40. | 11.92 | 1. | 0. | 0. | 0.29 | |
| + | HYDROGRAPH AT | !BC1 | 258. | 12.33 | 24. | 6. | 2. | 0.29 | |
| + | ROUTED TO | RBC1 | 178. | 12.58 | 24. | 6. | 2. | 0.29 | |
| + | HYDROGRAPH AT | 3 | 767. | 12.33 | 91. | 26. | 9. | 0.81 | |
| + | DIVERSION TO | 3RET | 697. | 12.25 | 46. | 12. | 4. | 0.81 | |
| + | HYDROGRAPH AT | 3OUT | 746. | 12.42 | 51. | 13. | 4. | 0.81 | |
| + | 2 COMBINED AT | I1CP3 | 855. | 12.42 | 74. | 19. | 6. | 1.10 | |
| + | 2 COMBINED AT | !BC2 | 2139. | 12.92 | 442. | 121. | 40. | 4.86 | |
| + | DIVERSION TO | DI189 | 0. | 0.00 | 0. | 0. | 0. | 4.86 | |
| + | HYDROGRAPH AT | D3 | 2139. | 12.92 | 442. | 121. | 40. | 4.86 | |
| + | ROUTED TO | RBC2 | 1951. | 13.25 | 440. | 121. | 40. | 4.86 | |
| + | HYDROGRAPH AT | 4 | 330. | 12.25 | 29. | 8. | 3. | 0.30 | |
| + | DIVERSION TO | 4RET | 322. | 12.17 | 16. | 4. | 1. | 0.30 | |
| + | HYDROGRAPH AT | 4OUT | 276. | 12.33 | 15. | 4. | 1. | 0.30 | |
| + | HYDROGRAPH AT | 5 | 769. | 12.25 | 69. | 19. | 6. | 0.72 | |
| + | DIVERSION TO | 5RET | 2. | 1.33 | 0. | 0. | 0. | 0.72 | |
| + | HYDROGRAPH AT | 5OUT | 769. | 12.25 | 69. | 19. | 6. | 0.72 | |
| + | 2 COMBINED AT | CP5 | 971. | 12.25 | 83. | 23. | 8. | 1.02 | |
| + | ROUTED TO | RCP5 | 965. | 12.33 | 83. | 23. | 8. | 1.02 | |
| + | HYDROGRAPH AT | 6 | 619. | 12.08 | 42. | 12. | 4. | 0.45 | |
| + | DIVERSION TO | 6RET | 2. | 4.17 | 1. | 0. | 0. | 0.45 | |
| + | HYDROGRAPH AT | 6OUT | 619. | 12.08 | 42. | 11. | 4. | 0.45 | |
| + | 2 COMBINED AT | CP6 | 1215. | 12.17 | 124. | 34. | 11. | 1.47 | |
| + | ROUTED TO | RCP6 | 1207. | 12.25 | 124. | 34. | 11. | 1.47 | |
| + | HYDROGRAPH AT | 7 | 408. | 12.08 | 29. | 8. | 3. | 0.31 | |
| | DIVERSION TO | | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| + | 7RET | 189. | 12.00 | 8. | 2. | 1. | 0.31 |
| + HYDROGRAPH AT | 7OUT | 408. | 12.08 | 22. | 6. | 2. | 0.31 |
| + 2 COMBINED AT | CP7 | 1550. | 12.17 | 144. | 39. | 13. | 1.78 |
| + ROUTED TO | RCP7 | 1357. | 12.42 | 144. | 39. | 13. | 1.78 |
| + HYDROGRAPH AT | 9 | 1139. | 12.33 | 130. | 36. | 12. | 1.40 |
| + 2 COMBINED AT | I1CP9 | 2467. | 12.42 | 271. | 75. | 25. | 3.18 |
| + HYDROGRAPH AT | 8 | 731. | 12.33 | 75. | 21. | 7. | 0.81 |
| + 2 COMBINED AT | CP9 | 3156. | 12.33 | 344. | 95. | 32. | 3.99 |
| + ROUTED TO | RCP9 | 2637. | 12.75 | 343. | 95. | 32. | 3.99 |
| + HYDROGRAPH AT | 10 | 1122. | 12.75 | 196. | 51. | 17. | 2.02 |
| + DIVERSION TO | 10RET | 476. | 12.25 | 28. | 8. | 3. | 2.02 |
| + HYDROGRAPH AT | 10OUT | 1122. | 12.75 | 172. | 44. | 15. | 2.02 |
| + 2 COMBINED AT | I1CP10 | 3729. | 12.75 | 511. | 138. | 46. | 6.01 |
| + 2 COMBINED AT | !BC3 | 4550. | 12.83 | 936. | 254. | 85. | 10.87 |
| + DIVERSION TO | 1DI188 | 0. | 0.00 | 0. | 0. | 0. | 10.87 |
| + HYDROGRAPH AT | 1D10 | 4550. | 12.83 | 936. | 254. | 85. | 10.87 |
| + DIVERSION TO | 2DI188 | 0. | 0.00 | 0. | 0. | 0. | 10.87 |
| + HYDROGRAPH AT | 2D10 | 4550. | 12.83 | 936. | 254. | 85. | 10.87 |
| + ROUTED TO | RBC3 | 4351. | 13.00 | 933. | 254. | 85. | 10.87 |
| + HYDROGRAPH AT | 12 | 1024. | 12.58 | 144. | 38. | 13. | 1.38 |
| + DIVERSION TO | 12RET | 480. | 12.17 | 25. | 7. | 2. | 1.38 |
| + HYDROGRAPH AT | 12OUT | 1024. | 12.58 | 123. | 31. | 10. | 1.38 |
| + 2 COMBINED AT | !BC4 | 4642. | 13.00 | 1039. | 282. | 94. | 12.25 |
| + ROUTED TO | RBC4 | 4518. | 13.08 | 1035. | 282. | 94. | 12.25 |
| + HYDROGRAPH AT | WT3 | 314. | 12.50 | 41. | 10. | 3. | 0.44 |
| + 2 COMBINED AT | !BC5 | 4569. | 13.08 | 1067. | 290. | 97. | 12.69 |
| + HYDROGRAPH AT | 11 | 1342. | 12.42 | 183. | 51. | 17. | 1.56 |
| + DIVERSION TO | 11RET | 5. | 1.92 | 1. | 0. | 0. | 1.56 |
| + HYDROGRAPH AT | 11OUT | 1342. | 12.42 | 183. | 51. | 17. | 1.56 |
| + ROUTED TO | RCP11 | 1078. | 12.75 | 183. | 51. | 17. | 1.56 |
| + HYDROGRAPH AT | 13 | 1096. | 12.42 | 150. | 42. | 14. | 1.30 |
| + DIVERSION TO | 13RET | 950. | 12.33 | 67. | 18. | 6. | 1.30 |
| + HYDROGRAPH AT | 13OUT | 1092. | 12.50 | 92. | 24. | 8. | 1.30 |
| + 2 COMBINED AT | CP13 | 1792. | 12.58 | 270. | 75. | 25. | 2.86 |
| + ROUTED TO | RCP13 | 1752. | 12.67 | 270. | 75. | 25. | 2.86 |
| + HYDROGRAPH AT | 14 | 1347. | 12.33 | 164. | 48. | 16. | 1.47 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| + | DIVERSION TO | 14RET | 7. | 1.67 | 2. | 0. | 0. | 1.47 |
| + | HYDROGRAPH AT | 14OUT | 1347. | 12.33 | 164. | 48. | 16. | 1.47 |
| + | ROUTED TO | RCP14 | 1213. | 12.58 | 164. | 48. | 16. | 1.47 |
| + | HYDROGRAPH AT | 15 | 1109. | 12.42 | 140. | 40. | 13. | 1.26 |
| + | DIVERSION TO | 15RET | 221. | 11.92 | 21. | 7. | 2. | 1.26 |
| + | HYDROGRAPH AT | 15OUT | 1109. | 12.42 | 129. | 34. | 11. | 1.26 |
| + | 2 COMBINED AT | I1CP15 | 2155. | 12.50 | 289. | 81. | 27. | 2.73 |
| + | HYDROGRAPH AT | 16 | 1011. | 12.42 | 124. | 34. | 11. | 1.13 |
| + | DIVERSION TO | 16RET | 1011. | 12.42 | 87. | 23. | 8. | 1.13 |
| + | HYDROGRAPH AT | 16OUT | 577. | 12.58 | 43. | 12. | 4. | 1.13 |
| + | ROUTED TO | SR16 | 0. | 0.00 | 0. | 0. | 0. | 1.13 |
| + | 2 COMBINED AT | CP15 | 2155. | 12.50 | 289. | 81. | 27. | 3.90 |
| + | ROUTED TO | RCP15 | 1763. | 12.75 | 287. | 81. | 27. | 3.90 |
| + | HYDROGRAPH AT | 17 | 973. | 12.42 | 128. | 38. | 13. | 1.07 |
| + | DIVERSION TO | 17RET | 971. | 12.33 | 87. | 23. | 8. | 1.07 |
| + | HYDROGRAPH AT | 17OUT | 641. | 12.58 | 52. | 15. | 5. | 1.07 |
| + | 2 COMBINED AT | I1CP17 | 2099. | 12.75 | 335. | 94. | 32. | 4.97 |
| + | 2 COMBINED AT | CP17 | 3806. | 12.75 | 600. | 168. | 56. | 7.83 |
| + | ROUTED TO | RCP17 | 3745. | 12.83 | 600. | 168. | 56. | 7.83 |
| + | 2 COMBINED AT | !!WT3 | 7232. | 13.00 | 1578. | 434. | 145. | 20.52 |
| + | ROUTED TO | SRWT3 | 0. | 0.00 | 0. | 0. | 0. | 20.52 |
| + | HYDROGRAPH AT | 116 | 744. | 12.33 | 94. | 29. | 10. | 0.66 |
| + | DIVERSION TO | 116RET | 744. | 12.33 | 92. | 25. | 8. | 0.66 |
| + | HYDROGRAPH AT | 116OUT | 22. | 13.00 | 10. | 4. | 1. | 0.66 |
| + | ROUTED TO | R116 | 11. | 15.83 | 9. | 4. | 1. | 0.66 |
| + | HYDROGRAPH AT | 117 | 787. | 12.58 | 137. | 41. | 14. | 0.92 |
| + | DIVERSION TO | 117RET | 787. | 12.58 | 130. | 35. | 12. | 0.92 |
| + | HYDROGRAPH AT | 117OUT | 57. | 13.83 | 18. | 6. | 2. | 0.92 |
| + | 2 COMBINED AT | CP117 | 63. | 13.83 | 25. | 9. | 3. | 1.65 |
| + | ROUTED TO | R117 | 32. | 14.92 | 24. | 9. | 3. | 1.65 |
| + | HYDROGRAPH AT | 123 | 288. | 13.00 | 67. | 18. | 6. | 0.44 |
| + | DIVERSION TO | 123RET | 288. | 13.00 | 57. | 15. | 5. | 0.44 |
| + | HYDROGRAPH AT | 123OUT | 84. | 13.92 | 13. | 4. | 1. | 0.44 |
| + | DIVERSION TO | DI134 | 0. | 0.00 | 0. | 0. | 0. | 0.44 |
| + | HYDROGRAPH AT | D123 | 84. | 13.92 | 13. | 4. | 1. | 0.44 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| + | ROUTED TO | R188 | 0. | 0.00 | 0. | 0. | 0. | 11.08 |
| + | HYDROGRAPH AT | 207A | 407. | 12.42 | 42. | 10. | 3. | 0.50 |
| + | DIVERSION TO | 207ART | 407. | 12.42 | 42. | 10. | 3. | 0.50 |
| + | HYDROGRAPH AT | 207AOT | 1. | 13.42 | 0. | 0. | 0. | 0.50 |
| + | 2 COMBINED AT | CP207A | 0. | 0.00 | 0. | 0. | 0. | 11.58 |
| + | ROUTED TO | R207A | 0. | 0.00 | 0. | 0. | 0. | 11.58 |
| + | HYDROGRAPH AT | 214 | 161. | 12.25 | 13. | 3. | 1. | 0.16 |
| + | DIVERSION TO | 214RET | 161. | 12.25 | 13. | 3. | 1. | 0.16 |
| + | HYDROGRAPH AT | 214OUT | 0. | 0.00 | 0. | 0. | 0. | 0.16 |
| + | 2 COMBINED AT | CP214 | 0. | 0.00 | 0. | 0. | 0. | 11.74 |
| + | ROUTED TO | R214 | 0. | 0.00 | 0. | 0. | 0. | 11.74 |
| + | HYDROGRAPH AT | 215A | 372. | 12.42 | 39. | 10. | 3. | 0.45 |
| + | DIVERSION TO | 215ART | 372. | 12.42 | 39. | 10. | 3. | 0.45 |
| + | HYDROGRAPH AT | 215AOT | 4. | 13.33 | 0. | 0. | 0. | 0.45 |
| + | ROUTED TO | R215A | 1. | 13.58 | 0. | 0. | 0. | 0.45 |
| + | HYDROGRAPH AT | 215 | 315. | 12.33 | 32. | 8. | 3. | 0.35 |
| + | DIVERSION TO | 215RET | 315. | 12.33 | 32. | 8. | 3. | 0.35 |
| + | HYDROGRAPH AT | 215OUT | 5. | 13.08 | 0. | 0. | 0. | 0.35 |
| + | 2 COMBINED AT | 1I215 | 4. | 13.08 | 0. | 0. | 0. | 0.80 |
| + | 2 COMBINED AT | 2I215 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | DIVERSION TO | 1DI216 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | HYDROGRAPH AT | 3I215 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | DIVERSION TO | 2DI216 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | HYDROGRAPH AT | 4I215 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | DIVERSION TO | 3DI216 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | HYDROGRAPH AT | 5I215 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | DIVERSION TO | 4DI216 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | HYDROGRAPH AT | CP215 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | ROUTED TO | R215 | 0. | 0.00 | 0. | 0. | 0. | 12.54 |
| + | HYDROGRAPH AT | 233 | 375. | 12.42 | 41. | 10. | 3. | 0.50 |
| + | DIVERSION TO | 233RET | 375. | 12.42 | 41. | 10. | 3. | 0.50 |
| + | HYDROGRAPH AT | 233OUT | 6. | 13.17 | 0. | 0. | 0. | 0.50 |
| + | 2 COMBINED AT | CP233 | 0. | 0.00 | 0. | 0. | 0. | 13.04 |
| + | ROUTED TO | R233 | 0. | 0.00 | 0. | 0. | 0. | 13.04 |
| + | HYDROGRAPH AT | 216 | 248. | 12.92 | 45. | 11. | 4. | 0.51 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| + | HYDROGRAPH AT | 232 | 885. | 12.42 | 118. | 35. | 12. | 0.93 |
| + | DIVERSION TO | 232RET | 885. | 12.42 | 83. | 22. | 7. | 0.93 |
| + | HYDROGRAPH AT | 232OUT | 554. | 12.58 | 45. | 13. | 4. | 0.93 |
| + | DIVERSION TO | 2D28 | 554. | 12.58 | 45. | 13. | 4. | 0.93 |
| + | HYDROGRAPH AT | D232 | 0. | 0.00 | 0. | 0. | 0. | 0.93 |
| + | ROUTED TO | R232 | 0. | 0.00 | 0. | 0. | 0. | 0.93 |
| + | HYDROGRAPH AT | 246 | 564. | 12.50 | 83. | 24. | 8. | 0.75 |
| + | DIVERSION TO | 246RET | 564. | 12.50 | 55. | 15. | 5. | 0.75 |
| + | HYDROGRAPH AT | 246OUT | 373. | 12.75 | 34. | 9. | 3. | 0.75 |
| + | 2 COMBINED AT | CP246 | 370. | 12.75 | 33. | 9. | 3. | 1.68 |
| + | ROUTED TO | R246 | 214. | 13.08 | 33. | 9. | 3. | 1.68 |
| + | HYDROGRAPH AT | 260 | 428. | 12.33 | 45. | 12. | 4. | 0.50 |
| + | DIVERSION TO | 260RET | 222. | 12.08 | 11. | 3. | 1. | 0.50 |
| + | HYDROGRAPH AT | 260OUT | 428. | 12.33 | 35. | 9. | 3. | 0.50 |
| + | 2 COMBINED AT | CP260 | 421. | 12.33 | 66. | 18. | 6. | 2.18 |
| + | ROUTED TO | R260 | 256. | 12.83 | 65. | 18. | 6. | 2.18 |
| + | HYDROGRAPH AT | 273 | 626. | 12.42 | 94. | 29. | 10. | 0.65 |
| + | DIVERSION TO | 273RET | 626. | 12.42 | 61. | 17. | 6. | 0.65 |
| + | HYDROGRAPH AT | 273OUT | 461. | 12.58 | 43. | 12. | 4. | 0.65 |
| + | 2 COMBINED AT | !10W1 | 586. | 12.58 | 106. | 30. | 10. | 2.83 |
| + | DIVERSION TO | 1D292 | 0. | 0.00 | 0. | 0. | 0. | 2.83 |
| + | HYDROGRAPH AT | D273 | 586. | 12.58 | 106. | 30. | 10. | 2.83 |
| + | ROUTED TO | R10W1 | 521. | 12.75 | 106. | 30. | 10. | 2.83 |
| + | HYDROGRAPH AT | 261 | 187. | 13.17 | 44. | 12. | 4. | 0.41 |
| + | DIVERSION TO | 261RET | 187. | 13.17 | 31. | 8. | 3. | 0.41 |
| + | DIVERSION TO | 261RET | 187. | 13.17 | 31. | 8. | 3. | 0.41 |
| + | HYDROGRAPH AT | 261OUT | 111. | 13.67 | 14. | 4. | 1. | 0.41 |
| + | HYDROGRAPH AT | D247 | 0. | 0.00 | 0. | 0. | 0. | 0.50 |
| + | ROUTED TO | R247 | 0. | 0.00 | 0. | 0. | 0. | 0.50 |
| + | 2 COMBINED AT | CP261 | 111. | 13.67 | 14. | 4. | 1. | 0.91 |
| + | DIVERSION TO | DI277 | 39. | 13.67 | 4. | 1. | 0. | 0.91 |
| + | HYDROGRAPH AT | D261 | 71. | 13.67 | 10. | 3. | 1. | 0.91 |
| + | ROUTED TO | R261 | 39. | 14.67 | 9. | 3. | 1. | 0.91 |
| + | HYDROGRAPH AT | 274 | 300. | 13.50 | 101. | 31. | 10. | 0.66 |
| + | DIVERSION TO | 274RET | 300. | 13.50 | 74. | 20. | 7. | 0.66 |
| + | HYDROGRAPH AT | 274OUT | 186. | 14.17 | 37. | 11. | 4. | 0.66 |

| | | | | 01-50 | | | |
|---|---|---|---|---|---|---|---|
| + | I5CWT4 | 264. | 12.33 | 29. | 9. | 3. | 0.32 |
| + 2 COMBINED AT | CP44 | 1095. | 13.58 | 298. | 90. | 30. | 14.12 |
| + HYDROGRAPH AT | 45-1 | 142. | 12.08 | 16. | 5. | 2. | 0.08 |
| + DIVERSION TO | 45-1RT | 142. | 12.08 | 11. | 3. | 1. | 0.08 |
| + HYDROGRAPH AT | 45-1OT | 75. | 12.25 | 7. | 2. | 1. | 0.08 |
| + HYDROGRAPH AT | D43 | 0. | 0.00 | 0. | 0. | 0. | 13.90 |
| + 2 COMBINED AT | CP45-1 | 98. | 12.25 | 7. | 2. | 1. | 13.98 |
| + ROUTED TO | SR45-1 | 25. | 12.42 | 5. | 2. | 1. | 13.98 |
| + DIVERSION TO | 7DWT#4 | 25. | 12.42 | 5. | 2. | 1. | 13.98 |
| + HYDROGRAPH AT | D45-1 | 0. | 0.00 | 0. | 0. | 0. | 13.98 |
| + ROUTED TO | R45-1 | 0. | 0.00 | 0. | 0. | 0. | 13.98 |
| + HYDROGRAPH AT | 45 | 777. | 12.00 | 56. | 17. | 6. | 0.38 |
| + DIVERSION TO | 45RET | 710. | 12.00 | 38. | 10. | 3. | 0.38 |
| + HYDROGRAPH AT | 45OUT | 590. | 12.08 | 23. | 7. | 2. | 0.38 |
| + 2 COMBINED AT | CP45 | 561. | 12.08 | 21. | 6. | 2. | 4.44 |
| + ROUTED TO | SR45 | 97. | 12.25 | 21. | 6. | 2. | 4.44 |
| + DIVERSION TO | 8DWT#4 | 97. | 12.25 | 21. | 6. | 2. | 4.44 |
| + HYDROGRAPH AT | D45 | 0. | 0.00 | 0. | 0. | 0. | 4.44 |
| + ROUTED TO | R45 | 0. | 0.00 | 0. | 0. | 0. | 4.44 |
| + HYDROGRAPH AT | 46-1 | 163. | 12.25 | 25. | 8. | 3. | 0.15 |
| + DIVERSION TO | 46-1RT | 163. | 12.25 | 17. | 5. | 2. | 0.15 |
| + HYDROGRAPH AT | 46-1OT | 89. | 12.50 | 11. | 3. | 1. | 0.15 |
| + 2 COMBINED AT | CP46-1 | 62. | 12.58 | 9. | 3. | 1. | 14.51 |
| + ROUTED TO | SR46-1 | 36. | 12.92 | 9. | 3. | 1. | 14.51 |
| + DIVERSION TO | 9DWT#4 | 36. | 12.92 | 9. | 3. | 1. | 14.51 |
| + HYDROGRAPH AT | D46-1 | 0. | 0.00 | 0. | 0. | 0. | 14.51 |
| + ROUTED TO | R46-1 | 0. | 0.00 | 0. | 0. | 0. | 14.51 |
| + HYDROGRAPH AT | 46 | 526. | 12.58 | 111. | 34. | 11. | 0.85 |
| + DIVERSION TO | 46RET | 526. | 12.58 | 76. | 21. | 7. | 0.85 |
| + HYDROGRAPH AT | 46OUT | 304. | 13.00 | 46. | 13. | 4. | 0.85 |
| + 2 COMBINED AT | I1CP46 | 218. | 13.00 | 39. | 11. | 4. | 15.36 |
| + HYDROGRAPH AT | 28 | 695. | 12.50 | 103. | 31. | 10. | 0.86 |
| + DIVERSION TO | 28RET | 695. | 12.50 | 70. | 19. | 6. | 0.86 |
| + HYDROGRAPH AT | 28OUT | 425. | 12.75 | 42. | 12. | 4. | 0.86 |
| + HYDROGRAPH AT | !JR1 | 554. | 12.58 | 45. | 13. | 4. | 0.93 |
| + DIVERSION TO | JRBSN | 462. | 12.58 | 30. | 8. | 3. | 0.93 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| + | HYDROGRAPH AT | DBJR1 | 92. | 12.58 | 15. | 4. | 1. | 0.93 |
| + | HYDROGRAPH AT | DBJR1 | 462. | 12.58 | 30. | 8. | 3. | 0.93 |
| + | ROUTED TO | SRJR1 | 0. | 0.00 | 0. | 0. | 0. | 0.93 |
| + | 2 COMBINED AT | 2JR1 | 92. | 12.58 | 15. | 4. | 1. | 0.93 |
| + | ROUTED TO | RJR1 | 63. | 13.17 | 14. | 4. | 1. | 0.93 |
| + | 2 COMBINED AT | !JR2 | 428. | 12.75 | 55. | 16. | 5. | 1.79 |
| + | ROUTED TO | RJR2 | 318. | 12.92 | 54. | 16. | 5. | 1.79 |
| + | HYDROGRAPH AT | 30 | 285. | 12.25 | 39. | 12. | 4. | 0.28 |
| + | DIVERSION TO | 30RET | 285. | 12.25 | 26. | 7. | 2. | 0.28 |
| + | HYDROGRAPH AT | 30OUT | 171. | 12.50 | 17. | 5. | 2. | 0.28 |
| + | 2 COMBINED AT | I1CP30 | 372. | 12.83 | 69. | 21. | 7. | 2.07 |
| + | HYDROGRAPH AT | 29 | 243. | 12.25 | 26. | 8. | 3. | 0.22 |
| + | DIVERSION TO | 29RET | 243. | 12.25 | 18. | 5. | 2. | 0.22 |
| + | HYDROGRAPH AT | 29OUT | 166. | 12.42 | 11. | 3. | 1. | 0.22 |
| + | ROUTED TO | SR29 | 0. | 0.00 | 0. | 0. | 0. | 0.22 |
| + | ROUTED TO | R29 | 0. | 0.00 | 0. | 0. | 0. | 0.22 |
| + | 2 COMBINED AT | !JR3 | 372. | 12.83 | 69. | 21. | 7. | 2.29 |
| + | ROUTED TO | RJR3 | 290. | 13.25 | 67. | 20. | 7. | 2.29 |
| + | HYDROGRAPH AT | 31 | 521. | 12.50 | 75. | 21. | 7. | 0.71 |
| + | DIVERSION TO | 31RET | 521. | 12.50 | 48. | 13. | 4. | 0.71 |
| + | HYDROGRAPH AT | 31OUT | 342. | 12.75 | 31. | 9. | 3. | 0.71 |
| + | 2 COMBINED AT | !JR4 | 369. | 13.17 | 96. | 29. | 10. | 3.00 |
| + | ROUTED TO | RJR4 | 346. | 13.25 | 94. | 29. | 10. | 3.00 |
| + | 2 COMBINED AT | !JR5 | 559. | 13.00 | 134. | 40. | 13. | 7.69 |
| + | ROUTED TO | SR46 | 561. | 13.00 | 134. | 40. | 13. | 7.69 |
| + | ROUTED TO | R46 | 478. | 13.50 | 131. | 40. | 13. | 7.69 |
| + | HYDROGRAPH AT | D45-1 | 25. | 12.42 | 5. | 2. | 1. | 13.98 |
| + | ROUTED TO | RD45-1 | 15. | 12.92 | 5. | 2. | 1. | 13.98 |
| + | HYDROGRAPH AT | D45 | 97. | 12.25 | 21. | 6. | 2. | 4.44 |
| + | ROUTED TO | RD45 | 72. | 12.67 | 20. | 6. | 2. | 4.44 |
| + | 2 COMBINED AT | I7CWT4 | 74. | 12.75 | 24. | 7. | 2. | 14.36 |
| + | HYDROGRAPH AT | D46-1 | 36. | 12.92 | 9. | 3. | 1. | 14.51 |
| + | ROUTED TO | RD46-1 | 29. | 13.42 | 9. | 3. | 1. | 14.51 |
| + | 2 COMBINED AT | I8CWT4 | 83. | 13.17 | 32. | 10. | 3. | 14.51 |
| + | HYDROGRAPH AT | WT4 | 971. | 12.25 | 130. | 43. | 14. | 0.77 |

# Appendix XIV
# FIRM Maps

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3175 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov

**Base map** information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

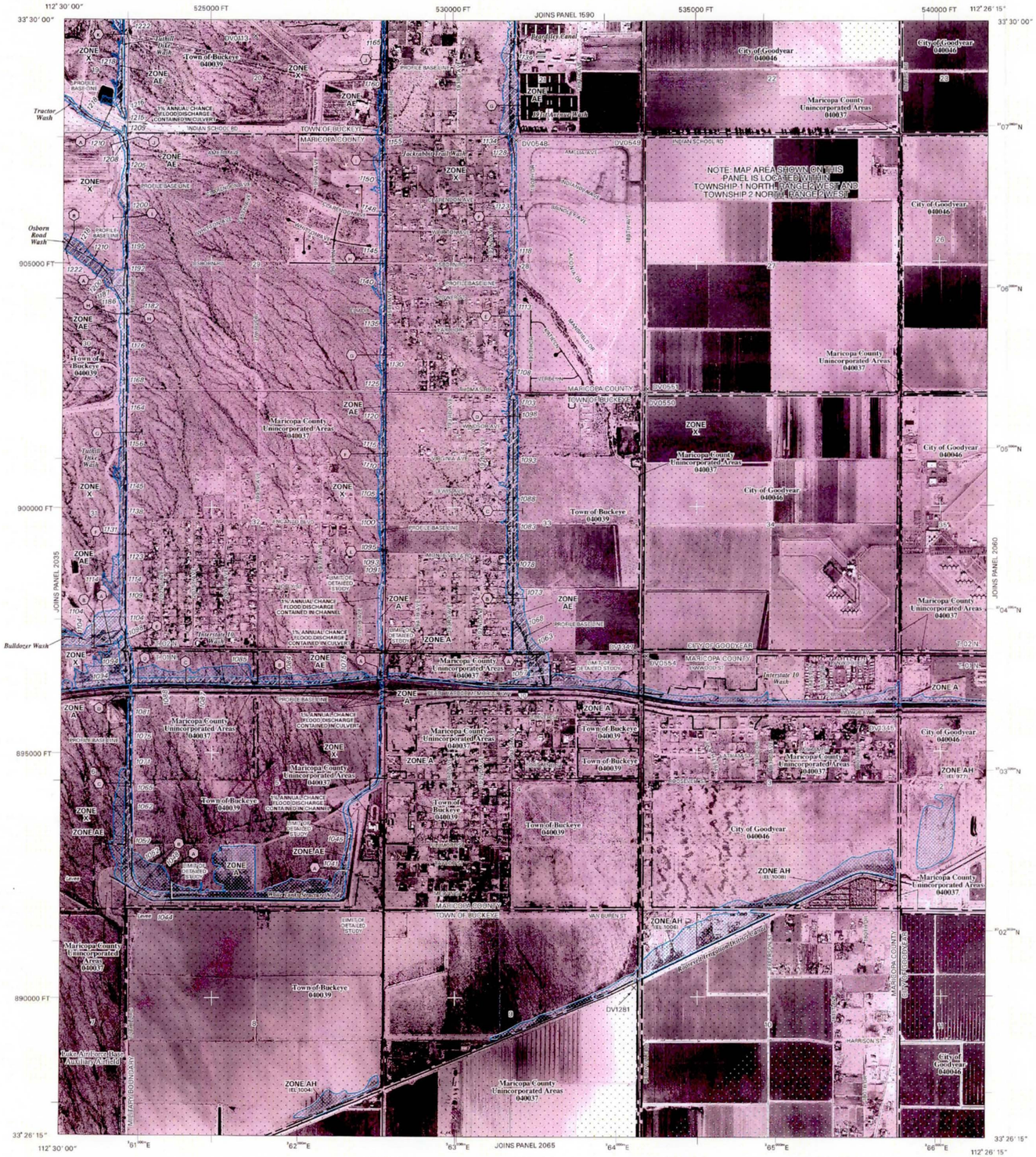
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/




## LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The **Base Flood Elevation** is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** — No Base Flood Elevations determined.
- **ZONE AE** — Base Flood Elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

- **ZONE X** — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

- **ZONE X** — Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet *
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet *

* Referenced to the National Geodetic Vertical Datum of 1929

- (A)—(A) — Cross section line
- (2)—(2) — Transect line
- 112° 07' 08", 33° 25' 41" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
- 76 mE — 1000-meter Universal Transverse Mercator grid tick values zone 12.
- 875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3175) NAD83 (Transverse Mercator)
- DV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M15 — River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 30, 1995, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

2-ENGINEERING 2055G

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2055G

# FIRM
## FLOOD INSURANCE RATE MAP
## MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

**PANEL 2055 OF 4350**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| BUCKEYE, TOWN OF | 040039 | 2055 | G |
| GOODYEAR, CITY OF | 040046 | 2055 | G |
| MARICOPA COUNTY | 040037 | 2055 | G |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**04013C2055G**
**MAP REVISED**
**SEPTEMBER 30, 2005**

Federal Emergency Management Agency

## NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify **all areas** subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding convers on between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

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National Geodetic Survey, NOAA
Silver Spring Metro Center
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**Base map** information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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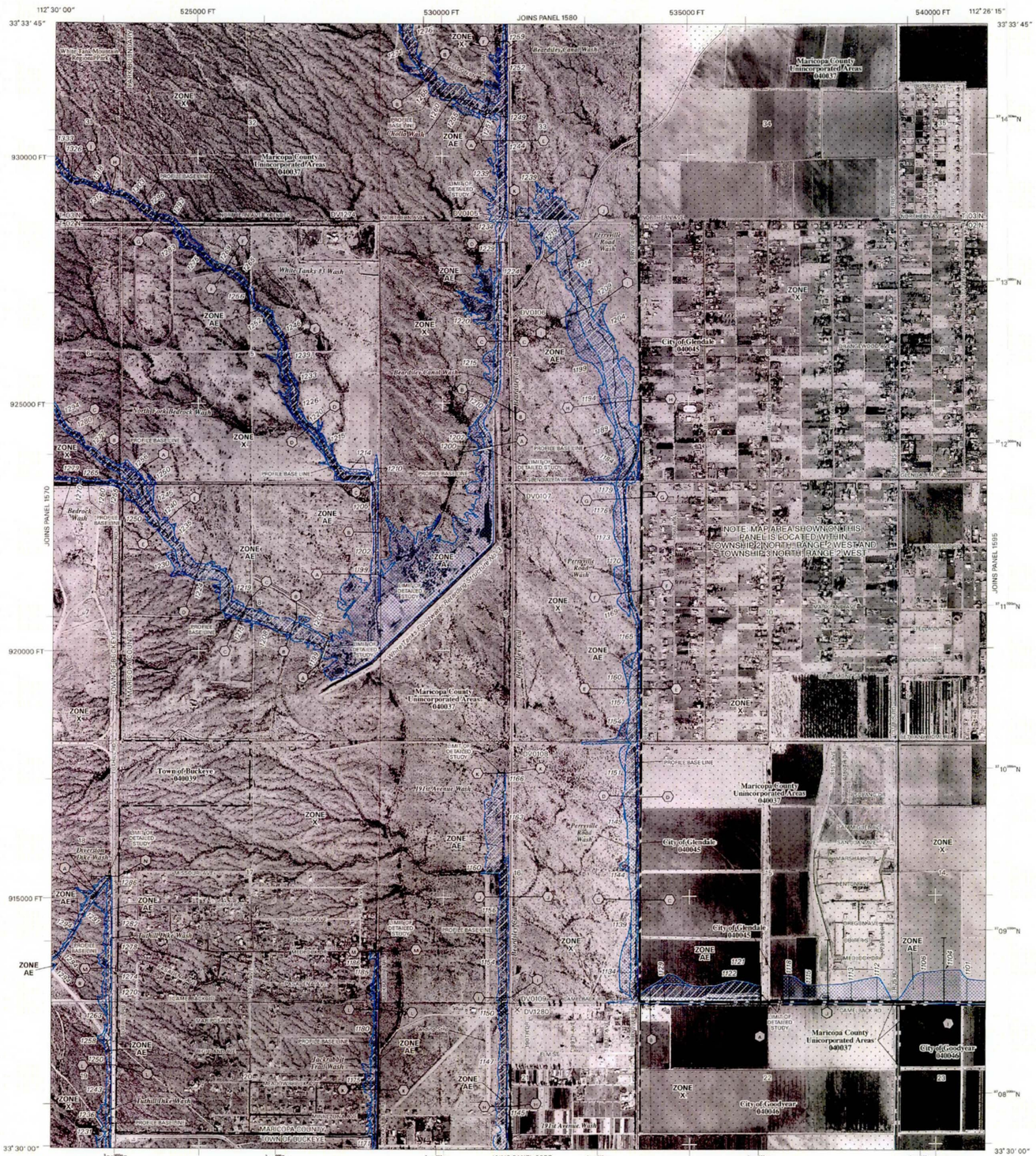


## LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A — No Base Flood Elevations determined.

ZONE AE — Base Flood Elevations determined.

ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referred to the National Geodetic Vertical Datum of 1929

A — A — Cross section line

7 — 7 — Transect line

112° 07' 08", 33° 25' 41" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

"76 000m E — 1000-meter Universal Transverse Mercator grid tick values zone 12.

875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)

DV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 — River Mile

MAP REPOSITORY

Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 4, 1991; September 30, 1995; July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment

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MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

2-ENGINEERING 1590H

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1590H

# FIRM

## FLOOD INSURANCE RATE MAP

## MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

### PANEL 1590 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| BUCKEYE, TOWN OF | 040039 | 1590 | H |
| GLENDALE, CITY OF | 040045 | 1590 | H |
| GOODYEAR, CITY OF | 040046 | 1590 | H |
| MARICOPA COUNTY | 040037 | 1590 | H |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1590H
MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

## NOTES TO USERS

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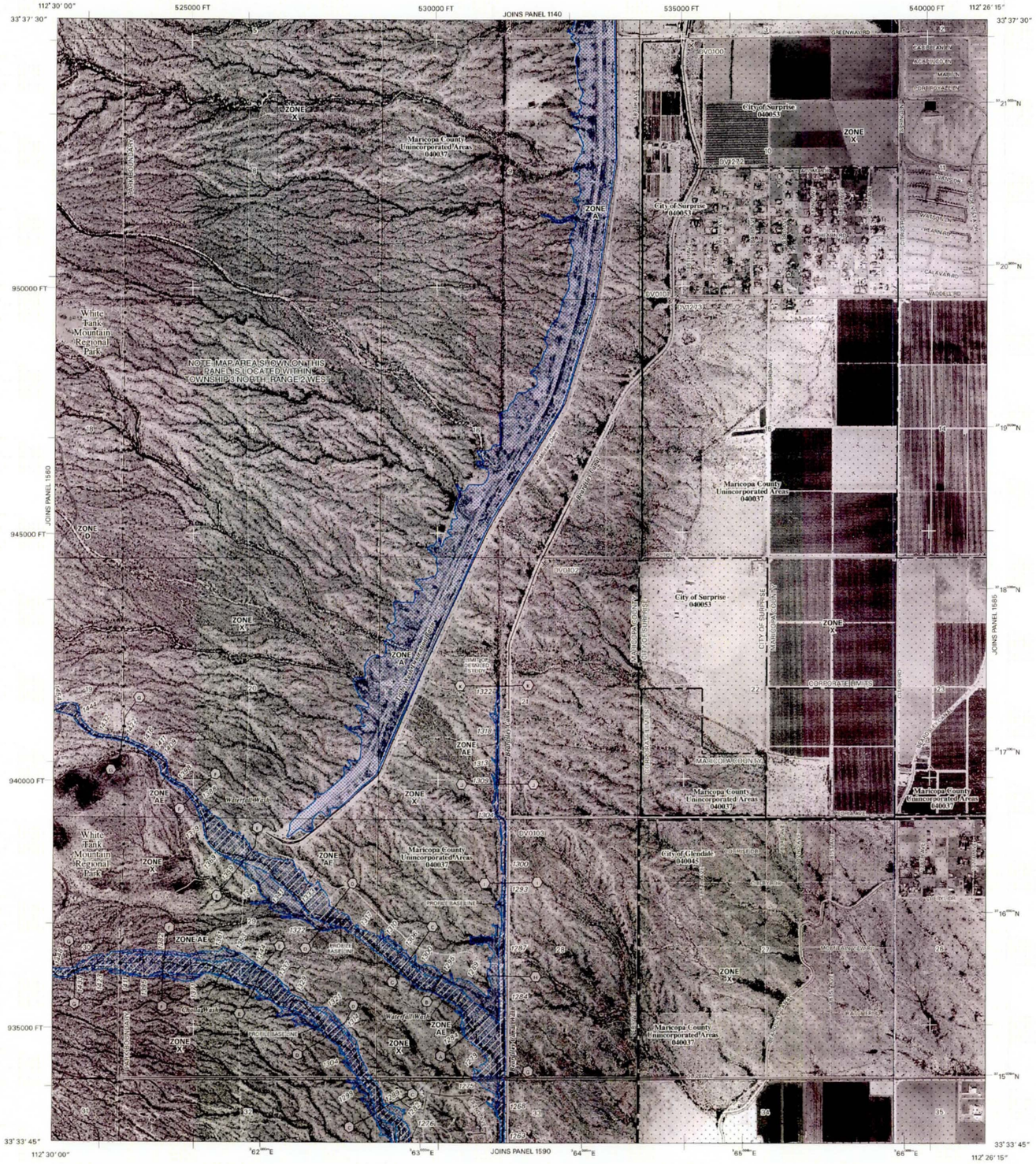


## LEGEND

**SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

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- **ZONE VE** — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

- **ZONE X** — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

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**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet.*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet.*

* Referenced to the National Geodetic Vertical Datum of 1929

- A — A — Cross section line
- 2 — 2 — Transect line

112°07'08",33°25'41" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

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875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator).

BV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

MILE — River Mile

MAP REPOSITORY
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MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

2-ENGINEERING 1580H

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PANEL 1580H

# FIRM
## FLOOD INSURANCE RATE MAP
## MARICOPA COUNTY, ARIZONA
## AND INCORPORATED AREAS

**PANEL 1580 OF 4350**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| GLENDALE, CITY OF | 040045 | 1580 | H |
| MARICOPA COUNTY | 040037 | 1580 | H |
| SURPRISE, CITY OF | 040053 | 1580 | H |

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**MAP NUMBER**
**04013C1580H**
**MAP REVISED**
**SEPTEMBER 30, 2005**

Federal Emergency Management Agency

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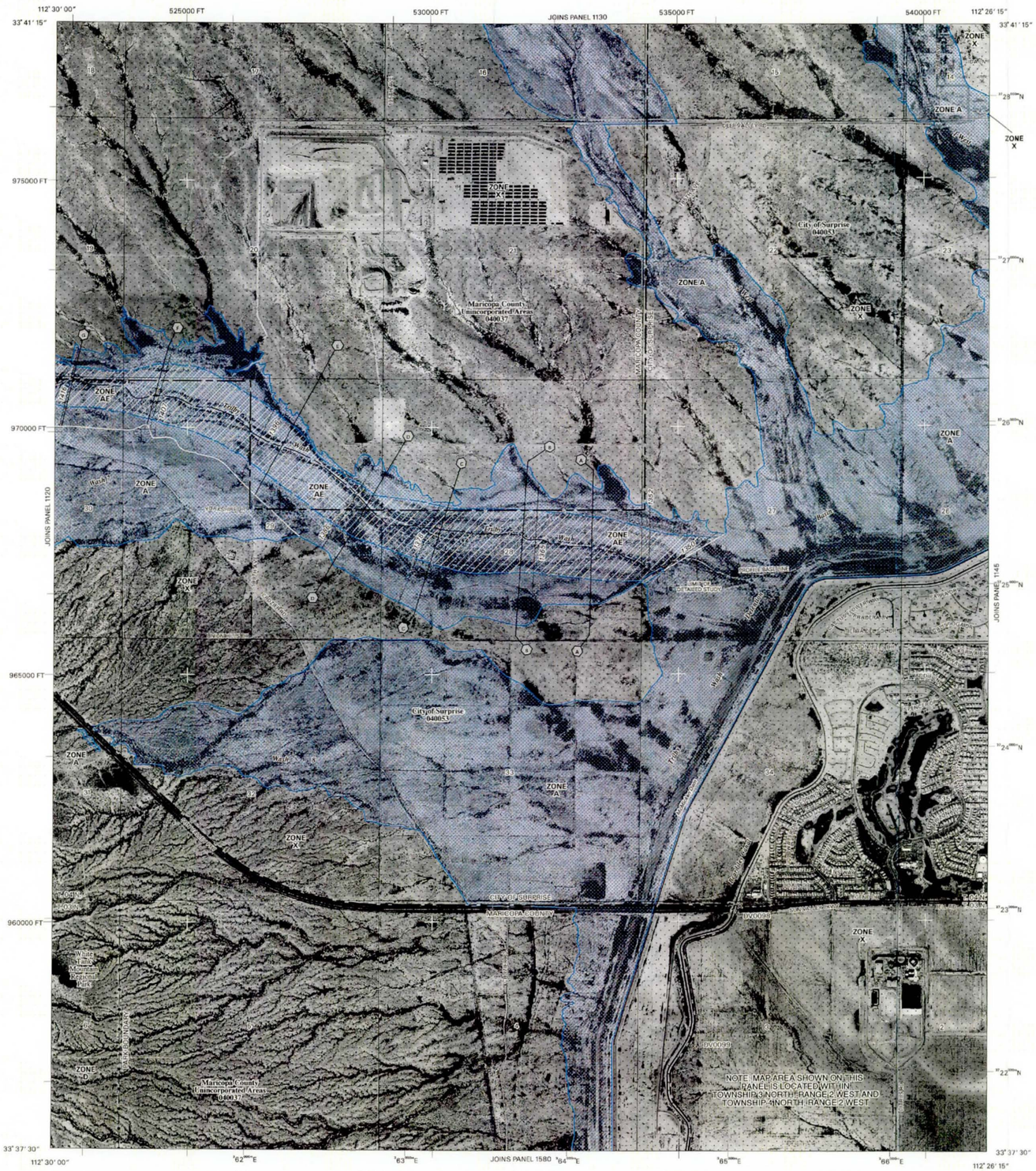


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PANEL 1140H

# FIRM
## FLOOD INSURANCE RATE MAP
## MARICOPA COUNTY, ARIZONA
## AND INCORPORATED AREAS

## PANEL 1140 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

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**MAP REVISED**
**SEPTEMBER 30, 2005**

Federal Emergency Management Agency

# Appendix XV
# Traffic Operations

# JACKRABBIT TRAIL: I-10 TO BELL ROAD
# ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY

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# TECHNICAL MEMORANDUM
# TRAFFIC OPERATIONS

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Prepared for:

DMJM HARRIS | AECOM

2777 E. Camelback Road, Suite 200
Phoenix, AZ 85016

Prepared by:

WILSON & COMPANY

410 North 44th Street
Suite 460
Phoenix, AZ 85008

September 15, 2008

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# 1.0 INTRODUCTION

In April 2008, *Technical Memorandum No. 2 – Traffic Analysis and Data* was prepared for the *Jackrabbit Trail: I-10 to Bell Road, Access Control and Corridor Improvement Study*. This document summarized the analysis of candidate alignment alternatives for Jackrabbit Trail and provided a detailed discussion of the long-range network performance of the preferred alignment alternative. The analysis was based primarily on roadway segment operation under daily volume conditions. The analysis also reviewed intersection entering volumes forecast by the Enhanced Year 2026 Travel Demand Assignment MCDOT Northwest Valley Corridor Studies Model to identify high-volume intersections within the corridor.

The purpose of this memorandum is to build upon the previous evaluation of corridor alternatives, analyzing various intersection configuration concepts using the SYNCHRO capacity analysis tool. The analysis of peak-hour operations was conducted for intersections located at key interchanges along Interstate 10 (I-10) and at major cross-street intersections along the Jackrabbit Trail Corridor, particularly those intersections identified as high-volume locations in the previous work effort. Special emphasis will be placed on the analysis of future traffic operations at the critical intersection of Jackrabbit Trail/Bell Road at the northern end of the corridor where future daily volume levels have been projected to be among the highest.

The document has been organized into the following topics of discussion:

- Intersection Forecast Volumes and Analysis Methodology
- Traditional intersection Configurations (Non-Arizona Parkway, Interim Conditions)
- Arizona Parkway Intersection Configuration (With Indirect Left-Turns)
- Single Point Urban Interchange Configuration (Long-term Development Conditions)

# 2.0 INTERSECTION FORECAST VOLUMES AND ANALYSIS METHODOLOGY

## *2.1 Analysis Criteria*

The analysis of these signalized intersections conforms to the operational analysis methodology outlined in Chapter 16 of the *Highway Capacity Manual 2000 (HCM 2000), Transportation Research Board Special Report 209*. The HCM 2000 methodology relates the intersection level of service (LOS) to intersection control delay, in terms of seconds per vehicle (sec/veh). A micro simulation program, *SYNCHRO*, was used for this analysis as it implements the methods of *HCM 2000* to calculate level of service.

The LOS criteria used for the analysis of signalized intersections are described in Table 2.1, identifying the thresholds of control delays and the associated LOS.

For purposes of this analysis, Level of Service D is considered the threshold for acceptable intersection delay. Intersections with overall intersection delay greater than the LOS D threshold require mitigation to reduce overall delay to acceptable levels.

**Table 2.1**
**Signalized Intersection Level of Service Criteria Definitions**

| Average Control Delay (seconds/vehicle) | Level of Service (LOS) Characteristics |
|---|---|
| <10 | *LOS A* describes operations with very low delay. This occurs when progression is extremely favorable, and most vehicles do not stop at all. Short cycle lengths may also contribute to low delay. |
| >10– 20 | *LOS B* describes operations with generally good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay. |
| >20 – 35 | *LOS C* describes operations with higher delays, which may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping. |
| >35– 55 | *LOS D* describes operations with high delay, resulting from some combination of unfavorable progression, long cycle lengths, or high volumes. The influence of congestion becomes more noticeable, and individual cycle failures are noticeable. |
| >55 – 80 | *LOS E* is considered the limit of acceptable delay. Individual cycle failures are frequent occurrences. |
| >80 | *LOS F* describes a condition of excessively high delay, considered unacceptable to most drivers. This condition often occurs when arrival flow rates exceed the LOS D capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes to such delay. |

Source: 2000 Highway Capacity Manual, TRB Special Report 209.

## *2.2 Analysis Methodology*

Table 2.2 provides a summary of the forecasted daily intersection entering volumes. As discussed in previous memorandums, traffic forecasts from the Enhanced Year 2026 Travel Demand Assignment MCDOT Northwest Valley Corridor Studies Model were selected as the most appropriate for use in this study. Based on the entering volumes summarized in Table 2.2, the intersections were categorized into three groups based on entering vehicles per day (vpd), as follows:

- Category 1: Daily Entering Volume: 80,000 to 95,000 vpd
  - Jackrabbit Trail & Greenway Road
- Category 2: Daily Entering Volume: 65,000 to 80,000 vpd
  - Jackrabbit Trail & Waddell Road
- Category 3: Daily Entering Volume: Less than 65,000 vpd
  - Jackrabbit Trail & Cactus Road
  - Jackrabbit Trail & Peoria Avenue
  - Jackrabbit Trail & Olive Avenue
  - Jackrabbit Trail & Northern Avenue
  - Jackrabbit Trail & Glendale Avenue
  - Jackrabbit Trail & Bethany Home Road
  - Jackrabbit Trail & Camelback Road
  - Jackrabbit Trail & Indian School Road
  - Jackrabbit Trail & Thomas Road
  - Jackrabbit Trail & McDowell Road
  - Perryville Road & Indian School Road
  - Perryville Road & Thomas Road
  - Perryville Road & McDowell Road

Various intersection configurations were analyzed for each of these three categories based on estimates of average peak hour turning movement volumes that might be experienced with each volume level. Findings for each category were assumed to be applicable to any corridor intersection whose daily volumes fell within the category range.

Only the intersection of Jackrabbit Trail & Bell Road is forecast to experience volumes in excess of the 95,000 vpd which was established as the upper limit for categorization. Therefore, detailed evaluation of this intersection was conducted individually. Also, operations at the interchanges of I-10 at Jackrabbit Trail and Perryville Road were also analyzed individually due to the unique characteristics associated with interchange operations.

While the ultimate configuration of Jackrabbit Trail has been recommended as a six-lane Arizona Parkway with indirect left-turns, analysis was also conducted assuming traditional intersection operations in the event that the facility is constructed as an arterial in the interim. The following sections provide a summary of the findings of the analysis.

## Table 2.2
## Summary of Daily Entering Volumes for Key Corridor Intersections
## Selected Long-Range Model Planning Forecast Horizon

| Facility Alignment | Cross Street Intersection | Enhanced Year 2026 Travel Demand Assignment MCDOT Northwest Valley Corridor Studies Model (1) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Daily Entering Volume Summary | | | | | |
| | | North | East | South | West | Summary Total | Intersection Entering Volume |
| Jackrabbit Trail | Bell Road | 42,201 | 47,000 | 75,000 | 73,000 | 237,201 | 118,601 |
| Jackrabbit Trail | Greenway Road | 75,000 | 40,000 | 71,000 | 0 | 186,000 | 93,000 |
| Jackrabbit Trail | Waddell Road | 71,000 | 30,000 | 57,000 | 0 | 158,000 | 79,000 |
| Jackrabbit Trail | Cactus Road | 57,000 | 15,000 | 44,000 | 0 | 116,000 | 58,000 |
| Jackrabbit Trail | Peoria Avenue | 44,000 | 23,000 | 44,000 | 0 | 111,000 | 55,500 |
| Jackrabbit Trail | Olive Avenue | 44,000 | 19,300 | 27,000 | 0 | 90,300 | 45,150 |
| Jackrabbit Trail | Northern Avenue | 27,000 | 1,400 | 26,000 | 0 | 54,400 | 27,200 |
| Jackrabbit Trail | Glendale Avenue | 26,000 | 20,900 | 27,800 | 0 | 74,700 | 37,350 |
| Jackrabbit Trail | Bethany Home Road | 27,800 | 7,400 | 28,300 | 0 | 63,500 | 31,750 |
| Jackrabbit Trail | Camelback Road | 28,300 | 22,800 | 33,500 | 26,300 | 110,900 | 55,450 |
| Jackrabbit Trail | Indian School Road | 33,500 | 25,800 | 22,700 | 14,700 | 96,700 | 48,350 |
| Jackrabbit Trail | Thomas Road | 22,700 | 25,600 | 23,800 | 19,000 | 91,100 | 45,550 |
| Jackrabbit Trail | McDowell Road | 23,800 | 26,000 | 28,000 | 20,500 | 98,300 | 49,150 |
| Jackrabbit Trail | Interstate 10 | 28,000 | 6,589 | 31,350 | 7,022 | 72,961 | 36,481 |
| Perryville Road | Indian School Road | 35,600 | 23,900 | 34,200 | 25,800 | 119,500 | 59,750 |
| Perryville Road | Thomas Road | 34,200 | 23,900 | 32,300 | 25,600 | 116,000 | 58,000 |
| Perryville Road | McDowell Road | 32,300 | 25,900 | 35,000 | 26,000 | 119,200 | 59,600 |
| Perryville Road | Interstate 10 | 35,000 | 9,378 | 30,762 | 9,689 | 84,829 | 42,415 |

Prepared by Wilson & Company February 6, 2008.

**Notes:**

(1) Adjusted Daily Volume Estimates developed by Wilson & Company based on actual roadway network conditions in current adopted community transportation plans or planned network improvements as compared to the roadway network coded into the MAG Regional Transportation Model. Further adjustments to segment volumes in the northern portion of the corridor in response to master planned community traffic impact analyses results provided by the City of Surprise.

- Red highlight indicates intersections with high daily intersection entering volumes > 95,000 vehicles per day (vpd).
- Category 1; Yellow highlight indicates intersections with moderate to high daily intersection entering volumes – 80,000 to 95,000 vpd.
- Category 2; Green highlight indicates intersections with moderate daily intersection entering volumes – 65,000 to 80,000 vpd.
- Category 3; No highlight indicates intersections with low to moderate daily intersection entering volumes <65,000 vpd.

Source: Jackrabbit Trail: I-10 to Bell Road Access Control and Corridor Improvement Study - Future Conditions Socioeconomic Database Review and planning Level Traffic Analysis January 21, 2008.

# 3.0 TRADITIONAL INTERSECTION CONFIGURATIONS (NON-ARIZONA PARKWAY, INTERIM CONDITIONS)

## *3.1 Category Based Operational Analysis – Base Condition*

Table 3.1 provides a summary of the forecasted peak hour intersection operations for each volume category with interim construction of Jackrabbit Trail as a traditional arterial facility. Figures 3.1–3.6 illustrate the assumed intersection geometry and AM and PM peak hour traffic volumes for Categories 1– 3, as follows:

- Figure 3.1 – Traditional Intersection Geometries and Volumes for Category 1, AM Peak
- Figure 3.2 – Traditional Intersection Geometries and Volumes for Category 2, AM Peak
- Figure 3.4 – Traditional Intersection Geometries and Volumes for Category 3, AM Peak
- Figure 3.5 – Traditional Intersection Geometries and Volumes for Category 1, PM Peak
- Figure 3.5 – Traditional Intersection Geometries and Volumes for Category 2, PM Peak
- Figure 3.6 – Traditional Intersection Geometries and Volumes for Category 3, PM Peak

Detailed level of service calculations and printouts are provided in Appendix A.

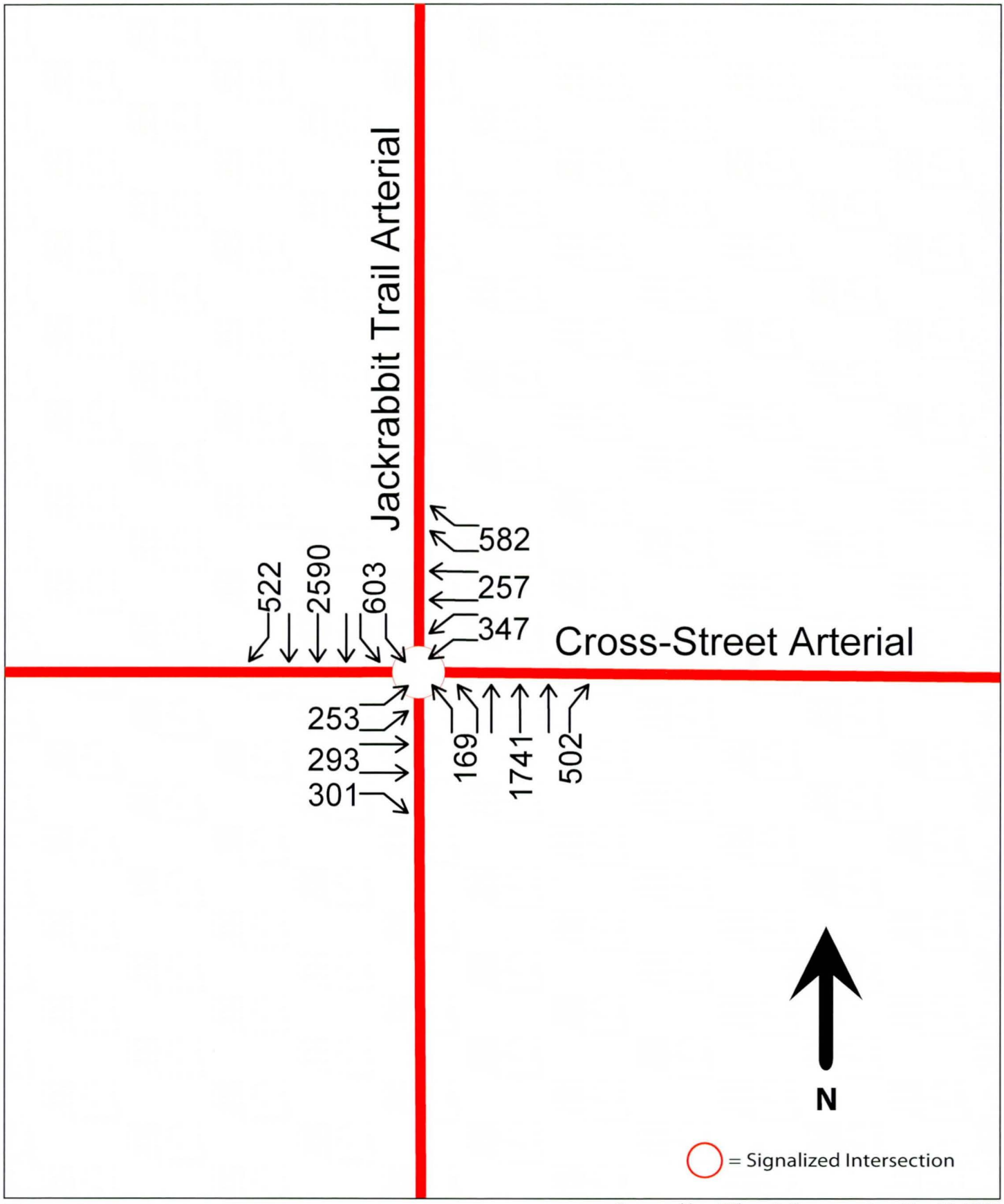
**Table 3.1**
**Traditional intersection Operations**
Categories 1–3
(Non-Arizona Parkway Conditions)

| BASE CONDITION – AM PEAK HOUR | | | |
|---|---|---|---|
| CATEGORY NO. | NAME/DESCRIPTION | DELAY | LOS |
| 1 | DAILY ENTERING VOL: 80,000 TO 95,000 vpd | 51.9 | D |
| 2 | DAILY ENTERING VOL: 65,000 TO 80,000 vpd | 53.9 | D |
| 3 | DAILY ENTERING VOL: LESS THAN 65,000 vpd | 41.9 | D |

| BASE CONDITION – PM PEAK HOUR | | | |
|---|---|---|---|
| CATEGORY NO. | NAME/DESCRIPTION | DELAY | LOS |
| 1 | DAILY ENTERING VOL: 80,000 TO 95,000 vpd | 54.9 | D |
| 2 | DAILY ENTERING VOL: 65,000 TO 80,000 vpd | 53.5 | D |
| 3 | DAILY ENTERING VOL: LESS THAN 65,000 vpd | 35.3 | D |

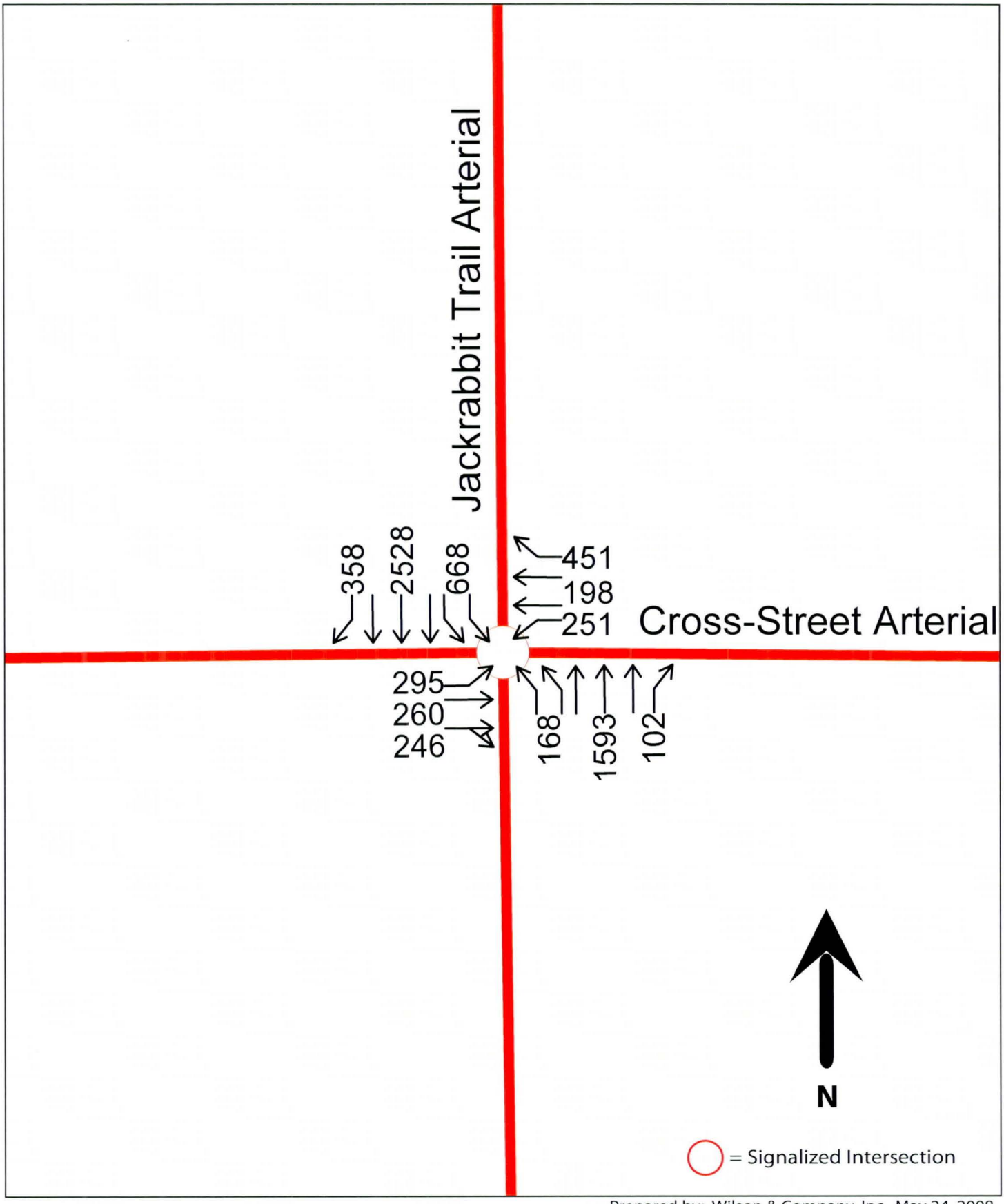
Source: Wilson & Company, May 22, 2008.

Results indicate that, while some approaches may operate with higher delays, Level of Service D can be provided with traditional intersection configurations with the forecast Enhanced Year 2026 traffic volumes for each intersection volume category provided the assumed geometry depicted in Figures 3.1–3.6 is constructed at each intersection.



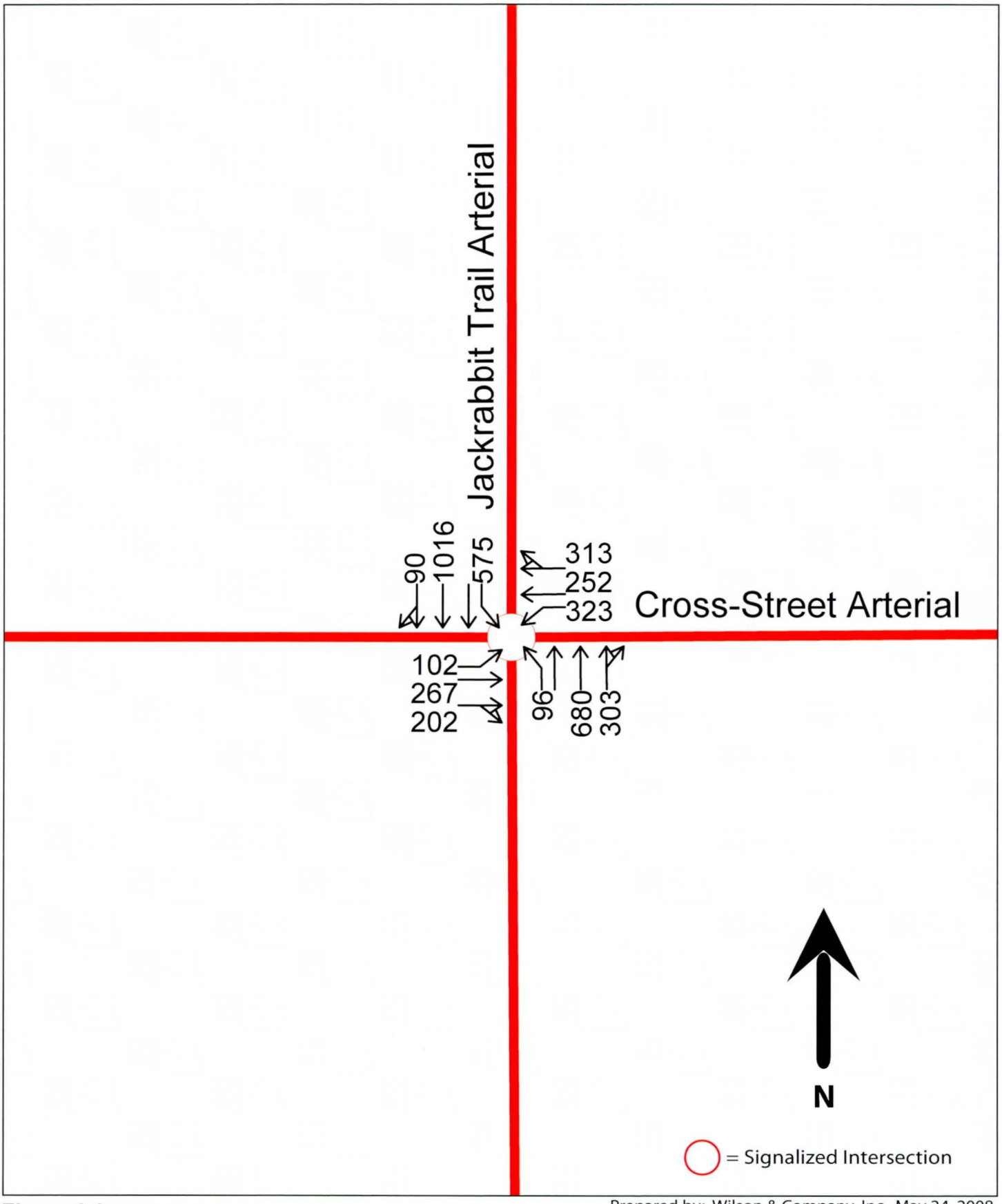

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.1**
**Traditional Intersection Geometrics and Volumes for Category 1, AM Peak**



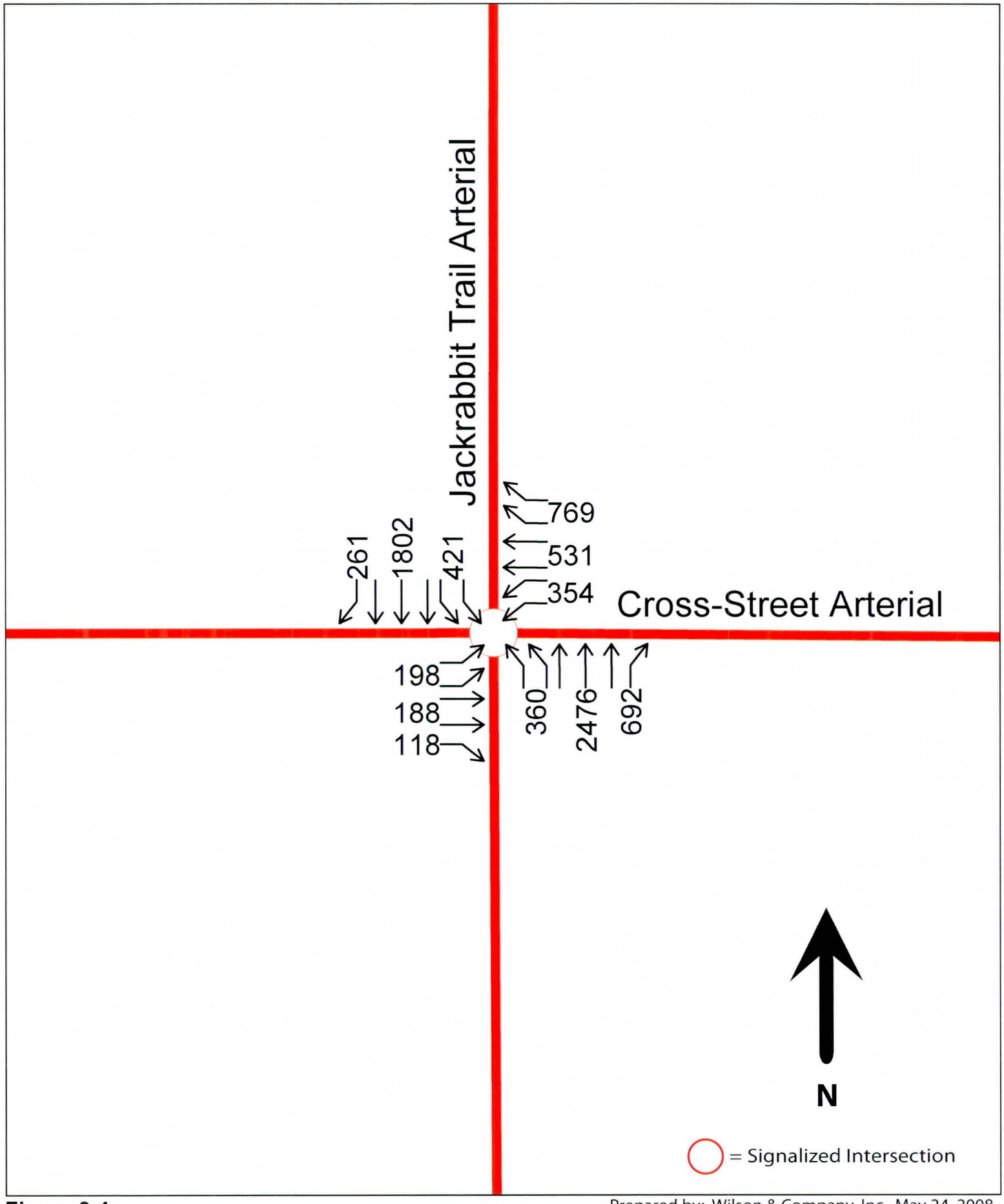

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.2**
**Traditional Intersection Geometries and Volumes for Category 2, AM Peak**



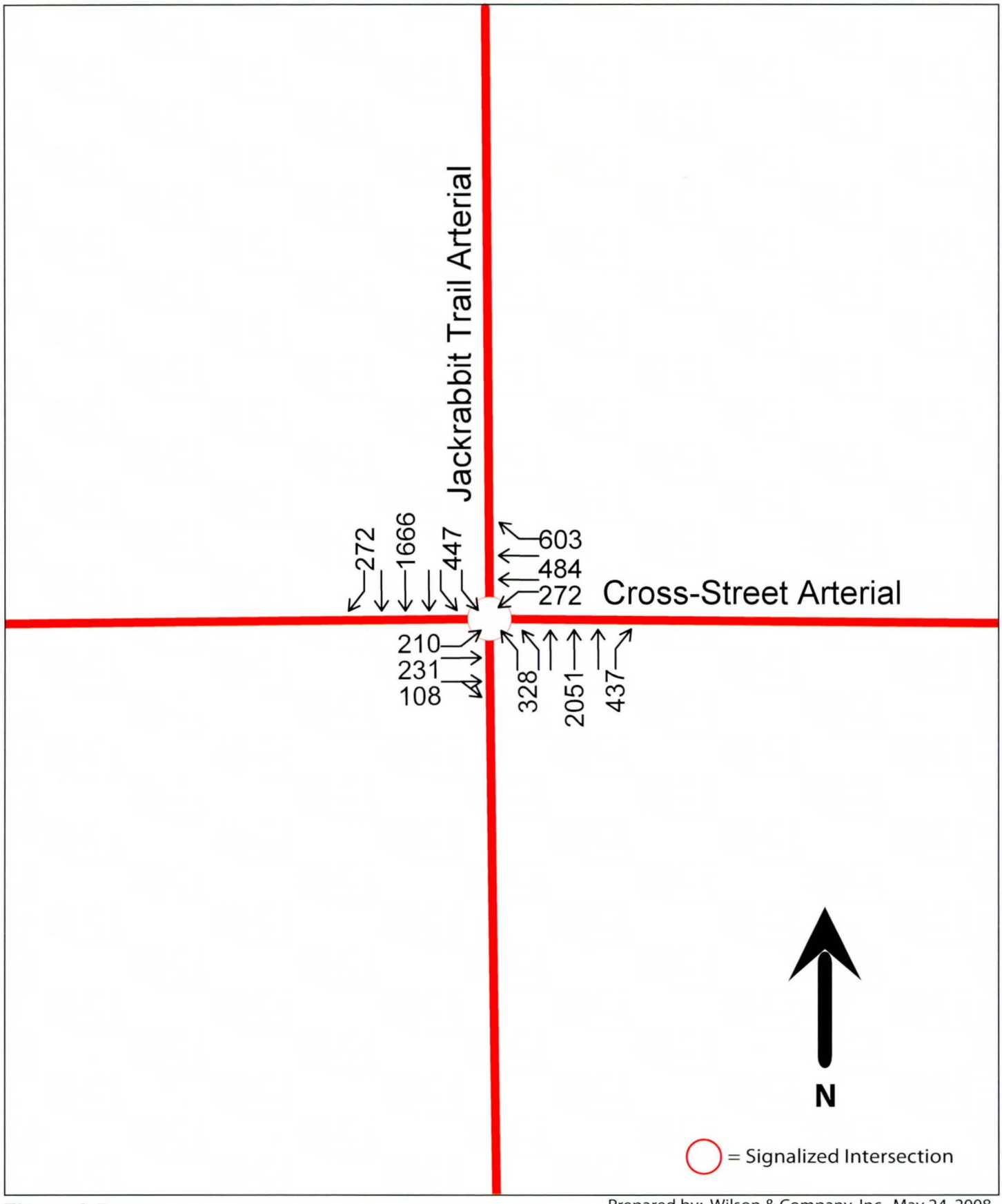

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.3**
**Traditional Intersection Geometries and Volumes for Category 3, AM Peak**



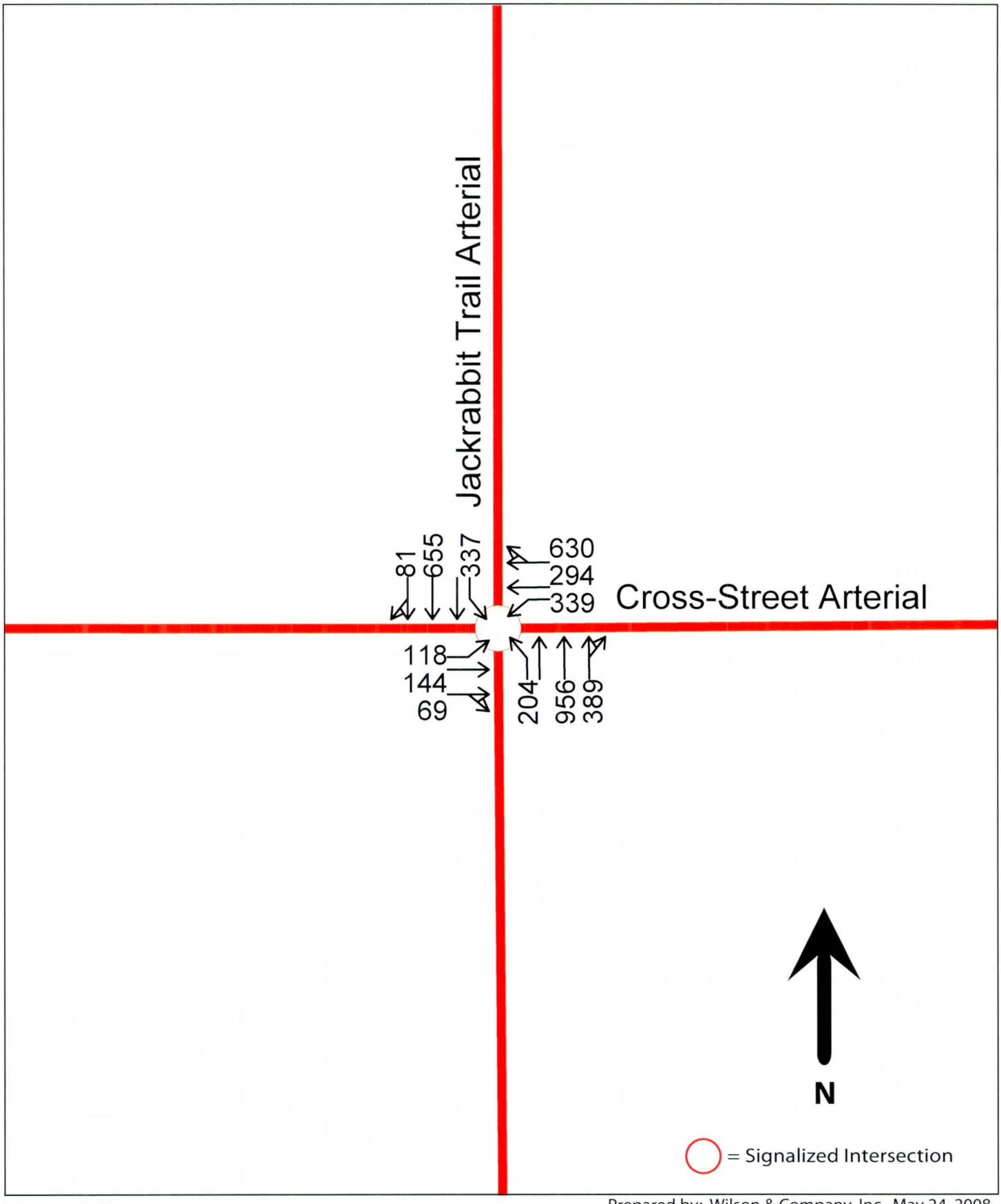

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.4**
**Traditional Intersection Geometries and Volumes for Category 1, PM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.5**
**Traditional Intersection Geometries and Volumes for Category 2, PM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.6**
**Traditional Intersection Geometries and Volumes for Category 3, PM Peak**

### *3.2 Individual Intersection Operational Analysis – Base Condition*

Table 3.2 provides a summary of the forecasted intersection operations for each of the individually analyzed intersections with interim construction of Jackrabbit Trail as a traditional arterial. Figures 3.7–3.12 illustrate the assumed intersection geometry and AM and PM peak hour volumes at each of the three intersections, as follows:

- Figure 3.7 – Traditional Intersection Geometries and AM Peak Volumes for Jackrabbit Trail & Bell Road
- Figure 3.8 – Traditional Intersection Geometries and AM Peak Volumes for Perryville Road and I-10
- Figure 3.9 – Traditional Intersection Geometries and AM Peak Volumes for Jackrabbit Trail and I-10
- Figure 3.10 – Traditional Intersection Geometries and PM Peak Volumes for Jackrabbit Trail & Bell Rd
- Figure 3.11 – Traditional Intersection Geometries and PM Peak Volumes for Perryville Road and I-10
- Figure 3.12 – Traditional Intersection Geometries and PM Peak Volumes for Jackrabbit Trail and I-10

Detailed level of service calculations and printouts are provided in Appendix A.

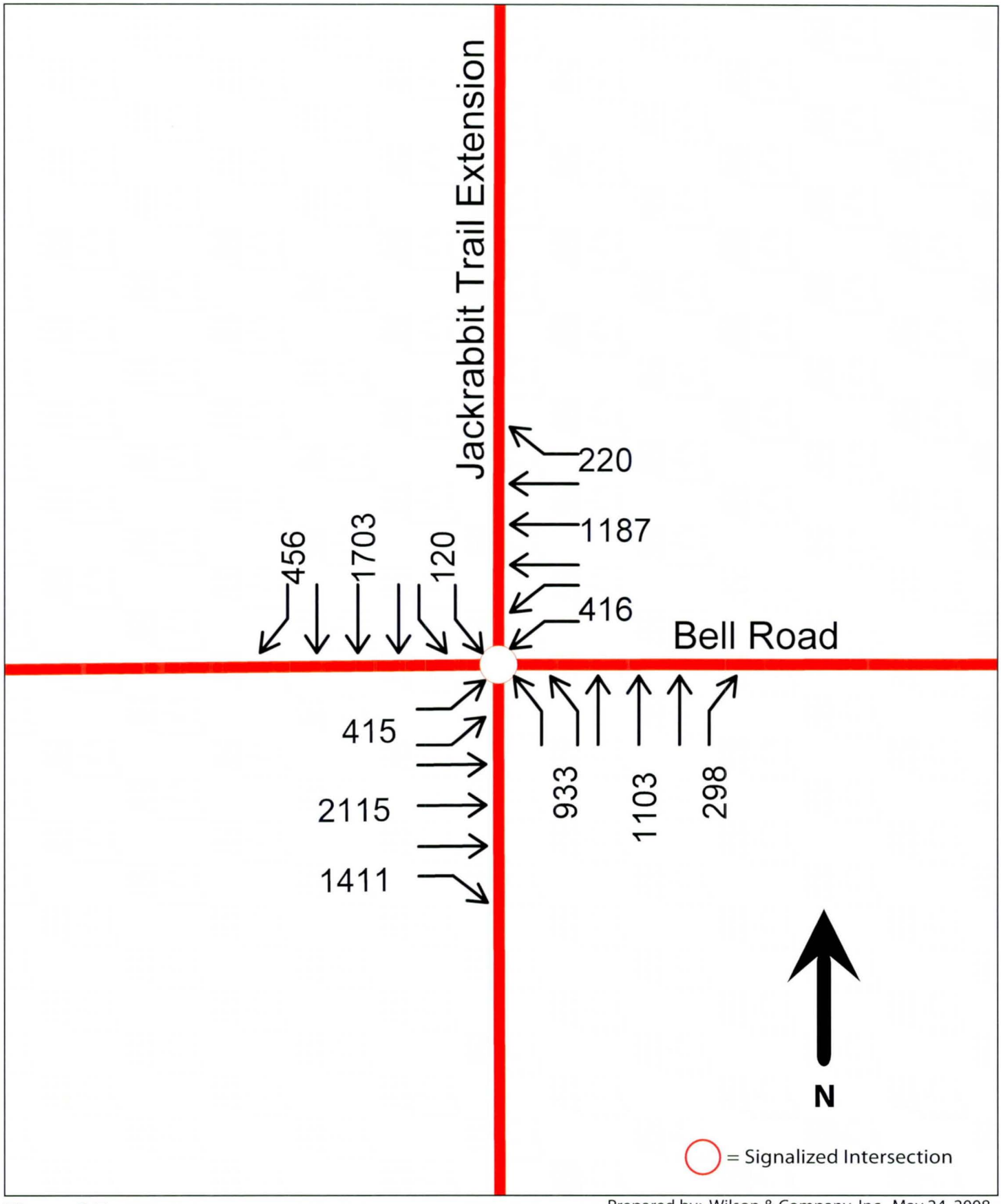
**Table 3.2**
**Traditional Intersection Operations**
**Individually Analyzed Intersections**
(Non-Arizona Parkway Conditions)

| BASE CONDITION – AM PEAK HOUR | | |
|---|---|---|
| **NAME** | **DELAY** | **LOS** |
| JACKRABBIT TRAIL & BELL RD | 221.8 | F |
| PERRYVILLE RD & I-10 WB | 84 | F |
| PERRYVILLE RD & I-10 EB | 109 | F |
| JACKRABBIT TRAIL & I-10 WB | 32.4 | C |
| JACKRABBIT TRAIL & I-10 EB | 34.8 | C |

| BASE CONDITION – PM PEAK HOUR | | |
|---|---|---|
| **NAME** | **DELAY** | **LOS** |
| JACKRABBIT TRAIL & BELL RD | 149.6 | F |
| PERRYVILLE RD & I-10 WB | 77.3 | E |
| PERRYVILLE RD & I-10 EB | 127.8 | F |
| JACKRABBIT TRAIL & I-10 WB | 43.7 | D |
| JACKRABBIT TRAIL & I-10 EB | 41.7 | D |

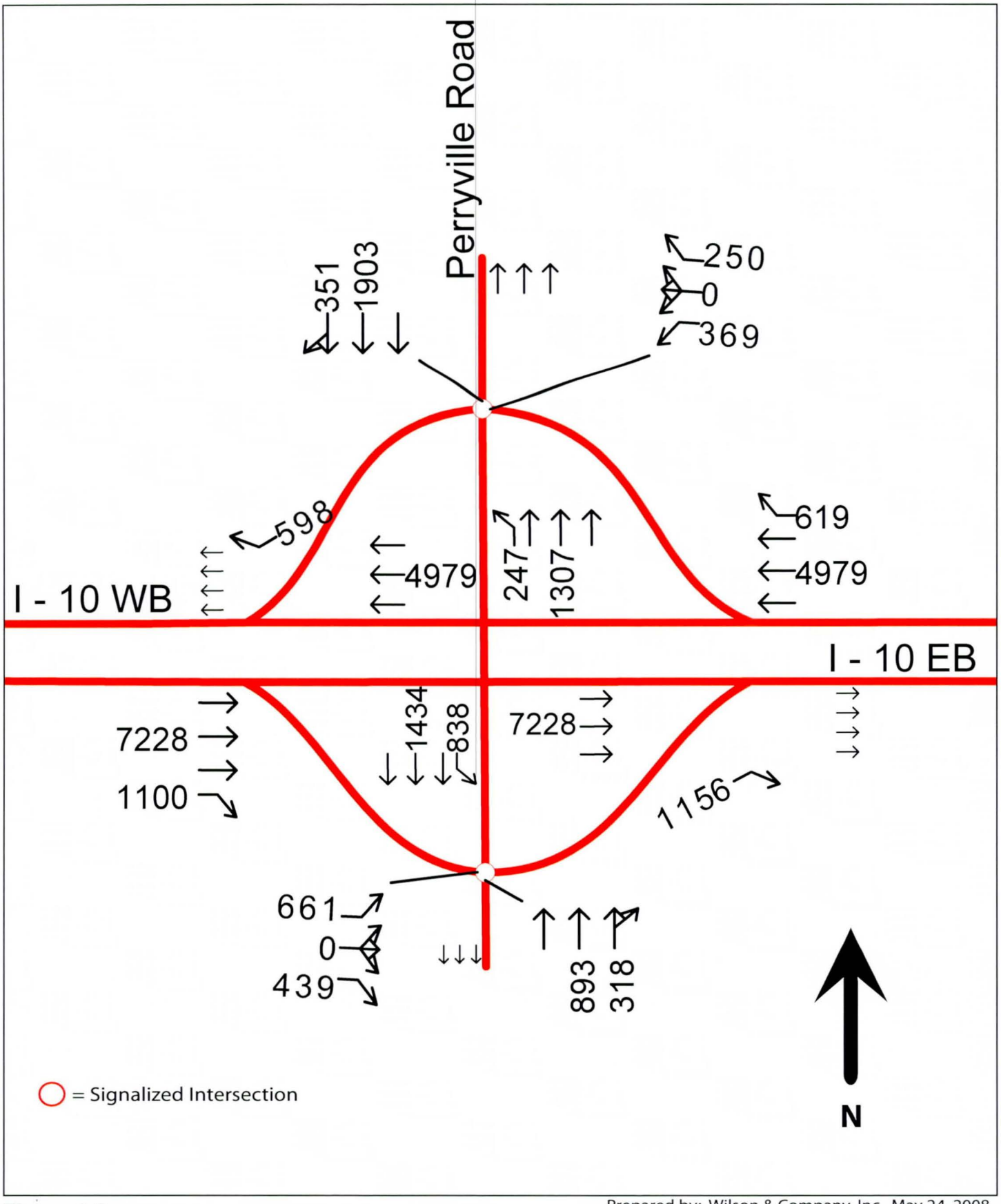
Source: Wilson & Company, May 22, 2008.

As indicated in Table 3.2, the intersection of Jackrabbit Trail at I-10 will operate acceptably with the assumed geometry of the interim traditional arterial intersection. However, additional mitigation would be necessary at the intersections of Jackrabbit Trail & Bell Road and Perryville Road at I-10.



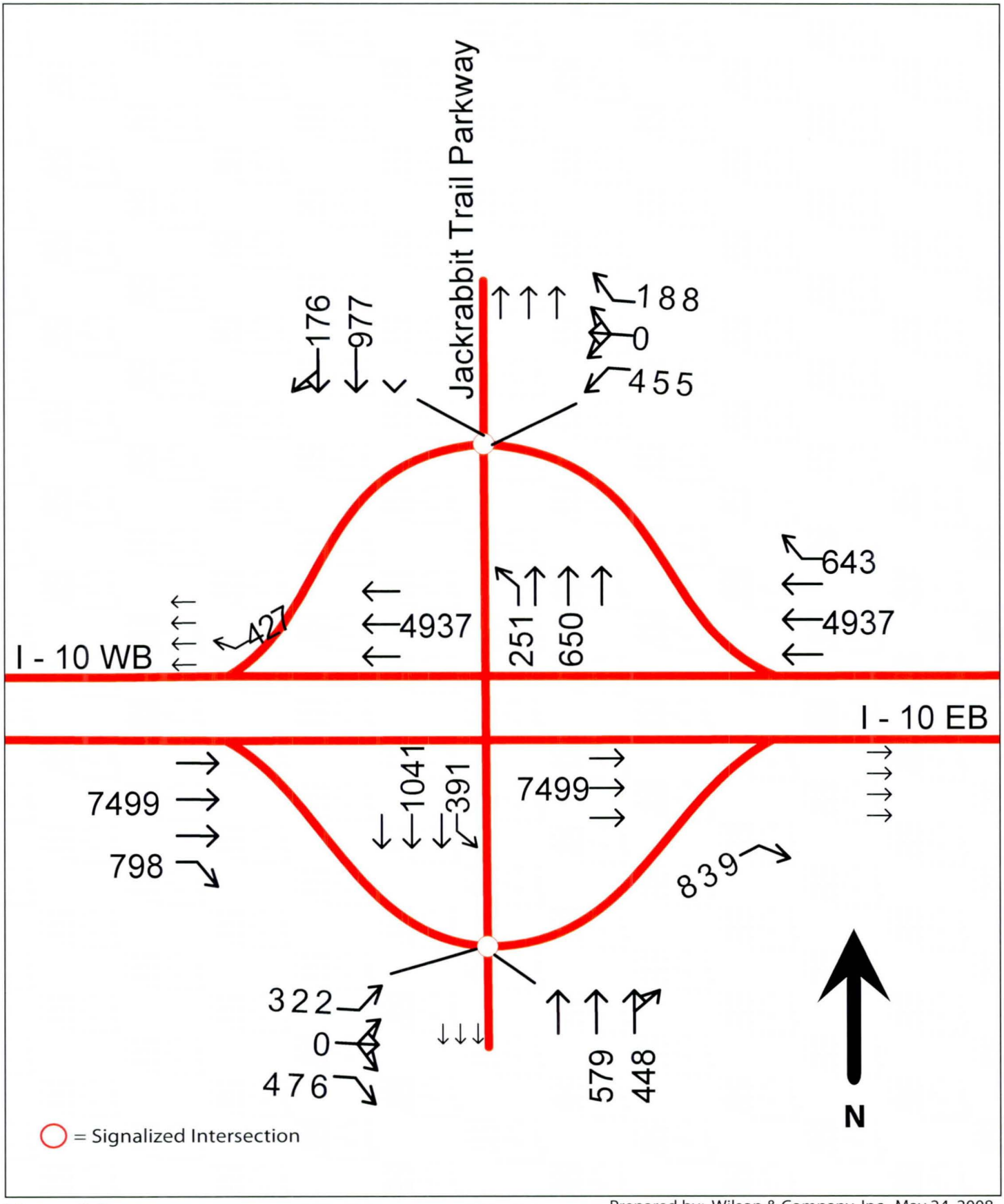

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.7**
**Traditional Intersection Geometries and AM Peak Volumes for Jackrabbit Trail & Bell Road**



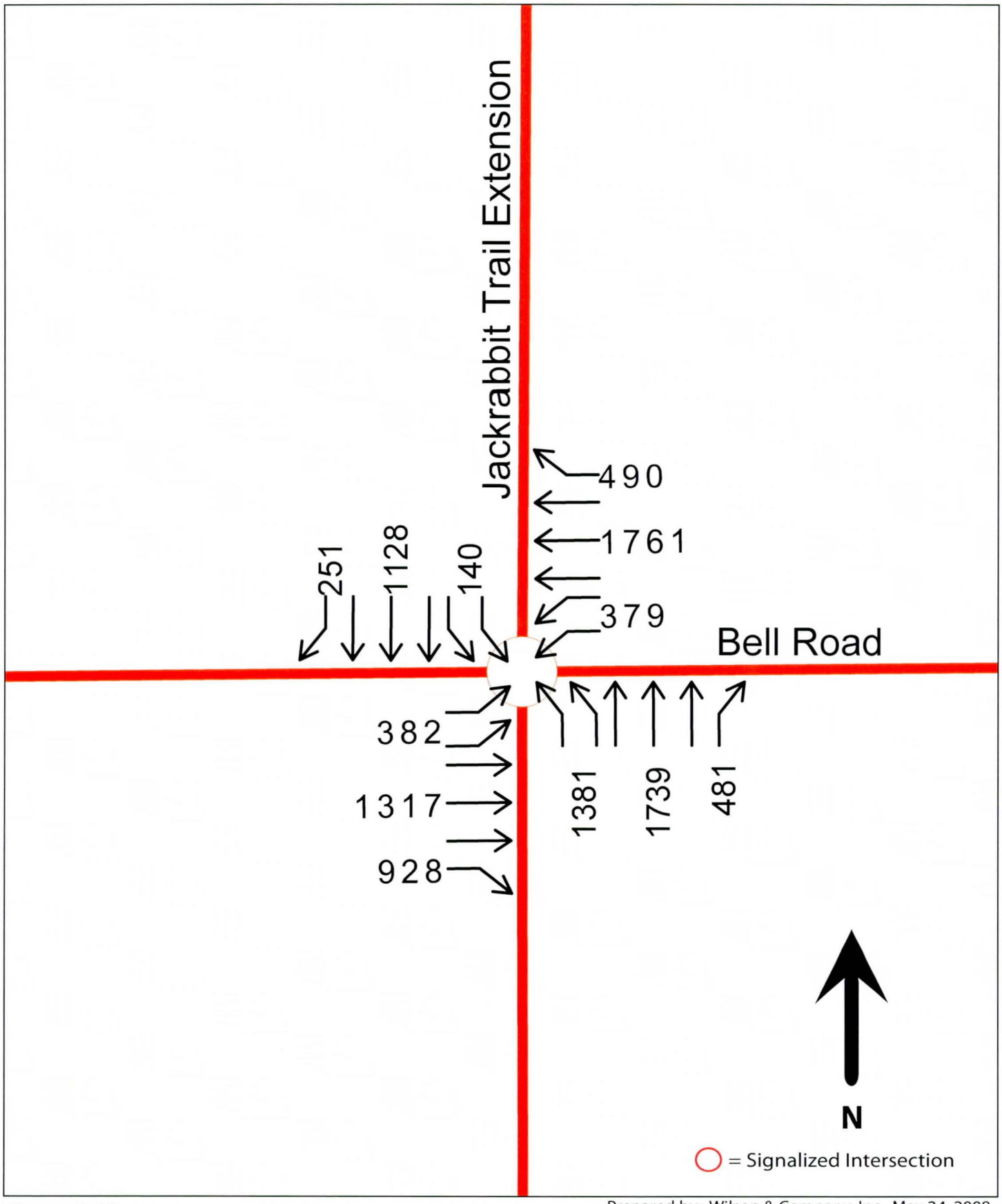

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.8**
**Traditional Intersection Geometries and AM Peak Volumes for Perryville Road and I-10**



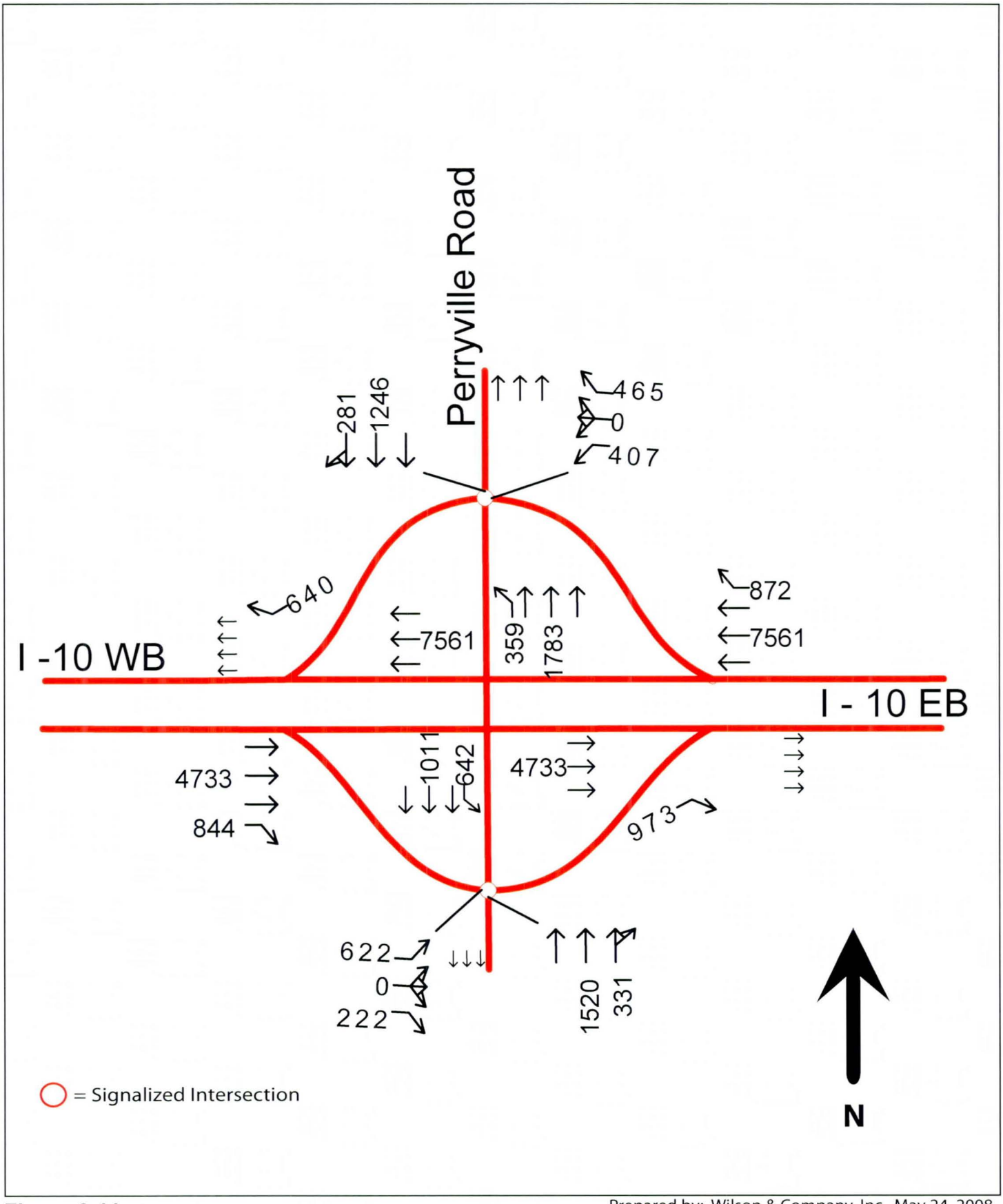

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.9**
**Traditional Intersection Geometries and AM Peak Volumes for Jackrabbit Trail and I-10**



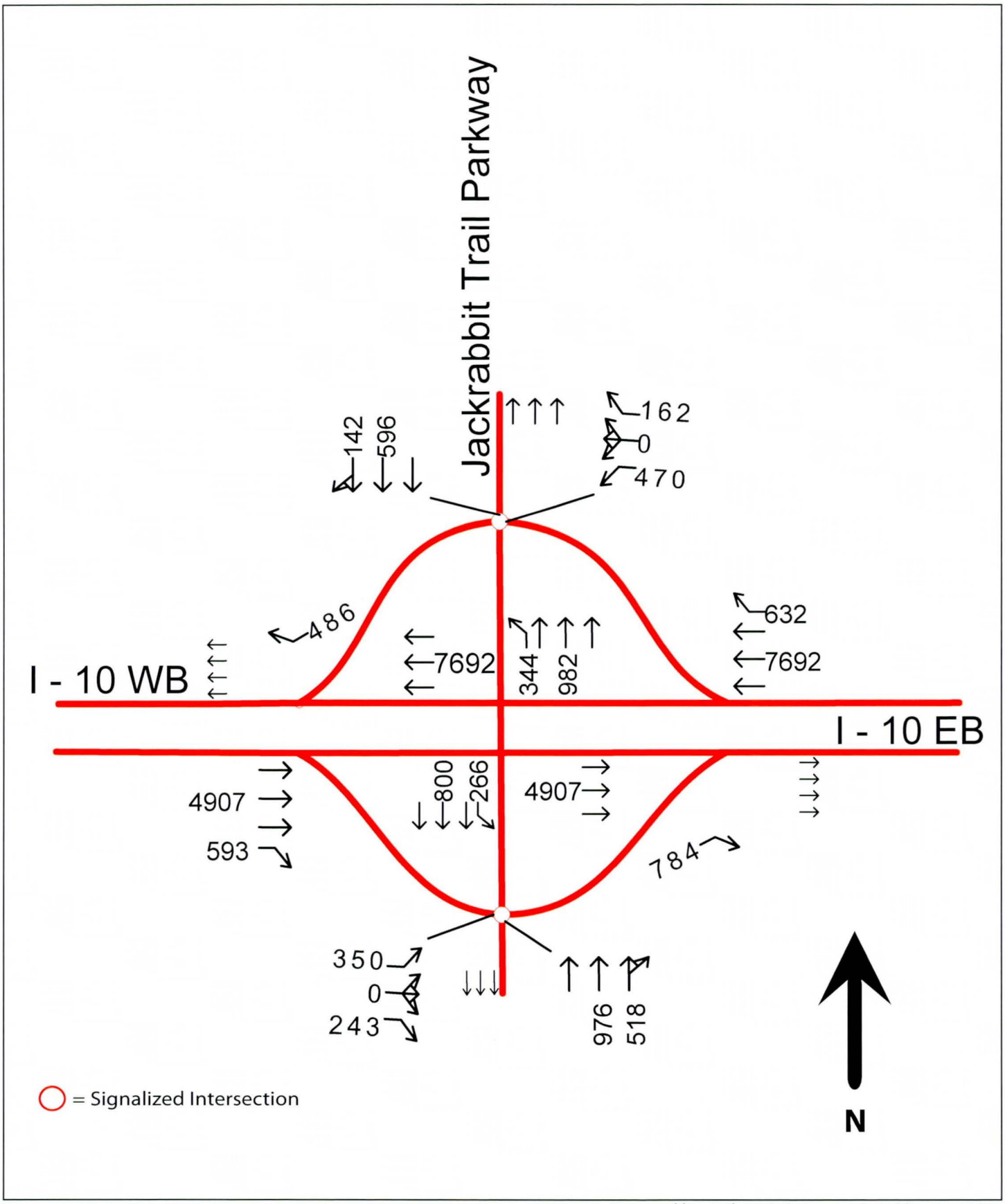

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.10**
**Traditional Intersection Geometries and PM Peak Volumes for Jackrabbit Trail & Bell Rd**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.11**
**Traditional Intersection Geometries and PM Peak Volumes for Perryville Road and I-10**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 3.12**
**Traditional Intersection Geometries and PM Peak Volumes for Jackrabbit Trail and I-10**

### *3.3 Individual Intersection Operational Analysis – Mitigated Condition*

Additional analysis was conducted to determine what mitigations would be necessary to provide acceptable intersection operations with the forecasted Enhanced Year 2026 peak hour traffic volumes at the intersections of Jackrabbit Trail & Bell Road and Perryville Road at I-10. Figure 3.13 provides a graphic summary of the lane configuration options which were considered as part of the mitigation analysis. Results of the mitigation analysis are summarized in Table 3.3.

At the intersection of Jackrabbit Trail & Bell Road, two mitigation options were considered. The first was the construction of a free eastbound-to-southbound right-turn lane. As indicated in Table 3.3, this would reduce average delays, but not to acceptable levels. Therefore, a second option was considered. This option included both a free-flow eastbound-to-southbound right-turn lane and a northbound-to-westbound flyover ramp. As indicated in Table 3.3, this mitigation would be sufficient to accommodate the forecasted Enhanced Year 2026 peak hour volumes.

At the Perryville Road and I-10 traffic interchange, mitigation assumed the addition of an exclusive southbound right-turn lane at westbound ramp intersection. Additional mitigation improvements were evaluated at the eastbound ramp intersection including dual southbound-to-eastbound left-turn lanes, an exclusive northbound right-turn lane and restriping of the eastbound off-ramp to provide dual left-turn lanes and an exclusive right-turn lane. As indicated in Table 3.3, this mitigation would provide adequate levels of service with forecasted Enhanced Year 2026 peak hour volumes.

**Table 3.3**
**Traditional Intersection Operations**
**Individually Analyzed Intersections with Mitigation**
(Non-Arizona Parkway Conditions)

| MITIGATED CONDITION – AM PEAK HOUR | | |
|---|---|---|
| **NAME** | **DELAY** | **LOS** |
| JACKRABBIT TRAIL & BELL RD (Option No.1 - Full At-Grade Improvements with Free EB TO SB Right-Turn Facility) | 140.4 | F |
| JACKRABBIT TRAIL & BELL RD (Option No. 2 - Full At-Grade Improvements with Free EB TO SB Right-Turn Facility and NB to WB Flyover) | 53.4 | D |
| PERRYVILLE RD & I-10 WB | 40.9 | D |
| PERRYVILLE RD & I-10 EB | 50.4 | D |
| | | |
| **MITIGATED CONDITION – PM PEAK HOUR** | | |
| **NAME** | **DELAY** | **LOS** |
| JACKRABBIT TRAIL & BELL RD (Option No. 1 - Full At-Grade Improvements with Free EB TO SB Right-Turn Facility) | 125.6 | F |
| JACKRABBIT TRAIL & BELL RD (Option No. 2 - Full At-Grade Improvements with Free EB TO SB Right-Turn Facility and NB to WB Flyover) | 54.5 | D |
| PERRYVILLE RD & I-10 WB (Option No.1) | 49.5 | D |
| PERRYVILLE RD & I-10 EB (Option No.1) | 54.4 | D |

Source: Wilson & Company, May 22, 2008.

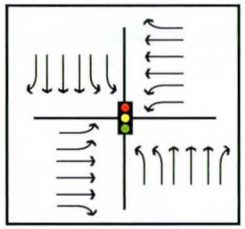
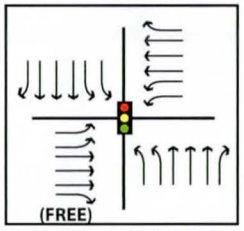
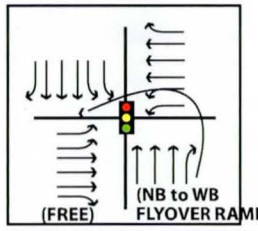
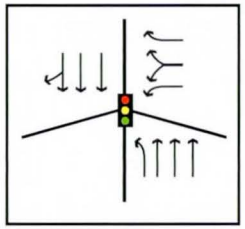
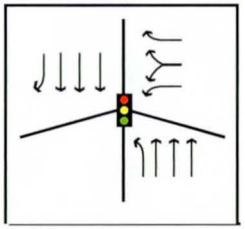
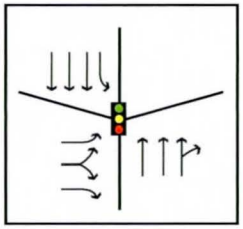
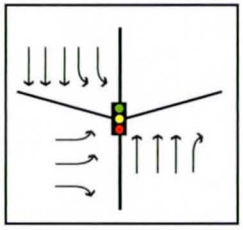
| INTERSECTION | FACILITY | BASE CONDITION | INTERSECTION CONFIGURATION OPTION NO. 1 | INTERSECTION CONFIGURATION OPTION NO. 2 |
|---|---|---|---|---|
| INTERSECTION 1 | BELL ROAD AT JACKRABBIT TRAIL (PREFERRED ALIGNMENT - PARKWAY FACILITY) |  |  |  |
| INTERSECTION 2 | PERRYVILLE ROAD/I-10 WESTBOUND RAMPS (PREFERRED ALIGNMENT - PARKWAY FACILITY) |  |  | N/A |
| INTERSECTION 2 | PERRYVILLE ROAD/I-10 EASTBOUND RAMPS (PREFERRED ALIGNMENT - PARKWAY FACILITY) |  |  | N/A |

**Figure 3.13**
**Intersection Lane Configuration Mitigation Analysis**

Prepared by: Wilson & Company, Inc. June 23, 2008.

# 4.0 ARIZONA PARKWAY INTERSECTION CONFIGURATIONS (WITH INDIRECT LEFT-TURNS)

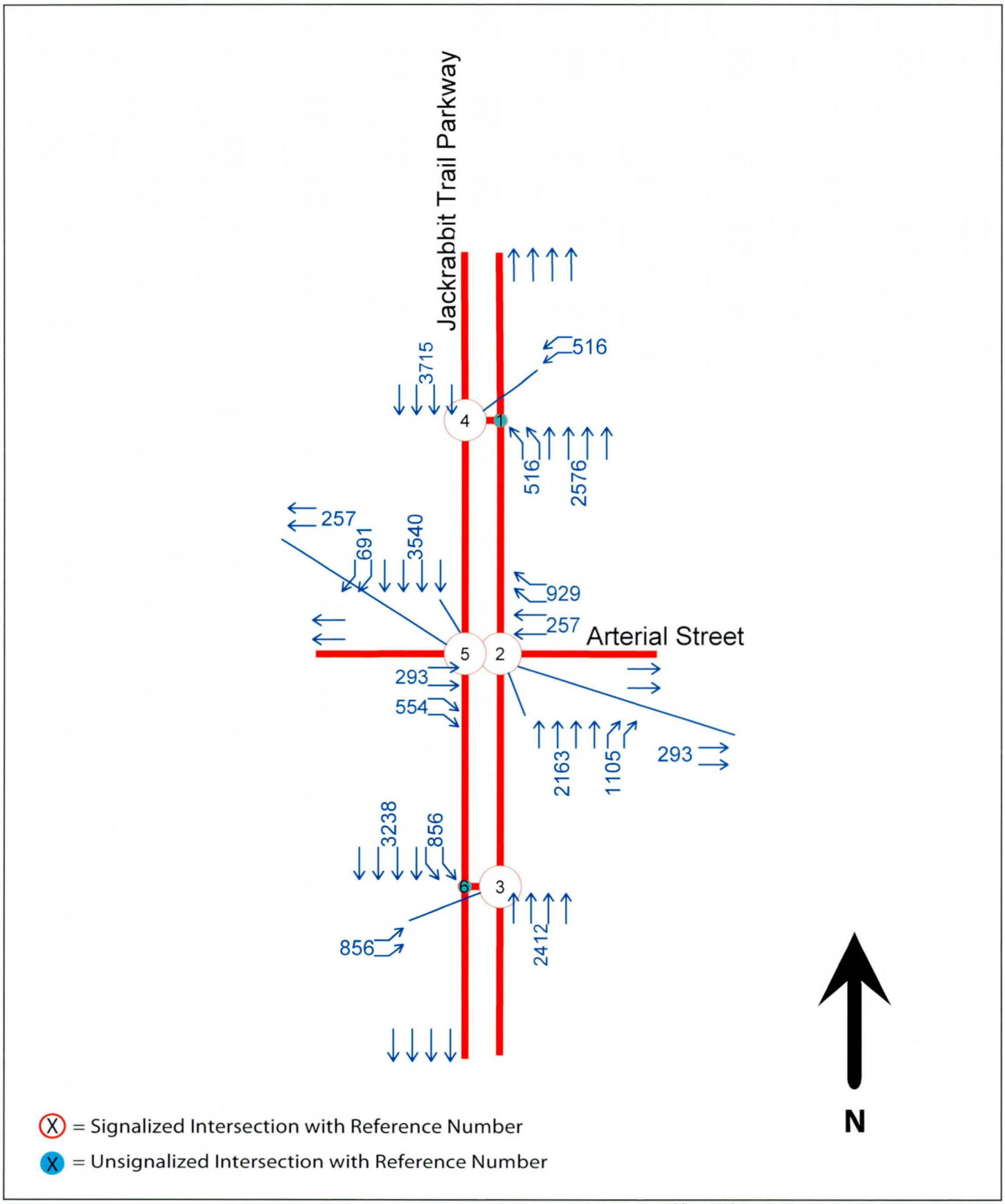
## *4.1 Parkway Based Operational Analysis – Base Condition*

The preferred alignment alternative for the Jackrabbit Trail Corridor includes construction of the facility as a six-lane Arizona Parkway with indirect left-turns. Table 4.1 provides a summary of the forecasted peak hour intersection operations for each volume category with construction of Jackrabbit Trail as a parkway facility. Figures 4.1–4.6 illustrate the assumed intersection geometry and AM and PM peak hour traffic volumes for Categories 1-3, as follows:

- Figure 4.1 – Arizona Parkway Geometry and Traffic Volumes for Category 1, AM Peak
- Figure 4.2 – Arizona Parkway Geometry and Traffic Volumes for Category 2, AM Peak
- Figure 4.3 – Arizona Parkway Geometry and Traffic Volumes for Category 3, AM Peak
- Figure 4.4 – Arizona Parkway Geometry and Traffic Volumes for Category 1, PM Peak
- Figure 4.5 – Arizona Parkway Geometry and Traffic Volumes for Category 2, PM Peak
- Figure 4.6 – Arizona Parkway Geometry and Traffic Volumes for Category 3, PM Peak

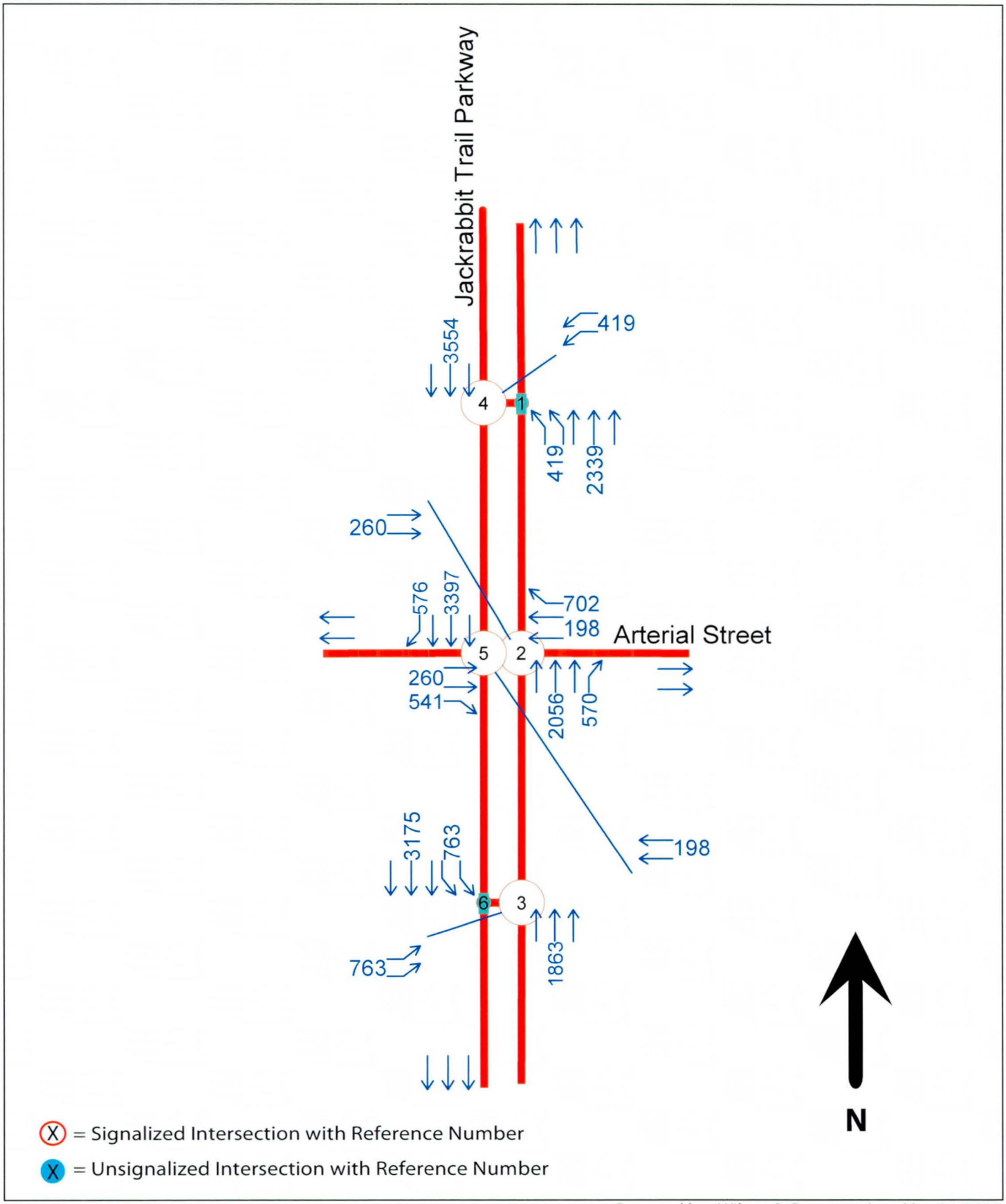
As indicated in the figures, traditional left-turn movements are prohibited at parkway intersections. To execute a left-turn movement from an arterial to the parkway, vehicles must first turn right onto the parkway, make a u-turn approximately 660' from the intersection, and then pass through the arterial/parkway intersection once more. To execute a left-turn from the parkway to arterial, vehicles must pass through the intersection, make a u-turn approximately 660' from the intersection, and then turn right onto the arterial street. Therefore, vehicles traveling thorough a parkway intersection may be required to pass through multiple traffic signals to execute a particular movement, particularly those movements that must make these indirect left-turns. Thus, the calculation of level of service at a parkway intersection involves multiple signal delays. The methodology utilized to derive estimate of vehicular delay and level of service at these parkway intersections is described in detail in Appendix B, along with detailed level of service calculations and HCM reports.

In addition to the detailed level of service calculations for the overall parkway intersection operations, Appendix B also provides detail on the level of service provided at each of the individual signalized intersections located in the immediate vicinity of the main signalized intersection, which in total, comprise the complete parkway intersection.



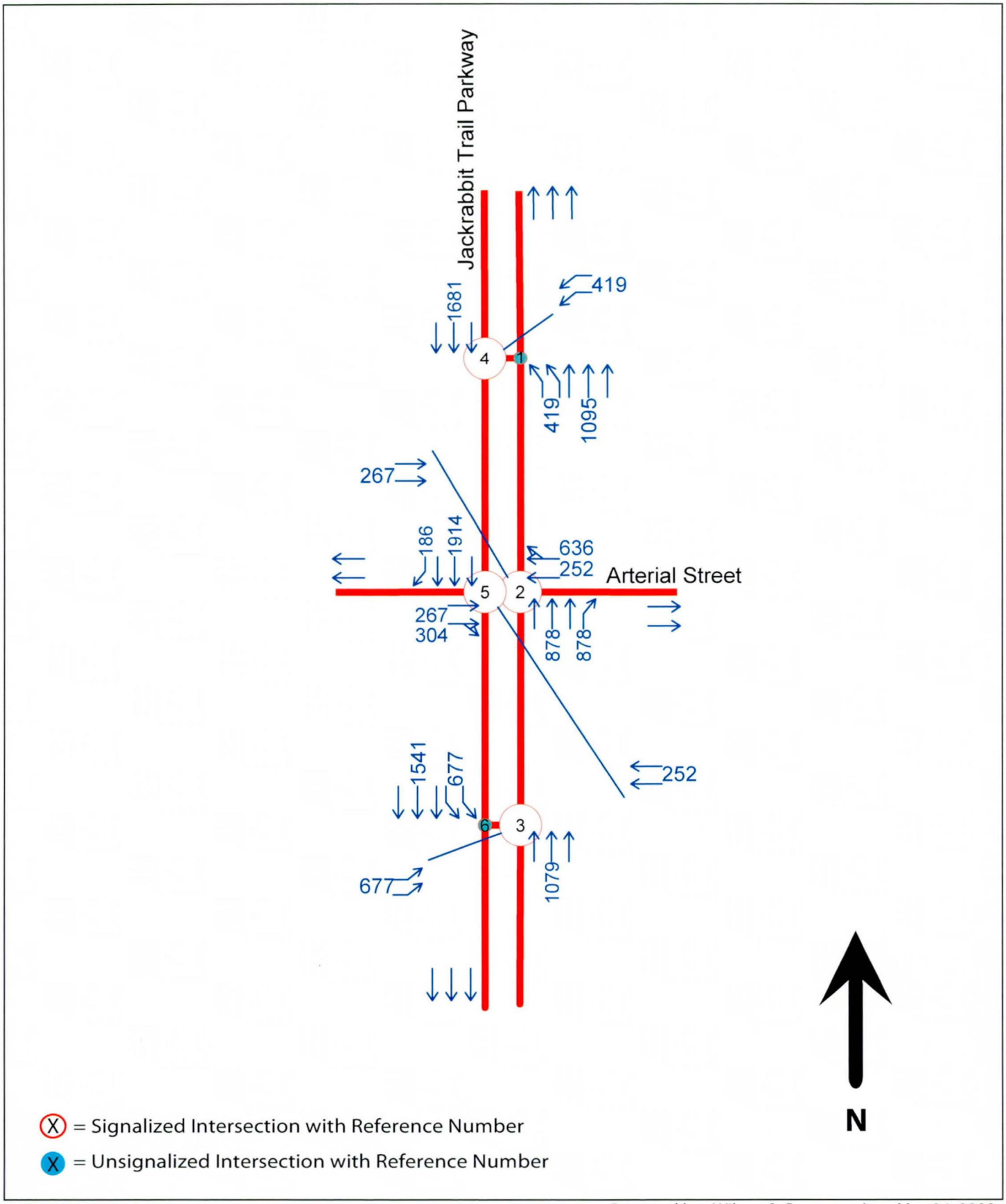

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.1**
**Arizona Parkway Geometry and Traffic Volumes for Category 1, AM Peak**



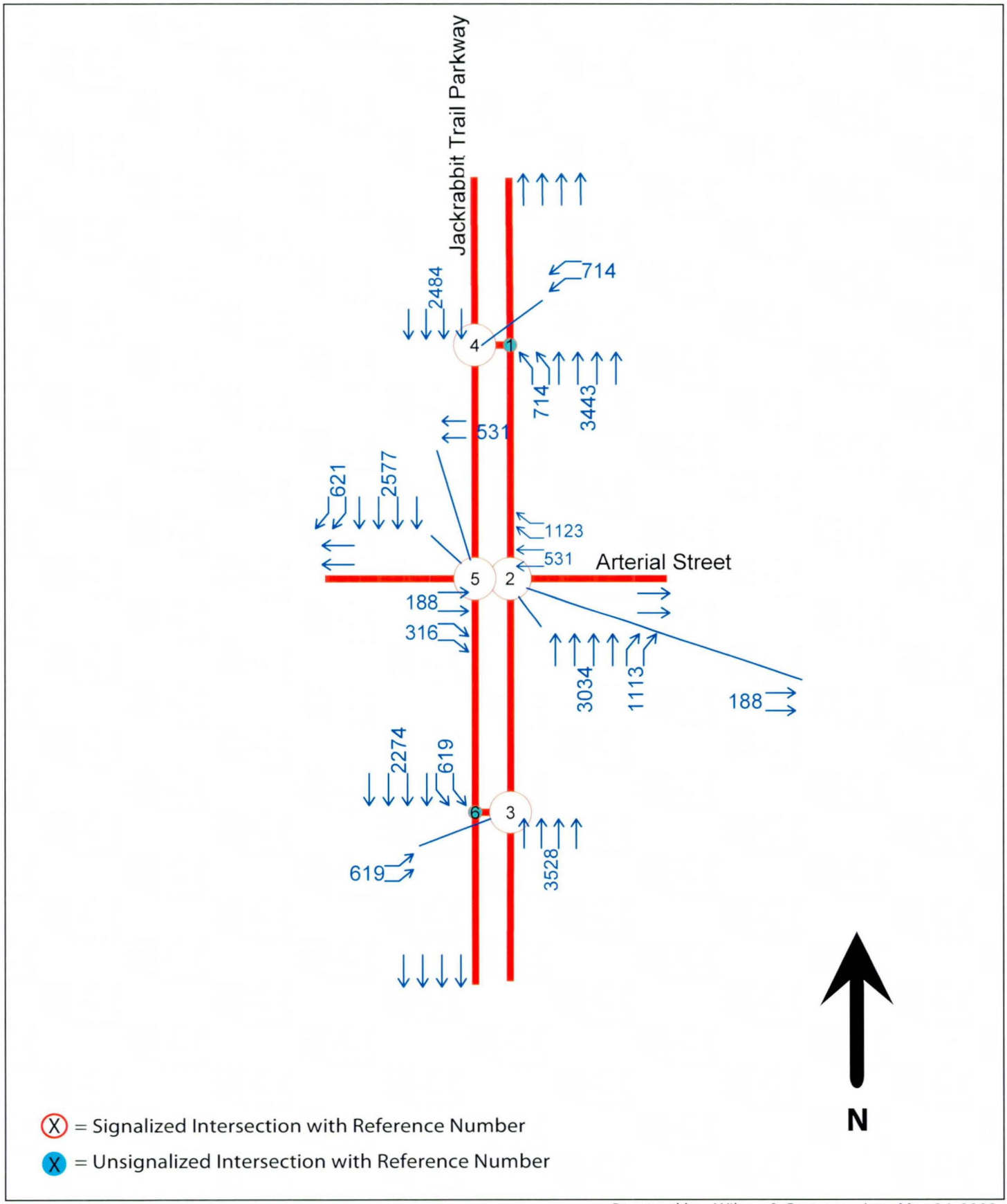

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.2**
**Arizona Parkway Geometry and Traffic Volumes for Category 2, AM Peak**



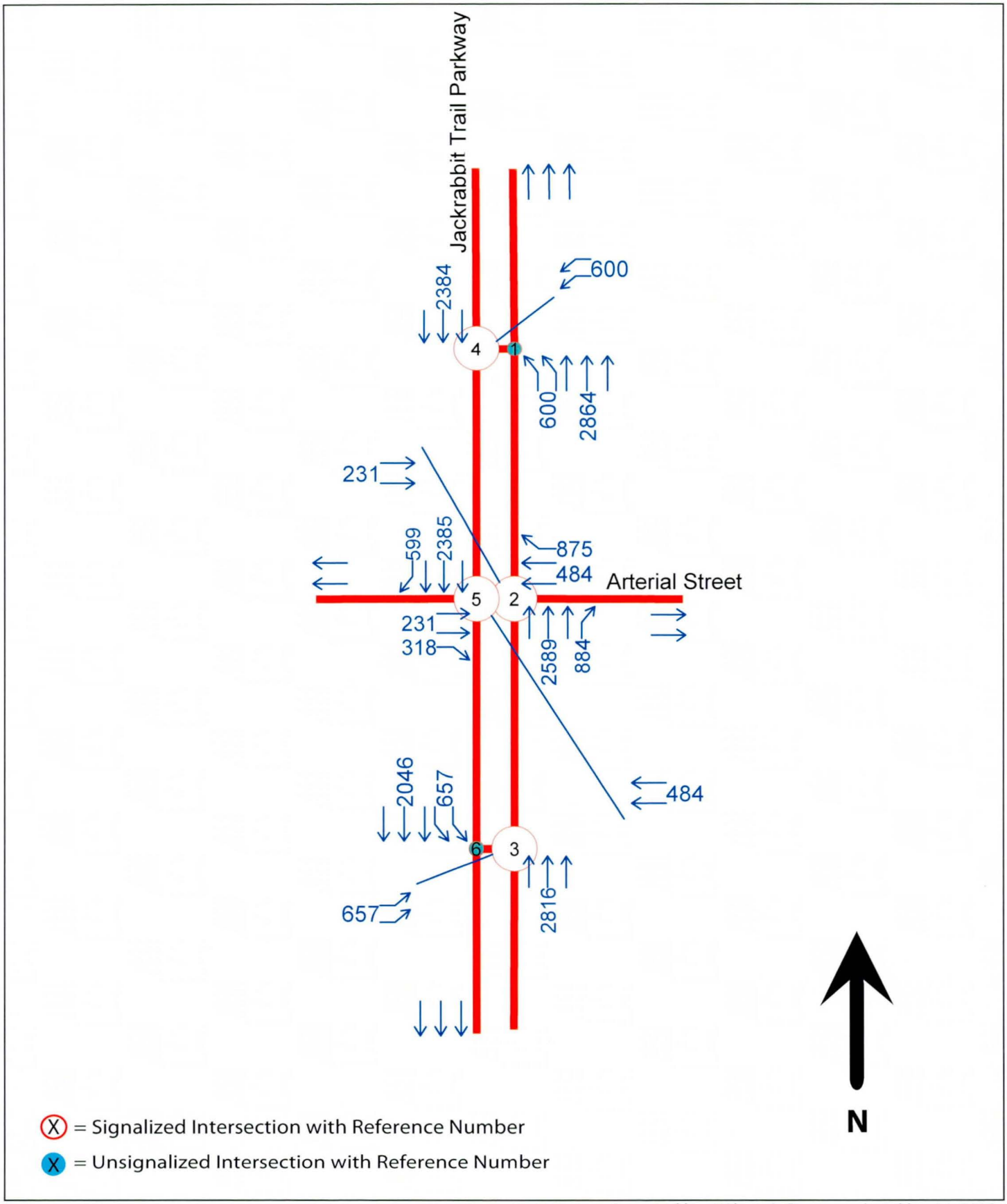

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.3**
**Arizona Parkway Geometry and Traffic Volumes for Category 3, AM Peak**



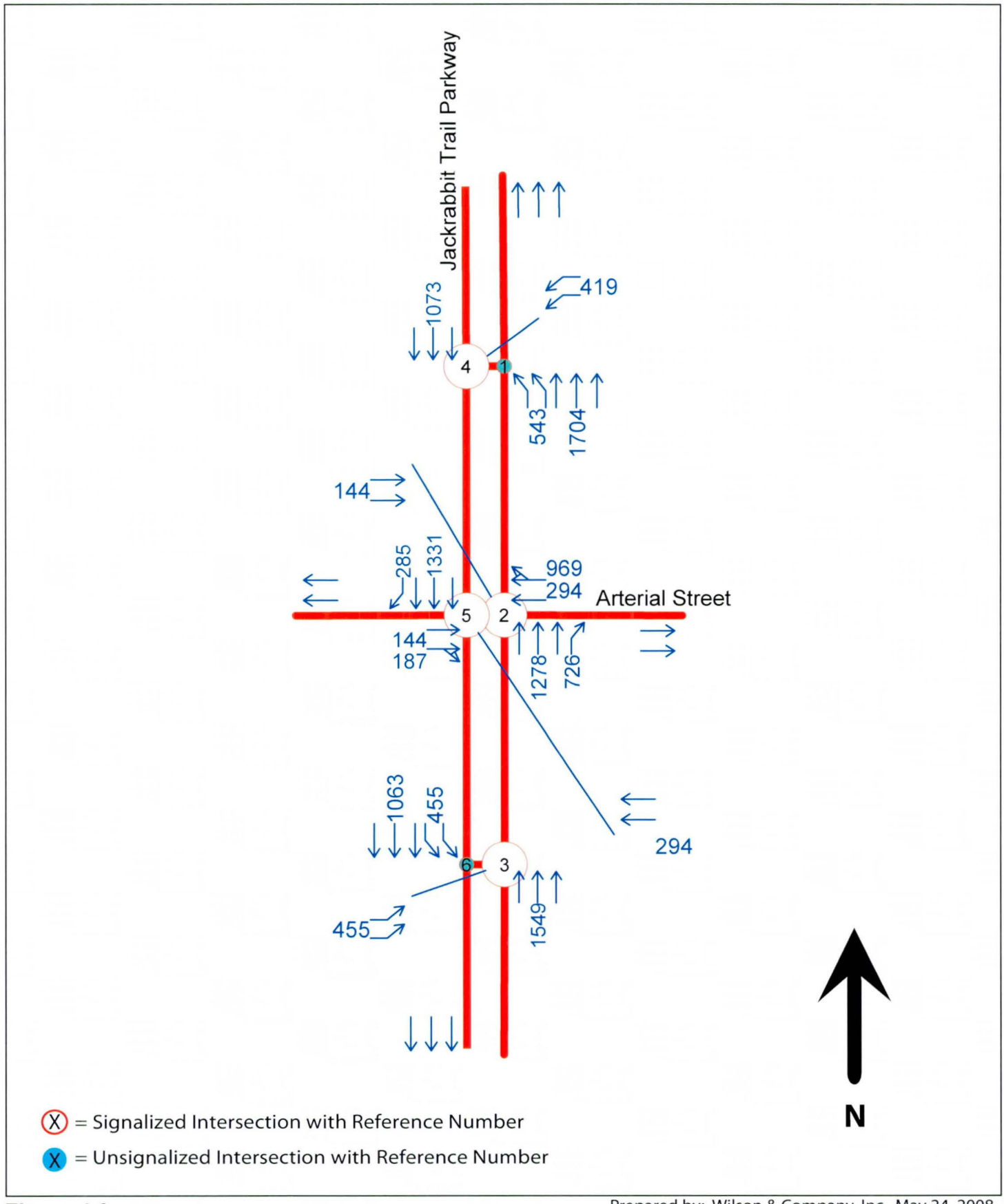

Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.4**
**Arizona Parkway Geometry and Traffic Volumes for Category 1, PM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.5**
**Arizona Parkway Geometry and Traffic Volumes for Category 2, PM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.6**
**Arizona Parkway Geometry and Traffic Volumes for Category 3, PM Peak**

Table 4.1 provides a summary of the resulting delays and level of service to vehicles passing through the series of signals at the parkway intersections.

**Table 4.1**
**Arizona Parkway Intersection Operations**
(Parkway Conditions with Indirect Left-Turns)
Categories 1-3

| BASE CONDITION – AM PEAK HOUR | | | |
|---|---|---|---|
| **CATEGORY NO.** | **NAME/DESCRIPTION** | **DELAY** | **LOS** |
| 1 | DAILY ENTERING VOL: 80,000 TO 95,000 vpd | 44.6 | D |
| 2 | DAILY ENTERING VOL: 65,000 TO 80,000 vpd | 32.4 | C |
| 3 | DAILY ENTERING VOL: LESS THAN 65,000 vpd | 30.6 | C |

| BASE CONDITION – PM PEAK HOUR | | | |
|---|---|---|---|
| **CATEGORY NO.** | **NAME/DESCRIPTION** | **DELAY** | **LOS** |
| 1 | DAILY ENTERING VOL: 80,000 TO 95,000 vpd | 42.7 | D |
| 2 | DAILY ENTERING VOL: 65,000 TO 80,000 vpd | 23.5 | C |
| 3 | DAILY ENTERING VOL: LESS THAN 65,000 vpd | 31.4 | C |

Source: Wilson & Company, May 22, 2008.

As indicated in Table 4.1, the Arizona Parkway with indirect left-turns will provide adequate capacity to service the forecast Enhanced Year 2026 peak hour traffic volumes with Level of Service D or better for each intersection category, provided the assumed geometry depicted in Figures 4.1–4.6 are constructed. As indicated in Figures 4.1–4.6, a six-lane cross section is sufficient to accommodate Category 2 & 3 intersection volumes, but an eight-lane cross-section will be necessary for Category 1 intersection volumes.

### *4.2 Individual Parkway Intersections Operational Analysis – Base Condition*

Individual intersection analysis was not conducted at the I-10 interchanges with Perryville Road or Jackrabbit Trail. It is assumed that the traditional diamond interchange would still be constructed at these interchanges even with the parkway cross-section. Therefore, findings from the Traditional Intersection analysis documented in the previous section would be applicable to the Arizona Parkway conditions at these two locations.

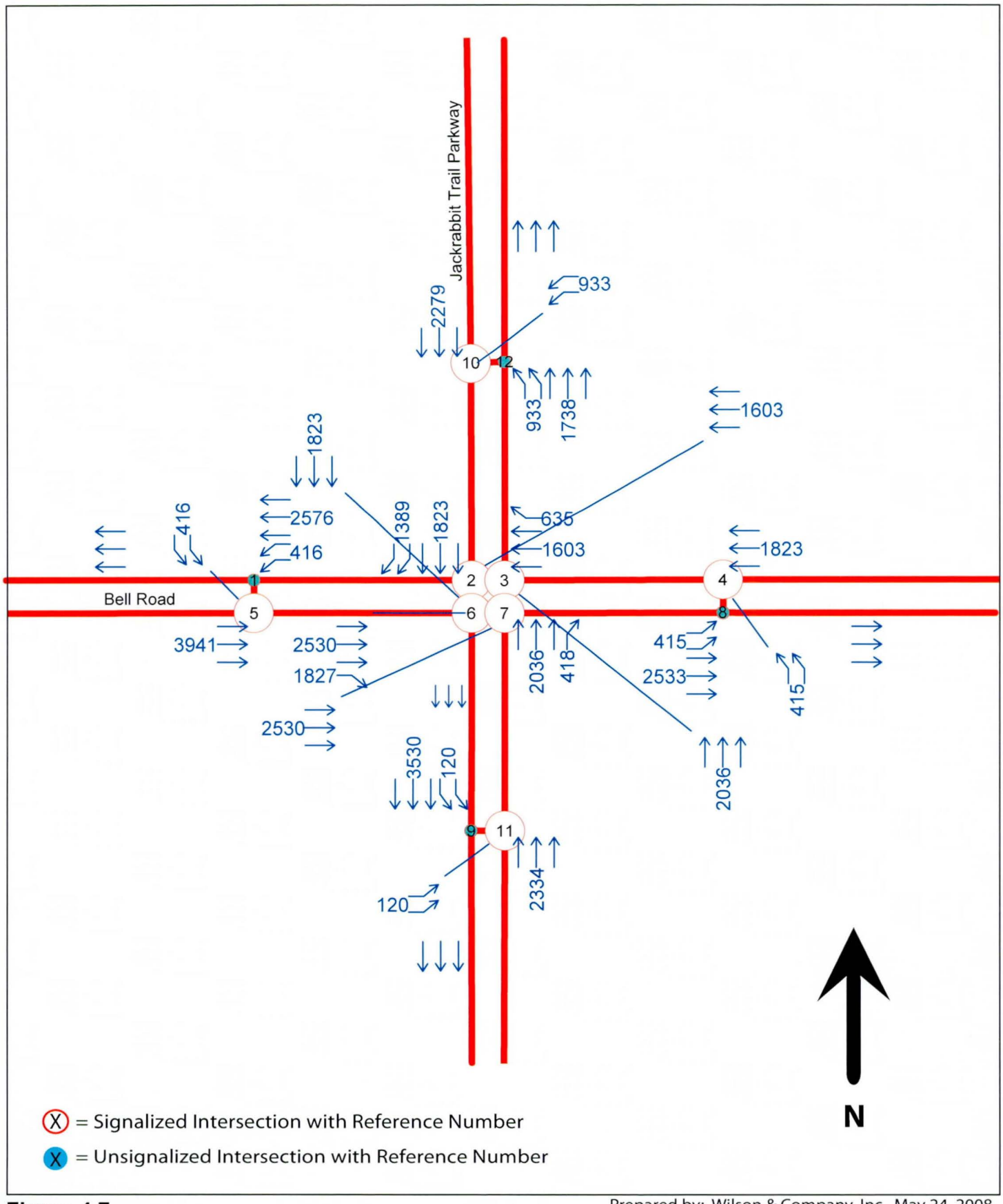
Bell Road in the vicinity of the Jackrabbit Trail Corridor is also planned for construction as a six-lane Arizona Parkway facility. Therefore, the intersection of Jackrabbit Trail & Bell Road would function as an intersection of two Arizona Parkway facilities. Traditional left-turns would be replaced with indirect turns, in which left turning vehicles would travel through the intersection, make a u-turn back toward the intersection, and then turn right en-route to their destination. Figures 4.7 and 4.8 display the assumed intersection

geometry and traffic volumes during the AM and PM peak hours, respectively. Table 4.2 provides a summary of the resulting delays and level of service at Jackrabbit Trail & Bell Road in Base Condition.

**Table 4.2**
**Six-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)**
**Jackrabbit Trail & Bell Road**

| BASE CONDITION – AM PEAK HOUR | | |
|---|---|---|
| **SCENARIO** | **DELAY** | **LOS** |
| BASE | 288.1 | F |
| **BASE CONDITION – PM PEAK HOUR** | | |
| **SCENARIO** | **DELAY** | **LOS** |
| BASE | 264.6 | F |

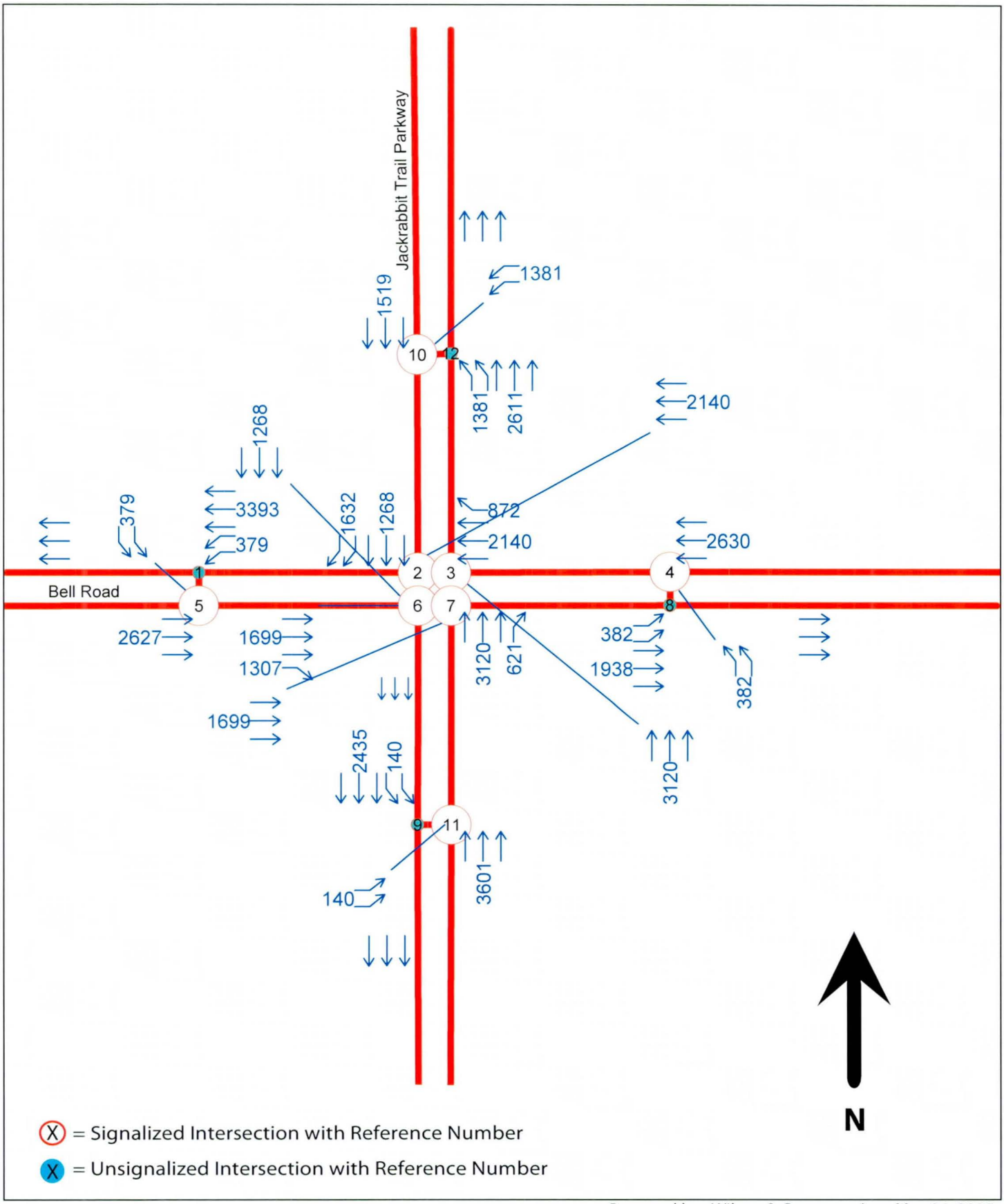
Source: Wilson & Company, May 22, 2008.




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.7**

**JRT & Bell Road Base Condition, 6-lane Parkways with Indirect Left Turns, AM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.8**

**JRT & Bell Road Base Condition, 6-lane Parkways with Indirect Left Turns, PM Peak**

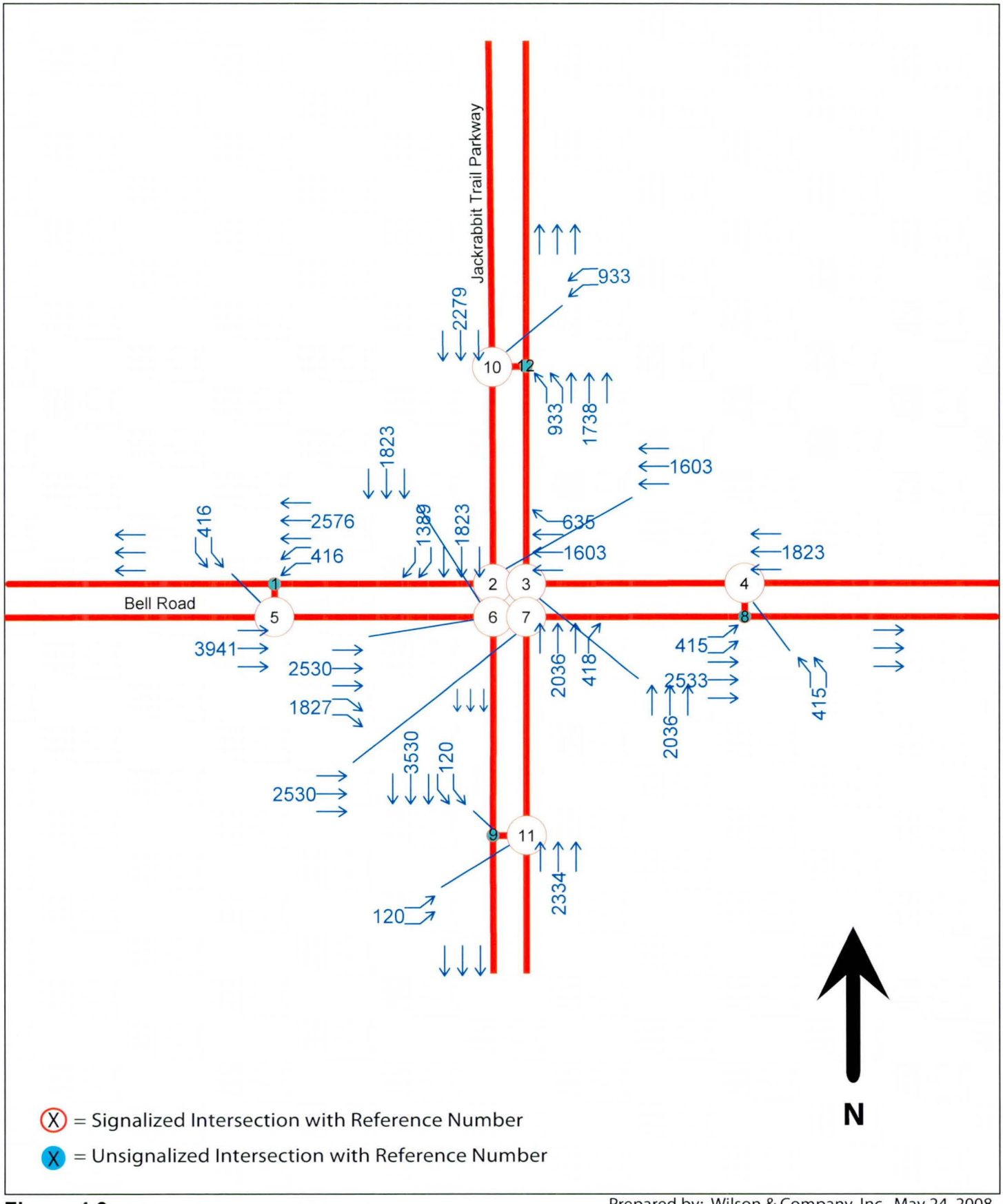
### *4.3 Jackrabbit Trail/Bell Road Parkway Intersections Operational Analysis – Mitigated Conditions (with Six-Lane Parkway Configuration)*

As detailed in Table 4.2, the results of the Base Conditions analysis indicates that the base geometry depicted in Figures 4.7 and 4.8 does not provide enough capacity to provide acceptable levels of service with forecast Enhanced Year 2026 traffic volumes. Therefore, several mitigation alternatives were also considered, as follows:

Alternative A – Includes dual right-turn lanes on the eastbound and southbound approaches
Alternative B – Includes dual right-turn lanes on the southbound approach and a separate ramp for free-flow right-turns on the eastbound approach
Alternative C – Includes separate ramps for free-flow right-turns on the eastbound and westbound approaches and cloverleaf ramps for northbound lefts and southbound lefts in the northeast and southwest quadrants

Figures 4.9–4.14 display the assumed geometry and AM and PM peak traffic volumes for Alternatives A-C, as follows:

- Figure 4.9 – JRT & Bell Road, Alt A Condition, 6-lane Parkways with Indirect Left-Turns, AM Peak
- Figure 4.10 – JRT & Bell Road, Alt B Condition, 6-lane Parkways with Indirect Left-Turns, AM Peak
- Figure 4.11 – JRT & Bell Road, Alt C Condition, 6-lane Parkways with Indirect Left-Turns, AM Peak
- Figure 4.12 – JRT & Bell Road, Alt A Condition, 6-lane Parkways with Indirect Left-Turns, PM Peak
- Figure 4.13 – JRT & Bell Road, Alt B Condition, 6-lane Parkways with Indirect Left-urns, PM Peak
- Figure 4.14 – JRT & Bell Road, Alt C Condition, 6-lane Parkways with Indirect Left-Turns, PM Peak




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.9**
**JRT & Bell Road Alt A Condition, 6-lane Parkways with Indirect Left Turns, AM Peak**

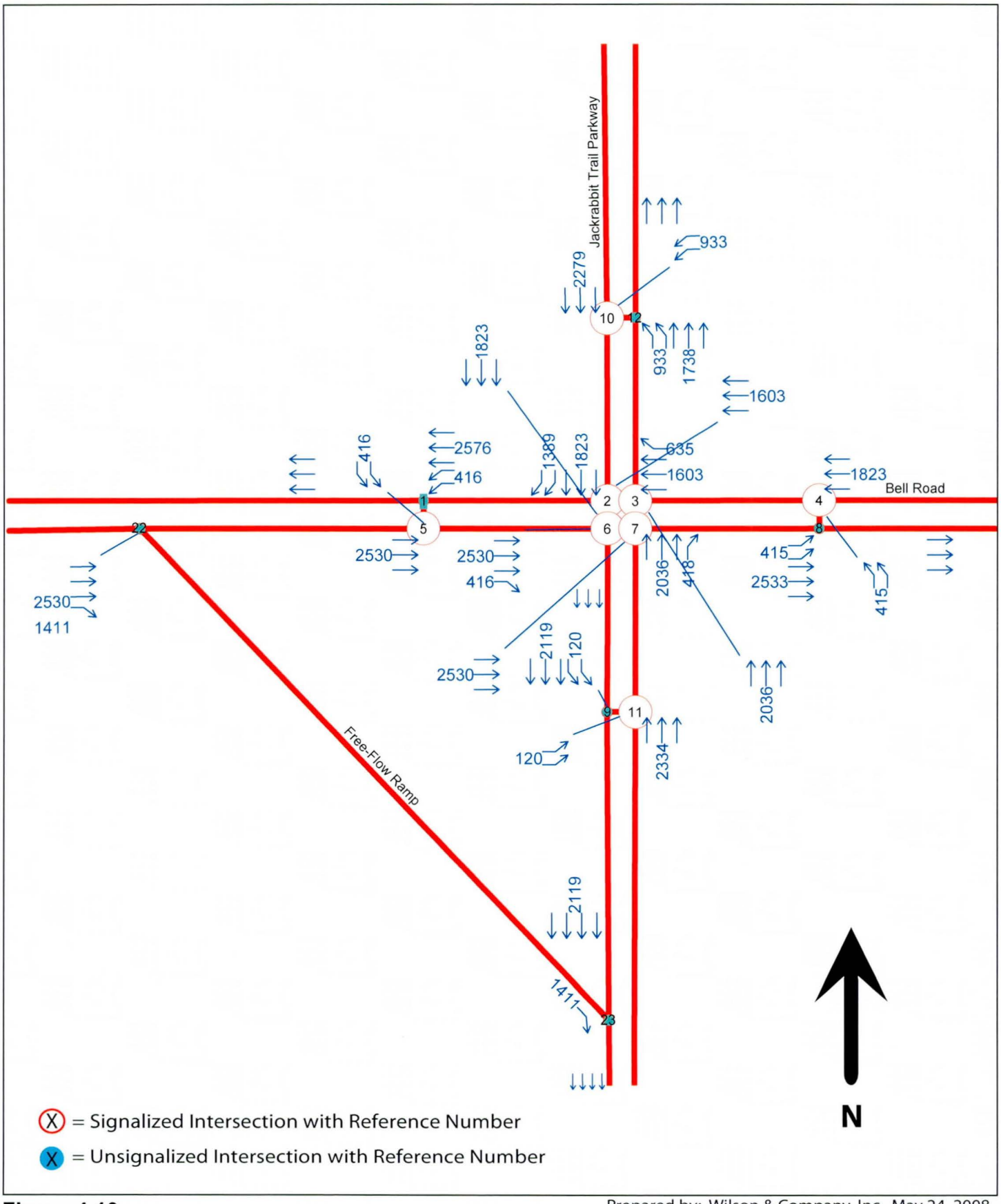
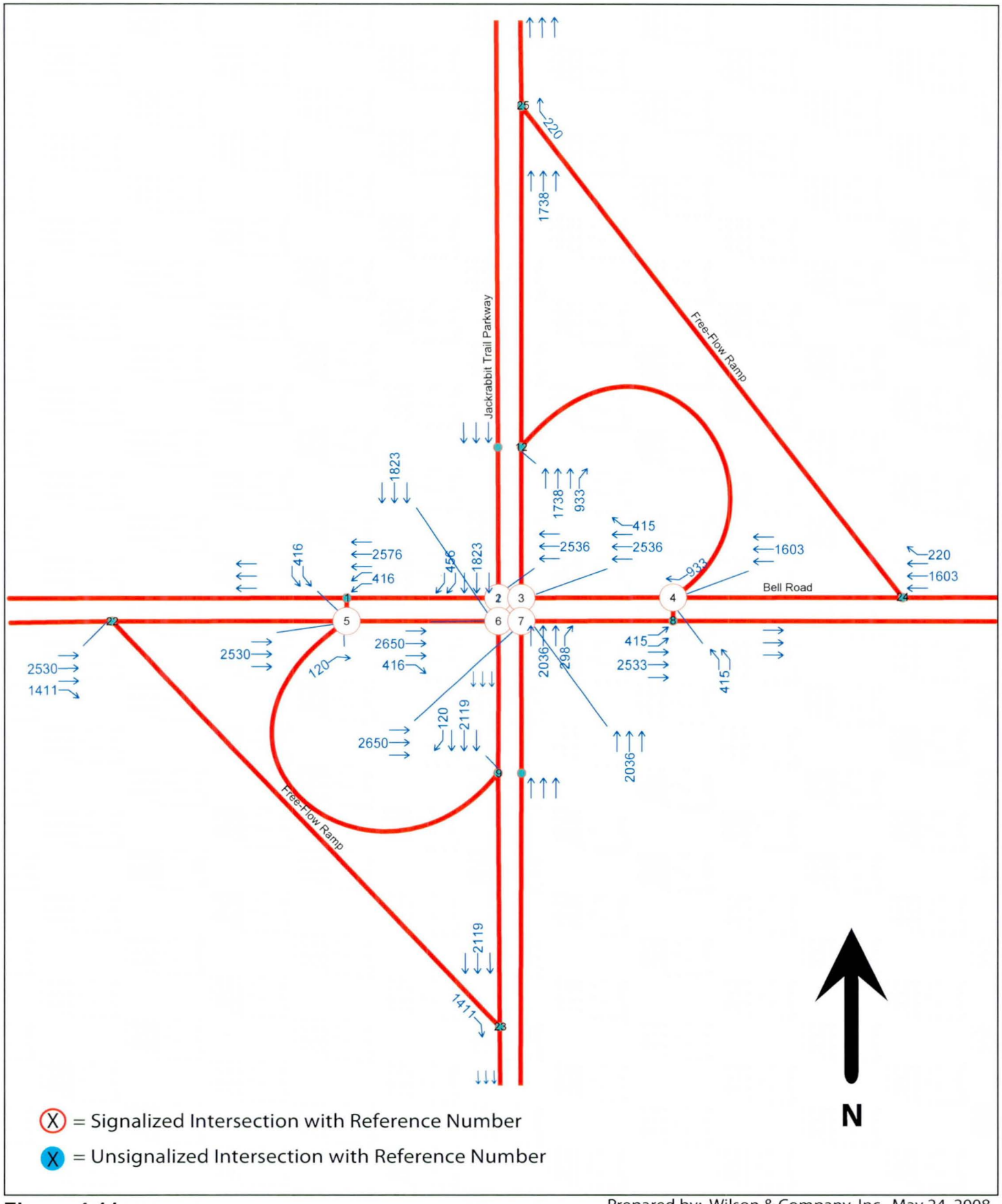



**Figure 4.10**

Prepared by: Wilson & Company, Inc., May 24, 2008.

**JRT & Bell Road Alt B Condition, 6-lane Parkways with Indirect Left Turns, AM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.11**

**JRT & Bell Road Alt C Condition, 6-lane Parkways with Indirect Left Turns, AM Peak**

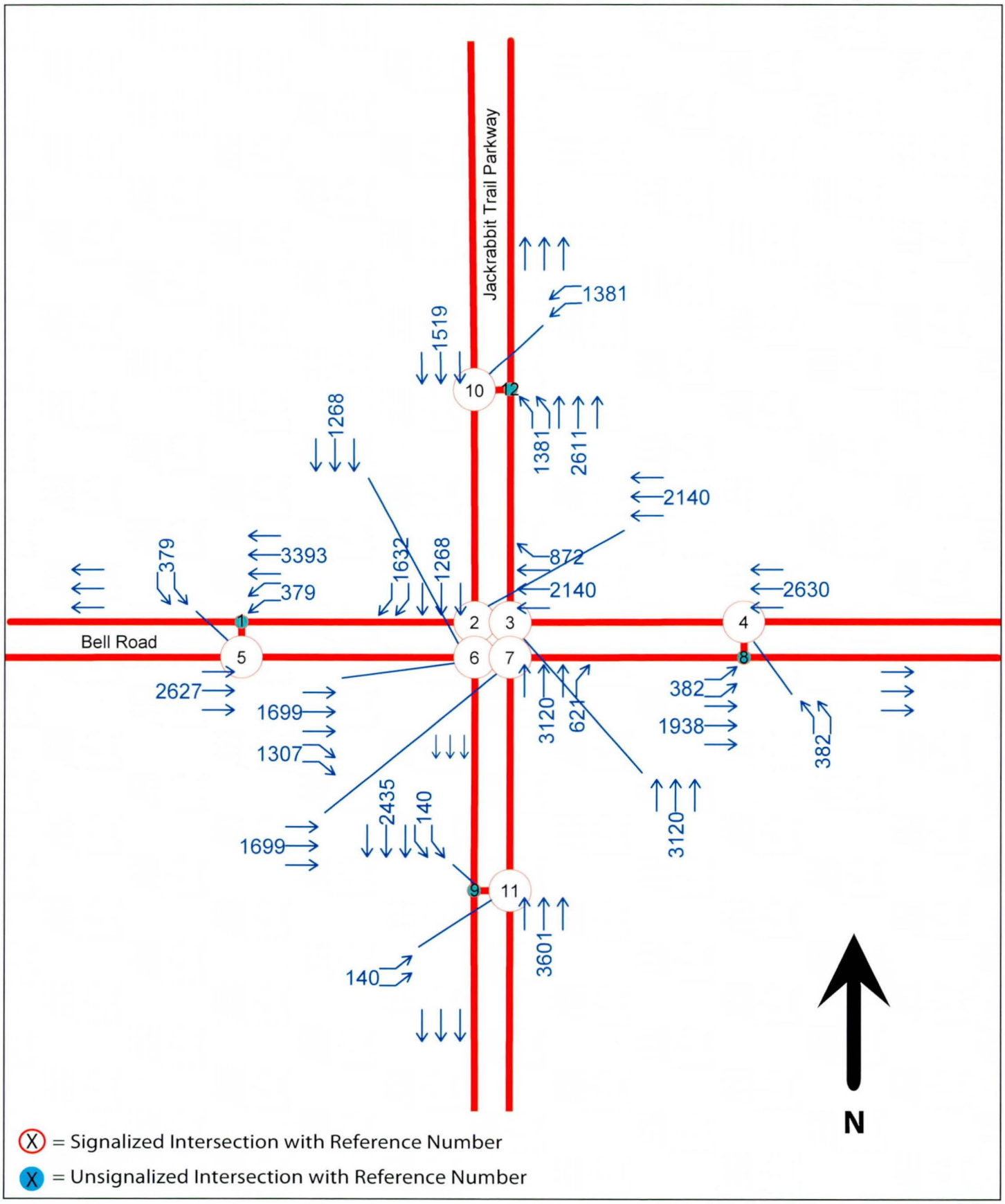
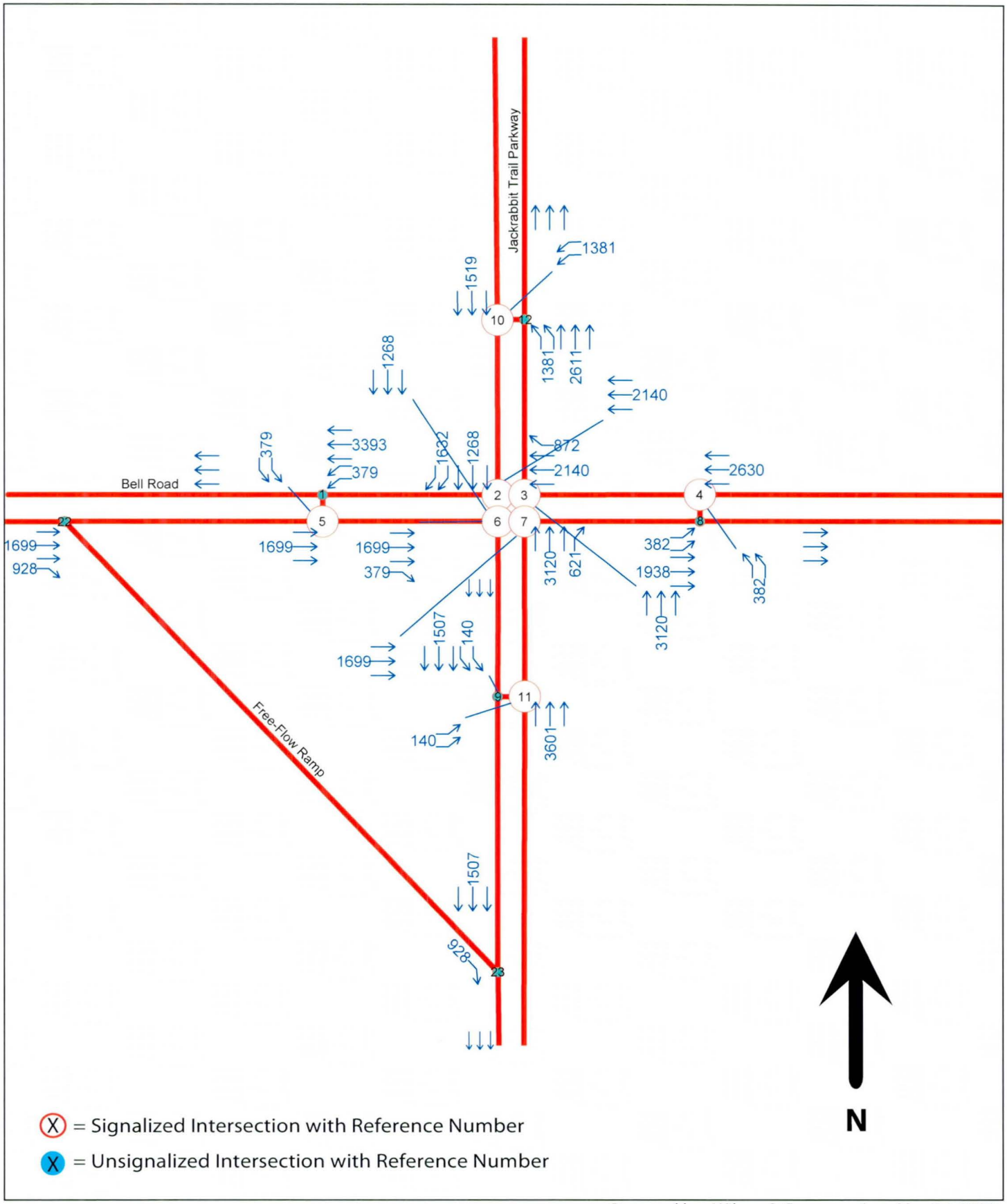



**Figure 4.12**

Prepared by: Wilson & Company, Inc., May 24, 2008.

**JRT & Bell Road Alt A Condition, 6-lane Parkways with Indirect Left Turns, PM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.13**

**JRT & Bell Road Alt B Condition, 6-lane Parkways with Indirect Left Turns, PM Peak**

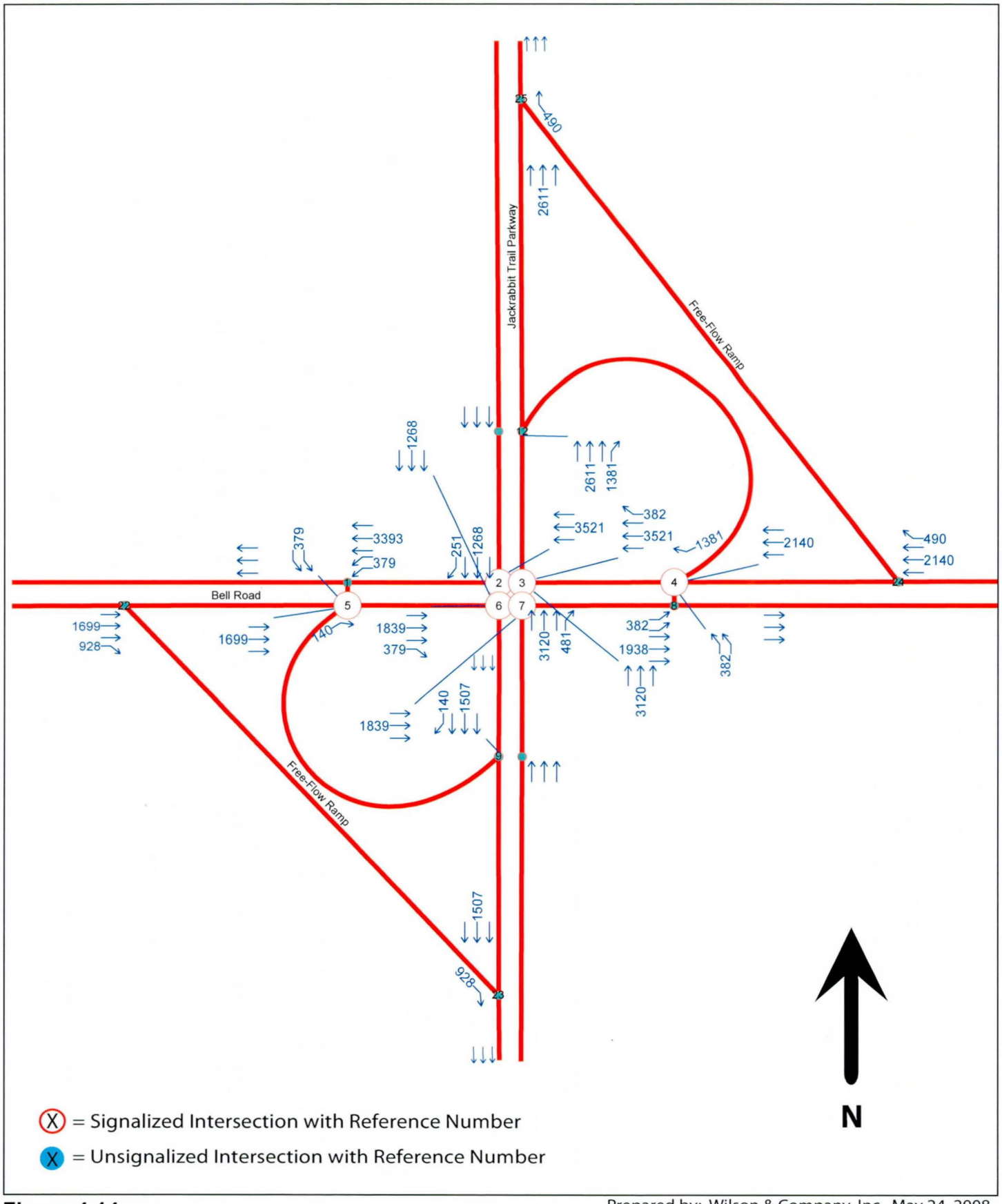



**Figure 4.14**

Prepared by: Wilson & Company, Inc., May 24, 2008.

**JRT & Bell Road Alt C Condition, 6-lane Parkways with Indirect Left Turns, PM Peak**

Table 4.3 provides a summary of the analysis of the 6-lane parkway alternative mitigation configurations for the intersection of Jackrabbit Trail & Bell Road. Detailed calculations and intersection capacity analysis reports are provided in Appendix B.

**Table 4.3**
**Six-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)**
**Jackrabbit Trail & Bell Road**

| MITIGATED CONDITION AM PEAK HOUR | | |
|---|---|---|
| **SCENARIO** | **DELAY** | **LOS** |
| ALTERNATIVE A | 179.7 | F |
| ALTERNATIVE B | 94.4 | F |
| ALTERNATIVE C | 53.3 | D |
| **MITIGATION CONDITION PM PEAK HOUR** | | |
| **SCENARIO** | **DELAY** | **LOS** |
| ALTERNATIVE A | 275.1 | F |
| ALTERNATIVE B | 259.8 | F |
| ALTERNATIVE C | 364.8 | F |

Source: Wilson & Company, May 22, 2008.

As indicated in Table 4.3, acceptable levels of service can not be provided for the Enhanced Year 2026 forecast volumes under any of the analyzed mitigation alternatives with a six-lane Arizona Parkway cross-section, with the exception of the Alternative C configuration in the AM peak hour only. Therefore, additional analysis was conducted to determine the effectiveness of eight-lane Arizona Parkway cross-sections on both Jackrabbit Trail and Bell Road in accommodating the forecast Enhanced Year 2026 traffic volumes.

## *4.4 Jackrabbit Trail/Bell Road Parkway Intersections Operational Analysis – Mitigated Conditions (with Eight-Lane Parkway Configuration)*

As detailed in the conclusions of Section 4.3, additional mitigation measures are required to accommodate Enhance Year 2026 traffic volumes at the Parkway/Parkway Intersection of Jack Rabbit Trail and Bell Road. Thus, the concept of an Eight-Lane Arizona Parkway Alternate was evaluated for both facilities at this key intersection. Figures 4.15 and 4.16 display the assumed geometry and AM and PM peak traffic volumes, respectively.

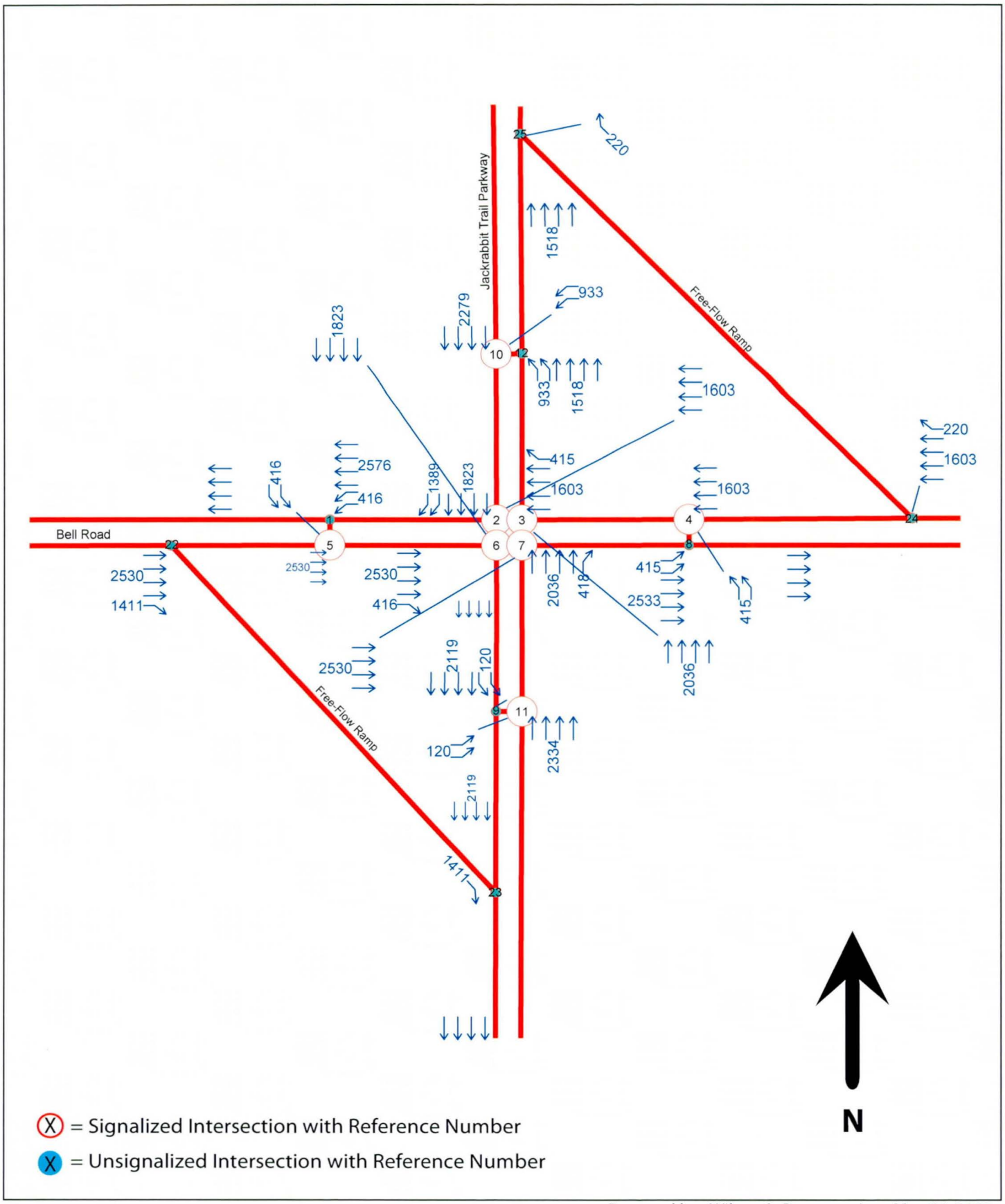
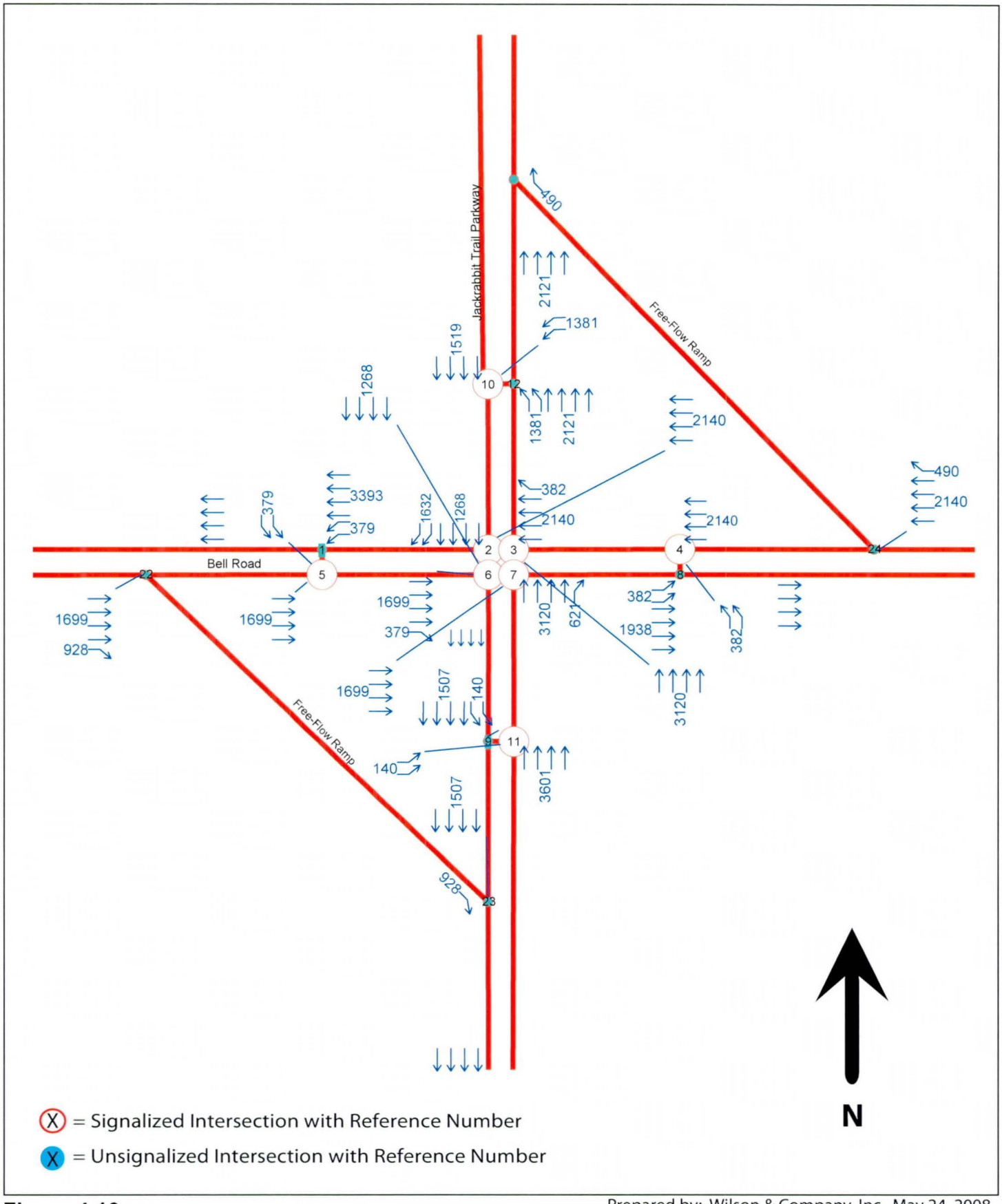



**Figure 4.15**

Prepared by: Wilson & Company, Inc., May 24, 2008.

**JRT & Bell Road Base Condition, 8-lane Parkways with Indirect Left Turns, AM Peak**




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.16**
**JRT & Bell Road Base Condition, 8-lane Parkways with Indirect Left Turns, PM Peak**

Results of the analysis of the Eight-Lane Arizona Parkway Alternative intersection configuration are summarized in Table 4.4. Detailed calculations and reports are provided in Appendix B.

**Table 4.4**
**Eight-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)**
**Jackrabbit Trail & Bell Road**

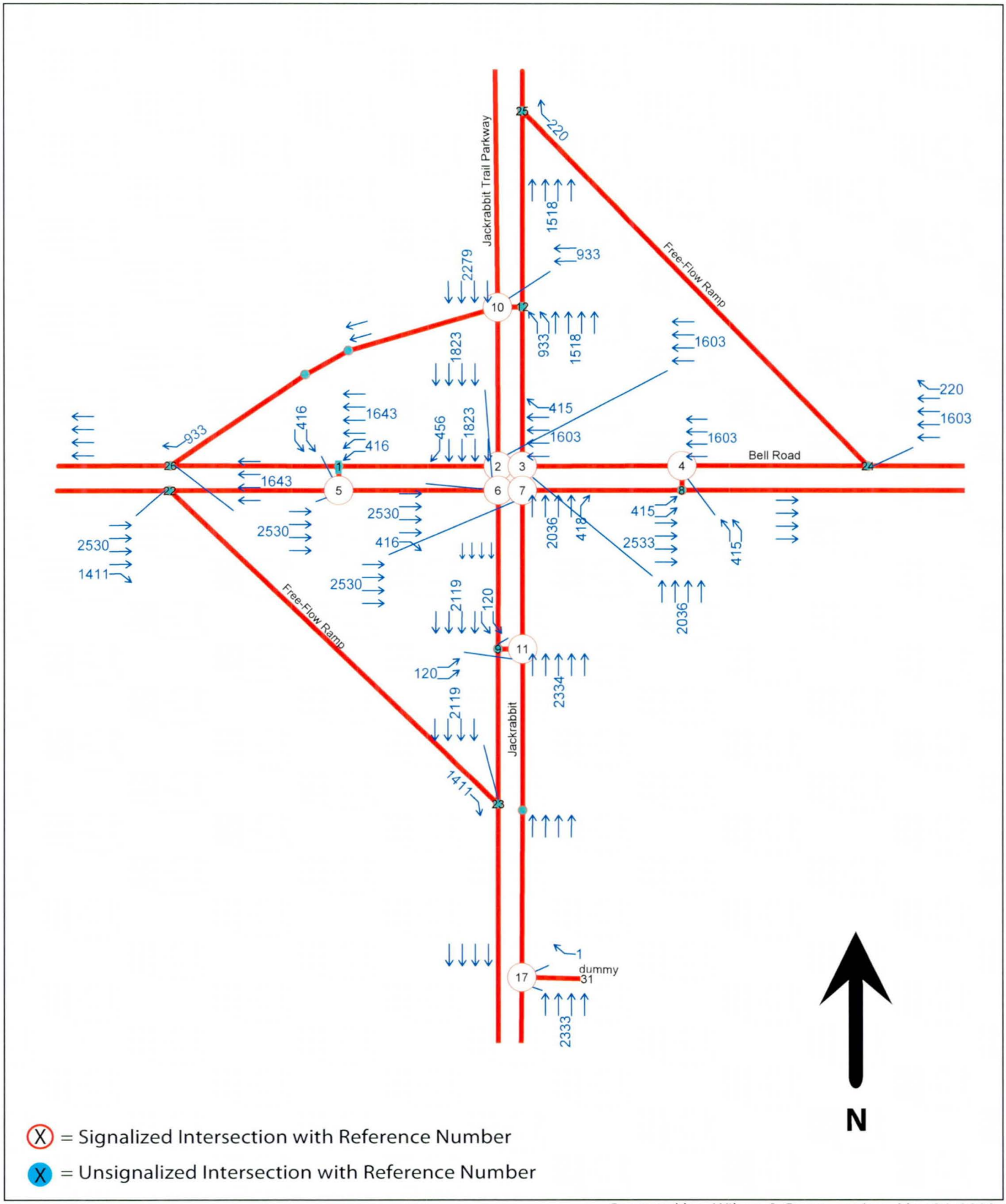
| MITIGATED CONDITION AM PEAK HOUR | | |
|---|---|---|
| **SCENARIO** | **DELAY** | **LOS** |
| BASE | 72.4 | E |
| MITIGATED | 53.3 | D |
| **MITIGATED CONDITION PM PEAK HOUR** | | |
| **SCENARIO** | **DELAY** | **LOS** |
| BASE | 89.2 | F |
| MITIGATED | 50.2 | D |

Source: Wilson & Company, May 22, 2008.

As indicated in Table 4.4, the base eight-lane parkway configuration does not have adequate capacity to provide acceptable levels of service with the forecasted Enhanced Year 2026 traffic volumes. Therefore, additional mitigation would be necessary. Figures 4.17 and 4.18 depict the mitigated intersection configurations with AM and PM peak hour traffic volumes, respectively. The mitigation includes the following:

- Construction of a diagonal ramp from the northbound u-turn intersection to westbound Bell Road in the northwest quadrant. The ramp will service both southbound right-turns and northbound left-turns, eliminating the northbound-to-southbound u-turn movement
- Widening the westbound exiting leg of Bell Road to provide adequate merging area and capacity to accommodate the traffic utilizing the diagonal ramp located in the northwest quadrant
- Widening of the northbound approach to a five lane facility from south of the southbound u-turn intersection to the main intersection
- Widening of the northbound and southbound exiting legs of Jackrabbit Trail to provide adequate merging area and capacity to accommodate the traffic utilizing the free-flow right-turn ramps located in the southwest and northeast quadrants

As indicated in Table 4.4, the mitigated configuration would be sufficient to provide adequate level of service with the forecasted Enhanced Year 2026 AM and PM peak hour traffic volumes.




Prepared by: Wilson & Company, Inc., May 24, 2008.

**Figure 4.17**
**JRT & Bell Road Mitigated Condition, 8-lane Parkways with Indirect Left Turns, AM Peak**

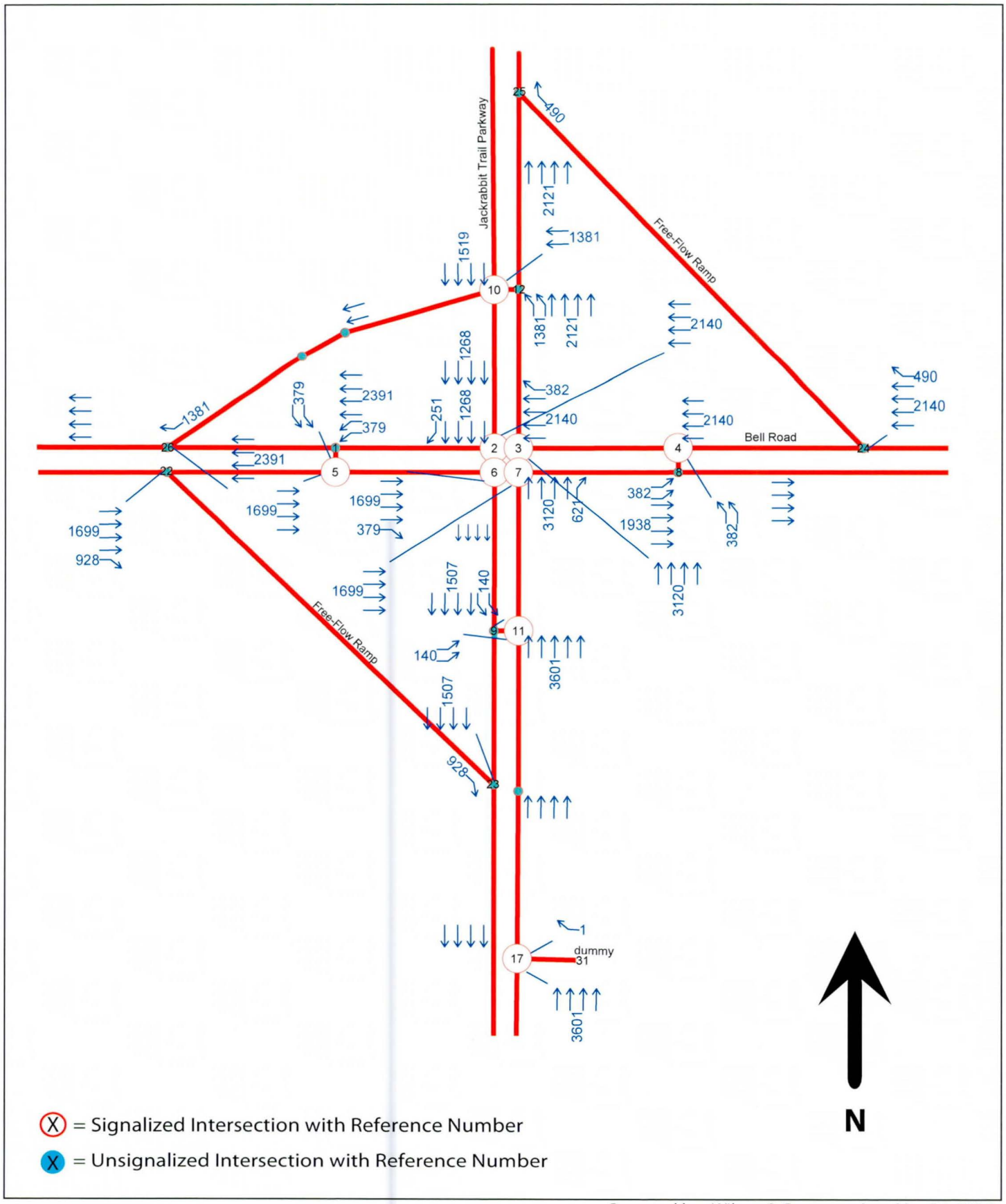



**Figure 4.18**

Prepared by: Wilson & Company, Inc., May 24, 2008.

**JRT & Bell Road Mitigated Condition, 8-lane Parkways with Indirect Left Turns, PM Peak**

# 5.0 GRADE SEPERATED/INTERCHANGE CONFIGURATION (LONG-TERM DEVELOPMENT SCENARIO)

## *5.1 Basis for Consideration of Grade Separation*

As discussed in the Section 4.0, the intersection of Jackrabbit Trail and Bell Road would require substantial intersection improvements, including multiple ramps and additional mainline widening to accommodate merging ramp traffic (beyond an eight lane facility), to provide adequate levels of service with the forecasted Enhanced Year 2026 AM and PM peak hour traffic volumes. While this model was selected for purposes of this analysis, model runs of buildout conditions conducted in conjunction with the I-10/Hassayampa Valley Roadway Framework Study indicate a significantly higher traffic demand at this intersection under buildout conditions. Table 5.1 provides a comparison of the Enhanced Year 2026 forecasts used in this analysis to those of the I-10/Hassayampa Valley Roadway Framework Study. As indicated in this table, buildout volumes are anticipated to be approximately three times greater at this intersection than analyzed in this study.

**Table 5.1**
**Summary of Daily Entering Volumes at Jackrabbit Trail & Bell Road Intersection**
**Comparison of Available Long-Range Model Planning Forecasts**

| Scenario | Daily Entering Volume Summary | | | | | |
|---|---|---|---|---|---|---|
| | North | East | South | West | Summary Total | Intersection Entering Volume |
| Enhanced Year 2026 Travel Demand Assignment, MCDOT Northwest Valley Corridor Studies Model | 42,201 | 47,000 | 75,000 | 73,000 | 237,201 | 118,601 |
| Future Buildout Travel Demand Assignment, Adopted MAG I-10 /Hassayampa Valley Roadway Framework Study | 217,000 | 141,000 | 239,000 | 160,000 | 757,000 | 378,500 |

The recommended improvements discussed in the Section 4.0 are forecast to provide LOS D operations with the Enhanced Year 2026 travel demand. Thus, little reserve capacity is anticipated to remain to service additional forecast growth beyond the Enhanced Year 2026 development levels. Therefore, additional analysis was conducted to determine whether grade separation at this intersection might provide more potential reserve capacity to accommodate growth beyond the Enhanced Year 2026 development levels.

## *5.2 Interchange Design Considerations*

Two types of interchange design strategies were reviewed: a Traditional Diamond Interchange (TDI) and a Single Point Urban Interchange (SPUI). A TDI requires two traffic signals, generally operated by one controller, with overlaps and phasing designed to minimize queuing between the ramp intersections. The design of the SPUI allows mainline left turns to operate concurrently and left turns from the ramps to operate concurrently, eliminating concern for queuing between multiple ramp intersections, and resulting in

fewer traffic signal phases and conflict points than a TDI. Fewer signal phases result in a decrease in lost time attributable to clearance intervals and vehicles start-up delays. It also permits shorter signal cycle lengths. The combined effect is fewer vehicle stops and shorter delay times at a SPUI than a TDI, increasing overall intersection capacity and level of service. A preliminary review of the Enhanced Year 2026 traffic volumes at this intersection indicates that there will be significant left turn volumes, in combination with substantial through volumes on Jackrabbit Trail. Therefore, a Single Point Urban Interchange (SPUI) was selected for analysis over a Traditional Diamond Interchange (TDI).

### *5.3 SPUI Operational Analysis – Base Condition*

Figures 5.1 and 5.2 illustrate the assumed intersection geometry and AM and PM peak hour volumes, respectively. Based on the significant volume of turns, dual turn lanes were assumed for all left turn movements under the base condition. Additionally, based on the high volume of eastbound to southbound right turns, dual right turns with merge lanes were assumed for the base interchange configuration. Table 5.2 provides a summary of the forecasted intersection operations at the intersection of Jackrabbit Trail and Bell Road with SPUI configuration and forecasted Enhanced Year 2026 traffic volumes.

**Table 5.2**
**Single Point Urban Interchange (SPUI) Intersection Operations**
**Jackrabbit Trail & Bell Road**

| AM PEAK HOUR | | |
|---|---|---|
| **SCENARIO** | **DELAY** | **LOS** |
| BASE SPUI | 28.9 | C |
| **PM PEAK HOUR** | | |
| **SCENARIO** | **DELAY** | **LOS** |
| BASE SPUI | 32.7 | C |

Source: Wilson & Company, September 15, 2008.

As indicated in Table 5.2, the base SPUI geometry illustrated in Figures 5.1 and 5.2, which assumed a base six-lane roadway cross section, is sufficient to provide acceptable LOS C operations during the AM and PM peak with the Enhanced Year 2026 traffic volumes. This is in comparison to the LOS D conditions documented in Table 4.4 (53.3 seconds delay in the AM and 50.2 seconds in the PM) associated with the recommended eight-lane parkway-to-parkway configuration discussed in Section 4.0. Therefore, it is evident that the SPUI intersection treatment will provide the greatest opportunity to service additional forecasted demand beyond the Enhanced Year 2026 development levels.

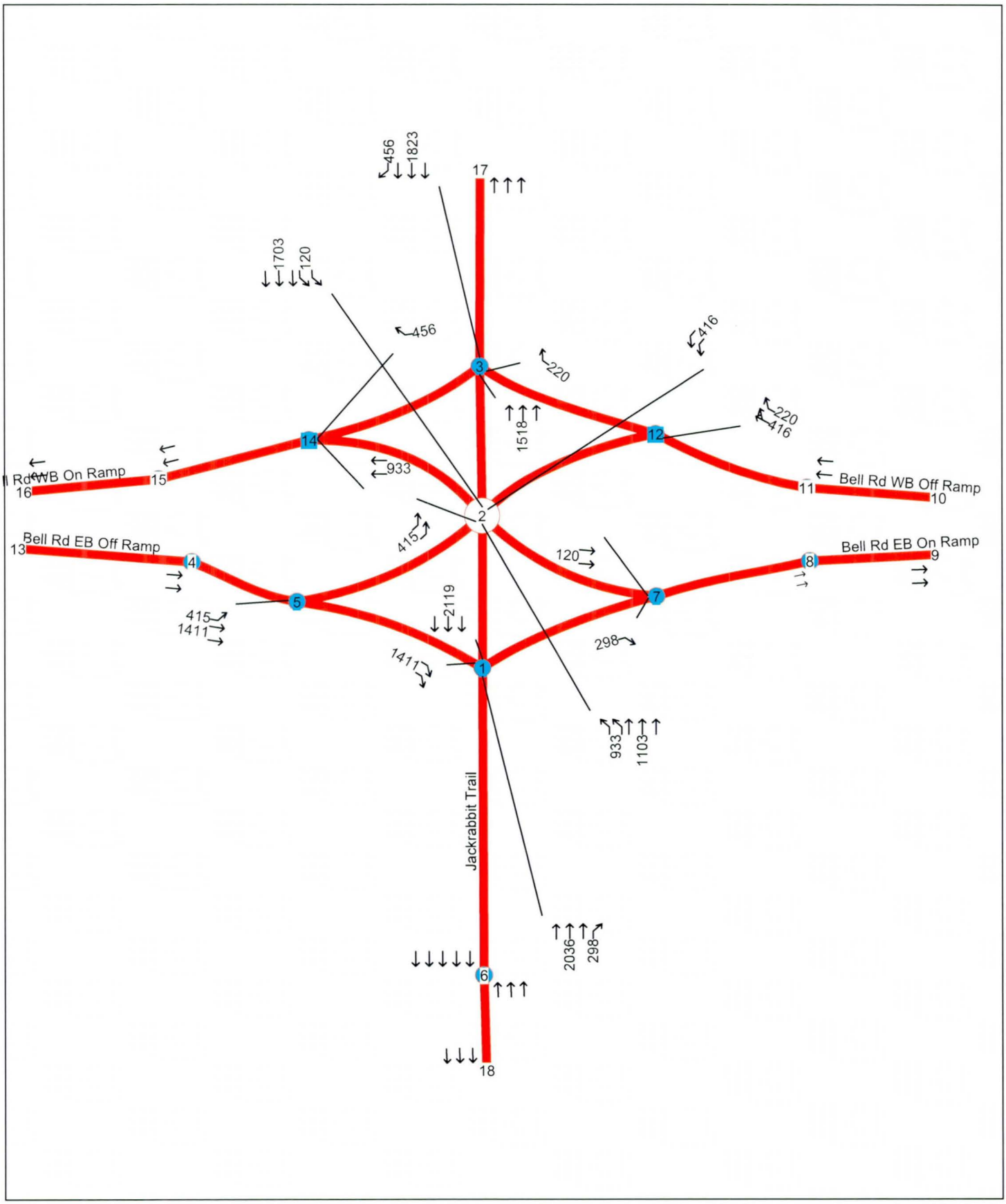



Figure 5.1 Prepared by: Wilson & Company, September 15, 2008.
JRT & Bell Road Mitigated Condition, SPUI Alternative, AM Peak

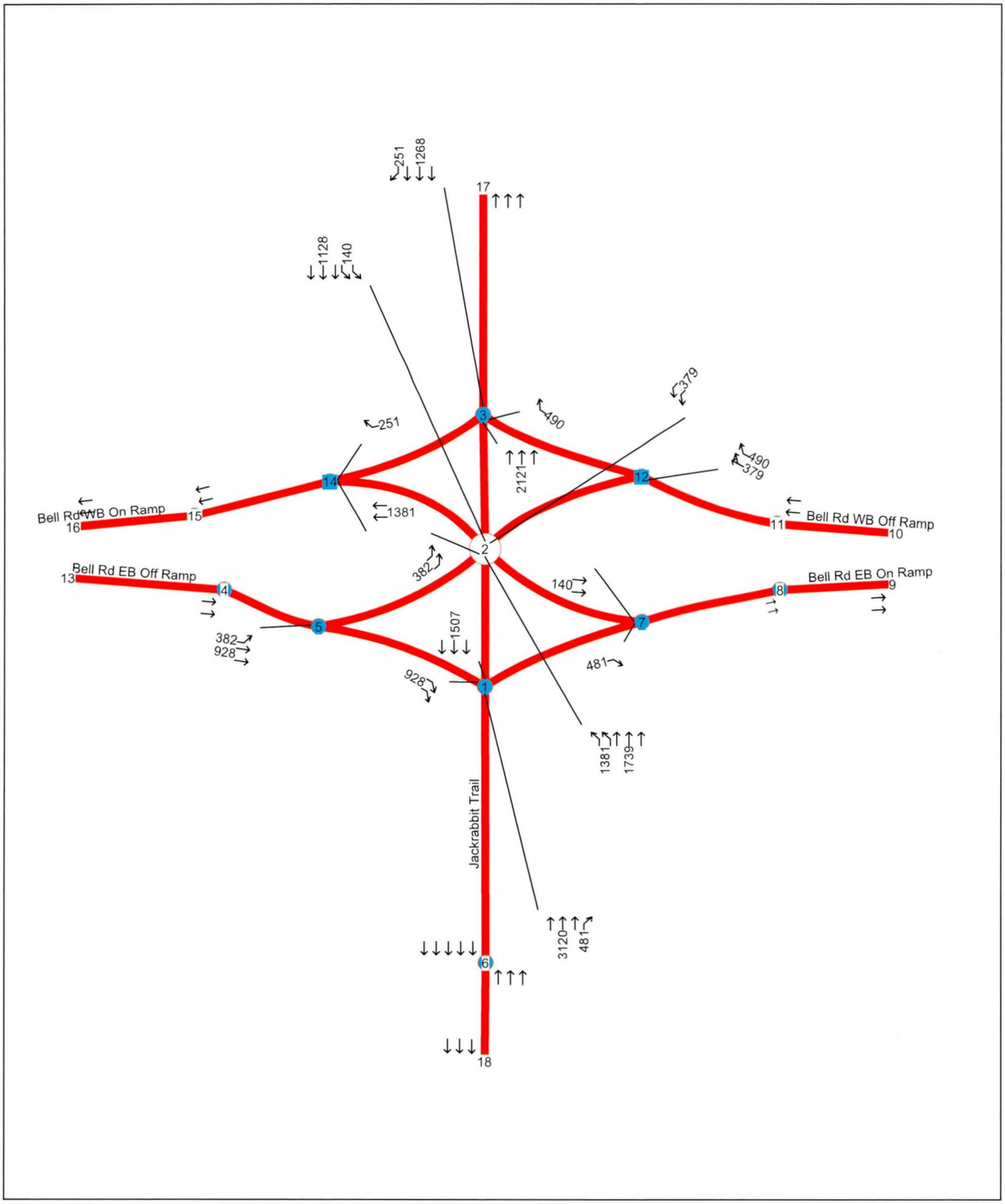



**Figure 5.2** **Prepared by: Wilson & Company, September 15, 2008.**

**JRT & Bell Road Mitigated Condition, SPUI Alternative, PM Peak**

# 6.0 FINDINGS AND CONCLUSIONS

As a result of the intersection capacity analyses conducted for the Jackrabbit Trail Access Control and Corridor Improvement Study a number of conclusions have been reached related to the lane configuration requirements for key intersections located within the corridor. As detailed in Section 1.0 all capacity analyses documented in this memorandum are based on future traffic volume conditions resulting from the Enhanced Year 2026 Travel Demand Assignment prepared by MCDOT for the Northwest Valley Corridor Studies. The following discussion summarizes key findings from the technical analyses documented in Sections 3, 4 and 5 of this technical memorandum.

## *6.1 Traditional Intersection Configurations*

As documented in Section 3.1, acceptable peak hour traffic operations can be achieved for each of the intersections included in Categories 1, 2, and 3. This conclusion assumes the implementation of traditional intersection configurations under interim conditions prior to the full implementation of the Arizona Parkway. Similar conclusions were reached for the individually analyzed intersections at the interchange of Perryville Road and I-10 as well as Jackrabbit Trail and I-10. The results of the capacity analyses detailed in Sections 3.2 and 3.3 document the anticipated levels of service at these locations under base and mitigated conditions.

The highest volume location analyzed in this study was the intersection of Jackrabbit Trail and Bell Road. As detailed in Section 3.3, if a traditional intersection was constructed at this location, prior to the implementation of the Arizona Parkway, the provision of a direct connector-flyover ramp to serve the northbound to westbound turn movement along with a free right-turn lane in the southwest quadrant of the intersection to serve the eastbound to southbound turn movement would be required. The provision of these geometric mitigation features would allow this intersection to achieve acceptable performance levels during the AM and PM peak hours.

## *6.2 Arizona Parkway Intersection Configurations*

Section 4.1 documents the results of the analysis of key corridor intersections with the implementation of the Arizona Parkway configuration. As was the case for the "Traditional Intersection Configuration" condition, all of the category based intersections would perform at an acceptable level of service assuming the construction of a six-lane Arizona Parkway with indirect left-turn treatments. Sections 4.2, 4.3 and 4.4 analyzed detailed traffic operations at the high volume location of Jackrabbit Trail and Bell Road under the Arizona Parkway condition. The results of these analyses indicated that in order to achieve acceptable peak-hour performance levels at this location, an eight-lane Parkway configuration would be required along with capacity enhancements detailed in Section 4.4. These enhancements include the following mitigation measures:

- Construction of free right-turn ramps in the southwest and northeast quadrants
- Construction of a diagonal ramp from the northbound u-turn intersection to westbound Bell Road in the northwest quadrant. The ramp will service both southbound right-turns and northbound left-turns, eliminating the northbound-to-southbound u-turn movement
- Widening the westbound exiting leg of Bell Road to provide adequate merging area and capacity to accommodate the traffic utilizing the diagonal ramp located in the northwest quadrant
- Widening of the northbound approach to a five lane facility from south of the southbound u-turn intersection to the main intersection

- Widening of the northbound and southbound exiting legs of Jackrabbit Trail to provide adequate merging area and capacity to accommodate the traffic utilizing the free-flow right-turn ramps located in the southwest and northeast quadrants

As illustrated by these enhanced geometric requirements, significant investment will be required at the intersection of Jackrabbit Trail and Bell Road to accommodate the high level of traffic activity that is anticipated for this location.

### *6.3 Grade Separated Intersection Configurations*

As detailed by the capacity analyses conducted in this study, any increase in future traffic activity beyond the levels predicted by the Enhanced Year 2026 Travel Demand Assignment MCDOT Northwest Valley Corridor Studies Model would require a grade-separated traffic interchange solution in order to provide an acceptable level of service at the intersection of Jackrabbit Trail and Bell Road under long-term conditions. A review of peak hour traffic volumes indicates that Single Point Urban Interchange (SPUI) would be the preferred grade separated configuration. Provision of a SPUI at this intersection would allow for a six-lane, rather than eight-lane, cross section and improve peak hour operations with the Enhanced Year 2026 forecast volumes to level of service C, with greater reserve capacity to accommodate additional growth beyond Year 2026 levels.

# APPENDIX A
# DETAILED LEVEL OF SERVICE CALCULATIONS AND REPORTS TRADITIONAL INTERSECTION GEOMETRICS

HCM Signalized Intersection Capacity Analysis
3: Cross-Street Arterial & Jackrabbit Trail Arterial

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | 0.88 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 3539 | 1583 | 3433 | 3539 | 2787 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 3539 | 1583 | 3433 | 3539 | 2787 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 253 | 293 | 301 | 347 | 257 | 582 | 169 | 1741 | 502 | 603 | 2590 | 522 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 275 | 318 | 327 | 377 | 279 | 633 | 184 | 1892 | 546 | 655 | 2815 | 567 |
| RTOR Reduction (vph) | 0 | 0 | 77 | 0 | 0 | 387 | 0 | 0 | 170 | 0 | 0 | 167 |
| Lane Group Flow (vph) | 275 | 318 | 250 | 377 | 279 | 246 | 184 | 1892 | 376 | 655 | 2815 | 400 |
| Turn Type | Prot | | Perm | Prot | | Perm | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 12.8 | 18.1 | 18.1 | 15.9 | 21.2 | 21.2 | 7.0 | 55.0 | 55.0 | 25.0 | 73.0 | 73.0 |
| Effective Green, g (s) | 12.8 | 18.1 | 18.1 | 15.9 | 21.2 | 21.2 | 7.0 | 55.0 | 55.0 | 25.0 | 73.0 | 73.0 |
| Actuated g/C Ratio | 0.10 | 0.14 | 0.14 | 0.12 | 0.16 | 0.16 | 0.05 | 0.42 | 0.42 | 0.19 | 0.56 | 0.56 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 338 | 493 | 220 | 420 | 577 | 454 | 185 | 2151 | 670 | 660 | 2855 | 889 |
| v/s Ratio Prot | 0.08 | 0.09 | | c0.11 | 0.08 | | 0.05 | 0.37 | | c0.19 | c0.55 | |
| v/s Ratio Perm | | | c0.16 | | | c0.09 | | | 0.24 | | | 0.25 |
| v/c Ratio | 0.81 | 0.65 | 1.14 | 0.90 | 0.48 | 0.54 | 0.99 | 0.88 | 0.56 | 0.99 | 0.99 | 0.45 |
| Uniform Delay, d1 | 57.4 | 52.9 | 56.0 | 56.2 | 49.4 | 49.9 | 61.5 | 34.5 | 28.4 | 52.4 | 28.0 | 16.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 13.9 | 2.9 | 102.9 | 21.2 | 0.6 | 1.3 | 64.3 | 4.5 | 1.1 | 33.0 | 13.6 | 0.4 |
| Delay (s) | 71.3 | 55.8 | 158.8 | 77.5 | 50.1 | 51.3 | 125.7 | 38.9 | 29.5 | 85.4 | 41.6 | 17.1 |
| Level of Service | E | E | F | E | D | D | F | D | C | F | D | B |
| Approach Delay (s) | | 97.1 | | | 58.7 | | | 43.0 | | | 45.3 | |
| Approach LOS | | F | | | E | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 51.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.01 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 88.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 0.93 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 3281 | | 1770 | 3539 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.62 | 1.00 | | 0.20 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1150 | 3281 | | 373 | 3539 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 295 | 260 | 246 | 251 | 198 | 451 | 168 | 1593 | 102 | 668 | 2528 | 358 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 321 | 283 | 267 | 273 | 215 | 490 | 183 | 1732 | 111 | 726 | 2748 | 389 |
| RTOR Reduction (vph) | 0 | 100 | 0 | 0 | 0 | 265 | 0 | 0 | 58 | 0 | 0 | 127 |
| Lane Group Flow (vph) | 321 | 450 | 0 | 273 | 215 | 225 | 183 | 1732 | 53 | 726 | 2748 | 262 |
| Turn Type | pm+pt | | | pm+pt | | Perm | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 28.0 | 16.0 | | 36.0 | 20.0 | 20.0 | 7.0 | 46.0 | 46.0 | 26.0 | 65.0 | 65.0 |
| Effective Green, g (s) | 28.0 | 16.0 | | 36.0 | 20.0 | 20.0 | 7.0 | 46.0 | 46.0 | 26.0 | 65.0 | 65.0 |
| Actuated g/C Ratio | 0.23 | 0.13 | | 0.30 | 0.17 | 0.17 | 0.06 | 0.38 | 0.38 | 0.22 | 0.54 | 0.54 |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 330 | 437 | | 298 | 590 | 264 | 200 | 1949 | 607 | 744 | 2754 | 857 |
| v/s Ratio Prot | 0.10 | 0.14 | | c0.12 | 0.06 | | 0.05 | 0.34 | | c0.21 | c0.54 | |
| v/s Ratio Perm | 0.13 | | | c0.15 | | 0.14 | | | 0.03 | | | 0.17 |
| v/c Ratio | 0.97 | 1.03 | | 0.92 | 0.36 | 0.85 | 0.92 | 0.89 | 0.09 | 0.98 | 1.00 | 0.31 |
| Uniform Delay, d1 | 44.1 | 52.0 | | 36.4 | 44.4 | 48.6 | 56.2 | 34.6 | 23.6 | 46.7 | 27.4 | 15.1 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 41.9 | 51.1 | | 31.0 | 0.4 | 22.4 | 40.4 | 5.4 | 0.1 | 26.8 | 16.5 | 0.2 |
| Delay (s) | 86.0 | 103.1 | | 67.4 | 44.7 | 70.9 | 96.6 | 40.0 | 23.7 | 73.5 | 43.9 | 15.3 |
| Level of Service | F | F | | E | D | E | F | D | C | E | D | B |
| Approach Delay (s) | | 96.8 | | | 64.2 | | | 44.2 | | | 46.6 | |
| Approach LOS | | F | | | E | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 53.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 96.0% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Cross-Street Arterial & Jackrabbit Trail Arterial

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.91 | | 1.00 | 0.91 | |
| Frt | 1.00 | 0.94 | | 1.00 | 0.92 | | 1.00 | 0.95 | | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 3310 | | 1770 | 3245 | | 1770 | 4850 | | 1770 | 5023 | |
| Flt Permitted | 0.28 | 1.00 | | 0.22 | 1.00 | | 0.22 | 1.00 | | 0.15 | 1.00 | |
| Satd. Flow (perm) | 514 | 3310 | | 403 | 3245 | | 414 | 4850 | | 288 | 5023 | |
| Volume (vph) | 102 | 267 | 202 | 323 | 252 | 313 | 96 | 680 | 303 | 575 | 1016 | 90 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 111 | 290 | 220 | 351 | 274 | 340 | 104 | 739 | 329 | 625 | 1104 | 98 |
| RTOR Reduction (vph) | 0 | 139 | 0 | 0 | 229 | 0 | 0 | 80 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 111 | 371 | 0 | 351 | 385 | 0 | 104 | 988 | 0 | 625 | 1192 | 0 |
| Turn Type | pm+pt | | | pm+pt | | | pm+pt | | | pm+pt | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 22.9 | 14.5 | | 34.5 | 22.1 | | 28.5 | 21.9 | | 56.9 | 46.3 | |
| Effective Green, g (s) | 22.9 | 14.5 | | 34.5 | 22.1 | | 28.5 | 21.9 | | 56.9 | 46.3 | |
| Actuated g/C Ratio | 0.23 | 0.15 | | 0.35 | 0.22 | | 0.29 | 0.22 | | 0.57 | 0.47 | |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 225 | 483 | | 360 | 721 | | 209 | 1069 | | 627 | 2340 | |
| v/s Ratio Prot | 0.04 | 0.11 | | c0.16 | 0.12 | | 0.03 | 0.20 | | c0.31 | 0.24 | |
| v/s Ratio Perm | 0.07 | | | c0.18 | | | 0.11 | | | c0.26 | | |
| v/c Ratio | 0.49 | 0.77 | | 0.98 | 0.53 | | 0.50 | 0.92 | | 1.00 | 0.51 | |
| Uniform Delay, d1 | 31.6 | 40.8 | | 27.8 | 34.1 | | 26.9 | 37.9 | | 26.9 | 18.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.7 | 7.2 | | 40.4 | 0.8 | | 1.9 | 13.0 | | 34.9 | 0.2 | |
| Delay (s) | 33.3 | 48.0 | | 68.2 | 34.9 | | 28.7 | 51.0 | | 61.8 | 18.8 | |
| Level of Service | C | D | | E | C | | C | D | | E | B | |
| Approach Delay (s) | | 45.4 | | | 47.0 | | | 49.0 | | | 33.5 | |
| Approach LOS | | D | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 41.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.96 | | |
| Actuated Cycle Length (s) | 99.4 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 96.9% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.95 | 1.00 | 0.97 | 0.95 | 0.88 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 3539 | 1583 | 3433 | 3539 | 2787 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 3539 | 1583 | 3433 | 3539 | 2787 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 198 | 188 | 118 | 354 | 531 | 769 | 360 | 2476 | 692 | 421 | 1802 | 261 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 215 | 204 | 128 | 385 | 577 | 836 | 391 | 2691 | 752 | 458 | 1959 | 284 |
| RTOR Reduction (vph) | 0 | 0 | 113 | 0 | 0 | 2 | 0 | 0 | 152 | 0 | 0 | 108 |
| Lane Group Flow (vph) | 215 | 204 | 15 | 385 | 577 | 834 | 391 | 2691 | 600 | 458 | 1959 | 176 |
| Turn Type | Prot | | Perm | Prot | | pm+ov | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 9.0 | 16.0 | 16.0 | 16.0 | 23.0 | 41.0 | 20.4 | 74.0 | 74.0 | 18.0 | 71.6 | 71.6 |
| Effective Green, g (s) | 9.0 | 16.0 | 16.0 | 16.0 | 23.0 | 41.0 | 20.4 | 74.0 | 74.0 | 18.0 | 71.6 | 71.6 |
| Actuated g/C Ratio | 0.06 | 0.11 | 0.11 | 0.11 | 0.16 | 0.29 | 0.15 | 0.53 | 0.53 | 0.13 | 0.51 | 0.51 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 221 | 404 | 181 | 392 | 581 | 896 | 500 | 2688 | 837 | 441 | 2601 | 810 |
| v/s Ratio Prot | 0.06 | 0.06 | | c0.11 | 0.16 | c0.12 | 0.11 | c0.53 | | 0.13 | 0.39 | |
| v/s Ratio Perm | | | 0.01 | | | 0.18 | | | 0.38 | | | 0.11 |
| v/c Ratio | 0.97 | 0.50 | 0.08 | 0.98 | 0.99 | 0.93 | 0.78 | 1.00 | 0.72 | 1.04 | 0.75 | 0.22 |
| Uniform Delay, d1 | 65.4 | 58.3 | 55.4 | 61.9 | 58.4 | 48.1 | 57.7 | 33.0 | 25.0 | 61.0 | 27.2 | 18.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 52.5 | 1.0 | 0.2 | 40.5 | 35.4 | 15.9 | 7.8 | 17.6 | 2.9 | 53.2 | 1.3 | 0.1 |
| Delay (s) | 117.9 | 59.3 | 55.6 | 102.3 | 93.8 | 64.0 | 65.5 | 50.6 | 28.0 | 114.2 | 28.5 | 18.9 |
| Level of Service | F | E | E | F | F | E | E | D | C | F | C | B |
| Approach Delay (s) | | 81.4 | | | 81.8 | | | 47.7 | | | 42.0 | |
| Approach LOS | | F | | | F | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 54.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 140.0 | Sum of lost time (s) | 4.0 |
| Intersection Capacity Utilization | 93.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Cross-Street Arterial & Jackrabbit Trail Arterial

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 0.95 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1770 | 3370 | | 1770 | 3539 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.27 | 1.00 | | 0.21 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 507 | 3370 | | 398 | 3539 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 210 | 231 | 108 | 272 | 484 | 603 | 328 | 2051 | 437 | 447 | 1666 | 272 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 228 | 251 | 117 | 296 | 526 | 655 | 357 | 2229 | 475 | 486 | 1811 | 296 |
| RTOR Reduction (vph) | 0 | 50 | 0 | 0 | 0 | 17 | 0 | 0 | 208 | 0 | 0 | 158 |
| Lane Group Flow (vph) | 228 | 318 | 0 | 296 | 526 | 638 | 357 | 2229 | 267 | 486 | 1811 | 138 |
| Turn Type | pm+pt | | | pm+pt | | pm+ov | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | 1 | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 25.7 | 14.7 | | 34.6 | 19.6 | 36.6 | 13.7 | 45.1 | 45.1 | 17.0 | 48.4 | 48.4 |
| Effective Green, g (s) | 25.7 | 14.7 | | 34.6 | 19.6 | 36.6 | 13.7 | 45.1 | 45.1 | 17.0 | 48.4 | 48.4 |
| Actuated g/C Ratio | 0.24 | 0.14 | | 0.32 | 0.18 | 0.34 | 0.13 | 0.41 | 0.41 | 0.16 | 0.45 | 0.45 |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 248 | 456 | | 327 | 638 | 591 | 433 | 2110 | 657 | 537 | 2264 | 705 |
| v/s Ratio Prot | 0.09 | 0.09 | | c0.13 | 0.15 | c0.17 | 0.10 | c0.44 | | 0.14 | c0.36 | |
| v/s Ratio Perm | 0.12 | | | 0.16 | | 0.23 | | | 0.17 | | | 0.09 |
| v/c Ratio | 0.92 | 0.70 | | 0.91 | 0.82 | 1.08 | 0.82 | 1.06 | 0.41 | 0.91 | 0.80 | 0.20 |
| Uniform Delay, d1 | 37.5 | 44.9 | | 31.2 | 42.9 | 36.1 | 46.3 | 31.8 | 22.4 | 45.1 | 26.0 | 18.3 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 35.7 | 4.6 | | 27.0 | 8.5 | 60.6 | 12.1 | 36.5 | 0.4 | 18.7 | 2.1 | 0.1 |
| Delay (s) | 73.2 | 49.5 | | 58.2 | 51.4 | 96.6 | 58.4 | 68.3 | 22.8 | 63.7 | 28.0 | 18.5 |
| Level of Service | E | D | | E | D | F | E | E | C | E | C | B |
| Approach Delay (s) | | 58.5 | | | 72.8 | | | 60.1 | | | 33.6 | |
| Approach LOS | | E | | | E | | | E | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 53.5 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.06 | | |
| Actuated Cycle Length (s) | 108.7 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 98.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Cross-Street Arterial & Jackrabbit Trail Arterial

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 0.91 | | 1.00 | 0.91 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.90 | | 1.00 | 0.96 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 3368 | | 1770 | 3177 | | 1770 | 4865 | | 1770 | 5001 | |
| Flt Permitted | 0.28 | 1.00 | | 0.43 | 1.00 | | 0.30 | 1.00 | | 0.13 | 1.00 | |
| Satd. Flow (perm) | 528 | 3368 | | 800 | 3177 | | 558 | 4865 | | 248 | 5001 | |
| Volume (vph) | 118 | 144 | 69 | 339 | 294 | 630 | 204 | 956 | 389 | 337 | 655 | 81 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 128 | 157 | 75 | 368 | 320 | 685 | 222 | 1039 | 423 | 366 | 712 | 88 |
| RTOR Reduction (vph) | 0 | 63 | 0 | 0 | 281 | 0 | 0 | 80 | 0 | 0 | 16 | 0 |
| Lane Group Flow (vph) | 128 | 169 | 0 | 368 | 724 | 0 | 222 | 1382 | 0 | 366 | 784 | 0 |
| Turn Type | pm+pt | | | pm+pt | | | pm+pt | | | pm+pt | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.1 | 14.1 | | 33.3 | 23.3 | | 37.5 | 26.1 | | 45.6 | 30.2 | |
| Effective Green, g (s) | 20.1 | 14.1 | | 33.3 | 23.3 | | 37.5 | 26.1 | | 45.6 | 30.2 | |
| Actuated g/C Ratio | 0.23 | 0.16 | | 0.38 | 0.27 | | 0.43 | 0.30 | | 0.52 | 0.35 | |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 208 | 546 | | 476 | 852 | | 400 | 1461 | | 402 | 1738 | |
| v/s Ratio Prot | 0.04 | 0.05 | | c0.14 | c0.23 | | 0.07 | 0.28 | | c0.16 | 0.16 | |
| v/s Ratio Perm | 0.10 | | | 0.16 | | | 0.17 | | | c0.32 | | |
| v/c Ratio | 0.62 | 0.31 | | 0.77 | 0.97dr | | 0.56 | 0.95 | | 0.91 | 0.45 | |
| Uniform Delay, d1 | 28.7 | 32.1 | | 21.1 | 30.1 | | 16.1 | 29.7 | | 23.1 | 21.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.3 | 0.3 | | 7.6 | 8.0 | | 1.7 | 12.7 | | 24.3 | 0.2 | |
| Delay (s) | 34.0 | 32.4 | | 28.8 | 38.1 | | 17.8 | 42.4 | | 47.4 | 22.1 | |
| Level of Service | C | C | | C | D | | B | D | | D | C | |
| Approach Delay (s) | | 33.0 | | | 35.6 | | | 39.2 | | | 30.0 | |
| Approach LOS | | C | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 35.3 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 86.9 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 94.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: Bell Road & Jackrabbit Trail Extension

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 415 | 2115 | 1411 | 416 | 1187 | 220 | 933 | 1103 | 298 | 120 | 1703 | 456 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 451 | 2299 | 1534 | 452 | 1290 | 239 | 1014 | 1199 | 324 | 130 | 1851 | 496 |
| RTOR Reduction (vph) | 0 | 0 | 175 | 0 | 0 | 109 | 0 | 0 | 117 | 0 | 0 | 188 |
| Lane Group Flow (vph) | 451 | 2299 | 1359 | 452 | 1290 | 130 | 1014 | 1199 | 207 | 130 | 1851 | 308 |
| Turn Type | Prot | | Perm | Prot | | Perm | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 18.4 | 46.0 | 46.0 | 9.0 | 36.6 | 36.6 | 18.0 | 41.2 | 41.2 | 7.8 | 31.0 | 31.0 |
| Effective Green, g (s) | 18.4 | 46.0 | 46.0 | 9.0 | 36.6 | 36.6 | 18.0 | 41.2 | 41.2 | 7.8 | 31.0 | 31.0 |
| Actuated g/C Ratio | 0.15 | 0.38 | 0.38 | 0.08 | 0.30 | 0.30 | 0.15 | 0.34 | 0.34 | 0.06 | 0.26 | 0.26 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 526 | 1949 | 607 | 257 | 1551 | 483 | 515 | 1746 | 543 | 223 | 1314 | 409 |
| v/s Ratio Prot | 0.13 | 0.45 | | c0.13 | 0.25 | | c0.30 | 0.24 | | 0.04 | c0.36 | |
| v/s Ratio Perm | | | c0.86 | | | 0.08 | | | 0.13 | | | 0.19 |
| v/c Ratio | 0.86 | 1.18 | 2.24 | 1.76 | 0.83 | 0.27 | 1.97 | 0.69 | 0.38 | 0.58 | 1.41 | 0.75 |
| Uniform Delay, d1 | 49.5 | 37.0 | 37.0 | 55.5 | 38.8 | 31.6 | 51.0 | 33.9 | 29.8 | 54.5 | 44.5 | 41.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 13.0 | 86.5 | 563.2 | 357.0 | 4.0 | 0.3 | 443.0 | 2.2 | 2.0 | 3.8 | 188.5 | 12.2 |
| Delay (s) | 62.5 | 123.5 | 600.2 | 412.5 | 42.8 | 31.9 | 494.0 | 36.1 | 31.8 | 58.4 | 233.0 | 53.1 |
| Level of Service | E | F | F | F | D | C | F | D | C | E | F | D |
| Approach Delay (s) | | 287.8 | | | 125.8 | | | 218.6 | | | 187.8 | |
| Approach LOS | | F | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 221.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.90 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 142.1% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Lane Util. Factor | | | | 0.95 | 0.91 | 0.95 | 1.00 | 0.91 | | | 0.91 | |
| Frt | | | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 0.98 | |
| Flt Protected | | | | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | | | 1681 | 1610 | 1504 | 1770 | 5085 | | | 4966 | |
| Flt Permitted | | | | 0.95 | 0.95 | 1.00 | 0.14 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | | | 1681 | 1610 | 1504 | 257 | 5085 | | | 4966 | |
| Volume (vph) | 0 | 0 | 0 | 369 | 0 | 250 | 247 | 1307 | 0 | 0 | 1903 | 351 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 0 | 0 | 401 | 0 | 272 | 268 | 1421 | 0 | 0 | 2068 | 382 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 236 | 0 | 0 | 0 | 0 | 22 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 201 | 200 | 36 | 268 | 1421 | 0 | 0 | 2428 | 0 |
| Turn Type | | | | Prot | | Perm | pm+pt | | | | | |
| Protected Phases | | | | 3 | 8 | | 5 | 2 | | | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | | | | |
| Actuated Green, G (s) | | | | 15.0 | 16.0 | 16.0 | 42.0 | 29.0 | | | 56.0 | |
| Effective Green, g (s) | | | | 15.0 | 16.0 | 16.0 | 42.0 | 29.0 | | | 56.0 | |
| Actuated g/C Ratio | | | | 0.12 | 0.13 | 0.13 | 0.35 | 0.24 | | | 0.47 | |
| Clearance Time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | | | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | | | | 210 | 215 | 201 | 254 | 1229 | | | 2317 | |
| v/s Ratio Prot | | | | 0.12 | c0.12 | | c0.11 | c0.28 | | | c0.49 | |
| v/s Ratio Perm | | | | | 0.01 | 0.02 | 0.26 | | | | | |
| v/c Ratio | | | | 0.96 | 0.93 | 0.18 | 1.06 | 1.16 | | | 1.05 | |
| Uniform Delay, d1 | | | | 52.2 | 51.4 | 46.2 | 55.7 | 45.5 | | | 32.0 | |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 | 0.60 | 1.15 | | | 1.00 | |
| Incremental Delay, d2 | | | | 49.4 | 42.3 | 0.4 | 33.8 | 71.3 | | | 32.7 | |
| Delay (s) | | | | 101.6 | 93.7 | 46.6 | 67.2 | 123.7 | | | 64.7 | |
| Level of Service | | | | F | F | D | E | F | | | E | |
| Approach Delay (s) | | 0.0 | | | 77.0 | | | 114.7 | | | 64.7 | |
| Approach LOS | | A | | | E | | | F | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 84.0 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.00 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 31.0 |
| Intersection Capacity Utilization | 103.6% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: I-10 EB & Perryville Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 0.95 | 0.91 | 0.95 | | | | | 0.91 | | 1.00 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | | | | | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.95 | 1.00 | | | | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1681 | 1610 | 1504 | | | | | 4885 | | 1770 | 5085 | |
| Flt Permitted | 0.95 | 0.95 | 1.00 | | | | | 1.00 | | 0.12 | 1.00 | |
| Satd. Flow (perm) | 1681 | 1610 | 1504 | | | | | 4885 | | 226 | 5085 | |
| Volume (vph) | 661 | 0 | 439 | 0 | 0 | 0 | 0 | 893 | 318 | 838 | 1434 | 0 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 718 | 0 | 477 | 0 | 0 | 0 | 0 | 971 | 346 | 911 | 1559 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 324 | 0 | 0 | 0 | 0 | 54 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 359 | 359 | 153 | 0 | 0 | 0 | 0 | 1263 | 0 | 911 | 1559 | 0 |
| Turn Type | Prot | | Perm | | | | | | | pm+pt | | |
| Protected Phases | 7 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | | 6 | | |
| Actuated Green, G (s) | 19.0 | 20.0 | 20.0 | | | | | 29.0 | | 73.0 | 56.0 | |
| Effective Green, g (s) | 19.0 | 20.0 | 20.0 | | | | | 29.0 | | 73.0 | 56.0 | |
| Actuated g/C Ratio | 0.16 | 0.17 | 0.17 | | | | | 0.24 | | 0.61 | 0.47 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | | | | | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 266 | 268 | 251 | | | | | 1181 | | 652 | 2373 | |
| v/s Ratio Prot | 0.21 | c0.21 | | | | | | 0.26 | | c0.47 | 0.31 | |
| v/s Ratio Perm | | 0.01 | 0.10 | | | | | | | c0.38 | | |
| v/c Ratio | 1.35 | 1.34 | 0.61 | | | | | 1.07 | | 1.40 | 0.66 | |
| Uniform Delay, d1 | 50.5 | 50.0 | 46.4 | | | | | 45.5 | | 36.8 | 24.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | | | | | 1.00 | | 0.69 | 1.21 | |
| Incremental Delay, d2 | 180.1 | 175.8 | 4.1 | | | | | 46.9 | | 179.6 | 0.1 | |
| Delay (s) | 230.6 | 225.8 | 50.5 | | | | | 92.4 | | 205.0 | 29.8 | |
| Level of Service | F | F | D | | | | | F | | F | C | |
| Approach Delay (s) | | 157.3 | | | 0.0 | | | 92.4 | | | 94.4 | |
| Approach LOS | | F | | | A | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 109.0 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.35 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 27.0 |
| Intersection Capacity Utilization | 103.6% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: I - 10 EB & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 0.95 | 0.91 | 0.95 | | | | | 0.91 | | 1.00 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | | | | | 0.93 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.95 | 1.00 | | | | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1681 | 1610 | 1504 | | | | | 4752 | | 1770 | 5085 | |
| Flt Permitted | 0.95 | 0.95 | 1.00 | | | | | 1.00 | | 0.19 | 1.00 | |
| Satd. Flow (perm) | 1681 | 1610 | 1504 | | | | | 4752 | | 355 | 5085 | |
| Volume (vph) | 322 | 0 | 476 | 0 | 0 | 0 | 0 | 579 | 448 | 391 | 1041 | 0 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 350 | 0 | 517 | 0 | 0 | 0 | 0 | 629 | 487 | 425 | 1132 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 408 | 0 | 0 | 0 | 0 | 185 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 175 | 175 | 109 | 0 | 0 | 0 | 0 | 931 | 0 | 425 | 1132 | 0 |
| Turn Type | Prot | | Perm | | | | | | | pm+pt | | |
| Protected Phases | 7 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | | 6 | | |
| Actuated Green, G (s) | 11.0 | 16.0 | 16.0 | | | | | 17.0 | | 36.0 | 24.0 | |
| Effective Green, g (s) | 11.0 | 16.0 | 16.0 | | | | | 17.0 | | 36.0 | 24.0 | |
| Actuated g/C Ratio | 0.14 | 0.21 | 0.21 | | | | | 0.22 | | 0.47 | 0.32 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | | | | | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 243 | 339 | 317 | | | | | 1063 | | 447 | 1606 | |
| v/s Ratio Prot | c0.10 | c0.07 | | | | | | 0.20 | | c0.19 | 0.22 | |
| v/s Ratio Perm | | 0.03 | 0.07 | | | | | | | c0.26 | | |
| v/c Ratio | 0.72 | 0.52 | 0.34 | | | | | 0.88 | | 0.95 | 0.70 | |
| Uniform Delay, d1 | 31.0 | 26.6 | 25.5 | | | | | 28.5 | | 18.8 | 22.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | | | | | 1.00 | | 1.25 | 1.34 | |
| Incremental Delay, d2 | 10.0 | 1.3 | 0.7 | | | | | 10.1 | | 19.7 | 1.4 | |
| Delay (s) | 41.1 | 27.9 | 26.2 | | | | | 38.6 | | 43.1 | 32.0 | |
| Level of Service | D | C | C | | | | | D | | D | C | |
| Approach Delay (s) | | 29.5 | | | 0.0 | | | 38.6 | | | 35.1 | |
| Approach LOS | | C | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 34.8 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 28.0 |
| Intersection Capacity Utilization | 66.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: I-10 WB & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Lane Util. Factor | | | | 0.95 | 0.91 | 0.95 | 1.00 | 0.91 | | | 0.91 | |
| Frt | | | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 0.98 | |
| Flt Protected | | | | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | | | 1681 | 1610 | 1504 | 1770 | 5085 | | | 4969 | |
| Flt Permitted | | | | 0.95 | 0.95 | 1.00 | 0.24 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | | | 1681 | 1610 | 1504 | 438 | 5085 | | | 4969 | |
| Volume (vph) | 0 | 0 | 0 | 455 | 0 | 188 | 251 | 650 | 0 | 0 | 977 | 176 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 0 | 0 | 495 | 0 | 204 | 273 | 707 | 0 | 0 | 1062 | 191 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 158 | 0 | 0 | 0 | 0 | 34 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 248 | 247 | 46 | 273 | 707 | 0 | 0 | 1219 | 0 |
| Turn Type | | | | Prot | | Perm | pm+pt | | | | | |
| Protected Phases | | | | 3 | 8 | | 5 | 2 | | | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | | | | |
| Actuated Green, G (s) | | | | 12.0 | 17.0 | 17.0 | 25.0 | 17.0 | | | 24.0 | |
| Effective Green, g (s) | | | | 12.0 | 17.0 | 17.0 | 25.0 | 17.0 | | | 24.0 | |
| Actuated g/C Ratio | | | | 0.16 | 0.22 | 0.22 | 0.33 | 0.22 | | | 0.32 | |
| Clearance Time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | | | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | | | | 265 | 360 | 336 | 284 | 1137 | | | 1569 | |
| v/s Ratio Prot | | | | c0.15 | c0.11 | | c0.10 | 0.14 | | | c0.25 | |
| v/s Ratio Perm | | | | | 0.05 | 0.03 | c0.21 | | | | | |
| v/c Ratio | | | | 0.94 | 0.69 | 0.14 | 0.96 | 0.62 | | | 0.78 | |
| Uniform Delay, d1 | | | | 31.6 | 27.1 | 23.6 | 21.9 | 26.6 | | | 23.6 | |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 | 0.96 | 0.84 | | | 1.00 | |
| Incremental Delay, d2 | | | | 38.0 | 5.3 | 0.2 | 28.8 | 1.3 | | | 3.9 | |
| Delay (s) | | | | 69.6 | 32.4 | 23.8 | 49.7 | 23.8 | | | 27.4 | |
| Level of Service | | | | E | C | C | D | C | | | C | |
| Approach Delay (s) | | 0.0 | | | 43.1 | | | 31.0 | | | 27.4 | |
| Approach LOS | | A | | | D | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 32.4 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 31.0 |
| Intersection Capacity Utilization | 66.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 382 | 1317 | 928 | 379 | 1761 | 490 | 1381 | 1739 | 481 | 140 | 1128 | 251 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 415 | 1432 | 1009 | 412 | 1914 | 533 | 1501 | 1890 | 523 | 152 | 1226 | 273 |
| RTOR Reduction (vph) | 0 | 0 | 366 | 0 | 0 | 84 | 0 | 0 | 134 | 0 | 0 | 127 |
| Lane Group Flow (vph) | 415 | 1432 | 643 | 412 | 1914 | 449 | 1501 | 1890 | 389 | 152 | 1226 | 146 |
| Turn Type | Prot | | Perm | Prot | | Perm | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 11.0 | 33.0 | 33.0 | 11.0 | 33.0 | 33.0 | 35.0 | 53.0 | 53.0 | 7.0 | 25.0 | 25.0 |
| Effective Green, g (s) | 11.0 | 33.0 | 33.0 | 11.0 | 33.0 | 33.0 | 35.0 | 53.0 | 53.0 | 7.0 | 25.0 | 25.0 |
| Actuated g/C Ratio | 0.09 | 0.28 | 0.28 | 0.09 | 0.28 | 0.28 | 0.29 | 0.44 | 0.44 | 0.06 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 315 | 1398 | 435 | 315 | 1398 | 435 | 1001 | 2246 | 699 | 200 | 1059 | 330 |
| v/s Ratio Prot | c0.12 | 0.28 | | 0.12 | 0.38 | | c0.44 | 0.37 | | 0.04 | c0.24 | |
| v/s Ratio Perm | | | c0.41 | | | 0.28 | | | 0.25 | | | 0.09 |
| v/c Ratio | 1.32 | 1.02 | 1.48 | 1.31 | 1.37 | 1.03 | 1.50 | 0.84 | 0.56 | 0.76 | 1.16 | 0.44 |
| Uniform Delay, d1 | 54.5 | 43.5 | 43.5 | 54.5 | 43.5 | 43.5 | 42.5 | 29.8 | 24.8 | 55.7 | 47.5 | 41.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 163.6 | 30.4 | 227.2 | 159.6 | 170.7 | 51.6 | 230.0 | 4.0 | 3.2 | 15.5 | 81.8 | 4.3 |
| Delay (s) | 218.1 | 73.9 | 270.7 | 214.1 | 214.2 | 95.1 | 272.5 | 33.8 | 28.0 | 71.2 | 129.3 | 45.7 |
| Level of Service | F | E | F | F | F | F | F | C | C | E | F | D |
| Approach Delay (s) | | 164.4 | | | 192.0 | | | 124.6 | | | 110.1 | |
| Approach LOS | | F | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 149.6 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.39 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 119.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: I - 10 EB & Perryville Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 0.95 | 0.91 | 0.95 | | | | | 0.91 | | 1.00 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | | | | | 0.97 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.95 | 1.00 | | | | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1681 | 1610 | 1504 | | | | | 4949 | | 1770 | 5085 | |
| Flt Permitted | 0.95 | 0.95 | 1.00 | | | | | 1.00 | | 0.20 | 1.00 | |
| Satd. Flow (perm) | 1681 | 1610 | 1504 | | | | | 4949 | | 365 | 5085 | |
| Volume (vph) | 622 | 0 | 222 | 0 | 0 | 0 | 0 | 1520 | 331 | 642 | 1011 | 0 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 676 | 0 | 241 | 0 | 0 | 0 | 0 | 1652 | 360 | 698 | 1099 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 213 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 338 | 338 | 28 | 0 | 0 | 0 | 0 | 1989 | 0 | 698 | 1099 | 0 |
| Turn Type | Prot | | Perm | | | | | | | pm+pt | | |
| Protected Phases | 7 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | | 6 | | |
| Actuated Green, G (s) | 24.0 | 24.0 | 17.6 | | | | | 51.0 | | 63.4 | 63.4 | |
| Effective Green, g (s) | 24.0 | 24.0 | 17.6 | | | | | 51.0 | | 63.4 | 63.4 | |
| Actuated g/C Ratio | 0.16 | 0.16 | 0.12 | | | | | 0.34 | | 0.42 | 0.42 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | | | | | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 269 | 258 | 176 | | | | | 1683 | | 557 | 2149 | |
| v/s Ratio Prot | 0.20 | c0.21 | | | | | | c0.40 | | c0.36 | 0.22 | |
| v/s Ratio Perm | | | 0.02 | | | | | | | c0.17 | | |
| v/c Ratio | 1.26 | 1.31 | 0.16 | | | | | 1.18 | | 1.25 | 0.51 | |
| Uniform Delay, d1 | 63.0 | 63.0 | 59.6 | | | | | 49.5 | | 50.2 | 31.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | | | | | 1.00 | | 1.04 | 1.26 | |
| Incremental Delay, d2 | 142.1 | 164.5 | 0.4 | | | | | 88.2 | | 122.2 | 0.5 | |
| Delay (s) | 205.1 | 227.5 | 60.0 | | | | | 137.7 | | 174.3 | 40.5 | |
| Level of Service | F | F | E | | | | | F | | F | D | |
| Approach Delay (s) | | 175.2 | | | 0.0 | | | 137.7 | | | 92.5 | |
| Approach LOS | | F | | | A | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 127.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.24 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 32.0 |
| Intersection Capacity Utilization | 101.8% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: I - 10 WB & Perryville Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Lane Util. Factor | | | | 0.95 | 0.91 | 0.95 | 1.00 | 0.91 | | | 0.91 | |
| Frt | | | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | | | | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | | | 1681 | 1610 | 1504 | 1770 | 5085 | | | 4945 | |
| Flt Permitted | | | | 0.95 | 0.95 | 1.00 | 0.20 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | | | 1681 | 1610 | 1504 | 365 | 5085 | | | 4945 | |
| Volume (vph) | 0 | 0 | 0 | 407 | 0 | 465 | 359 | 1783 | 0 | 0 | 1246 | 281 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 0 | 0 | 442 | 0 | 505 | 390 | 1938 | 0 | 0 | 1354 | 305 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 451 | 0 | 0 | 0 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 221 | 221 | 54 | 390 | 1938 | 0 | 0 | 1636 | 0 |
| Turn Type | | | | Prot | | Perm | pm+pt | | | | | |
| Protected Phases | | | | 3 | 8 | | 5 | 2 | | | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | | | | |
| Actuated Green, G (s) | | | | 22.4 | 22.4 | 16.0 | 51.0 | 51.0 | | | 63.4 | |
| Effective Green, g (s) | | | | 22.4 | 22.4 | 16.0 | 51.0 | 51.0 | | | 63.4 | |
| Actuated g/C Ratio | | | | 0.15 | 0.15 | 0.11 | 0.34 | 0.34 | | | 0.42 | |
| Clearance Time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | | | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | | | | 251 | 240 | 160 | 411 | 1729 | | | 2090 | |
| v/s Ratio Prot | | | | 0.13 | c0.14 | | 0.19 | c0.38 | | | c0.33 | |
| v/s Ratio Perm | | | | | | 0.04 | 0.13 | | | | | |
| v/c Ratio | | | | 0.88 | 0.92 | 0.34 | 0.95 | 1.12 | | | 0.78 | |
| Uniform Delay, d1 | | | | 62.5 | 62.9 | 62.1 | 61.0 | 49.5 | | | 37.4 | |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 | 1.36 | 1.03 | | | 1.00 | |
| Incremental Delay, d2 | | | | 28.1 | 37.2 | 1.3 | 5.4 | 55.3 | | | 3.0 | |
| Delay (s) | | | | 90.5 | 100.1 | 63.3 | 88.3 | 106.2 | | | 40.4 | |
| Level of Service | | | | F | F | E | F | F | | | D | |
| Approach Delay (s) | | 0.0 | | | 78.3 | | | 103.2 | | | 40.4 | |
| Approach LOS | | A | | | E | | | F | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 77.3 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 29.6 |
| Intersection Capacity Utilization | 101.8% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: I - 10 EB & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 0.95 | 0.91 | 0.95 | | | | | 0.91 | | 1.00 | 0.91 | |
| Frt | 1.00 | 0.99 | 0.85 | | | | | 0.95 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 0.96 | 1.00 | | | | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1681 | 1599 | 1504 | | | | | 4821 | | 1770 | 5085 | |
| Flt Permitted | 0.95 | 0.96 | 1.00 | | | | | 1.00 | | 0.13 | 1.00 | |
| Satd. Flow (perm) | 1681 | 1599 | 1504 | | | | | 4821 | | 247 | 5085 | |
| Volume (vph) | 350 | 0 | 243 | 0 | 0 | 0 | 0 | 976 | 518 | 266 | 800 | 0 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 380 | 0 | 264 | 0 | 0 | 0 | 0 | 1061 | 563 | 289 | 870 | 0 |
| RTOR Reduction (vph) | 0 | 3 | 215 | 0 | 0 | 0 | 0 | 61 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 198 | 198 | 30 | 0 | 0 | 0 | 0 | 1563 | 0 | 289 | 870 | 0 |
| Turn Type | Prot | | Perm | | | | | | | pm+pt | | |
| Protected Phases | 7 | 4 | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 | | | | | | | 6 | | |
| Actuated Green, G (s) | 22.2 | 22.2 | 16.2 | | | | | 56.6 | | 51.6 | 51.6 | |
| Effective Green, g (s) | 22.2 | 22.2 | 16.2 | | | | | 56.6 | | 51.6 | 51.6 | |
| Actuated g/C Ratio | 0.17 | 0.17 | 0.12 | | | | | 0.42 | | 0.38 | 0.38 | |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | | | | | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 278 | 264 | 181 | | | | | 2030 | | 337 | 1952 | |
| v/s Ratio Prot | 0.12 | c0.12 | | | | | | c0.32 | | c0.14 | 0.17 | |
| v/s Ratio Perm | | | 0.02 | | | | | | | c0.19 | | |
| v/c Ratio | 0.71 | 0.75 | 0.16 | | | | | 0.77 | | 0.86 | 0.45 | |
| Uniform Delay, d1 | 53.1 | 53.5 | 53.0 | | | | | 33.3 | | 42.1 | 30.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | | | | | 1.00 | | 0.98 | 1.08 | |
| Incremental Delay, d2 | 8.3 | 11.4 | 0.4 | | | | | 2.9 | | 15.5 | 0.6 | |
| Delay (s) | 61.4 | 64.9 | 53.4 | | | | | 36.2 | | 56.9 | 33.9 | |
| Level of Service | E | E | D | | | | | D | | E | C | |
| Approach Delay (s) | | 59.5 | | | 0.0 | | | 36.2 | | | 39.6 | |
| Approach LOS | | E | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 41.7 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 134.4 | Sum of lost time (s) | 34.2 |
| Intersection Capacity Utilization | 67.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: I - 10 WB & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Lane Util. Factor | | | | 0.95 | 0.91 | 0.95 | 1.00 | 0.91 | | | 0.91 | |
| Frt | | | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 0.97 | |
| Flt Protected | | | | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | | | 1681 | 1610 | 1504 | 1770 | 5085 | | | 4939 | |
| Flt Permitted | | | | 0.95 | 0.95 | 1.00 | 0.16 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | | | 1681 | 1610 | 1504 | 292 | 5085 | | | 4939 | |
| Volume (vph) | 0 | 0 | 0 | 470 | 0 | 162 | 344 | 982 | 0 | 0 | 596 | 142 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 0 | 0 | 511 | 0 | 176 | 374 | 1067 | 0 | 0 | 648 | 154 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 152 | 0 | 0 | 0 | 0 | 26 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 256 | 255 | 24 | 374 | 1067 | 0 | 0 | 776 | 0 |
| Turn Type | | | | Prot | | Perm | pm+pt | | | | | |
| Protected Phases | | | | 3 | 8 | | 5 | 2 | | | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | | | | |
| Actuated Green, G (s) | | | | 24.2 | 24.2 | 18.2 | 56.6 | 56.6 | | | 51.6 | |
| Effective Green, g (s) | | | | 24.2 | 24.2 | 18.2 | 56.6 | 56.6 | | | 51.6 | |
| Actuated g/C Ratio | | | | 0.18 | 0.18 | 0.14 | 0.42 | 0.42 | | | 0.38 | |
| Clearance Time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | | | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | | | | 303 | 290 | 204 | 413 | 2141 | | | 1896 | |
| v/s Ratio Prot | | | | 0.15 | c0.16 | | c0.18 | 0.21 | | | c0.16 | |
| v/s Ratio Perm | | | | | | 0.02 | c0.20 | | | | | |
| v/c Ratio | | | | 0.84 | 0.88 | 0.12 | 0.91 | 0.50 | | | 0.41 | |
| Uniform Delay, d1 | | | | 53.3 | 53.7 | 51.0 | 35.6 | 28.5 | | | 30.3 | |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 | 1.51 | 0.96 | | | 1.00 | |
| Incremental Delay, d2 | | | | 18.9 | 24.6 | 0.3 | 15.8 | 0.5 | | | 0.7 | |
| Delay (s) | | | | 72.2 | 78.3 | 51.3 | 69.7 | 27.9 | | | 30.9 | |
| Level of Service | | | | E | E | D | E | C | | | C | |
| Approach Delay (s) | | 0.0 | | | 69.1 | | | 38.7 | | | 30.9 | |
| Approach LOS | | A | | | E | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 43.7 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 134.4 | Sum of lost time (s) | 28.2 |
| Intersection Capacity Utilization | 67.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 415 | 2115 | 1411 | 416 | 1187 | 220 | 933 | 1103 | 298 | 120 | 1703 | 456 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 451 | 2299 | 1534 | 452 | 1290 | 239 | 1014 | 1199 | 324 | 130 | 1851 | 496 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 110 | 0 | 0 | 145 | 0 | 0 | 152 |
| Lane Group Flow (vph) | 451 | 2299 | 1534 | 452 | 1290 | 129 | 1014 | 1199 | 179 | 130 | 1851 | 344 |
| Turn Type | Prot | | Free | Prot | | Perm | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 16.0 | 38.0 | 120.0 | 11.0 | 33.0 | 33.0 | 22.0 | 47.2 | 47.2 | 7.8 | 33.0 | 33.0 |
| Effective Green, g (s) | 16.0 | 38.0 | 120.0 | 11.0 | 33.0 | 33.0 | 22.0 | 47.2 | 47.2 | 7.8 | 33.0 | 33.0 |
| Actuated g/C Ratio | 0.13 | 0.32 | 1.00 | 0.09 | 0.28 | 0.28 | 0.18 | 0.39 | 0.39 | 0.06 | 0.28 | 0.28 |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 458 | 1610 | 1583 | 315 | 1398 | 435 | 629 | 2000 | 623 | 223 | 1398 | 435 |
| v/s Ratio Prot | 0.13 | c0.45 | | c0.13 | 0.25 | | c0.30 | 0.24 | | 0.04 | c0.36 | |
| v/s Ratio Perm | | | c0.97 | | | 0.08 | | | 0.11 | | | 0.22 |
| v/c Ratio | 0.98 | 1.43 | 0.97 | 1.43 | 0.92 | 0.30 | 1.61 | 0.60 | 0.29 | 0.58 | 1.32 | 0.79 |
| Uniform Delay, d1 | 51.9 | 41.0 | 0.0 | 54.5 | 42.3 | 34.3 | 49.0 | 28.9 | 24.9 | 54.5 | 43.5 | 40.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 37.8 | 196.2 | 16.4 | 213.0 | 10.3 | 0.4 | 282.8 | 1.3 | 1.2 | 3.8 | 150.9 | 13.7 |
| Delay (s) | 89.6 | 237.2 | 16.4 | 267.5 | 52.6 | 34.7 | 331.8 | 30.2 | 26.1 | 58.4 | 194.4 | 54.0 |
| Level of Service | F | F | B | F | D | C | F | C | C | E | F | D |
| Approach Delay (s) | | 142.6 | | | 99.5 | | | 150.2 | | | 159.2 | |
| Approach LOS | | F | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 140.4 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.39 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 125.6% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 415 | 2115 | 1411 | 416 | 1187 | 220 | 0 | 1103 | 298 | 120 | 1703 | 456 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 451 | 2299 | 1534 | 452 | 1290 | 239 | 0 | 1199 | 324 | 130 | 1851 | 496 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 178 | 0 | 0 | 221 |
| Lane Group Flow (vph) | 451 | 2299 | 1534 | 452 | 1290 | 169 | 0 | 1199 | 146 | 130 | 1851 | 275 |
| Turn Type | Prot | | Free | Prot | | Perm | | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 20.1 | 51.0 | 120.0 | 15.0 | 45.9 | 45.9 | | 33.0 | 33.0 | 5.0 | 42.0 | 42.0 |
| Effective Green, g (s) | 20.1 | 51.0 | 120.0 | 15.0 | 45.9 | 45.9 | | 33.0 | 33.0 | 5.0 | 42.0 | 42.0 |
| Actuated g/C Ratio | 0.17 | 0.42 | 1.00 | 0.12 | 0.38 | 0.38 | | 0.28 | 0.28 | 0.04 | 0.35 | 0.35 |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 575 | 2161 | 1583 | 429 | 1945 | 605 | | 1398 | 435 | 143 | 1780 | 554 |
| v/s Ratio Prot | 0.13 | c0.45 | | 0.13 | 0.25 | | | 0.24 | | 0.04 | c0.36 | |
| v/s Ratio Perm | | | c0.97 | | | 0.11 | | | 0.09 | | | 0.17 |
| v/c Ratio | 0.78 | 1.06 | 0.97 | 1.05 | 0.66 | 0.28 | | 0.86 | 0.33 | 0.91 | 1.04 | 0.50 |
| Uniform Delay, d1 | 47.9 | 34.5 | 0.0 | 52.5 | 30.7 | 25.6 | | 41.3 | 34.7 | 57.3 | 39.0 | 30.7 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.9 | 39.0 | 16.4 | 58.3 | 0.9 | 0.3 | | 7.0 | 2.1 | 48.4 | 32.5 | 3.2 |
| Delay (s) | 54.8 | 73.5 | 16.4 | 110.8 | 31.5 | 25.9 | | 48.3 | 36.8 | 105.7 | 71.5 | 33.8 |
| Level of Service | D | E | B | F | C | C | | D | D | F | E | C |
| Approach Delay (s) | | 51.1 | | | 48.9 | | | 45.8 | | | 65.8 | |
| Approach LOS | | D | | | D | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 53.4 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.00 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 0.0 |
| Intersection Capacity Utilization | 95.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: I - 10 EB & Perryville Rd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | | 4.0 | | | | | 4.0 | | 4.0 | 4.0 | |
| Lane Util. Factor | 0.97 | | 1.00 | | | | | 0.91 | | 0.97 | 0.91 | |
| Frt | 1.00 | | 0.85 | | | | | 0.96 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | | 1.00 | | | | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 3433 | | 1583 | | | | | 4885 | | 3433 | 5085 | |
| Flt Permitted | 0.95 | | 1.00 | | | | | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 3433 | | 1583 | | | | | 4885 | | 3433 | 5085 | |
| Volume (vph) | 661 | 0 | 439 | 0 | 0 | 0 | 0 | 893 | 318 | 838 | 1434 | 0 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 718 | 0 | 477 | 0 | 0 | 0 | 0 | 971 | 346 | 911 | 1559 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 176 | 0 | 0 | 0 | 0 | 64 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 718 | 0 | 301 | 0 | 0 | 0 | 0 | 1253 | 0 | 911 | 1559 | 0 |
| Turn Type | Prot | | custom | | | | | | | Prot | | |
| Protected Phases | 4 | | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 6 | | | | | | | | | |
| Actuated Green, G (s) | 19.0 | | 63.0 | | | | | 29.0 | | 25.0 | 44.0 | |
| Effective Green, g (s) | 19.0 | | 63.0 | | | | | 29.0 | | 25.0 | 44.0 | |
| Actuated g/C Ratio | 0.19 | | 0.63 | | | | | 0.29 | | 0.25 | 0.44 | |
| Clearance Time (s) | 4.0 | | | | | | | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | | | | | | | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 652 | | 997 | | | | | 1417 | | 858 | 2237 | |
| v/s Ratio Prot | c0.21 | | | | | | | c0.26 | | c0.27 | 0.31 | |
| v/s Ratio Perm | | | 0.19 | | | | | | | | | |
| v/c Ratio | 1.10 | | 0.30 | | | | | 0.88 | | 1.06 | 0.70 | |
| Uniform Delay, d1 | 40.5 | | 8.4 | | | | | 33.9 | | 37.5 | 22.6 | |
| Progression Factor | 1.00 | | 1.00 | | | | | 1.00 | | 0.84 | 1.47 | |
| Incremental Delay, d2 | 66.2 | | 0.2 | | | | | 8.4 | | 36.5 | 0.6 | |
| Delay (s) | 106.7 | | 8.6 | | | | | 42.3 | | 68.1 | 33.8 | |
| Level of Service | F | | A | | | | | D | | E | C | |
| Approach Delay (s) | | 67.6 | | | 0.0 | | | 42.3 | | | 46.5 | |
| Approach LOS | | E | | | A | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 50.4 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.00 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 27.0 |
| Intersection Capacity Utilization | 77.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: I - 10 WB & Perryville Rd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.95 | 0.91 | 0.95 | 1.00 | 0.91 | | | 0.91 | 1.00 |
| Frt | | | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 1681 | 1610 | 1504 | 1770 | 5085 | | | 5085 | 1583 |
| Flt Permitted | | | | 0.95 | 0.95 | 1.00 | 0.14 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 1681 | 1610 | 1504 | 257 | 5085 | | | 5085 | 1583 |
| Volume (vph) | 0 | 0 | 0 | 369 | 0 | 250 | 247 | 1307 | 0 | 0 | 1903 | 351 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 0 | 0 | 401 | 0 | 272 | 268 | 1421 | 0 | 0 | 2068 | 382 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 90 | 0 | 0 | 0 | 0 | 0 | 199 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 201 | 200 | 182 | 268 | 1421 | 0 | 0 | 2068 | 183 |
| Turn Type | | | | Prot | | custom | pm+pt | | | | | Perm |
| Protected Phases | | | | 3 | 8 | | 5 | 2 | | | 6 | |
| Permitted Phases | | | | | | 2 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | | | | 11.0 | 34.0 | 67.0 | 39.0 | 29.0 | | | 44.0 | 44.0 |
| Effective Green, g (s) | | | | 11.0 | 34.0 | 67.0 | 39.0 | 29.0 | | | 44.0 | 44.0 |
| Actuated g/C Ratio | | | | 0.11 | 0.34 | 0.67 | 0.39 | 0.29 | | | 0.44 | 0.44 |
| Clearance Time (s) | | | | 4.0 | 4.0 | | 4.0 | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | 3.0 | 3.0 | | 3.0 | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | 185 | 547 | 1008 | 252 | 1475 | | | 2237 | 697 |
| v/s Ratio Prot | | | | c0.12 | c0.04 | | c0.11 | 0.28 | | | c0.41 | |
| v/s Ratio Perm | | | | | 0.08 | 0.12 | c0.31 | | | | | 0.12 |
| v/c Ratio | | | | 1.09 | 0.37 | 0.18 | 1.06 | 0.96 | | | 0.92 | 0.26 |
| Uniform Delay, d1 | | | | 44.5 | 24.9 | 6.2 | 47.2 | 35.0 | | | 26.4 | 17.7 |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 | 0.59 | 1.12 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 91.1 | 0.4 | 0.1 | 47.6 | 6.2 | | | 8.0 | 0.9 |
| Delay (s) | | | | 135.6 | 25.3 | 6.3 | 75.4 | 45.3 | | | 34.4 | 18.6 |
| Level of Service | | | | F | C | A | E | D | | | C | B |
| Approach Delay (s) | | 0.0 | | | 50.6 | | | 50.1 | | | 31.9 | |
| Approach LOS | | A | | | D | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 40.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 77.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 382 | 1317 | 928 | 379 | 1761 | 490 | 1381 | 1739 | 481 | 140 | 1128 | 251 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 415 | 1432 | 1009 | 412 | 1914 | 533 | 1501 | 1890 | 523 | 152 | 1226 | 273 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 84 | 0 | 0 | 134 | 0 | 0 | 127 |
| Lane Group Flow (vph) | 415 | 1432 | 1009 | 412 | 1914 | 449 | 1501 | 1890 | 389 | 152 | 1226 | 146 |
| Turn Type | Prot | | Free | Prot | | Perm | Prot | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 11.0 | 33.0 | 120.0 | 11.0 | 33.0 | 33.0 | 35.0 | 53.0 | 53.0 | 7.0 | 25.0 | 25.0 |
| Effective Green, g (s) | 11.0 | 33.0 | 120.0 | 11.0 | 33.0 | 33.0 | 35.0 | 53.0 | 53.0 | 7.0 | 25.0 | 25.0 |
| Actuated g/C Ratio | 0.09 | 0.28 | 1.00 | 0.09 | 0.28 | 0.28 | 0.29 | 0.44 | 0.44 | 0.06 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 315 | 1398 | 1583 | 315 | 1398 | 435 | 1001 | 2246 | 699 | 200 | 1059 | 330 |
| v/s Ratio Prot | c0.12 | 0.28 | | 0.12 | c0.38 | | c0.44 | 0.37 | | 0.04 | c0.24 | |
| v/s Ratio Perm | | | 0.64 | | | 0.28 | | | 0.25 | | | 0.09 |
| v/c Ratio | 1.32 | 1.02 | 0.64 | 1.31 | 1.37 | 1.03 | 1.50 | 0.84 | 0.56 | 0.76 | 1.16 | 0.44 |
| Uniform Delay, d1 | 54.5 | 43.5 | 0.0 | 54.5 | 43.5 | 43.5 | 42.5 | 29.8 | 24.8 | 55.7 | 47.5 | 41.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 163.6 | 30.4 | 2.0 | 159.6 | 170.7 | 51.6 | 230.0 | 4.0 | 3.2 | 15.5 | 81.8 | 4.3 |
| Delay (s) | 218.1 | 73.9 | 2.0 | 214.1 | 214.2 | 95.1 | 272.5 | 33.8 | 28.0 | 71.2 | 129.3 | 45.7 |
| Level of Service | F | E | A | F | F | F | F | C | C | E | F | D |
| Approach Delay (s) | | 69.5 | | | 192.0 | | | 124.6 | | | 110.1 | |
| Approach LOS | | E | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 125.6 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.36 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 119.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Lane Util. Factor | 0.97 | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 | | 0.91 | 1.00 | 0.97 | 0.91 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | | 5085 | 1583 | 3433 | 5085 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3433 | 5085 | 1583 | 3433 | 5085 | 1583 | | 5085 | 1583 | 3433 | 5085 | 1583 |
| Volume (vph) | 382 | 1317 | 928 | 379 | 1761 | 490 | 0 | 1739 | 481 | 140 | 1128 | 251 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 415 | 1432 | 1009 | 412 | 1914 | 533 | 0 | 1890 | 523 | 152 | 1226 | 273 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 170 | 0 | 0 | 155 |
| Lane Group Flow (vph) | 415 | 1432 | 1009 | 412 | 1914 | 475 | 0 | 1890 | 353 | 152 | 1226 | 118 |
| Turn Type | Prot | | Free | Prot | | Perm | | | Perm | Prot | | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | | 1 | 6 | |
| Permitted Phases | | | Free | | | 8 | | | 2 | | | 6 |
| Actuated Green, G (s) | 14.0 | 39.4 | 120.0 | 16.6 | 42.0 | 42.0 | | 43.0 | 43.0 | 5.0 | 52.0 | 52.0 |
| Effective Green, g (s) | 14.0 | 39.4 | 120.0 | 16.6 | 42.0 | 42.0 | | 43.0 | 43.0 | 5.0 | 52.0 | 52.0 |
| Actuated g/C Ratio | 0.12 | 0.33 | 1.00 | 0.14 | 0.35 | 0.35 | | 0.36 | 0.36 | 0.04 | 0.43 | 0.43 |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 401 | 1670 | 1583 | 475 | 1780 | 554 | | 1822 | 567 | 143 | 2204 | 686 |
| v/s Ratio Prot | c0.12 | 0.28 | | 0.12 | c0.38 | | | c0.37 | | 0.04 | 0.24 | |
| v/s Ratio Perm | | | c0.64 | | | 0.30 | | | 0.22 | | | 0.07 |
| v/c Ratio | 1.03 | 0.86 | 0.64 | 0.87 | 1.08 | 0.86 | | 1.04 | 0.62 | 1.06 | 0.56 | 0.17 |
| Uniform Delay, d1 | 53.0 | 37.7 | 0.0 | 50.6 | 39.0 | 36.2 | | 38.5 | 31.8 | 57.5 | 25.4 | 20.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 54.2 | 4.6 | 2.0 | 15.3 | 44.8 | 12.4 | | 31.5 | 5.1 | 93.0 | 1.0 | 0.5 |
| Delay (s) | 107.2 | 42.3 | 2.0 | 65.9 | 83.8 | 48.6 | | 70.0 | 36.9 | 150.5 | 26.4 | 21.4 |
| Level of Service | F | D | A | E | F | D | | E | D | F | C | C |
| Approach Delay (s) | | 37.5 | | | 74.7 | | | 62.8 | | | 37.0 | |
| Approach LOS | | D | | | E | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 54.5 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.00 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 95.9% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 7: I - 10 EB & Perryville Rd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | | 4.0 | | | | | 4.0 | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 0.97 | | 1.00 | | | | | 0.91 | 1.00 | 0.97 | 0.91 | |
| Frt | 1.00 | | 0.85 | | | | | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | | 1.00 | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 3433 | | 1583 | | | | | 5085 | 1583 | 3433 | 5085 | |
| Flt Permitted | 0.95 | | 1.00 | | | | | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 3433 | | 1583 | | | | | 5085 | 1583 | 3433 | 5085 | |
| Volume (vph) | 622 | 0 | 222 | 0 | 0 | 0 | 0 | 1520 | 331 | 642 | 1011 | 0 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 676 | 0 | 241 | 0 | 0 | 0 | 0 | 1652 | 360 | 698 | 1099 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 0 | 0 | 0 | 0 | 203 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 676 | 0 | 135 | 0 | 0 | 0 | 0 | 1652 | 157 | 698 | 1099 | 0 |
| Turn Type | Prot | | custom | | | | | | Perm | Prot | | |
| Protected Phases | 4 | | | | | | | 2 | | 1 | 6 | |
| Permitted Phases | | | 4 6 | | | | | | 2 | | | |
| Actuated Green, G (s) | 23.0 | | 65.0 | | | | | 43.0 | 43.0 | 21.0 | 38.0 | |
| Effective Green, g (s) | 23.0 | | 65.0 | | | | | 43.0 | 43.0 | 21.0 | 38.0 | |
| Actuated g/C Ratio | 0.20 | | 0.56 | | | | | 0.37 | 0.37 | 0.18 | 0.33 | |
| Clearance Time (s) | 4.0 | | | | | | | 4.0 | 4.0 | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | | | | | | | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 681 | | 887 | | | | | 1885 | 587 | 621 | 1666 | |
| v/s Ratio Prot | c0.20 | | | | | | | c0.32 | | c0.20 | 0.22 | |
| v/s Ratio Perm | | | 0.09 | | | | | | 0.10 | | | |
| v/c Ratio | 0.99 | | 0.15 | | | | | 0.88 | 0.27 | 1.12 | 0.66 | |
| Uniform Delay, d1 | 46.4 | | 12.3 | | | | | 34.0 | 25.5 | 47.5 | 33.5 | |
| Progression Factor | 1.00 | | 1.00 | | | | | 1.00 | 1.00 | 0.52 | 1.67 | |
| Incremental Delay, d2 | 32.5 | | 0.1 | | | | | 6.1 | 1.1 | 64.9 | 0.8 | |
| Delay (s) | 78.9 | | 12.3 | | | | | 40.1 | 26.6 | 89.5 | 56.8 | |
| Level of Service | E | | B | | | | | D | C | F | E | |
| Approach Delay (s) | | 61.4 | | | 0.0 | | | 37.7 | | | 69.5 | |
| Approach LOS | | E | | | A | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 54.4 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.97 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 29.0 |
| Intersection Capacity Utilization | 75.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: I - 10 WB & Perryville Rd

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 4.0 | 4.0 |
| Lane Util. Factor | | | | 0.95 | 0.91 | 0.95 | 1.00 | 0.91 | | | 0.91 | 1.00 |
| Frt | | | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | | | | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | 1681 | 1610 | 1504 | 1770 | 5085 | | | 5085 | 1583 |
| Flt Permitted | | | | 0.95 | 0.95 | 1.00 | 0.10 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | 1681 | 1610 | 1504 | 177 | 5085 | | | 5085 | 1583 |
| Volume (vph) | 0 | 0 | 0 | 407 | 0 | 465 | 359 | 1783 | 0 | 0 | 1246 | 281 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 0 | 0 | 0 | 442 | 0 | 505 | 390 | 1938 | 0 | 0 | 1354 | 305 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 126 | 0 | 0 | 0 | 0 | 0 | 205 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 221 | 221 | 379 | 390 | 1938 | 0 | 0 | 1354 | 100 |
| Turn Type | | | | Prot | | custom | pm+pt | | | | | Perm |
| Protected Phases | | | | 3 | 8 | | 5 | 2 | | | 6 | |
| Permitted Phases | | | | | | 2 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | | | | 13.0 | 40.0 | 87.0 | 68.0 | 43.0 | | | 38.0 | 38.0 |
| Effective Green, g (s) | | | | 13.0 | 40.0 | 87.0 | 68.0 | 43.0 | | | 38.0 | 38.0 |
| Actuated g/C Ratio | | | | 0.11 | 0.34 | 0.75 | 0.59 | 0.37 | | | 0.33 | 0.33 |
| Clearance Time (s) | | | | 4.0 | 4.0 | | 4.0 | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | 3.0 | 3.0 | | 3.0 | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | 188 | 555 | 1128 | 461 | 1885 | | | 1666 | 519 |
| v/s Ratio Prot | | | | c0.13 | c0.04 | | c0.19 | c0.38 | | | 0.27 | |
| v/s Ratio Perm | | | | | 0.09 | 0.25 | 0.31 | | | | | 0.06 |
| v/c Ratio | | | | 1.18 | 0.40 | 0.34 | 0.85 | 1.03 | | | 0.81 | 0.19 |
| Uniform Delay, d1 | | | | 51.5 | 28.9 | 4.8 | 34.8 | 36.5 | | | 35.7 | 28.0 |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 | 0.46 | 1.20 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 120.9 | 0.5 | 0.2 | 5.8 | 21.0 | | | 4.5 | 0.8 |
| Delay (s) | | | | 172.4 | 29.3 | 5.0 | 21.7 | 64.8 | | | 40.2 | 28.8 |
| Level of Service | | | | F | C | A | C | E | | | D | C |
| Approach Delay (s) | | 0.0 | | | 49.8 | | | 57.6 | | | 38.1 | |
| Approach LOS | | A | | | D | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 49.5 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.83 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 75.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# APPENDIX B
# METHODOLOGY AND DETAILED LEVEL OF SERVICE CALCULATIONS AND REPORTS ARIZONA PARKWAY CONFIGURATIONS

# APPENDIX B – PART 1
# Methodology for Calculating Level of Service at Arizona Parkway Intersections with Indirect Lefts

The following methodology would apply to the calculation of level of service for parkway-to-parkway intersections with indirect left-turns (Jackrabbit Trail & Bell Road):

1. Determine the volume of traffic *on each approach* that will execute the indirect left-turn. [A1, A2, A3, A4]
2. Calculate the aggregate delay to the indirect left-turns *on each approach* [B1, B2, B3, B4] by summing the following delays as they navigate through the intersection:
   - thru delay at u-turn signal entering the intersection
   - thru delay at main intersection signal
   - delay at signal when executing u-turn
   - right-turn delay at main intersection when executing right-turn
3. Determine the volume of thru traffic *on each approach* [C1, C2, C3, C4]
4. Calculate the aggregate delay to thru traffic *on each approach* [D1, D2, D3, D4] by summing the following delays:
   - thru delay at u-turn signal entering the intersection
   - thru delay at main intersection signal
5. Determine the volume of right-turn traffic *on each approach* [E1, E2, E3, E4]
6. Calculate the aggregate delay to right-turn traffic *on each approach* [F1, F2, F3, F4] by summing the following delays:
   - thru delay at u-turn signal entering the intersection
   - right-turn delay at main intersection signal
7. Calculate the total average intersection delay as follows:

$$\frac{\text{SUM(A1*B1...A4*B4)} + \text{SUM(C1*D1...C4*D4)} + \text{SUM(E1*F1...E4*F4)}}{\text{(A1+A2+A3+A4+C1+C2+C3+C4+E1+E2+E3+E4)}}$$

For parkway-to-arterial intersections (Categories 1-3), the methodology would be modified as follows to differentiate between parkway-to-arterial indirect left-turns and arterial-to-parkway indirect left-turns:

1. Determine the volume of traffic *on each approach* that will execute the indirect left-turn. [A1, A2, A3, A4]
2. Calculate the aggregate delay to the indirect left-turns *on each* ***parkway*** *approach* [B1, B2] by summing the following delays as they navigate through the intersection:
   - thru delay at u-turn signal entering the intersection
   - thru delay at main intersection signal
   - delay at signal when executing u-turn
   - right-turn delay at main intersection
3. Calculate the aggregate delay to the indirect left-turns *on each* ***arterial*** *approach* [B3, B4] by summing the following delays as they navigate through the intersection:
   - right-turn delay at main intersection signal

- delay at signal when executing u-turn
- thru delay at main intersection

4. Determine the volume of thru traffic *on each approach* [C1, C2, C3, C4]
5. Calculate the aggregate delay to thru traffic *on each approach* [D1, D2, D3, D4] by summing the following delays:
    - thru delay at u-turn signal entering the intersection (parkway approaches only)
    - thru delay at main intersection signal
6. Determine the volume of right-turn traffic *on each approach* [E1, E2, E3, E4]
7. Calculate the aggregate delay to right-turn traffic *on each approach* [F1, F2, F3, F4] by summing the following delays:
    - thru delay at u-turn signal entering the intersection parkway approaches only)
    - right-turn delay at main intersection signal
8. Calculate the total average intersection delay as follows:

$$\frac{\text{SUM(A1*B1...A4*B4) + SUM(C1*D1...C4*D4) + SUM(E1*F1...E4*F4)}}{\text{(A1+A2+A3+A4+C1+C2+C3+C4+E1+E2+E3+E4)}}$$

# Appendix B – Part 2
## Arizona Parkway Intersection Configuration
## Detailed Level of Service Calculations for Intersection Category Based Analyses

## Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Category 1 – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 169 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14 | 56.7 | 1741 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14 | 22.4 | 502 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14 | 21.4 | 44.6 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 8.4 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 32.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 8.4 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 7.4 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 2 | | | | | | | | | | |
| SB | 603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 40.7 | 89 | 2590 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 40.7 | 48 | 522 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 40.7 | 42.7 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.3 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 33.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.3 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 2 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 7.4 | | | | | | | | | | |
| EB | 253 | RIGHT TURN DELAY AT MAIN INTERSECTION | 26 | 68 | 293 | | | 23.5 | 301 | | | 26 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 33.6 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 8.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 23.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 26 | | |
| | | | | | | | | | | | | | |
| WB | 347 | RIGHT TURN DELAY AT MAIN INTERSECTION | 57 | 96.6 | 257 | | | 23.2 | 582 | | | 57 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 32.3 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 23.2 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 57 | | |
| | | | | | | | | | | | | | |

## Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Category 2 – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 168 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 6.7 | 63.3 | 1593 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 6.7 | 16.6 | 102 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 6.7 | 16.3 | 32.4 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 45.7 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 9.6 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 1 | | | | | | | | | | |
| SB | 668 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 20.7 | 94.1 | 2528 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 20.7 | 27.6 | 358 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 20.7 | 21.7 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 6.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 56.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 6.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 1 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 9.6 | | | | | | | | | | |
| EB | 295 | RIGHT TURN DELAY AT MAIN INTERSECTION | 0.1 | 66.9 | 260 | | | 41.2 | 246 | | | 0.1 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 56.9 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 41.2 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0.1 | | |
| | | | | | | | | | | | | | |
| WB | 251 | RIGHT TURN DELAY AT MAIN INTERSECTION | 0.2 | 52.8 | 198 | | | 40.1 | 451 | | | 0.2 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 45.7 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 6.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 40.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0.2 | | |
| | | | | | | | | | | | | | |

## Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Category 3 – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 96 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.4 | 43.4 | 680 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.4 | 22.8 | 303 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.4 | 36.9 | 30.6 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 10.4 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 13.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 10.4 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 24.5 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 6.8 | | | | | | | | | | |
| SB | 575 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 16 | 66.5 | 1016 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 16 | 25.8 | 90 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 16 | 22.8 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 16.2 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 6.8 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 24.5 | | | | | | | | | | |
| EB | 102 | RIGHT TURN DELAY AT MAIN INTERSECTION | 12.6 | 39.2 | 267 | | | 13.9 | 202 | | | 12.6 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 16.2 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 10.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 13.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 12.6 | | |
| | | | | | | | | | | | | | |
| WB | 323 | RIGHT TURN DELAY AT MAIN INTERSECTION | 14.8 | 38.4 | 252 | | | 16.9 | 313 | | | 14.8 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 13.8 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 14.8 | | |
| | | | | | | | | | | | | | |

## Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Category 1 – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 360 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.1 | 79.5 | 2476 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.1 | 35.1 | 692 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.1 | 34.8 | 42.7 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 13 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 34.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 13 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 12.7 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 9.9 | | | | | | | | | | |
| SB | 421 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.8 | 79.5 | 1802 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.8 | 27.1 | 261 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.8 | 22.7 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 14.3 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 39.7 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 14.3 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 9.9 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 12.7 | | | | | | | | | | |
| EB | 198 | RIGHT TURN DELAY AT MAIN INTERSECTION | 19.1 | 71.8 | 188 | | | 19 | 118 | | | 19.1 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 39.7 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 13 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 19.1 | | |
| | | | | | | | | | | | | | |
| WB | 354 | RIGHT TURN DELAY AT MAIN INTERSECTION | 64.4 | 113.2 | 531 | | | 21.8 | 769 | | | 64.4 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 34.5 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 14.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 64.4 | | |
| | | | | | | | | | | | | | |

## Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Category 2 – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 328 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14 | 52.7 | 2051 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14 | 21.9 | 437 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14 | 19.6 | 23.5 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 25.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 5.6 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 5.5 | | | | | | | | | | |
| SB | 447 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 10.7 | 52.4 | 1666 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 10.7 | 19.3 | 272 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 10.7 | 16.2 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 8.6 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 27.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 8.6 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 5.5 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 5.6 | | | | | | | | | | |
| EB | 210 | RIGHT TURN DELAY AT MAIN INTERSECTION | 0.1 | 35.5 | 231 | | | 25 | 108 | | | 0.1 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 27.5 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 25 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0.1 | | |
| | | | | | | | | | | | | | |
| WB | 272 | RIGHT TURN DELAY AT MAIN INTERSECTION | 0.4 | 34.3 | 484 | | | 27.9 | 603 | | | 0.4 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 25.3 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 8.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 27.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0.4 | | |
| | | | | | | | | | | | | | |

## Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Category 3 – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 204 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14.9 | 54.2 | 956 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14.9 | 26.4 | 389 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14.9 | 40.1 | 31.4 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.5 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 12.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 25.2 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 15.2 | | | | | | | | | | |
| SB | 337 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.4 | 66.5 | 655 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.4 | 24.3 | 81 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 12.4 | 27.6 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 17 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 15.2 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 25.2 | | | | | | | | | | |
| EB | 118 | RIGHT TURN DELAY AT MAIN INTERSECTION | 9.5 | 38 | 144 | | | 10.8 | 69 | | | 9.5 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 17 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 10.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 9.5 | | |
| | | | | | | | | | | | | | |
| WB | 339 | RIGHT TURN DELAY AT MAIN INTERSECTION | 19.4 | 43.9 | 294 | | | 20.8 | 630 | | | 19.4 | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 12.6 | | | | | | | | | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 20.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 19.4 | | |
| | | | | | | | | | | | | | |

## Appendix B – Part 3
## Arizona Parkway Intersection Configuration
## Detailed Level of Service Calculations for Jackrabbit Trail & Bell Road Intersection With Six-lane Parkway Facility

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Base Condition – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 933 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 148 | 527.3 | 2036 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 148 | 196.4 | 298 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 148 | 172.4 | 288.1117853 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 48.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 48.4 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 24.4 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 190.5 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 140.4 | | | | | | | | | | |
| SB | 120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 135.5 | 241.8 | 1823 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 135.5 | 172.6 | 456 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 135.5 | 275.9 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 37.1 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 37.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 140.4 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 44.8 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 24.4 | | | | | | | | | | |
| EB | 415 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 237.5 | 314.5 | 2530 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 237.5 | 254.3 | 1411 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 237.5 | 737.3 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 499.8 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 45.7 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 14.5 | | | | | | | | | | |
| WB | 416 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.9 | 580.4 | 1603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.9 | 34.9 | 220 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.9 | 37.4 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 12 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 12 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 14.5 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 45.7 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 499.8 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Alternative A Condition – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 933 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 57.8 | 207.7 | 2036 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 57.8 | 67.6 | 298 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 57.8 | 59 | 179.6894462 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 1.2 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 49.6 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 90.5 | | | | | | | | | | |
| SB | 120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 49.5 | 90.7 | 1823 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 49.5 | 62.4 | 456 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 49.5 | 140 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 12.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 12.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 90.5 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 27.1 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 1.2 | | | | | | | | | | |
| EB | 415 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 287.7 | 347.6 | 2530 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 287.7 | 307.5 | 1411 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 287.7 | 435.1 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 147.4 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 26.8 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 13.3 | | | | | | | | | | |
| WB | 416 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.6 | 199.1 | 1603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.6 | 24.9 | 220 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.6 | 30.9 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.3 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 13.3 | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 26.8 | | | | | | | | | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 147.4 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Alternative B Condition – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 933 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 60 | 149.8 | 2036 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 60 | 67.7 | 298 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 60 | 62.8 | 94.43557604 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.7 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 47.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 7.7 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 2.8 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 34.7 | | | | | | | | | | |
| SB | 120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 53.8 | 118.6 | 1823 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 53.8 | 66.9 | 456 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 53.8 | 88.5 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 13.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 48.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 13.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 34.7 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 2.8 | | | | | | | | | | |
| EB | 415 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 49.7 | 213.1 | 2530 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 49.7 | 132.2 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 82.5 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 53.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 82.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 27.1 | | | | | | | | | | |
| WB | 416 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 28.8 | 106.8 | 1603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 28.8 | 45 | 220 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 28.8 | 55.9 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.2 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 53.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.2 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 27.1 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 7.9 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Alternative C Condition – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 933 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 97.4 | 2036 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 58.1 | 298 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 31 | 53.34073377 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 58.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL AT THE END OF LOOP RAMP | 14 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 58.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 31 | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 25.3 | | | | | | | | | | |
| SB | 120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 76.2 | 1823 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 38.2 | 456 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 25.3 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 38.2 | | | | | | | | | | |
| | | DELAY AT SIGNAL AT THE END OF LOOP RAMP | 7 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 38.2 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 25.3 | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 31 | | | | | | | | | | |
| EB | 415 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14.9 | 107.9 | 2530 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 14.9 | 45.9 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 31 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 48.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 31 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 13.4 | | | | | | | | | | |
| WB | 416 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 10.2 | 97.3 | 1603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 10.2 | 35.5 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 25.3 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 47.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 25.3 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 14.3 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Base Condition – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 1381 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 222.1 | 585.7 | 3120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 222.1 | 324.1 | 481 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 222.1 | 232.3 | 264.5808358 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 102 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 202.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 102 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 10.2 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 59.1 | | | | | | | | | | |
| SB | 140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 23.6 | 99.6 | 1268 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 23.6 | 44.1 | 251 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 23.6 | 82.7 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 20.5 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 45.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 20.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 59.1 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 10.2 | | | | | | | | | | |
| EB | 382 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 162.7 | 260.6 | 1699 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 162.7 | 189 | 928 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 162.7 | 163.2 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 26.3 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 50.1 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 26.3 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0.5 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 21.5 | | | | | | | | | | |
| WB | 379 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 163.4 | 306.5 | 2140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 163.4 | 256.1 | 490 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 163.4 | 184.9 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 92.7 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 49.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 92.7 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 21.5 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 0.5 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Alternative A Condition – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 1381 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 275.1 | 641.2 | 3120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 275.1 | 402.2 | 481 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 275.1 | 284.7 | 275.129718 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 127.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 166.7 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 127.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 9.6 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 72.3 | | | | | | | | | | |
| SB | 140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 31 | 117.5 | 1268 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 31 | 52.9 | 251 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 31 | 103.3 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 55 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 72.3 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 9.6 | | | | | | | | | | |
| EB | 382 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 109.7 | 365.9 | 1699 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 109.7 | 131.6 | 928 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 109.7 | 172 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 63.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 62.3 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 170.7 | | | | | | | | | | |
| WB | 379 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 110.2 | 279.5 | 2140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 110.2 | 154 | 490 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 110.2 | 280.9 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 43.8 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 63.2 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 43.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 170.7 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 62.3 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Alternative B Condition – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 1381 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 209.8 | 762.6 | 3120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 209.8 | 352.3 | 481 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 209.8 | 211 | 259.8178246 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 142.5 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 330.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 142.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 1.2 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 79.8 | | | | | | | | | | |
| SB | 140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 25.7 | 103.9 | 1268 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 25.7 | 43.3 | 251 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 25.7 | 105.5 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.6 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 59.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.6 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 79.8 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 1.2 | | | | | | | | | | |
| EB | 382 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 36.8 | 260.9 | 1699 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 36.8 | 53.9 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 62.7 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 144.3 | | | | | | | | | | |
| WB | 379 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 118 | 208.5 | 2140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 118 | 139.9 | 490 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 118 | 262.3 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 62.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 144.3 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 6.2 | | | | | | | | | | |

## Six-Lane Arizona Parkway Intersection Operations (with Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Alternative C Condition – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 1381 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 725 | 3120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 383.9 | 481 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 37.9 | 364.7713904 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 383.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL AT THE END OF LOOP RAMP | 0.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 383.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 37.9 | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 340.5 | | | | | | | | | | |
| SB | 140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 50.1 | 1268 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 32.4 | 251 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 27.6 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 32.4 | | | | | | | | | | |
| | | DELAY AT SIGNAL AT THE END OF LOOP RAMP | 0 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 32.4 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 27.6 | | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.7 | | | | | | | | | | |
| EB | 382 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 30.8 | 108.6 | 1699 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 30.8 | 48.5 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.7 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 41.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 17.7 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 18.6 | | | | | | | | | | |
| WB | 379 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 37.6 | 439.2 | 2140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 37.6 | 718.6 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 340.5 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 46.3 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 340.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 14.8 | | | | | | | | | | |

## Appendix B – Part 4
## Arizona Parkway Intersection Configuration
## Detailed Level of Service Calculations for Jackrabbit Trail & Bell Road Intersection
## With Eight-lane Parkway Facility (Fully Mitigated Condition)

## Eight-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Base Condition – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 933 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 61.5 | 115.4 | 2036 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 61.5 | 74.2 | 298 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 61.5 | 73.4 | 72.41911571 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 12.7 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 13.2 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 12.7 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 11.9 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 28 | | | | | | | | | | |
| SB | 120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 55.3 | 91.4 | 1823 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 55.3 | 71.4 | 456 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 55.3 | 83.3 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 8.1 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 28 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 11.9 | | | | | | | | | | |
| EB | 415 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.2 | 128.6 | 2530 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.2 | 56.2 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 34 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 44.7 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 34 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 27.7 | | | | | | | | | | |
| WB | 416 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.2 | 105 | 1603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.2 | 44.2 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 27 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 39.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 27 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 21.4 | | | | | | | | | | |

## Eight-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Mitigated Condition – AM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 933 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 28 | 80.1 | 2036 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 28 | 49.2 | 298 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 28 | 47.2 | 53.3 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.2 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXITING VIA DIAGONAL CONNECTOR | 30.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 21.2 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 19.2 | | |
| | | | | | | | | | | | | | |
| SB | 120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 31.3 | 83.2 | 1823 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 31.3 | 48.2 | 456 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 31.3 | 48.5 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 15.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 17.2 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 19.2 | | | | | | | | | | |
| EB | 415 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 30.4 | 97.7 | 2530 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 30.4 | 46.8 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.4 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 34.2 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.4 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 16.7 | | | | | | | | | | |
| WB | 416 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.7 | 85 | 1603 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 22.7 | 39.5 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.8 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 32.9 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 12.6 | | | | | | | | | | |

## Eight-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Base Condition – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 1381 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 47.1 | 215.5 | 3120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 47.1 | 56.9 | 481 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 47.1 | 55.7 | 89.20871809 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 111.6 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 9.8 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 8.6 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 47 | | | | | | | | | | |
| SB | 140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 18.5 | 92 | 1268 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 18.5 | 37.6 | 251 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 18.5 | 65.5 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 45.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 47 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 8.6 | | | | | | | | | | |
| EB | 382 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 43.4 | 129.2 | 1699 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 43.4 | 70.4 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 27 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 31.4 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 27 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 27.4 | | | | | | | | | | |
| WB | 379 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 54.4 | 137.3 | 2140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 54.4 | 94.8 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 40.4 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 22.5 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 40.4 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 20 | | | | | | | | | | |

## Eight-Lane Arizona Parkway Intersection Operations (Indirect Left-Turns)
## Jackrabbit Trail & Bell Road
## Mitigated Condition – PM Peak Hour

| APPROACH | INDIRECT LEFT VOLUME | DELAY AT | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF THRU TRAFFIC | AGGREGATE DELAY TO THRU TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | VOLUME OF RIGHT TURN | AGGREGATE DELAY TO RIGHT TRAFFIC | DELAY (SEC) | TOTAL DELAY (SEC) | TOTAL AVERAGE INTERSECTION DELAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB | 1381 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 11.9 | 91.4 | 3120 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 11.9 | 28.2 | 481 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 11.9 | 23.9 | 50.2 |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.3 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXITING VIA DIAGONAL CONNECTOR | 63.2 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 16.3 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 12 | | |
| | | | | | | | | | | | | | |
| SB | 140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.5 | 61.8 | 1268 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.5 | 29 | 251 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 17.5 | 28.6 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.5 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 20.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 11.5 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 11.1 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 12 | | | | | | | | | | |
| EB | 382 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 30.3 | 93.4 | 1699 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 30.3 | 50.2 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19.9 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 24.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 19.9 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 18.4 | | | | | | | | | | |
| WB | 379 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 36.2 | 101.2 | 2140 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 36.2 | 59.3 | 0 | THRU DELAY AT U-TURN SIGNAL ENTERING THE INTERSECTION | 0 | 0 | |
| | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 23.1 | | | | | | | | | | |
| | | DELAY AT SIGNAL WHEN EXECUTING U-TURN | 24.8 | | | THRU DELAY AT MAIN INTERSECTION SIGNAL | 23.1 | | | RIGHT TURN DELAY AT MAIN INTERSECTION SIGNAL | 0 | | |
| | | RIGHT TURN DELAY AT MAIN INTERSECTION WHEN EXECUTING RIGHT-TURN | 17.1 | | | | | | | | | | |

# Appendix B – Part 5
# Arizona Parkway Intersection Configuration
# Detailed HCM Level of Service Reports
# (Supporting Calculations)

HCM Signalized Intersection Capacity Analysis
2: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | | | ↑↑ | ↱↱ | | ↑↑↑↑ | ↱↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | 3.0 | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | | | 0.95 | 0.88 | | 0.86 | 0.88 | | | |
| Frt | | 1.00 | | | 1.00 | 0.85 | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | | | 3539 | 2787 | | 6408 | 2787 | | | |
| Flt Permitted | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | | | 3539 | 2787 | | 6408 | 2787 | | | |
| Volume (vph) | 0 | 293 | 0 | 0 | 257 | 929 | 0 | 2163 | 1105 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 293 | 0 | 0 | 257 | 929 | 0 | 2163 | 1105 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 246 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 293 | 0 | 0 | 257 | 920 | 0 | 2163 | 859 | 0 | 0 | 0 |
| Turn Type | | | | | | Prot | | | Prot | | | |
| Protected Phases | | 4 | | | 8 | 8 | | 6 | 6 | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 29.0 | | | 29.0 | 29.0 | | 53.0 | 53.0 | | | |
| Effective Green, g (s) | | 30.0 | | | 30.0 | 30.0 | | 54.0 | 54.0 | | | |
| Actuated g/C Ratio | | 0.33 | | | 0.33 | 0.33 | | 0.60 | 0.60 | | | |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 8.0 | | | 3.0 | 3.0 | | 3.2 | 3.2 | | | |
| Lane Grp Cap (vph) | | 1180 | | | 1180 | 929 | | 3845 | 1672 | | | |
| v/s Ratio Prot | | 0.08 | | | 0.07 | c0.33 | | c0.34 | 0.31 | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.25 | | | 0.22 | 0.99 | | 0.56 | 0.51 | | | |
| Uniform Delay, d1 | | 21.8 | | | 21.6 | 29.9 | | 10.9 | 10.4 | | | |
| Progression Factor | | 0.05 | | | 1.00 | 1.00 | | 0.76 | 0.69 | | | |
| Incremental Delay, d2 | | 0.5 | | | 0.1 | 27.1 | | 0.1 | 0.2 | | | |
| Delay (s) | | 1.6 | | | 21.7 | 57.0 | | 8.4 | 7.4 | | | |
| Level of Service | | A | | | C | E | | A | A | | | |
| Approach Delay (s) | | 1.6 | | | 49.3 | | | 8.1 | | | 0.0 | |
| Approach LOS | | A | | | D | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 18.0 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 77.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: SB Left - U Turn & Jackrabbit Trail Parkway

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.86 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 6408 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 6408 | | |
| Volume (vph) | 856 | 0 | 0 | 2412 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 856 | 0 | 0 | 2412 | 0 | 0 |
| RTOR Reduction (vph) | 4 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 852 | 0 | 0 | 2412 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | 1 7 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 25.0 | | | 49.0 | | |
| Effective Green, g (s) | 27.0 | | | 51.0 | | |
| Actuated g/C Ratio | 0.30 | | | 0.57 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1030 | | | 3631 | | |
| v/s Ratio Prot | c0.25 | | | c0.38 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.83 | | | 0.66 | | |
| Uniform Delay, d1 | 29.3 | | | 13.6 | | |
| Progression Factor | 1.06 | | | 1.00 | | |
| Incremental Delay, d2 | 2.6 | | | 0.5 | | |
| Delay (s) | 33.6 | | | 14.0 | | |
| Level of Service | C | | | B | | |
| Approach Delay (s) | 33.6 | | | 14.0 | 0.0 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 19.1 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 102.6% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
4: NB Left - U Turn & Jackrabbit Trail Parkway

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.86 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 6408 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 6408 |
| Volume (vph) | 516 | 0 | 0 | 0 | 0 | 3715 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 516 | 0 | 0 | 0 | 0 | 3715 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 516 | 0 | 0 | 0 | 0 | 3715 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | | | 1 7 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 25.0 | | | | | 49.0 |
| Effective Green, g (s) | 27.0 | | | | | 51.0 |
| Actuated g/C Ratio | 0.30 | | | | | 0.57 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1030 | | | | | 3631 |
| v/s Ratio Prot | c0.15 | | | | | c0.58 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.50 | | | | | 1.02 |
| Uniform Delay, d1 | 26.0 | | | | | 19.5 |
| Progression Factor | 1.23 | | | | | 1.00 |
| Incremental Delay, d2 | 0.3 | | | | | 21.2 |
| Delay (s) | 32.3 | | | | | 40.7 |
| Level of Service | C | | | | | D |
| Approach Delay (s) | 32.3 | | 0.0 | | | 40.7 |
| Approach LOS | C | | A | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 39.7 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 97.8% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | ↱↱ | | ↑↑ | | | | | | ↑↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | 0.88 | | 0.95 | | | | | | 0.86 | 0.88 |
| Frt | | 1.00 | 0.85 | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | 3539 | 2787 | | 3539 | | | | | | 6408 | 2787 |
| Flt Permitted | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | 3539 | 2787 | | 3539 | | | | | | 6408 | 2787 |
| Volume (vph) | 0 | 293 | 554 | 0 | 257 | 0 | 0 | 0 | 0 | 0 | 3540 | 691 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 293 | 554 | 0 | 257 | 0 | 0 | 0 | 0 | 0 | 3540 | 691 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 276 |
| Lane Group Flow (vph) | 0 | 293 | 554 | 0 | 257 | 0 | 0 | 0 | 0 | 0 | 3540 | 415 |
| Turn Type | | | Prot | | | | | | | | | Prot |
| Protected Phases | | 8 | 8 | | 4 | | | | | | 2 | 2 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 29.0 | 29.0 | | 29.0 | | | | | | 53.0 | 53.0 |
| Effective Green, g (s) | | 30.0 | 30.0 | | 30.0 | | | | | | 54.0 | 54.0 |
| Actuated g/C Ratio | | 0.33 | 0.33 | | 0.33 | | | | | | 0.60 | 0.60 |
| Clearance Time (s) | | 4.0 | 4.0 | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 8.0 | | | | | | 3.2 | 3.2 |
| Lane Grp Cap (vph) | | 1180 | 929 | | 1180 | | | | | | 3845 | 1672 |
| v/s Ratio Prot | | 0.08 | c0.20 | | 0.07 | | | | | | c0.55 | 0.15 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.25 | 0.60 | | 0.22 | | | | | | 0.92 | 0.25 |
| Uniform Delay, d1 | | 21.8 | 25.0 | | 21.6 | | | | | | 16.1 | 8.5 |
| Progression Factor | | 1.00 | 1.00 | | 0.05 | | | | | | 0.37 | 0.24 |
| Incremental Delay, d2 | | 0.1 | 1.0 | | 0.4 | | | | | | 1.4 | 0.0 |
| Delay (s) | | 21.9 | 26.0 | | 1.5 | | | | | | 7.3 | 2.0 |
| Level of Service | | C | C | | A | | | | | | A | A |
| Approach Delay (s) | | 24.6 | | | 1.5 | | | 0.0 | | | 6.4 | |
| Approach LOS | | C | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 77.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | | | ↑↑ | ↱ | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | 3.0 | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | | | 0.95 | 1.00 | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | 1.00 | 0.85 | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | | | 3539 | 1583 | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | | | 3539 | 1583 | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 260 | 0 | 0 | 198 | 702 | 0 | 2056 | 570 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 260 | 0 | 0 | 198 | 702 | 0 | 2056 | 570 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 260 | 0 | 0 | 198 | 702 | 0 | 2056 | 510 | 0 | 0 | 0 |
| Turn Type | | | | | | custom | | | Perm | | | |
| Protected Phases | | 4 | | | 8 | | | 6 | | | | |
| Permitted Phases | | | | | | 6 8 | | | 6 | | | |
| Actuated Green, G (s) | | 24.0 | | | 24.0 | 116.0 | | 84.0 | 84.0 | | | |
| Effective Green, g (s) | | 25.0 | | | 25.0 | 116.0 | | 85.0 | 85.0 | | | |
| Actuated g/C Ratio | | 0.22 | | | 0.22 | 1.00 | | 0.73 | 0.73 | | | |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 8.0 | | | 3.0 | | | 3.2 | 3.2 | | | |
| Lane Grp Cap (vph) | | 763 | | | 763 | 1583 | | 3726 | 1160 | | | |
| v/s Ratio Prot | | 0.07 | | | 0.06 | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | c0.44 | | | 0.32 | | | |
| v/c Ratio | | 0.34 | | | 0.26 | 0.44 | | 0.55 | 0.44 | | | |
| Uniform Delay, d1 | | 38.5 | | | 37.8 | 0.0 | | 7.0 | 6.1 | | | |
| Progression Factor | | 0.03 | | | 1.00 | 1.00 | | 1.41 | 1.54 | | | |
| Incremental Delay, d2 | | 1.1 | | | 0.2 | 0.2 | | 0.1 | 0.2 | | | |
| Delay (s) | | 2.4 | | | 38.0 | 0.2 | | 9.9 | 9.6 | | | |
| Level of Service | | A | | | D | A | | A | A | | | |
| Approach Delay (s) | | 2.4 | | | 8.5 | | | 9.9 | | | 0.0 | |
| Approach LOS | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.0 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 3.0 |
| Intersection Capacity Utilization | 105.8% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: SB Left - U Turn & Jackrabbit Trail Parkway

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 763 | 0 | 0 | 1863 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 763 | 0 | 0 | 1863 | 0 | 0 |
| RTOR Reduction (vph) | 53 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 710 | 0 | 0 | 1863 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | 1 7 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 24.0 | | | 84.0 | | |
| Effective Green, g (s) | 25.0 | | | 85.0 | | |
| Actuated g/C Ratio | 0.22 | | | 0.73 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 740 | | | 3726 | | |
| v/s Ratio Prot | c0.21 | | | c0.37 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.96 | | | 0.50 | | |
| Uniform Delay, d1 | 45.0 | | | 6.5 | | |
| Progression Factor | 0.93 | | | 1.00 | | |
| Incremental Delay, d2 | 15.1 | | | 0.1 | | |
| Delay (s) | 56.9 | | | 6.7 | | |
| Level of Service | E | | | A | | |
| Approach Delay (s) | 56.9 | | | 6.7 | 0.0 | |
| Approach LOS | E | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 21.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 115.4% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 4: NB Left - U Turn & Jackrabbit Trail Parkway

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 419 | 0 | 0 | 0 | 0 | 3554 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 419 | 0 | 0 | 0 | 0 | 3554 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 417 | 0 | 0 | 0 | 0 | 3554 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | | | 1 7 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 24.0 | | | | | 84.0 |
| Effective Green, g (s) | 25.0 | | | | | 85.0 |
| Actuated g/C Ratio | 0.22 | | | | | 0.73 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 740 | | | | | 3726 |
| v/s Ratio Prot | c0.12 | | | | | c0.70 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.56 | | | | | 0.95 |
| Uniform Delay, d1 | 40.6 | | | | | 13.8 |
| Progression Factor | 1.10 | | | | | 1.00 |
| Incremental Delay, d2 | 0.9 | | | | | 6.9 |
| Delay (s) | 45.7 | | | | | 20.7 |
| Level of Service | D | | | | | C |
| Approach Delay (s) | 45.7 | | 0.0 | | | 20.7 |
| Approach LOS | D | | A | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 23.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.5% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
5: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | ↱ | | ↑↑ | | | | | | ↑↑↑ | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | 1.00 | | 0.95 | | | | | | 0.91 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | 3539 | 1583 | | 3539 | | | | | | 5085 | 1583 |
| Flt Permitted | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | 3539 | 1583 | | 3539 | | | | | | 5085 | 1583 |
| Volume (vph) | 0 | 260 | 541 | 0 | 198 | 0 | 0 | 0 | 0 | 0 | 3397 | 576 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 260 | 541 | 0 | 198 | 0 | 0 | 0 | 0 | 0 | 3397 | 576 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89 |
| Lane Group Flow (vph) | 0 | 260 | 541 | 0 | 198 | 0 | 0 | 0 | 0 | 0 | 3397 | 487 |
| Turn Type | | | custom | | | | | | | | | Perm |
| Protected Phases | | 8 | | | 4 | | | | | | 2 | |
| Permitted Phases | | | 2 8 | | | | | | | | | 2 |
| Actuated Green, G (s) | | 24.0 | 116.0 | | 24.0 | | | | | | 84.0 | 84.0 |
| Effective Green, g (s) | | 25.0 | 116.0 | | 25.0 | | | | | | 85.0 | 85.0 |
| Actuated g/C Ratio | | 0.22 | 1.00 | | 0.22 | | | | | | 0.73 | 0.73 |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 8.0 | | | | | | 3.2 | 3.2 |
| Lane Grp Cap (vph) | | 763 | 1583 | | 763 | | | | | | 3726 | 1160 |
| v/s Ratio Prot | | 0.07 | | | 0.06 | | | | | | c0.67 | |
| v/s Ratio Perm | | | c0.34 | | | | | | | | | 0.31 |
| v/c Ratio | | 0.34 | 0.34 | | 0.26 | | | | | | 0.91 | 0.42 |
| Uniform Delay, d1 | | 38.5 | 0.0 | | 37.8 | | | | | | 12.5 | 6.0 |
| Progression Factor | | 1.00 | 1.00 | | 0.04 | | | | | | 0.42 | 0.16 |
| Incremental Delay, d2 | | 0.3 | 0.1 | | 0.8 | | | | | | 1.6 | 0.1 |
| Delay (s) | | 38.8 | 0.1 | | 2.1 | | | | | | 6.9 | 1.0 |
| Level of Service | | D | A | | A | | | | | | A | A |
| Approach Delay (s) | | 12.7 | | | 2.1 | | | 0.0 | | | 6.0 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.0 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 3.0 |
| Intersection Capacity Utilization | 105.8% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | | | ↑↑↱ | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | | | 0.95 | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | 0.89 | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | 1.00 | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | | | 3159 | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | 1.00 | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | | | 3159 | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 267 | 0 | 0 | 252 | 636 | 0 | 878 | 878 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 267 | 0 | 0 | 252 | 636 | 0 | 878 | 878 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 | 247 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 267 | 0 | 0 | 831 | 0 | 0 | 878 | 631 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 4 | | | 8 | | | 6 | | | | |
| Permitted Phases | | | | | | | | | 6 | | | |
| Actuated Green, G (s) | | 24.0 | | | 18.5 | | | 28.0 | 28.0 | | | |
| Effective Green, g (s) | | 25.0 | | | 25.0 | | | 29.0 | 29.0 | | | |
| Actuated g/C Ratio | | 0.42 | | | 0.42 | | | 0.48 | 0.48 | | | |
| Clearance Time (s) | | 4.0 | | | 9.5 | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 8.0 | | | 3.0 | | | 3.2 | 3.2 | | | |
| Lane Grp Cap (vph) | | 1475 | | | 1316 | | | 2458 | 765 | | | |
| v/s Ratio Prot | | 0.08 | | | c0.26 | | | 0.17 | | | | |
| v/s Ratio Perm | | | | | | | | | c0.40 | | | |
| v/c Ratio | | 0.18 | | | 0.87dr | | | 0.36 | 0.82 | | | |
| Uniform Delay, d1 | | 11.0 | | | 13.9 | | | 9.7 | 13.3 | | | |
| Progression Factor | | 0.09 | | | 1.00 | | | 1.06 | 1.36 | | | |
| Incremental Delay, d2 | | 0.2 | | | 1.0 | | | 0.1 | 6.5 | | | |
| Delay (s) | | 1.3 | | | 14.8 | | | 10.4 | 24.5 | | | |
| Level of Service | | A | | | B | | | B | C | | | |
| Approach Delay (s) | | 1.3 | | | 14.8 | | | 17.5 | | | 0.0 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.2 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 68.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

## HCM Signalized Intersection Capacity Analysis
## 3: SB Left - U Turn & Jackrabbit Trail Parkway

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 677 | 0 | 0 | 1079 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 677 | 0 | 0 | 1079 | 0 | 0 |
| RTOR Reduction (vph) | 47 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 630 | 0 | 0 | 1079 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | 1 7 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 20.0 | | | 24.0 | | |
| Effective Green, g (s) | 22.0 | | | 26.0 | | |
| Actuated g/C Ratio | 0.37 | | | 0.43 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1259 | | | 2204 | | |
| v/s Ratio Prot | c0.18 | | | c0.21 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.50 | | | 0.49 | | |
| Uniform Delay, d1 | 14.7 | | | 12.2 | | |
| Progression Factor | 1.09 | | | 1.00 | | |
| Incremental Delay, d2 | 0.2 | | | 0.2 | | |
| Delay (s) | 16.2 | | | 12.4 | | |
| Level of Service | B | | | B | | |
| Approach Delay (s) | 16.2 | | | 12.4 | 0.0 | |
| Approach LOS | B | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.9 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 419 | 0 | 0 | 0 | 0 | 1681 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 419 | 0 | 0 | 0 | 0 | 1681 |
| RTOR Reduction (vph) | 6 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 413 | 0 | 0 | 0 | 0 | 1681 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | | | 1 7 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 20.0 | | | | | 24.0 |
| Effective Green, g (s) | 22.0 | | | | | 26.0 |
| Actuated g/C Ratio | 0.37 | | | | | 0.43 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1259 | | | | | 2204 |
| v/s Ratio Prot | c0.12 | | | | | c0.33 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.33 | | | | | 0.76 |
| Uniform Delay, d1 | 13.7 | | | | | 14.4 |
| Progression Factor | 1.00 | | | | | 1.00 |
| Incremental Delay, d2 | 0.1 | | | | | 1.6 |
| Delay (s) | 13.8 | | | | | 16.0 |
| Level of Service | B | | | | | B |
| Approach Delay (s) | 13.8 | | 0.0 | | | 16.0 |
| Approach LOS | B | | A | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 60.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | | | | | 0.91 | 1.00 |
| Frt | | 0.92 | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | 3257 | | | 3539 | | | | | | 5085 | 1583 |
| Flt Permitted | | 1.00 | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | 3257 | | | 3539 | | | | | | 5085 | 1583 |
| Volume (vph) | 0 | 267 | 304 | 0 | 252 | 0 | 0 | 0 | 0 | 0 | 1914 | 186 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 267 | 304 | 0 | 252 | 0 | 0 | 0 | 0 | 0 | 1914 | 186 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 96 |
| Lane Group Flow (vph) | 0 | 569 | 0 | 0 | 252 | 0 | 0 | 0 | 0 | 0 | 1914 | 90 |
| Turn Type | | | | | | | | | | | | Perm |
| Protected Phases | | 8 | | | 4 | | | | | | 2 | |
| Permitted Phases | | | | | | | | | | | | 2 |
| Actuated Green, G (s) | | 18.5 | | | 24.0 | | | | | | 28.0 | 28.0 |
| Effective Green, g (s) | | 25.0 | | | 25.0 | | | | | | 29.0 | 29.0 |
| Actuated g/C Ratio | | 0.42 | | | 0.42 | | | | | | 0.48 | 0.48 |
| Clearance Time (s) | | 9.5 | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 8.0 | | | | | | 3.2 | 3.2 |
| Lane Grp Cap (vph) | | 1357 | | | 1475 | | | | | | 2458 | 765 |
| v/s Ratio Prot | | c0.17 | | | 0.07 | | | | | | c0.38 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.06 |
| v/c Ratio | | 0.42 | | | 0.17 | | | | | | 0.78 | 0.12 |
| Uniform Delay, d1 | | 12.4 | | | 11.0 | | | | | | 12.8 | 8.5 |
| Progression Factor | | 1.00 | | | 0.18 | | | | | | 0.67 | 0.79 |
| Incremental Delay, d2 | | 0.2 | | | 0.2 | | | | | | 1.2 | 0.1 |
| Delay (s) | | 12.6 | | | 2.1 | | | | | | 9.8 | 6.8 |
| Level of Service | | B | | | A | | | | | | A | A |
| Approach Delay (s) | | 12.6 | | | 2.1 | | | 0.0 | | | 9.5 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.5 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 68.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | | | ↑↑ | ↱↱ | | ↑↑↑↑ | ↱↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | 3.0 | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | | | 0.95 | 0.88 | | 0.86 | 0.88 | | | |
| Frt | | 1.00 | | | 1.00 | 0.85 | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | | | 3539 | 2787 | | 6408 | 2787 | | | |
| Flt Permitted | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | | | 3539 | 2787 | | 6408 | 2787 | | | |
| Volume (vph) | 0 | 188 | 0 | 0 | 531 | 1123 | 0 | 3034 | 1113 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 188 | 0 | 0 | 531 | 1123 | 0 | 3034 | 1113 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 471 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 188 | 0 | 0 | 531 | 1122 | 0 | 3034 | 642 | 0 | 0 | 0 |
| Turn Type | | | | | | Prot | | | Prot | | | |
| Protected Phases | | 4 | | | 8 | 8 | | 6 | 6 | | | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 34.0 | | | 28.5 | 28.5 | | 48.0 | 48.0 | | | |
| Effective Green, g (s) | | 35.0 | | | 35.0 | 35.0 | | 49.0 | 49.0 | | | |
| Actuated g/C Ratio | | 0.39 | | | 0.39 | 0.39 | | 0.54 | 0.54 | | | |
| Clearance Time (s) | | 4.0 | | | 9.5 | 9.5 | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 8.0 | | | 3.0 | 3.0 | | 3.2 | 3.2 | | | |
| Lane Grp Cap (vph) | | 1376 | | | 1376 | 1084 | | 3489 | 1517 | | | |
| v/s Ratio Prot | | 0.05 | | | 0.15 | c0.40 | | c0.47 | 0.23 | | | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.14 | | | 0.39 | 1.04 | | 0.87 | 0.42 | | | |
| Uniform Delay, d1 | | 17.7 | | | 19.8 | 27.5 | | 17.7 | 12.1 | | | |
| Progression Factor | | 0.06 | | | 1.00 | 1.00 | | 0.67 | 1.04 | | | |
| Incremental Delay, d2 | | 0.2 | | | 0.2 | 36.9 | | 1.1 | 0.1 | | | |
| Delay (s) | | 1.2 | | | 20.0 | 64.4 | | 13.0 | 12.7 | | | |
| Level of Service | | A | | | B | E | | B | B | | | |
| Approach Delay (s) | | 1.2 | | | 50.1 | | | 12.9 | | | 0.0 | |
| Approach LOS | | A | | | D | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 22.8 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 89.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: SB Left - U Turn & Jackrabbit Trail Parkway

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.86 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 6408 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 6408 | | |
| Volume (vph) | 619 | 0 | 0 | 3528 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 619 | 0 | 0 | 3528 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 619 | 0 | 0 | 3528 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | 1 7 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 23.0 | | | 51.0 | | |
| Effective Green, g (s) | 25.0 | | | 53.0 | | |
| Actuated g/C Ratio | 0.28 | | | 0.59 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 954 | | | 3774 | | |
| v/s Ratio Prot | c0.18 | | | c0.55 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.65 | | | 0.93 | | |
| Uniform Delay, d1 | 28.6 | | | 16.9 | | |
| Progression Factor | 1.35 | | | 1.00 | | |
| Incremental Delay, d2 | 1.1 | | | 5.2 | | |
| Delay (s) | 39.7 | | | 22.1 | | |
| Level of Service | D | | | C | | |
| Approach Delay (s) | 39.7 | | | 22.1 | 0.0 | |
| Approach LOS | D | | | C | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 24.7 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 98.1% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 4: NB Left - U Turn & Jackrabbit Trail Parkway

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | | | | | ↑↑↑↑ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.86 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 6408 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 6408 |
| Volume (vph) | 714 | 0 | 0 | 0 | 0 | 2484 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 714 | 0 | 0 | 0 | 0 | 2484 |
| RTOR Reduction (vph) | 4 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 710 | 0 | 0 | 0 | 0 | 2484 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | | | 1 7 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 23.0 | | | | | 51.0 |
| Effective Green, g (s) | 25.0 | | | | | 53.0 |
| Actuated g/C Ratio | 0.28 | | | | | 0.59 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 954 | | | | | 3774 |
| v/s Ratio Prot | c0.21 | | | | | c0.39 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.74 | | | | | 0.66 |
| Uniform Delay, d1 | 29.6 | | | | | 12.4 |
| Progression Factor | 1.12 | | | | | 1.00 |
| Incremental Delay, d2 | 1.3 | | | | | 0.4 |
| Delay (s) | 34.5 | | | | | 12.8 |
| Level of Service | C | | | | | B |
| Approach Delay (s) | 34.5 | | 0.0 | | | 12.8 |
| Approach LOS | C | | A | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 17.7 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 92.6% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
5: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | ↱↱ | | ↑↑ | | | | | | ↑↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | 0.88 | | 0.95 | | | | | | 0.86 | 0.88 |
| Frt | | 1.00 | 0.85 | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | 3539 | 2787 | | 3539 | | | | | | 6408 | 2787 |
| Flt Permitted | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | 3539 | 2787 | | 3539 | | | | | | 6408 | 2787 |
| Volume (vph) | 0 | 188 | 316 | 0 | 531 | 0 | 0 | 0 | 0 | 0 | 2577 | 621 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 188 | 316 | 0 | 531 | 0 | 0 | 0 | 0 | 0 | 2577 | 621 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 146 |
| Lane Group Flow (vph) | 0 | 188 | 315 | 0 | 531 | 0 | 0 | 0 | 0 | 0 | 2577 | 475 |
| Turn Type | | | Prot | | | | | | | | | Prot |
| Protected Phases | | 8 | 8 | | 4 | | | | | | 2 | 2 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 28.5 | 28.5 | | 34.0 | | | | | | 48.0 | 48.0 |
| Effective Green, g (s) | | 35.0 | 35.0 | | 35.0 | | | | | | 49.0 | 49.0 |
| Actuated g/C Ratio | | 0.39 | 0.39 | | 0.39 | | | | | | 0.54 | 0.54 |
| Clearance Time (s) | | 9.5 | 9.5 | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 8.0 | | | | | | 3.2 | 3.2 |
| Lane Grp Cap (vph) | | 1376 | 1084 | | 1376 | | | | | | 3489 | 1517 |
| v/s Ratio Prot | | 0.05 | 0.11 | | c0.15 | | | | | | c0.40 | 0.17 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.14 | 0.29 | | 0.39 | | | | | | 0.74 | 0.31 |
| Uniform Delay, d1 | | 17.7 | 18.9 | | 19.8 | | | | | | 15.6 | 11.3 |
| Progression Factor | | 1.00 | 1.00 | | 0.05 | | | | | | 0.88 | 0.87 |
| Incremental Delay, d2 | | 0.0 | 0.1 | | 0.7 | | | | | | 0.6 | 0.1 |
| Delay (s) | | 17.8 | 19.1 | | 1.8 | | | | | | 14.3 | 9.9 |
| Level of Service | | B | B | | A | | | | | | B | A |
| Approach Delay (s) | | 18.6 | | | 1.8 | | | 0.0 | | | 13.4 | |
| Approach LOS | | B | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 12.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 90.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 89.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | | | ↑↑ | ↱ | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | 3.0 | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | | | 0.95 | 1.00 | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | 1.00 | 0.85 | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | | | 3539 | 1583 | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | 1.00 | 1.00 | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | | | 3539 | 1583 | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 231 | 0 | 0 | 484 | 875 | 0 | 2589 | 884 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 231 | 0 | 0 | 484 | 875 | 0 | 2589 | 884 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 141 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 231 | 0 | 0 | 484 | 875 | 0 | 2589 | 743 | 0 | 0 | 0 |
| Turn Type | | | | | | custom | | | Perm | | | |
| Protected Phases | | 4 | | | 8 | | | 6 | | | | |
| Permitted Phases | | | | | | 6 8 | | | 6 | | | |
| Actuated Green, G (s) | | 24.0 | | | 24.0 | 86.0 | | 54.0 | 54.0 | | | |
| Effective Green, g (s) | | 25.0 | | | 25.0 | 86.0 | | 55.0 | 55.0 | | | |
| Actuated g/C Ratio | | 0.29 | | | 0.29 | 1.00 | | 0.64 | 0.64 | | | |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 8.0 | | | 3.0 | | | 3.2 | 3.2 | | | |
| Lane Grp Cap (vph) | | 1029 | | | 1029 | 1583 | | 3252 | 1012 | | | |
| v/s Ratio Prot | | 0.07 | | | 0.14 | | | c0.51 | | | | |
| v/s Ratio Perm | | | | | | c0.55 | | | 0.47 | | | |
| v/c Ratio | | 0.22 | | | 0.47 | 0.55 | | 0.80 | 0.73 | | | |
| Uniform Delay, d1 | | 23.1 | | | 25.1 | 0.0 | | 11.4 | 10.5 | | | |
| Progression Factor | | 0.05 | | | 1.00 | 1.00 | | 0.62 | 0.39 | | | |
| Incremental Delay, d2 | | 0.5 | | | 0.3 | 0.4 | | 0.8 | 1.6 | | | |
| Delay (s) | | 1.7 | | | 25.4 | 0.4 | | 7.9 | 5.6 | | | |
| Level of Service | | A | | | C | A | | A | A | | | |
| Approach Delay (s) | | 1.7 | | | 9.3 | | | 7.3 | | | 0.0 | |
| Approach LOS | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.6 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.71 | | |
| Actuated Cycle Length (s) | 86.0 | Sum of lost time (s) | 3.0 |
| Intersection Capacity Utilization | 110.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: SB Left - U Turn & Jackrabbit Trail Parkway

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 657 | 0 | 0 | 2816 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 657 | 0 | 0 | 2816 | 0 | 0 |
| RTOR Reduction (vph) | 3 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 654 | 0 | 0 | 2816 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | 1 7 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 23.0 | | | 55.0 | | |
| Effective Green, g (s) | 24.0 | | | 56.0 | | |
| Actuated g/C Ratio | 0.28 | | | 0.65 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 958 | | | 3311 | | |
| v/s Ratio Prot | c0.19 | | | c0.55 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.68 | | | 0.85 | | |
| Uniform Delay, d1 | 27.6 | | | 11.7 | | |
| Progression Factor | 0.94 | | | 1.00 | | |
| Incremental Delay, d2 | 1.5 | | | 2.3 | | |
| Delay (s) | 27.5 | | | 14.0 | | |
| Level of Service | C | | | B | | |
| Approach Delay (s) | 27.5 | | | 14.0 | 0.0 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 16.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 86.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 109.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 600 | 0 | 0 | 0 | 0 | 2384 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 600 | 0 | 0 | 0 | 0 | 2384 |
| RTOR Reduction (vph) | 9 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 591 | 0 | 0 | 0 | 0 | 2384 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | | | 1 7 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 23.0 | | | | | 55.0 |
| Effective Green, g (s) | 24.0 | | | | | 56.0 |
| Actuated g/C Ratio | 0.28 | | | | | 0.65 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 958 | | | | | 3311 |
| v/s Ratio Prot | c0.17 | | | | | c0.47 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.62 | | | | | 0.72 |
| Uniform Delay, d1 | 27.0 | | | | | 9.9 |
| Progression Factor | 0.91 | | | | | 1.00 |
| Incremental Delay, d2 | 0.8 | | | | | 0.8 |
| Delay (s) | 25.3 | | | | | 10.7 |
| Level of Service | C | | | | | B |
| Approach Delay (s) | 25.3 | | 0.0 | | | 10.7 |
| Approach LOS | C | | A | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 86.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 108.1% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | ↱ | | ↑↑ | | | | | | ↑↑↑ | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | 1.00 | | 0.95 | | | | | | 0.91 | 1.00 |
| Frt | | 1.00 | 0.85 | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | 3539 | 1583 | | 3539 | | | | | | 5085 | 1583 |
| Flt Permitted | | 1.00 | 1.00 | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | 3539 | 1583 | | 3539 | | | | | | 5085 | 1583 |
| Volume (vph) | 0 | 231 | 318 | 0 | 484 | 0 | 0 | 0 | 0 | 0 | 2385 | 599 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 231 | 318 | 0 | 484 | 0 | 0 | 0 | 0 | 0 | 2385 | 599 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 |
| Lane Group Flow (vph) | 0 | 231 | 318 | 0 | 484 | 0 | 0 | 0 | 0 | 0 | 2385 | 555 |
| Turn Type | | | custom | | | | | | | | | Perm |
| Protected Phases | | 8 | | | 4 | | | | | | 2 | |
| Permitted Phases | | | 2 8 | | | | | | | | | 2 |
| Actuated Green, G (s) | | 24.0 | 86.0 | | 24.0 | | | | | | 54.0 | 54.0 |
| Effective Green, g (s) | | 25.0 | 86.0 | | 25.0 | | | | | | 55.0 | 55.0 |
| Actuated g/C Ratio | | 0.29 | 1.00 | | 0.29 | | | | | | 0.64 | 0.64 |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 8.0 | | | | | | 3.2 | 3.2 |
| Lane Grp Cap (vph) | | 1029 | 1583 | | 1029 | | | | | | 3252 | 1012 |
| v/s Ratio Prot | | 0.07 | | | c0.14 | | | | | | c0.47 | |
| v/s Ratio Perm | | | 0.20 | | | | | | | | | 0.35 |
| v/c Ratio | | 0.22 | 0.20 | | 0.47 | | | | | | 0.73 | 0.55 |
| Uniform Delay, d1 | | 23.1 | 0.0 | | 25.1 | | | | | | 10.5 | 8.6 |
| Progression Factor | | 1.00 | 1.00 | | 0.05 | | | | | | 0.76 | 0.59 |
| Incremental Delay, d2 | | 0.1 | 0.1 | | 1.3 | | | | | | 0.6 | 0.4 |
| Delay (s) | | 23.3 | 0.1 | | 2.5 | | | | | | 8.6 | 5.5 |
| Level of Service | | C | A | | A | | | | | | A | A |
| Approach Delay (s) | | 9.8 | | | 2.5 | | | 0.0 | | | 8.0 | |
| Approach LOS | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.6 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 86.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 110.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑ | | | ↑↑↱ | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.95 | | | 0.95 | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | 0.88 | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | 1.00 | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 3539 | | | 3132 | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | 1.00 | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 3539 | | | 3132 | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 144 | 0 | 0 | 294 | 969 | 0 | 1278 | 726 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 144 | 0 | 0 | 294 | 969 | 0 | 1278 | 726 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 411 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 144 | 0 | 0 | 1252 | 0 | 0 | 1278 | 315 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 4 | | | 8 | | | 6 | | | | |
| Permitted Phases | | | | | | | | | 6 | | | |
| Actuated Green, G (s) | | 27.0 | | | 27.0 | | | 25.0 | 25.0 | | | |
| Effective Green, g (s) | | 28.0 | | | 28.0 | | | 26.0 | 26.0 | | | |
| Actuated g/C Ratio | | 0.47 | | | 0.47 | | | 0.43 | 0.43 | | | |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 8.0 | | | 3.0 | | | 3.2 | 3.2 | | | |
| Lane Grp Cap (vph) | | 1652 | | | 1462 | | | 2204 | 686 | | | |
| v/s Ratio Prot | | 0.04 | | | c0.40 | | | c0.25 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.20 | | | |
| v/c Ratio | | 0.09 | | | 1.27dr | | | 0.58 | 0.46 | | | |
| Uniform Delay, d1 | | 8.9 | | | 14.2 | | | 12.9 | 12.0 | | | |
| Progression Factor | | 0.14 | | | 1.00 | | | 0.87 | 2.06 | | | |
| Incremental Delay, d2 | | 0.1 | | | 5.2 | | | 0.3 | 0.4 | | | |
| Delay (s) | | 1.3 | | | 19.4 | | | 11.5 | 25.2 | | | |
| Level of Service | | A | | | B | | | B | C | | | |
| Approach Delay (s) | | 1.3 | | | 19.4 | | | 16.4 | | | 0.0 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 16.9 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 70.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 455 | 0 | 0 | 1549 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 455 | 0 | 0 | 1549 | 0 | 0 |
| RTOR Reduction (vph) | 10 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 446 | 0 | 0 | 1549 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | 1 7 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 20.0 | | | 24.0 | | |
| Effective Green, g (s) | 22.0 | | | 26.0 | | |
| Actuated g/C Ratio | 0.37 | | | 0.43 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1259 | | | 2204 | | |
| v/s Ratio Prot | c0.13 | | | c0.30 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.35 | | | 0.70 | | |
| Uniform Delay, d1 | 13.8 | | | 13.9 | | |
| Progression Factor | 1.22 | | | 1.00 | | |
| Incremental Delay, d2 | 0.1 | | | 1.1 | | |
| Delay (s) | 17.0 | | | 14.9 | | |
| Level of Service | B | | | B | | |
| Approach Delay (s) | 17.0 | | | 14.9 | 0.0 | |
| Approach LOS | B | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.54 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 59.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 4: NB Left - U Turn & Jackrabbit Trail Parkway

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 419 | 0 | 0 | 0 | 0 | 1073 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 419 | 0 | 0 | 0 | 0 | 1073 |
| RTOR Reduction (vph) | 48 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 372 | 0 | 0 | 0 | 0 | 1073 |
| Turn Type | | | | | | |
| Protected Phases | 3 5 | | | | | 1 7 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 20.0 | | | | | 24.0 |
| Effective Green, g (s) | 22.0 | | | | | 26.0 |
| Actuated g/C Ratio | 0.37 | | | | | 0.43 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1259 | | | | | 2204 |
| v/s Ratio Prot | c0.11 | | | | | c0.21 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.30 | | | | | 0.49 |
| Uniform Delay, d1 | 13.5 | | | | | 12.2 |
| Progression Factor | 0.93 | | | | | 1.00 |
| Incremental Delay, d2 | 0.1 | | | | | 0.2 |
| Delay (s) | 12.6 | | | | | 12.4 |
| Level of Service | B | | | | | B |
| Approach Delay (s) | 12.6 | | 0.0 | | | 12.4 |
| Approach LOS | B | | A | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 12.5 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 60.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
5: Arterial Street & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | | | | | 0.91 | 1.00 |
| Frt | | 0.92 | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | 3239 | | | 3539 | | | | | | 5085 | 1583 |
| Flt Permitted | | 1.00 | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | 3239 | | | 3539 | | | | | | 5085 | 1583 |
| Volume (vph) | 0 | 144 | 187 | 0 | 294 | 0 | 0 | 0 | 0 | 0 | 1331 | 285 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 144 | 187 | 0 | 294 | 0 | 0 | 0 | 0 | 0 | 1331 | 285 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 162 |
| Lane Group Flow (vph) | 0 | 322 | 0 | 0 | 294 | 0 | 0 | 0 | 0 | 0 | 1331 | 124 |
| Turn Type | | | | | | | | | | | | Perm |
| Protected Phases | | 8 | | | 4 | | | | | | 2 | |
| Permitted Phases | | | | | | | | | | | | 2 |
| Actuated Green, G (s) | | 27.0 | | | 27.0 | | | | | | 25.0 | 25.0 |
| Effective Green, g (s) | | 28.0 | | | 28.0 | | | | | | 26.0 | 26.0 |
| Actuated g/C Ratio | | 0.47 | | | 0.47 | | | | | | 0.43 | 0.43 |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 8.0 | | | | | | 3.2 | 3.2 |
| Lane Grp Cap (vph) | | 1512 | | | 1652 | | | | | | 2204 | 686 |
| v/s Ratio Prot | | c0.10 | | | 0.08 | | | | | | c0.26 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.08 |
| v/c Ratio | | 0.21 | | | 0.18 | | | | | | 0.60 | 0.18 |
| Uniform Delay, d1 | | 9.5 | | | 9.3 | | | | | | 13.0 | 10.4 |
| Progression Factor | | 1.00 | | | 0.14 | | | | | | 0.88 | 1.45 |
| Incremental Delay, d2 | | 0.1 | | | 0.1 | | | | | | 0.4 | 0.1 |
| Delay (s) | | 9.5 | | | 1.4 | | | | | | 11.9 | 15.2 |
| Level of Service | | A | | | A | | | | | | B | B |
| Approach Delay (s) | | 9.5 | | | 1.4 | | | 0.0 | | | 12.5 | |
| Approach LOS | | A | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 70.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1366 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 69.0 | | | | | | 49.0 | 49.0 |
| Effective Green, g (s) | | | | | 70.0 | | | | | | 50.0 | 50.0 |
| Actuated g/C Ratio | | | | | 0.56 | | | | | | 0.40 | 0.40 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2825 | | | | | | 2018 | 1106 |
| v/s Ratio Prot | | | | | c0.32 | | | | | | 0.36 | c0.49 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.57 | | | | | | 0.90 | 1.24 |
| Uniform Delay, d1 | | | | | 18.2 | | | | | | 35.7 | 38.0 |
| Progression Factor | | | | | 0.03 | | | | | | 0.89 | 0.89 |
| Incremental Delay, d2 | | | | | 0.2 | | | | | | 0.6 | 106.6 |
| Delay (s) | | | | | 0.8 | | | | | | 32.5 | 140.4 |
| Level of Service | | | | | A | | | | | | C | F |
| Approach Delay (s) | | 0.0 | | | 0.8 | | | 0.0 | | | 79.1 | |
| Approach LOS | | A | | | A | | | A | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 53.0 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 86.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 69.0 | 69.0 | | 49.0 | | | | |
| Effective Green, g (s) | | | | | 70.0 | 70.0 | | 50.0 | | | | |
| Actuated g/C Ratio | | | | | 0.56 | 0.56 | | 0.40 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2825 | 879 | | 2018 | | | | |
| v/s Ratio Prot | | | | | 0.32 | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | c0.40 | | | | | | |
| v/c Ratio | | | | | 0.57 | 0.72 | | 1.01 | | | | |
| Uniform Delay, d1 | | | | | 18.2 | 20.8 | | 38.0 | | | | |
| Progression Factor | | | | | 0.61 | 0.58 | | 0.06 | | | | |
| Incremental Delay, d2 | | | | | 0.2 | 2.4 | | 8.4 | | | | |
| Delay (s) | | | | | 11.2 | 14.5 | | 10.7 | | | | |
| Level of Service | | | | | B | B | | B | | | | |
| Approach Delay (s) | | 0.0 | | | 12.2 | | | 10.7 | | | 0.0 | |
| Approach LOS | | A | | | B | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 11.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 86.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.91 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 5085 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 5085 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 1823 | 415 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 1823 | 415 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 349 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 1823 | 66 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 65.0 | 19.0 | |
| Effective Green, g (s) | | | | 67.0 | 20.0 | |
| Actuated g/C Ratio | | | | 0.53 | 0.16 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | | | 2704 | 545 | |
| v/s Ratio Prot | | | | c0.36 | c0.02 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.67 | 0.12 | |
| Uniform Delay, d1 | | | | 21.5 | 45.5 | |
| Progression Factor | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | | | 1.4 | 0.2 | |
| Delay (s) | | | | 22.9 | 45.7 | |
| Level of Service | | | | C | D | |
| Approach Delay (s) | 0.0 | | | 22.9 | 45.7 | |
| Approach LOS | A | | | C | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 27.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 39.0 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Bell Road & WB Left - U Turn

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.91 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 5085 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 5085 | | | 3433 | |
| Volume (vph) | 0 | 3941 | 0 | 0 | 416 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 3941 | 0 | 0 | 416 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 350 | 0 |
| Lane Group Flow (vph) | 0 | 3941 | 0 | 0 | 66 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 65.0 | | | 19.0 | |
| Effective Green, g (s) | | 67.0 | | | 20.0 | |
| Actuated g/C Ratio | | 0.53 | | | 0.16 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | 2704 | | | 545 | |
| v/s Ratio Prot | | c0.77 | | | c0.02 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 1.46 | | | 0.12 | |
| Uniform Delay, d1 | | 29.5 | | | 45.5 | |
| Progression Factor | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 208.0 | | | 0.2 | |
| Delay (s) | | 237.5 | | | 45.7 | |
| Level of Service | | F | | | D | |
| Approach Delay (s) | | 237.5 | 0.0 | | 45.7 | |
| Approach LOS | | F | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 219.1 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.15 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 39.0 |
| Intersection Capacity Utilization | 132.6% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 1.00 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 1583 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 1583 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 2530 | 1827 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 1827 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 1826 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 69.0 | 69.0 | | | | | | | | 49.0 | |
| Effective Green, g (s) | | 70.0 | 70.0 | | | | | | | | 50.0 | |
| Actuated g/C Ratio | | 0.56 | 0.56 | | | | | | | | 0.40 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2825 | 879 | | | | | | | | 2018 | |
| v/s Ratio Prot | | 0.50 | | | | | | | | | c0.36 | |
| v/s Ratio Perm | | | c1.15 | | | | | | | | | |
| v/c Ratio | | 0.90 | 2.08 | | | | | | | | 0.90 | |
| Uniform Delay, d1 | | 24.8 | 28.0 | | | | | | | | 35.7 | |
| Progression Factor | | 0.55 | 0.52 | | | | | | | | 0.05 | |
| Incremental Delay, d2 | | 0.4 | 485.2 | | | | | | | | 2.7 | |
| Delay (s) | | 14.0 | 499.8 | | | | | | | | 4.6 | |
| Level of Service | | B | F | | | | | | | | A | |
| Approach Delay (s) | | 217.7 | | | 0.0 | | | 0.0 | | | 4.6 | |
| Approach LOS | | F | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 154.9 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.59 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 155.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 417 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 69.0 | | | | | | 49.0 | 49.0 | | | |
| Effective Green, g (s) | | 70.0 | | | | | | 50.0 | 50.0 | | | |
| Actuated g/C Ratio | | 0.56 | | | | | | 0.40 | 0.40 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2825 | | | | | | 2018 | 628 | | | |
| v/s Ratio Prot | | c0.50 | | | | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.26 | | | |
| v/c Ratio | | 0.90 | | | | | | 1.01 | 0.66 | | | |
| Uniform Delay, d1 | | 24.8 | | | | | | 38.0 | 31.1 | | | |
| Progression Factor | | 0.04 | | | | | | 0.77 | 0.77 | | | |
| Incremental Delay, d2 | | 1.8 | | | | | | 8.4 | 0.5 | | | |
| Delay (s) | | 2.8 | | | | | | 37.7 | 24.4 | | | |
| Level of Service | | A | | | | | | D | C | | | |
| Approach Delay (s) | | 2.8 | | | 0.0 | | | 35.4 | | | 0.0 | |
| Approach LOS | | A | | | A | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 18.9 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 94.9% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| RTOR Reduction (vph) | 785 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 148 | 0 | 0 | 0 | 0 | 2279 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 19.0 | | | | | 45.0 |
| Effective Green, g (s) | 20.0 | | | | | 47.0 |
| Actuated g/C Ratio | 0.16 | | | | | 0.37 |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 545 | | | | | 1897 |
| v/s Ratio Prot | c0.04 | | | | | c0.45 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.27 | | | | | 1.20 |
| Uniform Delay, d1 | 46.6 | | | | | 39.5 |
| Progression Factor | 4.08 | | | | | 1.00 |
| Incremental Delay, d2 | 0.4 | | | | | 96.0 |
| Delay (s) | 190.5 | | | | | 135.5 |
| Level of Service | F | | | | | F |
| Approach Delay (s) | 190.5 | | 0.0 | | | 135.5 |
| Approach LOS | F | | A | | | F |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 151.5 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.92 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 59.0 |
| Intersection Capacity Utilization | 84.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| RTOR Reduction (vph) | 101 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 19 | 0 | 0 | 2334 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 19.0 | | | 45.0 | | |
| Effective Green, g (s) | 20.0 | | | 47.0 | | |
| Actuated g/C Ratio | 0.16 | | | 0.37 | | |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 545 | | | 1897 | | |
| v/s Ratio Prot | c0.01 | | | c0.46 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.03 | | | 1.23 | | |
| Uniform Delay, d1 | 44.8 | | | 39.5 | | |
| Progression Factor | 1.00 | | | 1.00 | | |
| Incremental Delay, d2 | 0.0 | | | 108.5 | | |
| Delay (s) | 44.8 | | | 148.0 | | |
| Level of Service | D | | | F | | |
| Approach Delay (s) | 44.8 | | | 148.0 | 0.0 | |
| Approach LOS | D | | | F | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 143.0 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 126.0 | Sum of lost time (s) | 59.0 |
| Intersection Capacity Utilization | 120.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1375 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 37.0 | | | | | | 31.0 | 31.0 |
| Effective Green, g (s) | | | | | 38.0 | | | | | | 32.0 | 32.0 |
| Actuated g/C Ratio | | | | | 0.50 | | | | | | 0.42 | 0.42 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2543 | | | | | | 2141 | 1173 |
| v/s Ratio Prot | | | | | c0.32 | | | | | | 0.36 | c0.49 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.63 | | | | | | 0.85 | 1.17 |
| Uniform Delay, d1 | | | | | 13.9 | | | | | | 19.9 | 22.0 |
| Progression Factor | | | | | 0.01 | | | | | | 0.40 | 0.43 |
| Incremental Delay, d2 | | | | | 0.4 | | | | | | 1.2 | 81.0 |
| Delay (s) | | | | | 0.6 | | | | | | 9.2 | 90.5 |
| Level of Service | | | | | A | | | | | | A | F |
| Approach Delay (s) | | 0.0 | | | 0.6 | | | 0.0 | | | 44.3 | |
| Approach LOS | | A | | | A | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 29.8 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 86.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 37.0 | 37.0 | | 31.0 | | | | |
| Effective Green, g (s) | | | | | 38.0 | 38.0 | | 32.0 | | | | |
| Actuated g/C Ratio | | | | | 0.50 | 0.50 | | 0.42 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2543 | 792 | | 2141 | | | | |
| v/s Ratio Prot | | | | | 0.32 | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | c0.40 | | | | | | |
| v/c Ratio | | | | | 0.63 | 0.80 | | 0.95 | | | | |
| Uniform Delay, d1 | | | | | 13.9 | 15.8 | | 21.2 | | | | |
| Progression Factor | | | | | 0.46 | 0.56 | | 0.12 | | | | |
| Incremental Delay, d2 | | | | | 0.4 | 4.4 | | 4.4 | | | | |
| Delay (s) | | | | | 6.7 | 13.3 | | 7.0 | | | | |
| Level of Service | | | | | A | B | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 8.6 | | | 7.0 | | | 0.0 | |
| Approach LOS | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.8 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 86.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.91 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 5085 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 5085 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 1823 | 415 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 1823 | 415 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 344 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 1823 | 71 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 36.0 | 12.0 | |
| Effective Green, g (s) | | | | 37.0 | 13.0 | |
| Actuated g/C Ratio | | | | 0.49 | 0.17 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | | | 2476 | 587 | |
| v/s Ratio Prot | | | | c0.36 | c0.02 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.74 | 0.12 | |
| Uniform Delay, d1 | | | | 15.6 | 26.7 | |
| Progression Factor | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | | | 2.0 | 0.1 | |
| Delay (s) | | | | 17.6 | 26.8 | |
| Level of Service | | | | B | C | |
| Approach Delay (s) | 0.0 | | | 17.6 | 26.8 | |
| Approach LOS | A | | | B | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 19.3 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 26.0 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Bell Road & WB Left U-Turn

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.91 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 5085 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 5085 | | | 3433 | |
| Volume (vph) | 0 | 3941 | 0 | 0 | 416 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 3941 | 0 | 0 | 416 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 345 | 0 |
| Lane Group Flow (vph) | 0 | 3941 | 0 | 0 | 71 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 36.0 | | | 12.0 | |
| Effective Green, g (s) | | 37.0 | | | 13.0 | |
| Actuated g/C Ratio | | 0.49 | | | 0.17 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | 2476 | | | 587 | |
| v/s Ratio Prot | | c0.77 | | | c0.02 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 1.59 | | | 0.12 | |
| Uniform Delay, d1 | | 19.5 | | | 26.7 | |
| Progression Factor | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 268.2 | | | 0.2 | |
| Delay (s) | | 287.7 | | | 26.8 | |
| Level of Service | | F | | | C | |
| Approach Delay (s) | | 287.7 | 0.0 | | 26.8 | |
| Approach LOS | | F | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 262.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.21 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 26.0 |
| Intersection Capacity Utilization | 132.6% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.88 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 2787 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 2787 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 2530 | 1827 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 1827 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 1825 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Turn Type | | | Prot | | | | | | | | | |
| Protected Phases | | 2 | 2 | | | | | | | | 8 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 37.0 | 37.0 | | | | | | | | 31.0 | |
| Effective Green, g (s) | | 38.0 | 38.0 | | | | | | | | 32.0 | |
| Actuated g/C Ratio | | 0.50 | 0.50 | | | | | | | | 0.42 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2543 | 1394 | | | | | | | | 2141 | |
| v/s Ratio Prot | | 0.50 | c0.65 | | | | | | | | c0.36 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.99 | 1.31 | | | | | | | | 0.85 | |
| Uniform Delay, d1 | | 18.9 | 19.0 | | | | | | | | 19.9 | |
| Progression Factor | | 0.38 | 0.41 | | | | | | | | 0.10 | |
| Incremental Delay, d2 | | 4.3 | 139.6 | | | | | | | | 1.8 | |
| Delay (s) | | 11.5 | 147.4 | | | | | | | | 3.7 | |
| Level of Service | | B | F | | | | | | | | A | |
| Approach Delay (s) | | 68.5 | | | 0.0 | | | 0.0 | | | 3.7 | |
| Approach LOS | | E | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 49.4 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.10 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 105.8% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 417 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 37.0 | | | | | | 31.0 | 31.0 | | | |
| Effective Green, g (s) | | 38.0 | | | | | | 32.0 | 32.0 | | | |
| Actuated g/C Ratio | | 0.50 | | | | | | 0.42 | 0.42 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2543 | | | | | | 2141 | 667 | | | |
| v/s Ratio Prot | | c0.50 | | | | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.26 | | | |
| v/c Ratio | | 0.99 | | | | | | 0.95 | 0.63 | | | |
| Uniform Delay, d1 | | 18.9 | | | | | | 21.2 | 17.3 | | | |
| Progression Factor | | 0.04 | | | | | | 0.07 | 0.05 | | | |
| Incremental Delay, d2 | | 7.5 | | | | | | 1.4 | 0.4 | | | |
| Delay (s) | | 8.3 | | | | | | 2.8 | 1.2 | | | |
| Level of Service | | A | | | | | | A | A | | | |
| Approach Delay (s) | | 8.3 | | | 0.0 | | | 2.5 | | | 0.0 | |
| Approach LOS | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 5.4 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.97 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 94.9% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| RTOR Reduction (vph) | 765 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 168 | 0 | 0 | 0 | 0 | 2279 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 11.0 | | | | | 32.0 |
| Effective Green, g (s) | 12.0 | | | | | 33.0 |
| Actuated g/C Ratio | 0.16 | | | | | 0.43 |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 542 | | | | | 2208 |
| v/s Ratio Prot | c0.05 | | | | | c0.45 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.31 | | | | | 1.03 |
| Uniform Delay, d1 | 28.3 | | | | | 21.5 |
| Progression Factor | 1.73 | | | | | 1.00 |
| Incremental Delay, d2 | 0.5 | | | | | 28.0 |
| Delay (s) | 49.6 | | | | | 49.5 |
| Level of Service | D | | | | | D |
| Approach Delay (s) | 49.6 | | 0.0 | | | 49.5 |
| Approach LOS | D | | A | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 49.5 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 31.0 |
| Intersection Capacity Utilization | 84.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| RTOR Reduction (vph) | 101 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 19 | 0 | 0 | 2334 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 11.0 | | | 32.0 | | |
| Effective Green, g (s) | 12.0 | | | 33.0 | | |
| Actuated g/C Ratio | 0.16 | | | 0.43 | | |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 542 | | | 2208 | | |
| v/s Ratio Prot | c0.01 | | | c0.46 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.03 | | | 1.06 | | |
| Uniform Delay, d1 | 27.1 | | | 21.5 | | |
| Progression Factor | 1.00 | | | 1.00 | | |
| Incremental Delay, d2 | 0.0 | | | 36.3 | | |
| Delay (s) | 27.1 | | | 57.8 | | |
| Level of Service | C | | | E | | |
| Approach Delay (s) | 27.1 | | | 57.8 | 0.0 | |
| Approach LOS | C | | | E | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 56.3 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 0.78 | | |
| Actuated Cycle Length (s) | 76.0 | Sum of lost time (s) | 31.0 |
| Intersection Capacity Utilization | 120.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Bell Road & Jackrabbit Trail Pakrway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1380 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 65.0 | | | | | | 68.0 | 68.0 |
| Effective Green, g (s) | | | | | 66.0 | | | | | | 69.0 | 69.0 |
| Actuated g/C Ratio | | | | | 0.47 | | | | | | 0.49 | 0.49 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2380 | | | | | | 2488 | 1364 |
| v/s Ratio Prot | | | | | c0.32 | | | | | | 0.36 | c0.50 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.67 | | | | | | 0.73 | 1.01 |
| Uniform Delay, d1 | | | | | 29.1 | | | | | | 28.7 | 36.0 |
| Progression Factor | | | | | 0.01 | | | | | | 0.37 | 0.45 |
| Incremental Delay, d2 | | | | | 0.6 | | | | | | 0.5 | 18.5 |
| Delay (s) | | | | | 0.8 | | | | | | 11.1 | 34.7 |
| Level of Service | | | | | A | | | | | | B | C |
| Approach Delay (s) | | 0.0 | | | 0.8 | | | 0.0 | | | 21.3 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 14.5 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.85 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 86.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 635 | 0 | 2036 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 633 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 65.0 | 65.0 | | 68.0 | | | | |
| Effective Green, g (s) | | | | | 66.0 | 66.0 | | 69.0 | | | | |
| Actuated g/C Ratio | | | | | 0.47 | 0.47 | | 0.49 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2380 | 741 | | 2488 | | | | |
| v/s Ratio Prot | | | | | 0.32 | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | c0.40 | | | | | | |
| v/c Ratio | | | | | 0.67 | 0.85 | | 0.82 | | | | |
| Uniform Delay, d1 | | | | | 29.1 | 33.3 | | 30.7 | | | | |
| Progression Factor | | | | | 0.51 | 0.59 | | 0.00 | | | | |
| Incremental Delay, d2 | | | | | 0.6 | 7.5 | | 1.6 | | | | |
| Delay (s) | | | | | 15.4 | 27.1 | | 1.7 | | | | |
| Level of Service | | | | | B | C | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 18.7 | | | 1.7 | | | 0.0 | |
| Approach LOS | | A | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.84 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 86.2% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.91 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 5085 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 5085 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 1823 | 415 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 1823 | 415 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 359 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 1823 | 56 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 70.0 | 18.0 | |
| Effective Green, g (s) | | | | 71.0 | 19.0 | |
| Actuated g/C Ratio | | | | 0.50 | 0.13 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | | | 2561 | 463 | |
| v/s Ratio Prot | | | | c0.36 | c0.02 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.71 | 0.12 | |
| Uniform Delay, d1 | | | | 27.1 | 53.7 | |
| Progression Factor | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | | | 1.7 | 0.1 | |
| Delay (s) | | | | 28.8 | 53.8 | |
| Level of Service | | | | C | D | |
| Approach Delay (s) | 0.0 | | | 28.8 | 53.8 | |
| Approach LOS | A | | | C | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 33.4 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 51.0 |
| Intersection Capacity Utilization | 92.3% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: WB Left U-Turn & Bell Road

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.91 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 5085 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 5085 | | | 3433 | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 416 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 416 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 360 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 56 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 70.0 | | | 18.0 | |
| Effective Green, g (s) | | 71.0 | | | 19.0 | |
| Actuated g/C Ratio | | 0.50 | | | 0.13 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | 2561 | | | 463 | |
| v/s Ratio Prot | | c0.50 | | | c0.02 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 0.99 | | | 0.12 | |
| Uniform Delay, d1 | | 34.6 | | | 53.7 | |
| Progression Factor | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 15.2 | | | 0.3 | |
| Delay (s) | | 49.7 | | | 53.9 | |
| Level of Service | | D | | | D | |
| Approach Delay (s) | | 49.7 | 0.0 | | 53.9 | |
| Approach LOS | | D | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 50.3 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 51.0 |
| Intersection Capacity Utilization | 105.3% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 1.00 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 1583 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 1583 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 2530 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 413 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 65.0 | 65.0 | | | | | | | | 68.0 | |
| Effective Green, g (s) | | 66.0 | 66.0 | | | | | | | | 69.0 | |
| Actuated g/C Ratio | | 0.47 | 0.47 | | | | | | | | 0.49 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2380 | 741 | | | | | | | | 2488 | |
| v/s Ratio Prot | | c0.50 | | | | | | | | | c0.36 | |
| v/s Ratio Perm | | | 0.26 | | | | | | | | | |
| v/c Ratio | | 1.06 | 0.56 | | | | | | | | 0.73 | |
| Uniform Delay, d1 | | 37.5 | 27.0 | | | | | | | | 28.7 | |
| Progression Factor | | 0.51 | 0.28 | | | | | | | | 0.04 | |
| Incremental Delay, d2 | | 32.9 | 0.4 | | | | | | | | 0.8 | |
| Delay (s) | | 51.9 | 7.9 | | | | | | | | 2.0 | |
| Level of Service | | D | A | | | | | | | | A | |
| Approach Delay (s) | | 45.7 | | | 0.0 | | | 0.0 | | | 2.0 | |
| Approach LOS | | D | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 29.0 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.89 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 90.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road and Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 65.0 | | | | | | 68.0 | 68.0 | | | |
| Effective Green, g (s) | | 66.0 | | | | | | 69.0 | 69.0 | | | |
| Actuated g/C Ratio | | 0.47 | | | | | | 0.49 | 0.49 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2380 | | | | | | 2488 | 775 | | | |
| v/s Ratio Prot | | c0.50 | | | | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.26 | | | |
| v/c Ratio | | 1.06 | | | | | | 0.82 | 0.54 | | | |
| Uniform Delay, d1 | | 37.5 | | | | | | 30.7 | 25.0 | | | |
| Progression Factor | | 0.03 | | | | | | 0.17 | 0.08 | | | |
| Incremental Delay, d2 | | 29.5 | | | | | | 0.9 | 0.7 | | | |
| Delay (s) | | 30.6 | | | | | | 6.0 | 2.8 | | | |
| Level of Service | | C | | | | | | A | A | | | |
| Approach Delay (s) | | 30.6 | | | 0.0 | | | 5.5 | | | 0.0 | |
| Approach LOS | | C | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 18.2 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 94.9% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| RTOR Reduction (vph) | 741 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 192 | 0 | 0 | 0 | 0 | 2279 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 23.0 | | | | | 63.0 |
| Effective Green, g (s) | 24.0 | | | | | 64.0 |
| Actuated g/C Ratio | 0.17 | | | | | 0.45 |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 584 | | | | | 2308 |
| v/s Ratio Prot | c0.06 | | | | | c0.45 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.33 | | | | | 0.99 |
| Uniform Delay, d1 | 51.4 | | | | | 38.1 |
| Progression Factor | 0.91 | | | | | 1.00 |
| Incremental Delay, d2 | 0.8 | | | | | 15.7 |
| Delay (s) | 47.4 | | | | | 53.8 |
| Level of Service | D | | | | | D |
| Approach Delay (s) | 47.4 | | 0.0 | | | 53.8 |
| Approach LOS | D | | A | | | D |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 51.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.81 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 53.0 |
| Intersection Capacity Utilization | 84.3% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| RTOR Reduction (vph) | 100 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 20 | 0 | 0 | 2334 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 23.0 | | | 63.0 | | |
| Effective Green, g (s) | 24.0 | | | 64.0 | | |
| Actuated g/C Ratio | 0.17 | | | 0.45 | | |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 584 | | | 2308 | | |
| v/s Ratio Prot | c0.01 | | | c0.46 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.03 | | | 1.01 | | |
| Uniform Delay, d1 | 48.8 | | | 38.5 | | |
| Progression Factor | 1.00 | | | 1.00 | | |
| Incremental Delay, d2 | 0.1 | | | 21.5 | | |
| Delay (s) | 48.9 | | | 60.0 | | |
| Level of Service | D | | | E | | |
| Approach Delay (s) | 48.9 | | | 60.0 | 0.0 | |
| Approach LOS | D | | | E | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 59.5 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 0.74 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 53.0 |
| Intersection Capacity Utilization | 92.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2536 | 0 | 0 | 0 | 0 | 0 | 1823 | 456 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2536 | 0 | 0 | 0 | 0 | 0 | 1823 | 456 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2536 | 0 | 0 | 0 | 0 | 0 | 1823 | 455 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 56.0 | | | | | | 42.0 | 42.0 |
| Effective Green, g (s) | | | | | 57.0 | | | | | | 43.0 | 43.0 |
| Actuated g/C Ratio | | | | | 0.54 | | | | | | 0.41 | 0.41 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2734 | | | | | | 2063 | 1131 |
| v/s Ratio Prot | | | | | c0.50 | | | | | | c0.36 | 0.16 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.93 | | | | | | 0.88 | 0.40 |
| Uniform Delay, d1 | | | | | 22.6 | | | | | | 29.2 | 22.4 |
| Progression Factor | | | | | 0.03 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | | 2.5 | | | | | | 4.9 | 0.2 |
| Delay (s) | | | | | 3.2 | | | | | | 34.1 | 22.6 |
| Level of Service | | | | | A | | | | | | C | C |
| Approach Delay (s) | | 0.0 | | | 3.2 | | | 0.0 | | | 31.8 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 16.8 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 106.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 95.0% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 2536 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2536 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2536 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 56.0 | 56.0 | | 42.0 | | | | |
| Effective Green, g (s) | | | | | 57.0 | 57.0 | | 43.0 | | | | |
| Actuated g/C Ratio | | | | | 0.54 | 0.54 | | 0.41 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2734 | 851 | | 2063 | | | | |
| v/s Ratio Prot | | | | | c0.50 | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | 0.26 | | | | | | |
| v/c Ratio | | | | | 0.93 | 0.49 | | 0.99 | | | | |
| Uniform Delay, d1 | | | | | 22.6 | 15.3 | | 31.2 | | | | |
| Progression Factor | | | | | 0.75 | 0.85 | | 0.08 | | | | |
| Incremental Delay, d2 | | | | | 5.2 | 0.4 | | 7.3 | | | | |
| Delay (s) | | | | | 22.1 | 13.4 | | 9.9 | | | | |
| Level of Service | | | | | C | B | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 20.9 | | | 9.9 | | | 0.0 | |
| Approach LOS | | A | | | C | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 16.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 106.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 95.0% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
4: Bell Road & EB Left U-turn

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SWL | SWR |
|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | ↰↰ | | | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | 3.0 | | | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | 0.97 | | | 1.00 |
| Frt | | | | | 1.00 | | 1.00 | | | 0.86 |
| Flt Protected | | | | | 1.00 | | 0.95 | | | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | 3433 | | | 1611 |
| Flt Permitted | | | | | 1.00 | | 0.95 | | | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | 3433 | | | 1611 |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 415 | 0 | 0 | 933 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 415 | 0 | 0 | 933 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 82 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 411 | 0 | 0 | 851 |
| Turn Type | | | | | | | | | | |
| Protected Phases | | | | | 1 7 | | 3 5 | | | |
| Permitted Phases | | | | | | | | | | 1 7 |
| Actuated Green, G (s) | | | | | 67.5 | | 30.5 | | | 67.5 |
| Effective Green, g (s) | | | | | 68.5 | | 31.5 | | | 68.5 |
| Actuated g/C Ratio | | | | | 0.65 | | 0.30 | | | 0.65 |
| Clearance Time (s) | | | | | | | | | | |
| Vehicle Extension (s) | | | | | | | | | | |
| Lane Grp Cap (vph) | | | | | 3286 | | 1020 | | | 1041 |
| v/s Ratio Prot | | | | | 0.32 | | c0.12 | | | |
| v/s Ratio Perm | | | | | | | | | | c0.53 |
| v/c Ratio | | | | | 0.49 | | 0.40 | | | 0.82 |
| Uniform Delay, d1 | | | | | 9.7 | | 29.7 | | | 14.1 |
| Progression Factor | | | | | 1.00 | | 1.62 | | | 0.74 |
| Incremental Delay, d2 | | | | | 0.5 | | 0.4 | | | 3.6 |
| Delay (s) | | | | | 10.2 | | 48.6 | | | 14.0 |
| Level of Service | | | | | B | | D | | | B |
| Approach Delay (s) | | 0.0 | | | 10.2 | | 48.6 | | 14.0 | |
| Approach LOS | | A | | | B | | D | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 16.8 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 106.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 95.4% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
5: WB Left U-Turn & Bell Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | SBL | SBR | NEL | NER |
|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | ↰↰ | | | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | 3.0 | | | 3.0 |
| Lane Util. Factor | | 0.91 | | | | | 0.97 | | | 1.00 |
| Frt | | 1.00 | | | | | 1.00 | | | 0.86 |
| Flt Protected | | 1.00 | | | | | 0.95 | | | 1.00 |
| Satd. Flow (prot) | | 5085 | | | | | 3433 | | | 1611 |
| Flt Permitted | | 1.00 | | | | | 0.95 | | | 1.00 |
| Satd. Flow (perm) | | 5085 | | | | | 3433 | | | 1611 |
| Volume (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 416 | 0 | 0 | 120 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 416 | 0 | 0 | 120 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 42 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 413 | 0 | 0 | 78 |
| Turn Type | | | | | | | Prot | | | custom |
| Protected Phases | | 1 7 | | | | | 3 5 | | | |
| Permitted Phases | | | | | | | | | | 1 7 |
| Actuated Green, G (s) | | 67.5 | | | | | 30.5 | | | 67.5 |
| Effective Green, g (s) | | 68.5 | | | | | 31.5 | | | 68.5 |
| Actuated g/C Ratio | | 0.65 | | | | | 0.30 | | | 0.65 |
| Clearance Time (s) | | | | | | | | | | |
| Vehicle Extension (s) | | | | | | | | | | |
| Lane Grp Cap (vph) | | 3286 | | | | | 1020 | | | 1041 |
| v/s Ratio Prot | | c0.50 | | | | | c0.12 | | | |
| v/s Ratio Perm | | | | | | | | | | 0.05 |
| v/c Ratio | | 0.77 | | | | | 0.41 | | | 0.07 |
| Uniform Delay, d1 | | 13.2 | | | | | 29.8 | | | 7.0 |
| Progression Factor | | 1.00 | | | | | 1.58 | | | 1.00 |
| Incremental Delay, d2 | | 1.7 | | | | | 0.6 | | | 0.1 |
| Delay (s) | | 14.9 | | | | | 47.5 | | | 7.0 |
| Level of Service | | B | | | | | D | | | A |
| Approach Delay (s) | | 14.9 | | | 0.0 | | 47.5 | | 7.0 | |
| Approach LOS | | B | | | A | | D | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 19.0 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 106.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 67.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 1.00 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 1583 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 1583 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 2650 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2650 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2650 | 415 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 56.0 | 56.0 | | | | | | | | 42.0 | |
| Effective Green, g (s) | | 57.0 | 57.0 | | | | | | | | 43.0 | |
| Actuated g/C Ratio | | 0.54 | 0.54 | | | | | | | | 0.41 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2734 | 851 | | | | | | | | 2063 | |
| v/s Ratio Prot | | c0.52 | | | | | | | | | c0.36 | |
| v/s Ratio Perm | | | 0.26 | | | | | | | | | |
| v/c Ratio | | 0.97 | 0.49 | | | | | | | | 0.88 | |
| Uniform Delay, d1 | | 23.7 | 15.4 | | | | | | | | 29.2 | |
| Progression Factor | | 0.74 | 0.91 | | | | | | | | 0.06 | |
| Incremental Delay, d2 | | 8.5 | 0.3 | | | | | | | | 2.3 | |
| Delay (s) | | 25.9 | 14.3 | | | | | | | | 4.1 | |
| Level of Service | | C | B | | | | | | | | A | |
| Approach Delay (s) | | 24.4 | | | 0.0 | | | 0.0 | | | 4.1 | |
| Approach LOS | | C | | | A | | | A | | | A | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM Average Control Delay | 16.8 | HCM Level of Service | B | |
| HCM Volume to Capacity ratio | 0.93 | | | |
| Actuated Cycle Length (s) | 106.0 | Sum of lost time (s) | 6.0 | |
| Intersection Capacity Utilization | 93.1% | ICU Level of Service | F | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 2650 | 0 | 0 | 0 | 0 | 0 | 2036 | 298 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2650 | 0 | 0 | 0 | 0 | 0 | 2036 | 298 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2650 | 0 | 0 | 0 | 0 | 0 | 2036 | 297 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 56.0 | | | | | | 42.0 | 42.0 | | | |
| Effective Green, g (s) | | 57.0 | | | | | | 43.0 | 43.0 | | | |
| Actuated g/C Ratio | | 0.54 | | | | | | 0.41 | 0.41 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2734 | | | | | | 2063 | 642 | | | |
| v/s Ratio Prot | | c0.52 | | | | | | c0.40 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.19 | | | |
| v/c Ratio | | 0.97 | | | | | | 0.99 | 0.46 | | | |
| Uniform Delay, d1 | | 23.7 | | | | | | 31.2 | 23.1 | | | |
| Progression Factor | | 0.03 | | | | | | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 4.3 | | | | | | 17.0 | 2.3 | | | |
| Delay (s) | | 5.1 | | | | | | 48.2 | 25.3 | | | |
| Level of Service | | A | | | | | | D | C | | | |
| Approach Delay (s) | | 5.1 | | | 0.0 | | | 45.3 | | | 0.0 | |
| Approach LOS | | A | | | A | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 23.9 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.98 | | |
| Actuated Cycle Length (s) | 106.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 97.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 50.0 | | | | | | 72.0 | 72.0 |
| Effective Green, g (s) | | | | | 51.0 | | | | | | 73.0 | 73.0 |
| Actuated g/C Ratio | | | | | 0.39 | | | | | | 0.56 | 0.56 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 1995 | | | | | | 2855 | 1565 |
| v/s Ratio Prot | | | | | c0.42 | | | | | | 0.25 | c0.59 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 1.07 | | | | | | 0.44 | 1.04 |
| Uniform Delay, d1 | | | | | 39.5 | | | | | | 16.6 | 28.5 |
| Progression Factor | | | | | 0.05 | | | | | | 1.14 | 1.10 |
| Incremental Delay, d2 | | | | | 33.9 | | | | | | 0.1 | 27.9 |
| Delay (s) | | | | | 35.7 | | | | | | 19.0 | 59.1 |
| Level of Service | | | | | D | | | | | | B | E |
| Approach Delay (s) | | 0.0 | | | 35.7 | | | 0.0 | | | 41.6 | |
| Approach LOS | | A | | | D | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 39.1 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 1.05 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 50.0 | 50.0 | | 72.0 | | | | |
| Effective Green, g (s) | | | | | 51.0 | 51.0 | | 73.0 | | | | |
| Actuated g/C Ratio | | | | | 0.39 | 0.39 | | 0.56 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 1995 | 621 | | 2855 | | | | |
| v/s Ratio Prot | | | | | 0.42 | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | c0.55 | | | | | | |
| v/c Ratio | | | | | 1.07 | 1.40 | | 1.09 | | | | |
| Uniform Delay, d1 | | | | | 39.5 | 39.5 | | 28.5 | | | | |
| Progression Factor | | | | | 0.59 | 0.58 | | 0.05 | | | | |
| Incremental Delay, d2 | | | | | 33.9 | 182.8 | | 42.4 | | | | |
| Delay (s) | | | | | 57.0 | 205.8 | | 43.9 | | | | |
| Level of Service | | | | | E | F | | D | | | | |
| Approach Delay (s) | | 0.0 | | | 100.1 | | | 43.9 | | | 0.0 | |
| Approach LOS | | A | | | F | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 71.5 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 1.22 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.91 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 5085 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 5085 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 2630 | 382 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 2630 | 382 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 332 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 2630 | 50 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 51.0 | 16.0 | |
| Effective Green, g (s) | | | | 53.0 | 17.0 | |
| Actuated g/C Ratio | | | | 0.41 | 0.13 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | | | 2073 | 449 | |
| v/s Ratio Prot | | | | c0.52 | c0.01 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 1.27 | 0.11 | |
| Uniform Delay, d1 | | | | 38.5 | 49.8 | |
| Progression Factor | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | | | 124.9 | 0.3 | |
| Delay (s) | | | | 163.4 | 50.1 | |
| Level of Service | | | | F | D | |
| Approach Delay (s) | 0.0 | | | 163.4 | 50.1 | |
| Approach LOS | A | | | F | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 149.0 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 60.0 |
| Intersection Capacity Utilization | 95.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.91 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 5085 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 5085 | | | 3433 | |
| Volume (vph) | 0 | 2627 | 0 | 0 | 379 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2627 | 0 | 0 | 379 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 329 | 0 |
| Lane Group Flow (vph) | 0 | 2627 | 0 | 0 | 50 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 51.0 | | | 16.0 | |
| Effective Green, g (s) | | 53.0 | | | 17.0 | |
| Actuated g/C Ratio | | 0.41 | | | 0.13 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | 2073 | | | 449 | |
| v/s Ratio Prot | | c0.52 | | | c0.01 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 1.27 | | | 0.11 | |
| Uniform Delay, d1 | | 38.5 | | | 49.8 | |
| Progression Factor | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 124.2 | | | 0.0 | |
| Delay (s) | | 162.7 | | | 49.9 | |
| Level of Service | | F | | | D | |
| Approach Delay (s) | | 162.7 | 0.0 | | 49.9 | |
| Approach LOS | | F | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 148.5 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 60.0 |
| Intersection Capacity Utilization | 123.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 1.00 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 1583 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 1583 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 1699 | 1307 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 1307 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 1275 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 50.0 | 50.0 | | | | | | | | 72.0 | |
| Effective Green, g (s) | | 51.0 | 51.0 | | | | | | | | 73.0 | |
| Actuated g/C Ratio | | 0.39 | 0.39 | | | | | | | | 0.56 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 1995 | 621 | | | | | | | | 2855 | |
| v/s Ratio Prot | | 0.33 | | | | | | | | | c0.25 | |
| v/s Ratio Perm | | | c0.81 | | | | | | | | | |
| v/c Ratio | | 0.85 | 2.05 | | | | | | | | 0.44 | |
| Uniform Delay, d1 | | 36.0 | 39.5 | | | | | | | | 16.6 | |
| Progression Factor | | 0.62 | 0.58 | | | | | | | | 0.08 | |
| Incremental Delay, d2 | | 0.4 | 474.3 | | | | | | | | 0.1 | |
| Delay (s) | | 22.7 | 497.1 | | | | | | | | 1.5 | |
| Level of Service | | C | F | | | | | | | | A | |
| Approach Delay (s) | | 229.0 | | | 0.0 | | | 0.0 | | | 1.5 | |
| Approach LOS | | F | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 161.5 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.11 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 112.1% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 620 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 50.0 | | | | | | 72.0 | 72.0 | | | |
| Effective Green, g (s) | | 51.0 | | | | | | 73.0 | 73.0 | | | |
| Actuated g/C Ratio | | 0.39 | | | | | | 0.56 | 0.56 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 1995 | | | | | | 2855 | 889 | | | |
| v/s Ratio Prot | | c0.33 | | | | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.39 | | | |
| v/c Ratio | | 0.85 | | | | | | 1.09 | 0.70 | | | |
| Uniform Delay, d1 | | 36.0 | | | | | | 28.5 | 20.5 | | | |
| Progression Factor | | 0.05 | | | | | | 0.55 | 0.48 | | | |
| Incremental Delay, d2 | | 1.9 | | | | | | 42.4 | 0.4 | | | |
| Delay (s) | | 3.6 | | | | | | 58.2 | 10.2 | | | |
| Level of Service | | A | | | | | | E | B | | | |
| Approach Delay (s) | | 3.6 | | | 0.0 | | | 50.2 | | | 0.0 | |
| Approach LOS | | A | | | A | | | D | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 35.7 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| RTOR Reduction (vph) | 586 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 795 | 0 | 0 | 0 | 0 | 1519 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 21.0 | | | | | 63.0 |
| Effective Green, g (s) | 22.0 | | | | | 65.0 |
| Actuated g/C Ratio | 0.17 | | | | | 0.50 |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 581 | | | | | 2543 |
| v/s Ratio Prot | c0.23 | | | | | c0.30 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 1.37 | | | | | 0.60 |
| Uniform Delay, d1 | 54.0 | | | | | 23.2 |
| Progression Factor | 0.64 | | | | | 1.00 |
| Incremental Delay, d2 | 167.0 | | | | | 0.4 |
| Delay (s) | 201.5 | | | | | 23.6 |
| Level of Service | F | | | | | C |
| Approach Delay (s) | 201.5 | | 0.0 | | | 23.6 |
| Approach LOS | F | | A | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 108.3 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 43.0 |
| Intersection Capacity Utilization | 86.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| RTOR Reduction (vph) | 116 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 24 | 0 | 0 | 3601 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 21.0 | | | 63.0 | | |
| Effective Green, g (s) | 22.0 | | | 65.0 | | |
| Actuated g/C Ratio | 0.17 | | | 0.50 | | |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 581 | | | 2543 | | |
| v/s Ratio Prot | c0.01 | | | c0.71 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.04 | | | 1.42 | | |
| Uniform Delay, d1 | 45.2 | | | 32.5 | | |
| Progression Factor | 1.00 | | | 1.00 | | |
| Incremental Delay, d2 | 0.0 | | | 189.6 | | |
| Delay (s) | 45.2 | | | 222.1 | | |
| Level of Service | D | | | F | | |
| Approach Delay (s) | 45.2 | | | 222.1 | 0.0 | |
| Approach LOS | D | | | F | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 215.5 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.07 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 43.0 |
| Intersection Capacity Utilization | 123.3% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 61.0 | | | | | | 81.0 | 81.0 |
| Effective Green, g (s) | | | | | 62.0 | | | | | | 82.0 | 82.0 |
| Actuated g/C Ratio | | | | | 0.41 | | | | | | 0.55 | 0.55 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2102 | | | | | | 2780 | 1524 |
| v/s Ratio Prot | | | | | c0.42 | | | | | | 0.25 | c0.59 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 1.02 | | | | | | 0.46 | 1.07 |
| Uniform Delay, d1 | | | | | 44.0 | | | | | | 20.5 | 34.0 |
| Progression Factor | | | | | 0.04 | | | | | | 0.99 | 0.99 |
| Incremental Delay, d2 | | | | | 11.3 | | | | | | 0.1 | 38.7 |
| Delay (s) | | | | | 12.9 | | | | | | 20.4 | 72.3 |
| Level of Service | | | | | B | | | | | | C | E |
| Approach Delay (s) | | 0.0 | | | 12.9 | | | 0.0 | | | 49.6 | |
| Approach LOS | | A | | | B | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 34.0 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 1.05 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 61.0 | 61.0 | | 81.0 | | | | |
| Effective Green, g (s) | | | | | 62.0 | 62.0 | | 82.0 | | | | |
| Actuated g/C Ratio | | | | | 0.41 | 0.41 | | 0.55 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2102 | 654 | | 2780 | | | | |
| v/s Ratio Prot | | | | | 0.42 | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | c0.55 | | | | | | |
| v/c Ratio | | | | | 1.02 | 1.33 | | 1.12 | | | | |
| Uniform Delay, d1 | | | | | 44.0 | 44.0 | | 34.0 | | | | |
| Progression Factor | | | | | 0.45 | 0.45 | | 0.06 | | | | |
| Incremental Delay, d2 | | | | | 11.3 | 151.0 | | 55.6 | | | | |
| Delay (s) | | | | | 30.9 | 170.7 | | 57.4 | | | | |
| Level of Service | | | | | C | F | | E | | | | |
| Approach Delay (s) | | 0.0 | | | 71.4 | | | 57.4 | | | 0.0 | |
| Approach LOS | | A | | | E | | | E | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 64.3 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 1.21 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.91 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 5085 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 5085 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 2630 | 382 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 2630 | 382 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 349 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 2630 | 33 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 66.0 | 12.0 | |
| Effective Green, g (s) | | | | 68.0 | 13.0 | |
| Actuated g/C Ratio | | | | 0.45 | 0.09 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | | | 2305 | 298 | |
| v/s Ratio Prot | | | | c0.52 | c0.01 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 1.14 | 0.11 | |
| Uniform Delay, d1 | | | | 41.0 | 63.2 | |
| Progression Factor | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | | | 69.2 | 0.4 | |
| Delay (s) | | | | 110.2 | 63.6 | |
| Level of Service | | | | F | E | |
| Approach Delay (s) | 0.0 | | | 110.2 | 63.6 | |
| Approach LOS | A | | | F | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 104.3 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.98 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 69.0 |
| Intersection Capacity Utilization | 95.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Bell Road & WB Left U-Turn

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.91 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 5085 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 5085 | | | 3433 | |
| Volume (vph) | 0 | 2627 | 0 | 0 | 379 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2627 | 0 | 0 | 379 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 346 | 0 |
| Lane Group Flow (vph) | 0 | 2627 | 0 | 0 | 33 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 66.0 | | | 12.0 | |
| Effective Green, g (s) | | 68.0 | | | 13.0 | |
| Actuated g/C Ratio | | 0.45 | | | 0.09 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | 2305 | | | 298 | |
| v/s Ratio Prot | | c0.52 | | | c0.01 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 1.14 | | | 0.11 | |
| Uniform Delay, d1 | | 41.0 | | | 63.2 | |
| Progression Factor | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 68.7 | | | 0.1 | |
| Delay (s) | | 109.7 | | | 63.2 | |
| Level of Service | | F | | | E | |
| Approach Delay (s) | | 109.7 | 0.0 | | 63.2 | |
| Approach LOS | | F | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 103.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.97 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 69.0 |
| Intersection Capacity Utilization | 123.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱↑ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 0.88 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 2787 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 2787 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 1699 | 1307 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 1307 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 1257 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Turn Type | | | Prot | | | | | | | | | |
| Protected Phases | | 2 | 2 | | | | | | | | 8 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 61.0 | 61.0 | | | | | | | | 81.0 | |
| Effective Green, g (s) | | 62.0 | 62.0 | | | | | | | | 82.0 | |
| Actuated g/C Ratio | | 0.41 | 0.41 | | | | | | | | 0.55 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2102 | 1152 | | | | | | | | 2780 | |
| v/s Ratio Prot | | 0.33 | c0.45 | | | | | | | | c0.25 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.81 | 1.09 | | | | | | | | 0.46 | |
| Uniform Delay, d1 | | 38.8 | 44.0 | | | | | | | | 20.5 | |
| Progression Factor | | 0.49 | 0.45 | | | | | | | | 0.07 | |
| Incremental Delay, d2 | | 0.2 | 42.7 | | | | | | | | 0.1 | |
| Delay (s) | | 19.1 | 62.3 | | | | | | | | 1.5 | |
| Level of Service | | B | E | | | | | | | | A | |
| Approach Delay (s) | | 37.9 | | | 0.0 | | | 0.0 | | | 1.5 | |
| Approach LOS | | D | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 27.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 105.1% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 619 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 61.0 | | | | | | 81.0 | 81.0 | | | |
| Effective Green, g (s) | | 62.0 | | | | | | 82.0 | 82.0 | | | |
| Actuated g/C Ratio | | 0.41 | | | | | | 0.55 | 0.55 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2102 | | | | | | 2780 | 865 | | | |
| v/s Ratio Prot | | c0.33 | | | | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.39 | | | |
| v/c Ratio | | 0.81 | | | | | | 1.12 | 0.72 | | | |
| Uniform Delay, d1 | | 38.8 | | | | | | 34.0 | 25.3 | | | |
| Progression Factor | | 0.04 | | | | | | 0.42 | 0.36 | | | |
| Incremental Delay, d2 | | 1.4 | | | | | | 55.6 | 0.5 | | | |
| Delay (s) | | 2.8 | | | | | | 69.7 | 9.6 | | | |
| Level of Service | | A | | | | | | E | A | | | |
| Approach Delay (s) | | 2.8 | | | 0.0 | | | 59.8 | | | 0.0 | |
| Approach LOS | | A | | | A | | | E | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 42.0 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| RTOR Reduction (vph) | 732 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 649 | 0 | 0 | 0 | 0 | 1519 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 21.0 | | | | | 68.0 |
| Effective Green, g (s) | 22.0 | | | | | 70.0 |
| Actuated g/C Ratio | 0.15 | | | | | 0.47 |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 504 | | | | | 2373 |
| v/s Ratio Prot | c0.19 | | | | | c0.30 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 1.29 | | | | | 0.64 |
| Uniform Delay, d1 | 64.0 | | | | | 30.4 |
| Progression Factor | 0.56 | | | | | 1.00 |
| Incremental Delay, d2 | 130.7 | | | | | 0.6 |
| Delay (s) | 166.7 | | | | | 31.0 |
| Level of Service | F | | | | | C |
| Approach Delay (s) | 166.7 | | 0.0 | | | 31.0 |
| Approach LOS | F | | A | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 95.6 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 58.0 |
| Intersection Capacity Utilization | 86.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 11: Jackrabbit Trail Parkway & SB Left U-turn

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| RTOR Reduction (vph) | 119 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 21 | 0 | 0 | 3601 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 21.0 | | | 68.0 | | |
| Effective Green, g (s) | 22.0 | | | 70.0 | | |
| Actuated g/C Ratio | 0.15 | | | 0.47 | | |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 504 | | | 2373 | | |
| v/s Ratio Prot | c0.01 | | | c0.71 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.04 | | | 1.52 | | |
| Uniform Delay, d1 | 54.9 | | | 40.0 | | |
| Progression Factor | 1.00 | | | 1.00 | | |
| Incremental Delay, d2 | 0.1 | | | 235.1 | | |
| Delay (s) | 55.0 | | | 275.1 | | |
| Level of Service | E | | | F | | |
| Approach Delay (s) | 55.0 | | | 275.1 | 0.0 | |
| Approach LOS | E | | | F | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 266.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.16 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 58.0 |
| Intersection Capacity Utilization | 123.3% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1631 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 63.0 | | | | | | 79.0 | 79.0 |
| Effective Green, g (s) | | | | | 64.0 | | | | | | 80.0 | 80.0 |
| Actuated g/C Ratio | | | | | 0.43 | | | | | | 0.53 | 0.53 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2170 | | | | | | 2712 | 1486 |
| v/s Ratio Prot | | | | | c0.42 | | | | | | 0.25 | c0.59 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.99 | | | | | | 0.47 | 1.10 |
| Uniform Delay, d1 | | | | | 42.6 | | | | | | 21.8 | 35.0 |
| Progression Factor | | | | | 0.02 | | | | | | 0.74 | 0.87 |
| Incremental Delay, d2 | | | | | 6.9 | | | | | | 0.1 | 49.3 |
| Delay (s) | | | | | 7.7 | | | | | | 16.1 | 79.8 |
| Level of Service | | | | | A | | | | | | B | E |
| Approach Delay (s) | | 0.0 | | | 7.7 | | | 0.0 | | | 51.9 | |
| Approach LOS | | A | | | A | | | A | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 33.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 1.05 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 872 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 63.0 | 63.0 | | 79.0 | | | | |
| Effective Green, g (s) | | | | | 64.0 | 64.0 | | 80.0 | | | | |
| Actuated g/C Ratio | | | | | 0.43 | 0.43 | | 0.53 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2170 | 675 | | 2712 | | | | |
| v/s Ratio Prot | | | | | 0.42 | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | c0.55 | | | | | | |
| v/c Ratio | | | | | 0.99 | 1.29 | | 1.15 | | | | |
| Uniform Delay, d1 | | | | | 42.6 | 43.0 | | 35.0 | | | | |
| Progression Factor | | | | | 0.25 | 0.28 | | 0.06 | | | | |
| Incremental Delay, d2 | | | | | 3.4 | 132.4 | | 68.2 | | | | |
| Delay (s) | | | | | 14.2 | 144.3 | | 70.2 | | | | |
| Level of Service | | | | | B | F | | E | | | | |
| Approach Delay (s) | | 0.0 | | | 51.8 | | | 70.2 | | | 0.0 | |
| Approach LOS | | A | | | D | | | E | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 61.2 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 1.21 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 4: EB Left U-turn & Bell Road

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.91 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 5085 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 5085 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 2630 | 382 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 2630 | 382 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 346 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 2630 | 36 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 66.0 | 13.0 | |
| Effective Green, g (s) | | | | 67.0 | 14.0 | |
| Actuated g/C Ratio | | | | 0.45 | 0.09 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | | | 2271 | 320 | |
| v/s Ratio Prot | | | | c0.52 | c0.01 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 1.16 | 0.11 | |
| Uniform Delay, d1 | | | | 41.5 | 62.3 | |
| Progression Factor | | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | | | 76.5 | 0.4 | |
| Delay (s) | | | | 118.0 | 62.7 | |
| Level of Service | | | | F | E | |
| Approach Delay (s) | 0.0 | | | 118.0 | 62.7 | |
| Approach LOS | A | | | F | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 111.0 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.98 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 69.0 |
| Intersection Capacity Utilization | 95.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.91 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 5085 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 5085 | | | 3433 | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 379 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 379 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 344 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 35 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 66.0 | | | 13.0 | |
| Effective Green, g (s) | | 67.0 | | | 14.0 | |
| Actuated g/C Ratio | | 0.45 | | | 0.09 | |
| Clearance Time (s) | | | | | 4.0 | |
| Vehicle Extension (s) | | | | | 8.0 | |
| Lane Grp Cap (vph) | | 2271 | | | 320 | |
| v/s Ratio Prot | | c0.33 | | | c0.01 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 0.75 | | | 0.11 | |
| Uniform Delay, d1 | | 34.5 | | | 62.3 | |
| Progression Factor | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 2.3 | | | 0.1 | |
| Delay (s) | | 36.8 | | | 62.4 | |
| Level of Service | | D | | | E | |
| Approach Delay (s) | | 36.8 | 0.0 | | 62.4 | |
| Approach LOS | | D | A | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 41.4 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 69.0 |
| Intersection Capacity Utilization | 105.1% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 1.00 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 1583 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 1583 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 1699 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 353 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 63.0 | 63.0 | | | | | | | | 79.0 | |
| Effective Green, g (s) | | 64.0 | 64.0 | | | | | | | | 80.0 | |
| Actuated g/C Ratio | | 0.43 | 0.43 | | | | | | | | 0.53 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2170 | 675 | | | | | | | | 2712 | |
| v/s Ratio Prot | | c0.33 | | | | | | | | | c0.25 | |
| v/s Ratio Perm | | | 0.22 | | | | | | | | | |
| v/c Ratio | | 0.78 | 0.52 | | | | | | | | 0.47 | |
| Uniform Delay, d1 | | 37.0 | 31.7 | | | | | | | | 21.8 | |
| Progression Factor | | 0.39 | 0.18 | | | | | | | | 0.06 | |
| Incremental Delay, d2 | | 1.4 | 0.6 | | | | | | | | 0.1 | |
| Delay (s) | | 15.8 | 6.2 | | | | | | | | 1.5 | |
| Level of Service | | B | A | | | | | | | | A | |
| Approach Delay (s) | | 14.0 | | | 0.0 | | | 0.0 | | | 1.5 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 105.1% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 619 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 63.0 | | | | | | 79.0 | 79.0 | | | |
| Effective Green, g (s) | | 64.0 | | | | | | 80.0 | 80.0 | | | |
| Actuated g/C Ratio | | 0.43 | | | | | | 0.53 | 0.53 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2170 | | | | | | 2712 | 844 | | | |
| v/s Ratio Prot | | c0.33 | | | | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.39 | | | |
| v/c Ratio | | 0.78 | | | | | | 1.15 | 0.73 | | | |
| Uniform Delay, d1 | | 37.0 | | | | | | 35.0 | 26.8 | | | |
| Progression Factor | | 0.00 | | | | | | 0.12 | 0.02 | | | |
| Incremental Delay, d2 | | 1.2 | | | | | | 68.2 | 0.5 | | | |
| Delay (s) | | 1.3 | | | | | | 72.3 | 1.2 | | | |
| Level of Service | | A | | | | | | E | A | | | |
| Approach Delay (s) | | 1.3 | | | 0.0 | | | 60.5 | | | 0.0 | |
| Approach LOS | | A | | | A | | | E | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 42.0 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 120.9% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.91 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 5085 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 5085 |
| Volume (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| RTOR Reduction (vph) | 752 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 629 | 0 | 0 | 0 | 0 | 1519 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 16.0 | | | | | 76.0 |
| Effective Green, g (s) | 17.0 | | | | | 77.0 |
| Actuated g/C Ratio | 0.11 | | | | | 0.51 |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 389 | | | | | 2610 |
| v/s Ratio Prot | c0.18 | | | | | c0.30 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 1.62 | | | | | 0.58 |
| Uniform Delay, d1 | 66.5 | | | | | 25.3 |
| Progression Factor | 0.78 | | | | | 1.00 |
| Incremental Delay, d2 | 278.8 | | | | | 0.3 |
| Delay (s) | 330.5 | | | | | 25.7 |
| Level of Service | F | | | | | C |
| Approach Delay (s) | 330.5 | | 0.0 | | | 25.7 |
| Approach LOS | F | | A | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 170.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 56.0 |
| Intersection Capacity Utilization | 86.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.91 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 5085 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 5085 | | |
| Volume (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| RTOR Reduction (vph) | 124 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 16 | 0 | 0 | 3601 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 16.0 | | | 76.0 | | |
| Effective Green, g (s) | 17.0 | | | 77.0 | | |
| Actuated g/C Ratio | 0.11 | | | 0.51 | | |
| Clearance Time (s) | 4.0 | | | | | |
| Vehicle Extension (s) | 8.0 | | | | | |
| Lane Grp Cap (vph) | 389 | | | 2610 | | |
| v/s Ratio Prot | c0.00 | | | c0.71 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.04 | | | 1.38 | | |
| Uniform Delay, d1 | 59.2 | | | 36.5 | | |
| Progression Factor | 1.00 | | | 1.00 | | |
| Incremental Delay, d2 | 0.2 | | | 173.3 | | |
| Delay (s) | 59.4 | | | 209.8 | | |
| Level of Service | E | | | F | | |
| Approach Delay (s) | 59.4 | | | 209.8 | 0.0 | |
| Approach LOS | E | | | F | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 204.2 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.14 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 56.0 |
| Intersection Capacity Utilization | 105.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | | | | | ↑↑↑ | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | | | | | 0.91 | 1.00 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | | | | | 5085 | 1583 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | | | | | 5085 | 1583 |
| Volume (vph) | 0 | 0 | 0 | 0 | 3521 | 0 | 0 | 0 | 0 | 0 | 1268 | 251 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 3521 | 0 | 0 | 0 | 0 | 0 | 1268 | 251 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 3521 | 0 | 0 | 0 | 0 | 0 | 1268 | 251 |
| Turn Type | | | | | | | | | | | | Perm |
| Protected Phases | | | | | 6 | | | | | | 8 | |
| Permitted Phases | | | | | | | | | | | | 8 |
| Actuated Green, G (s) | | | | | 76.0 | | | | | | 66.0 | 66.0 |
| Effective Green, g (s) | | | | | 77.0 | | | | | | 67.0 | 67.0 |
| Actuated g/C Ratio | | | | | 0.51 | | | | | | 0.45 | 0.45 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2610 | | | | | | 2271 | 707 |
| v/s Ratio Prot | | | | | c0.69 | | | | | | c0.25 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.16 |
| v/c Ratio | | | | | 1.35 | | | | | | 0.56 | 0.36 |
| Uniform Delay, d1 | | | | | 36.5 | | | | | | 30.6 | 27.3 |
| Progression Factor | | | | | 0.03 | | | | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | | 157.3 | | | | | | 0.3 | 0.3 |
| Delay (s) | | | | | 158.4 | | | | | | 30.9 | 27.6 |
| Level of Service | | | | | F | | | | | | C | C |
| Approach Delay (s) | | 0.0 | | | 158.4 | | | 0.0 | | | 30.3 | |
| Approach LOS | | A | | | F | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 119.8 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.98 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 135.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Jackrabbit Trail Parkway & Bell Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | ↱ | | ↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.91 | 1.00 | | 0.91 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 5085 | 1583 | | 5085 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 5085 | 1583 | | 5085 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 3521 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 3521 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 3521 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 76.0 | 76.0 | | 66.0 | | | | |
| Effective Green, g (s) | | | | | 77.0 | 77.0 | | 67.0 | | | | |
| Actuated g/C Ratio | | | | | 0.51 | 0.51 | | 0.45 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2610 | 813 | | 2271 | | | | |
| v/s Ratio Prot | | | | | c0.69 | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | 0.24 | | | | | | |
| v/c Ratio | | | | | 1.35 | 0.47 | | 1.37 | | | | |
| Uniform Delay, d1 | | | | | 36.5 | 23.4 | | 41.5 | | | | |
| Progression Factor | | | | | 0.65 | 0.78 | | 0.07 | | | | |
| Incremental Delay, d2 | | | | | 158.6 | 0.3 | | 168.5 | | | | |
| Delay (s) | | | | | 182.1 | 18.6 | | 171.3 | | | | |
| Level of Service | | | | | F | B | | F | | | | |
| Approach Delay (s) | | 0.0 | | | 166.1 | | | 171.3 | | | 0.0 | |
| Approach LOS | | A | | | F | | | F | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 168.4 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.36 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 135.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBR | SWL | SWR |
|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑ | | ↰↰ | | | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | 3.0 | | | 3.0 |
| Lane Util. Factor | | | | | 0.91 | | 0.97 | | | 1.00 |
| Frt | | | | | 1.00 | | 1.00 | | | 0.86 |
| Flt Protected | | | | | 1.00 | | 0.95 | | | 1.00 |
| Satd. Flow (prot) | | | | | 5085 | | 3433 | | | 1611 |
| Flt Permitted | | | | | 1.00 | | 0.95 | | | 1.00 |
| Satd. Flow (perm) | | | | | 5085 | | 3433 | | | 1611 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 382 | 0 | 0 | 1381 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 382 | 0 | 0 | 1381 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 382 | 0 | 0 | 1381 |
| Turn Type | | | | | | | Prot | | | custom |
| Protected Phases | | | | | 1 7 | | 3 5 | | | |
| Permitted Phases | | | | | | | | | | 4 6 |
| Actuated Green, G (s) | | | | | 72.5 | | 69.5 | | | 150.0 |
| Effective Green, g (s) | | | | | 73.5 | | 70.5 | | | 150.0 |
| Actuated g/C Ratio | | | | | 0.49 | | 0.47 | | | 1.00 |
| Clearance Time (s) | | | | | | | | | | |
| Vehicle Extension (s) | | | | | | | | | | |
| Lane Grp Cap (vph) | | | | | 2492 | | 1614 | | | 1611 |
| v/s Ratio Prot | | | | | 0.42 | | 0.11 | | | |
| v/s Ratio Perm | | | | | | | | | | c0.86 |
| v/c Ratio | | | | | 0.86 | | 0.24 | | | 0.86 |
| Uniform Delay, d1 | | | | | 33.7 | | 23.7 | | | 0.0 |
| Progression Factor | | | | | 1.00 | | 1.74 | | | 1.00 |
| Incremental Delay, d2 | | | | | 4.0 | | 0.2 | | | 0.6 |
| Delay (s) | | | | | 37.6 | | 41.5 | | | 0.6 |
| Level of Service | | | | | D | | D | | | A |
| Approach Delay (s) | | 0.0 | | | 37.6 | | 41.5 | | 0.6 | |
| Approach LOS | | A | | | D | | D | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 24.9 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 0.0 |
| Intersection Capacity Utilization | 133.5% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## HCM Signalized Intersection Capacity Analysis
## 5: Bell Road & WB Left U-Turn

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | SBL | SBR | NEL | NER |
|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | ↰↰ | | | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | 3.0 | | | 3.0 |
| Lane Util. Factor | | 0.91 | | | | | 0.97 | | | 1.00 |
| Frt | | 1.00 | | | | | 1.00 | | | 0.86 |
| Flt Protected | | 1.00 | | | | | 0.95 | | | 1.00 |
| Satd. Flow (prot) | | 5085 | | | | | 3433 | | | 1611 |
| Flt Permitted | | 1.00 | | | | | 0.95 | | | 1.00 |
| Satd. Flow (perm) | | 5085 | | | | | 3433 | | | 1611 |
| Volume (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 379 | 0 | 0 | 140 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 379 | 0 | 0 | 140 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 372 | 0 | 0 | 140 |
| Turn Type | | | | | | | | | | |
| Protected Phases | | 1 7 | | | | | 3 5 | | | |
| Permitted Phases | | | | | | | | | | 2 8 |
| Actuated Green, G (s) | | 72.5 | | | | | 69.5 | | | 150.0 |
| Effective Green, g (s) | | 73.5 | | | | | 70.5 | | | 150.0 |
| Actuated g/C Ratio | | 0.49 | | | | | 0.47 | | | 1.00 |
| Clearance Time (s) | | | | | | | | | | |
| Vehicle Extension (s) | | | | | | | | | | |
| Lane Grp Cap (vph) | | 2492 | | | | | 1614 | | | 1611 |
| v/s Ratio Prot | | c0.33 | | | | | c0.11 | | | |
| v/s Ratio Perm | | | | | | | | | | 0.09 |
| v/c Ratio | | 0.68 | | | | | 0.23 | | | 0.09 |
| Uniform Delay, d1 | | 29.3 | | | | | 23.6 | | | 0.0 |
| Progression Factor | | 1.00 | | | | | 1.96 | | | 1.00 |
| Incremental Delay, d2 | | 1.5 | | | | | 0.0 | | | 0.0 |
| Delay (s) | | 30.8 | | | | | 46.3 | | | 0.0 |
| Level of Service | | C | | | | | D | | | A |
| Approach Delay (s) | | 30.8 | | | 0.0 | | 46.3 | | 0.0 | |
| Approach LOS | | C | | | A | | D | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 31.5 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 52.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | ↱ | | | | | | | | ↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.91 | 1.00 | | | | | | | | 0.91 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 5085 | 1583 | | | | | | | | 5085 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 5085 | 1583 | | | | | | | | 5085 | |
| Volume (vph) | 0 | 1839 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1839 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1839 | 368 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 76.0 | 76.0 | | | | | | | | 66.0 | |
| Effective Green, g (s) | | 77.0 | 77.0 | | | | | | | | 67.0 | |
| Actuated g/C Ratio | | 0.51 | 0.51 | | | | | | | | 0.45 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2610 | 813 | | | | | | | | 2271 | |
| v/s Ratio Prot | | c0.36 | | | | | | | | | c0.25 | |
| v/s Ratio Perm | | | 0.23 | | | | | | | | | |
| v/c Ratio | | 0.70 | 0.45 | | | | | | | | 0.56 | |
| Uniform Delay, d1 | | 27.8 | 23.1 | | | | | | | | 30.6 | |
| Progression Factor | | 0.57 | 0.63 | | | | | | | | 0.04 | |
| Incremental Delay, d2 | | 0.7 | 0.4 | | | | | | | | 0.3 | |
| Delay (s) | | 16.6 | 14.8 | | | | | | | | 1.5 | |
| Level of Service | | B | B | | | | | | | | A | |
| Approach Delay (s) | | 16.3 | | | 0.0 | | | 0.0 | | | 1.5 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM Average Control Delay | 10.9 | HCM Level of Service | B | |
| HCM Volume to Capacity ratio | 0.64 | | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 | |
| Intersection Capacity Utilization | 99.2% | ICU Level of Service | F | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

HCM Signalized Intersection Capacity Analysis
7: Jackrabbit Trail Parkway & Bell Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑ | | | | | | ↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.91 | | | | | | 0.91 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 5085 | | | | | | 5085 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 5085 | | | | | | 5085 | 1583 | | | |
| Volume (vph) | 0 | 1839 | 0 | 0 | 0 | 0 | 0 | 3120 | 481 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1839 | 0 | 0 | 0 | 0 | 0 | 3120 | 481 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1839 | 0 | 0 | 0 | 0 | 0 | 3120 | 477 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 76.0 | | | | | | 66.0 | 66.0 | | | |
| Effective Green, g (s) | | 77.0 | | | | | | 67.0 | 67.0 | | | |
| Actuated g/C Ratio | | 0.51 | | | | | | 0.45 | 0.45 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2610 | | | | | | 2271 | 707 | | | |
| v/s Ratio Prot | | c0.36 | | | | | | c0.61 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.30 | | | |
| v/c Ratio | | 0.70 | | | | | | 1.37 | 0.67 | | | |
| Uniform Delay, d1 | | 27.8 | | | | | | 41.5 | 32.9 | | | |
| Progression Factor | | 0.02 | | | | | | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.6 | | | | | | 171.1 | 5.1 | | | |
| Delay (s) | | 1.1 | | | | | | 212.6 | 37.9 | | | |
| Level of Service | | A | | | | | | F | D | | | |
| Approach Delay (s) | | 1.1 | | | 0.0 | | | 189.3 | | | 0.0 | |
| Approach LOS | | A | | | A | | | F | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 125.7 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 1.02 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 135.0% | ICU Level of Service | H |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.86 | | | | | | 0.86 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 6408 | | | | | | 6408 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 6408 | | | | | | 6408 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1389 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 1384 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 50.0 | | | | | | 62.0 | 62.0 |
| Effective Green, g (s) | | | | | 51.0 | | | | | | 63.0 | 63.0 |
| Actuated g/C Ratio | | | | | 0.42 | | | | | | 0.52 | 0.52 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2723 | | | | | | 3364 | 1463 |
| v/s Ratio Prot | | | | | c0.25 | | | | | | 0.28 | c0.50 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.59 | | | | | | 0.54 | 0.95 |
| Uniform Delay, d1 | | | | | 26.5 | | | | | | 18.9 | 26.9 |
| Progression Factor | | | | | 0.02 | | | | | | 0.78 | 0.76 |
| Incremental Delay, d2 | | | | | 0.3 | | | | | | 0.1 | 7.4 |
| Delay (s) | | | | | 0.8 | | | | | | 14.8 | 28.0 |
| Level of Service | | | | | A | | | | | | B | C |
| Approach Delay (s) | | 0.0 | | | 0.8 | | | 0.0 | | | 20.5 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 14.0 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 78.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | ↱ | | ↑↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.86 | 1.00 | | 0.86 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 6408 | 1583 | | 6408 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 6408 | 1583 | | 6408 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 412 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 50.0 | 50.0 | | 62.0 | | | | |
| Effective Green, g (s) | | | | | 51.0 | 51.0 | | 63.0 | | | | |
| Actuated g/C Ratio | | | | | 0.42 | 0.42 | | 0.52 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2723 | 673 | | 3364 | | | | |
| v/s Ratio Prot | | | | | 0.25 | | | c0.32 | | | | |
| v/s Ratio Perm | | | | | | c0.26 | | | | | | |
| v/c Ratio | | | | | 0.59 | 0.61 | | 0.61 | | | | |
| Uniform Delay, d1 | | | | | 26.5 | 26.8 | | 19.8 | | | | |
| Progression Factor | | | | | 0.98 | 0.98 | | 0.00 | | | | |
| Incremental Delay, d2 | | | | | 0.3 | 1.6 | | 0.6 | | | | |
| Delay (s) | | | | | 26.2 | 27.7 | | 0.6 | | | | |
| Level of Service | | | | | C | C | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 26.5 | | | 0.6 | | | 0.0 | |
| Approach LOS | | A | | | C | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.5 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 78.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.86 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 6408 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 6408 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 1603 | 415 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 1603 | 415 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 24 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 1603 | 391 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 63.0 | 41.0 | |
| Effective Green, g (s) | | | | 65.0 | 43.0 | |
| Actuated g/C Ratio | | | | 0.54 | 0.36 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | | | 3471 | 1230 | |
| v/s Ratio Prot | | | | c0.25 | c0.11 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.46 | 0.32 | |
| Uniform Delay, d1 | | | | 16.8 | 27.9 | |
| Progression Factor | | | | 1.00 | 1.60 | |
| Incremental Delay, d2 | | | | 0.4 | 0.1 | |
| Delay (s) | | | | 17.2 | 44.7 | |
| Level of Service | | | | B | D | |
| Approach Delay (s) | 0.0 | | | 17.2 | 44.7 | |
| Approach LOS | A | | | B | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 22.9 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.86 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 6408 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 6408 | | | 3433 | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 416 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 416 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 414 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 63.0 | | | 41.0 | |
| Effective Green, g (s) | | 65.0 | | | 43.0 | |
| Actuated g/C Ratio | | 0.54 | | | 0.36 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | 3471 | | | 1230 | |
| v/s Ratio Prot | | c0.39 | | | c0.12 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 0.73 | | | 0.34 | |
| Uniform Delay, d1 | | 20.8 | | | 28.1 | |
| Progression Factor | | 1.00 | | | 1.40 | |
| Incremental Delay, d2 | | 1.4 | | | 0.1 | |
| Delay (s) | | 22.2 | | | 39.4 | |
| Level of Service | | C | | | D | |
| Approach Delay (s) | | 22.2 | 0.0 | | 39.4 | |
| Approach LOS | | C | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 24.6 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.57 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 80.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | ↱ | | | | | | | | ↑↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.86 | 1.00 | | | | | | | | 0.86 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 6408 | 1583 | | | | | | | | 6408 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 6408 | 1583 | | | | | | | | 6408 | |
| Volume (vph) | 0 | 2530 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 411 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 50.0 | 50.0 | | | | | | | | 62.0 | |
| Effective Green, g (s) | | 51.0 | 51.0 | | | | | | | | 63.0 | |
| Actuated g/C Ratio | | 0.42 | 0.42 | | | | | | | | 0.52 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2723 | 673 | | | | | | | | 3364 | |
| v/s Ratio Prot | | c0.39 | | | | | | | | | c0.28 | |
| v/s Ratio Perm | | | 0.26 | | | | | | | | | |
| v/c Ratio | | 0.93 | 0.61 | | | | | | | | 0.54 | |
| Uniform Delay, d1 | | 32.8 | 26.8 | | | | | | | | 18.9 | |
| Progression Factor | | 0.79 | 0.75 | | | | | | | | 0.06 | |
| Incremental Delay, d2 | | 4.8 | 1.2 | | | | | | | | 0.2 | |
| Delay (s) | | 30.6 | 21.4 | | | | | | | | 1.3 | |
| Level of Service | | C | C | | | | | | | | A | |
| Approach Delay (s) | | 29.3 | | | 0.0 | | | 0.0 | | | 1.3 | |
| Approach LOS | | C | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 18.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 78.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.86 | | | | | | 0.86 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 6408 | | | | | | 6408 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 6408 | | | | | | 6408 | 1583 | | | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 50.0 | | | | | | 62.0 | 62.0 | | | |
| Effective Green, g (s) | | 51.0 | | | | | | 63.0 | 63.0 | | | |
| Actuated g/C Ratio | | 0.42 | | | | | | 0.52 | 0.52 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2723 | | | | | | 3364 | 831 | | | |
| v/s Ratio Prot | | c0.39 | | | | | | c0.32 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.26 | | | |
| v/c Ratio | | 0.93 | | | | | | 0.61 | 0.50 | | | |
| Uniform Delay, d1 | | 32.8 | | | | | | 19.8 | 18.4 | | | |
| Progression Factor | | 0.03 | | | | | | 0.60 | 0.62 | | | |
| Incremental Delay, d2 | | 2.6 | | | | | | 0.2 | 0.6 | | | |
| Delay (s) | | 3.4 | | | | | | 12.1 | 11.9 | | | |
| Level of Service | | A | | | | | | B | B | | | |
| Approach Delay (s) | | 3.4 | | | 0.0 | | | 12.1 | | | 0.0 | |
| Approach LOS | | A | | | A | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.7 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 72.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.86 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 6408 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 6408 |
| Volume (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 933 | 0 | 0 | 0 | 0 | 2279 |
| Turn Type | | | | | | |
| Protected Phases | 1 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 63.0 | | | | | 41.0 |
| Effective Green, g (s) | 65.0 | | | | | 43.0 |
| Actuated g/C Ratio | 0.54 | | | | | 0.36 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1860 | | | | | 2296 |
| v/s Ratio Prot | c0.27 | | | | | c0.36 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.50 | | | | | 0.99 |
| Uniform Delay, d1 | 17.3 | | | | | 38.3 |
| Progression Factor | 0.72 | | | | | 1.00 |
| Incremental Delay, d2 | 0.7 | | | | | 17.0 |
| Delay (s) | 13.2 | | | | | 55.3 |
| Level of Service | B | | | | | E |
| Approach Delay (s) | 13.2 | | 0.0 | | | 55.3 |
| Approach LOS | B | | A | | | E |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 43.1 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
11: SB Left - U Turn & Jackrabbit Trail Parkway

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.86 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 6408 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 6408 | | |
| Volume (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 1 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 63.0 | | | 41.0 | | |
| Effective Green, g (s) | 65.0 | | | 43.0 | | |
| Actuated g/C Ratio | 0.54 | | | 0.36 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1860 | | | 2296 | | |
| v/s Ratio Prot | c0.03 | | | c0.36 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.06 | | | 1.02 | | |
| Uniform Delay, d1 | 13.1 | | | 38.5 | | |
| Progression Factor | 0.62 | | | 1.00 | | |
| Incremental Delay, d2 | 0.1 | | | 23.0 | | |
| Delay (s) | 8.1 | | | 61.5 | | |
| Level of Service | A | | | E | | |
| Approach Delay (s) | 8.1 | | | 61.5 | 0.0 | |
| Approach LOS | A | | | E | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 58.9 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 0.44 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 71.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.86 | | | | | | 0.86 | 1.00 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 6408 | | | | | | 6408 | 1583 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 6408 | | | | | | 6408 | 1583 |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 456 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 456 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 0 | 0 | 0 | 0 | 0 | 1823 | 448 |
| Turn Type | | | | | | | | | | | | Perm |
| Protected Phases | | | | | 6 | | | | | | 8 | |
| Permitted Phases | | | | | | | | | | | | 8 |
| Actuated Green, G (s) | | | | | 58.0 | | | | | | 50.0 | 50.0 |
| Effective Green, g (s) | | | | | 59.0 | | | | | | 51.0 | 51.0 |
| Actuated g/C Ratio | | | | | 0.51 | | | | | | 0.44 | 0.44 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 3259 | | | | | | 2817 | 696 |
| v/s Ratio Prot | | | | | c0.25 | | | | | | c0.28 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.28 |
| v/c Ratio | | | | | 0.49 | | | | | | 0.65 | 0.64 |
| Uniform Delay, d1 | | | | | 18.7 | | | | | | 25.5 | 25.4 |
| Progression Factor | | | | | 0.03 | | | | | | 0.64 | 0.63 |
| Incremental Delay, d2 | | | | | 0.1 | | | | | | 0.3 | 1.1 |
| Delay (s) | | | | | 0.6 | | | | | | 16.5 | 17.2 |
| Level of Service | | | | | A | | | | | | B | B |
| Approach Delay (s) | | 0.0 | | | 0.6 | | | 0.0 | | | 16.6 | |
| Approach LOS | | A | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.0 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 61.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | ↱ | | ↑↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.86 | 1.00 | | 0.86 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 6408 | 1583 | | 6408 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 6408 | 1583 | | 6408 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 1603 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 415 | 0 | 2036 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1603 | 414 | 0 | 2036 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 58.0 | 58.0 | | 50.0 | | | | |
| Effective Green, g (s) | | | | | 59.0 | 59.0 | | 51.0 | | | | |
| Actuated g/C Ratio | | | | | 0.51 | 0.51 | | 0.44 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 3259 | 805 | | 2817 | | | | |
| v/s Ratio Prot | | | | | 0.25 | | | c0.32 | | | | |
| v/s Ratio Perm | | | | | | c0.26 | | | | | | |
| v/c Ratio | | | | | 0.49 | 0.51 | | 0.72 | | | | |
| Uniform Delay, d1 | | | | | 18.7 | 19.0 | | 26.7 | | | | |
| Progression Factor | | | | | 0.86 | 0.85 | | 0.05 | | | | |
| Incremental Delay, d2 | | | | | 0.1 | 0.5 | | 1.1 | | | | |
| Delay (s) | | | | | 16.2 | 16.7 | | 2.5 | | | | |
| Level of Service | | | | | B | B | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 16.3 | | | 2.5 | | | 0.0 | |
| Approach LOS | | A | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.4 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 61.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.86 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 6408 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 6408 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 1603 | 415 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 1603 | 415 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 11 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 1603 | 404 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 52.0 | 48.0 | |
| Effective Green, g (s) | | | | 54.0 | 50.0 | |
| Actuated g/C Ratio | | | | 0.47 | 0.43 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | | | 2983 | 1480 | |
| v/s Ratio Prot | | | | c0.25 | c0.12 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.54 | 0.27 | |
| Uniform Delay, d1 | | | | 22.1 | 21.3 | |
| Progression Factor | | | | 1.00 | 1.60 | |
| Incremental Delay, d2 | | | | 0.7 | 0.1 | |
| Delay (s) | | | | 22.7 | 34.2 | |
| Level of Service | | | | C | C | |
| Approach Delay (s) | 0.0 | | | 22.7 | 34.2 | |
| Approach LOS | A | | | C | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 25.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
5: WB Left U-Turn & Bell Road

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.86 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 6408 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 6408 | | | 3433 | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 416 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 416 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 415 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 52.0 | | | 48.0 | |
| Effective Green, g (s) | | 54.0 | | | 50.0 | |
| Actuated g/C Ratio | | 0.47 | | | 0.43 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | 2983 | | | 1480 | |
| v/s Ratio Prot | | c0.39 | | | c0.12 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 0.85 | | | 0.28 | |
| Uniform Delay, d1 | | 27.4 | | | 21.4 | |
| Progression Factor | | 1.00 | | | 1.54 | |
| Incremental Delay, d2 | | 3.1 | | | 0.1 | |
| Delay (s) | | 30.4 | | | 32.9 | |
| Level of Service | | C | | | C | |
| Approach Delay (s) | | 30.4 | 0.0 | | 32.9 | |
| Approach LOS | | C | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 30.8 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 67.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | ↱ | | | | | | | | ↑↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.86 | 1.00 | | | | | | | | 0.86 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 6408 | 1583 | | | | | | | | 6408 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 6408 | 1583 | | | | | | | | 6408 | |
| Volume (vph) | 0 | 2530 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 416 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 415 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1823 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 58.0 | 58.0 | | | | | | | | 50.0 | |
| Effective Green, g (s) | | 59.0 | 59.0 | | | | | | | | 51.0 | |
| Actuated g/C Ratio | | 0.51 | 0.51 | | | | | | | | 0.44 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 3259 | 805 | | | | | | | | 2817 | |
| v/s Ratio Prot | | c0.39 | | | | | | | | | c0.28 | |
| v/s Ratio Perm | | | 0.26 | | | | | | | | | |
| v/c Ratio | | 0.78 | 0.51 | | | | | | | | 0.65 | |
| Uniform Delay, d1 | | 23.1 | 19.0 | | | | | | | | 25.5 | |
| Progression Factor | | 0.61 | 0.64 | | | | | | | | 0.00 | |
| Incremental Delay, d2 | | 0.8 | 0.4 | | | | | | | | 0.4 | |
| Delay (s) | | 15.0 | 12.6 | | | | | | | | 0.4 | |
| Level of Service | | B | B | | | | | | | | A | |
| Approach Delay (s) | | 14.6 | | | 0.0 | | | 0.0 | | | 0.4 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.2 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.72 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 69.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.86 | | | | | | 0.86 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 6408 | | | | | | 6408 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 6408 | | | | | | 6408 | 1583 | | | |
| Volume (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 418 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 2530 | 0 | 0 | 0 | 0 | 0 | 2036 | 417 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 58.0 | | | | | | 50.0 | 50.0 | | | |
| Effective Green, g (s) | | 59.0 | | | | | | 51.0 | 51.0 | | | |
| Actuated g/C Ratio | | 0.51 | | | | | | 0.44 | 0.44 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 3259 | | | | | | 2817 | 696 | | | |
| v/s Ratio Prot | | c0.39 | | | | | | c0.32 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.26 | | | |
| v/c Ratio | | 0.78 | | | | | | 0.72 | 0.60 | | | |
| Uniform Delay, d1 | | 23.1 | | | | | | 26.7 | 24.7 | | | |
| Progression Factor | | 0.03 | | | | | | 0.65 | 0.67 | | | |
| Incremental Delay, d2 | | 0.7 | | | | | | 1.2 | 2.5 | | | |
| Delay (s) | | 1.4 | | | | | | 18.6 | 19.2 | | | |
| Level of Service | | A | | | | | | B | B | | | |
| Approach Delay (s) | | 1.4 | | | 0.0 | | | 18.7 | | | 0.0 | |
| Approach LOS | | A | | | A | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.9 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.75 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 72.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑ | | | | | | ↑↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | |
| Lane Util. Factor | | | | | 0.95 | | | | | | 0.86 | |
| Frt | | | | | 1.00 | | | | | | 1.00 | |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | |
| Satd. Flow (prot) | | | | | 3539 | | | | | | 6408 | |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | |
| Satd. Flow (perm) | | | | | 3539 | | | | | | 6408 | |
| Volume (vph) | 0 | 0 | 0 | 0 | 933 | 0 | 0 | 0 | 0 | 0 | 2279 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 933 | 0 | 0 | 0 | 0 | 0 | 2279 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 933 | 0 | 0 | 0 | 0 | 0 | 2279 | 0 |
| Turn Type | | | | | | | | | | | | |
| Protected Phases | | | | | 1 7 | | | | | | 3 5 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 52.0 | | | | | | 48.0 | |
| Effective Green, g (s) | | | | | 54.0 | | | | | | 50.0 | |
| Actuated g/C Ratio | | | | | 0.47 | | | | | | 0.43 | |
| Clearance Time (s) | | | | | | | | | | | | |
| Vehicle Extension (s) | | | | | | | | | | | | |
| Lane Grp Cap (vph) | | | | | 1647 | | | | | | 2762 | |
| v/s Ratio Prot | | | | | c0.26 | | | | | | c0.36 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.57 | | | | | | 0.83 | |
| Uniform Delay, d1 | | | | | 22.5 | | | | | | 29.1 | |
| Progression Factor | | | | | 1.33 | | | | | | 1.00 | |
| Incremental Delay, d2 | | | | | 0.9 | | | | | | 2.1 | |
| Delay (s) | | | | | 30.9 | | | | | | 31.3 | |
| Level of Service | | | | | C | | | | | | C | |
| Approach Delay (s) | | 0.0 | | | 30.9 | | | 0.0 | | | 31.3 | |
| Approach LOS | | A | | | C | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 31.2 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
11: Jackrabbit Trail Parkway & SB Left U-turn

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.81 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 7544 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 7544 | | |
| Volume (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 120 | 0 | 0 | 2334 | 0 | 0 |
| RTOR Reduction (vph) | 1 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 119 | 0 | 0 | 2334 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 1 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 52.0 | | | 48.0 | | |
| Effective Green, g (s) | 54.0 | | | 50.0 | | |
| Actuated g/C Ratio | 0.47 | | | 0.43 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1598 | | | 3252 | | |
| v/s Ratio Prot | c0.03 | | | c0.31 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.07 | | | 0.72 | | |
| Uniform Delay, d1 | 17.2 | | | 27.2 | | |
| Progression Factor | 0.92 | | | 1.00 | | |
| Incremental Delay, d2 | 0.1 | | | 0.8 | | |
| Delay (s) | 15.8 | | | 28.0 | | |
| Level of Service | B | | | C | | |
| Approach Delay (s) | 15.8 | | | 28.0 | 0.0 | |
| Approach LOS | B | | | C | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 27.4 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.38 | | |
| Actuated Cycle Length (s) | 116.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 64.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | ↑↑↑↑ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 1.00 | 0.86 | | | |
| Frt | | 0.86 | 1.00 | | | |
| Flt Protected | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 1611 | 6408 | | | |
| Flt Permitted | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 1611 | 6408 | | | |
| Volume (vph) | 0 | 1 | 2333 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1 | 2333 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 2333 | 0 | 0 | 0 |
| Turn Type | | custom | | | | |
| Protected Phases | | | 2 | | | |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | | 16.0 | 16.0 | | | |
| Effective Green, g (s) | | 17.0 | 17.0 | | | |
| Actuated g/C Ratio | | 0.42 | 0.42 | | | |
| Clearance Time (s) | | 4.0 | 4.0 | | | |
| Lane Grp Cap (vph) | | 685 | 2723 | | | |
| v/s Ratio Prot | | | c0.36 | | | |
| v/s Ratio Perm | | c0.00 | | | | |
| v/c Ratio | | 0.00 | 0.86 | | | |
| Uniform Delay, d1 | | 6.6 | 10.4 | | | |
| Progression Factor | | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.0 | 3.7 | | | |
| Delay (s) | | 6.6 | 14.1 | | | |
| Level of Service | | A | B | | | |
| Approach Delay (s) | 6.6 | | 14.1 | | 0.0 | |
| Approach LOS | A | | B | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 14.1 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 40.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 43.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.86 | | | | | | 0.86 | 0.88 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 6408 | | | | | | 6408 | 2787 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 6408 | | | | | | 6408 | 2787 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 1632 |
| Turn Type | | | | | | | | | | | | Prot |
| Protected Phases | | | | | 6 | | | | | | 8 | 8 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 50.0 | | | | | | 88.0 | 88.0 |
| Effective Green, g (s) | | | | | 51.0 | | | | | | 89.0 | 89.0 |
| Actuated g/C Ratio | | | | | 0.35 | | | | | | 0.61 | 0.61 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2238 | | | | | | 3906 | 1699 |
| v/s Ratio Prot | | | | | c0.33 | | | | | | 0.20 | c0.59 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 0.96 | | | | | | 0.32 | 0.96 |
| Uniform Delay, d1 | | | | | 46.4 | | | | | | 13.9 | 26.8 |
| Progression Factor | | | | | 0.04 | | | | | | 1.29 | 1.38 |
| Incremental Delay, d2 | | | | | 4.2 | | | | | | 0.0 | 10.0 |
| Delay (s) | | | | | 5.9 | | | | | | 17.9 | 47.0 |
| Level of Service | | | | | A | | | | | | B | D |
| Approach Delay (s) | | 0.0 | | | 5.9 | | | 0.0 | | | 34.3 | |
| Approach LOS | | A | | | A | | | A | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 22.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.96 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 94.8% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | ↱ | | ↑↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.86 | 1.00 | | 0.86 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 6408 | 1583 | | 6408 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 6408 | 1583 | | 6408 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 381 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 50.0 | 50.0 | | 88.0 | | | | |
| Effective Green, g (s) | | | | | 51.0 | 51.0 | | 89.0 | | | | |
| Actuated g/C Ratio | | | | | 0.35 | 0.35 | | 0.61 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2238 | 553 | | 3906 | | | | |
| v/s Ratio Prot | | | | | c0.33 | | | c0.49 | | | | |
| v/s Ratio Perm | | | | | | 0.24 | | | | | | |
| v/c Ratio | | | | | 0.96 | 0.69 | | 0.80 | | | | |
| Uniform Delay, d1 | | | | | 46.4 | 40.7 | | 21.7 | | | | |
| Progression Factor | | | | | 0.60 | 0.62 | | 0.01 | | | | |
| Incremental Delay, d2 | | | | | 6.5 | 2.0 | | 1.0 | | | | |
| Delay (s) | | | | | 34.5 | 27.4 | | 1.1 | | | | |
| Level of Service | | | | | C | C | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 33.4 | | | 1.1 | | | 0.0 | |
| Approach LOS | | A | | | C | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.86 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 94.8% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.86 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 6408 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 6408 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 2140 | 382 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 2140 | 382 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 2140 | 382 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 50.0 | 80.0 | |
| Effective Green, g (s) | | | | 52.0 | 82.0 | |
| Actuated g/C Ratio | | | | 0.36 | 0.56 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | | | 2282 | 1928 | |
| v/s Ratio Prot | | | | c0.33 | c0.11 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.94 | 0.20 | |
| Uniform Delay, d1 | | | | 45.4 | 15.8 | |
| Progression Factor | | | | 1.00 | 1.99 | |
| Incremental Delay, d2 | | | | 9.0 | 0.0 | |
| Delay (s) | | | | 54.4 | 31.4 | |
| Level of Service | | | | D | C | |
| Approach Delay (s) | 0.0 | | | 54.4 | 31.4 | |
| Approach LOS | A | | | D | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 51.0 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.86 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 6408 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 6408 | | | 3433 | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 379 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 379 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 378 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 50.0 | | | 80.0 | |
| Effective Green, g (s) | | 52.0 | | | 82.0 | |
| Actuated g/C Ratio | | 0.36 | | | 0.56 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | 2282 | | | 1928 | |
| v/s Ratio Prot | | c0.27 | | | c0.11 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 0.74 | | | 0.20 | |
| Uniform Delay, d1 | | 41.2 | | | 15.8 | |
| Progression Factor | | 1.00 | | | 1.43 | |
| Incremental Delay, d2 | | 2.2 | | | 0.0 | |
| Delay (s) | | 43.4 | | | 22.5 | |
| Level of Service | | D | | | C | |
| Approach Delay (s) | | 43.4 | 0.0 | | 22.5 | |
| Approach LOS | | D | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 39.6 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 80.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | ↱ | | | | | | | | ↑↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.86 | 1.00 | | | | | | | | 0.86 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 6408 | 1583 | | | | | | | | 6408 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 6408 | 1583 | | | | | | | | 6408 | |
| Volume (vph) | 0 | 1699 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 335 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 50.0 | 50.0 | | | | | | | | 88.0 | |
| Effective Green, g (s) | | 51.0 | 51.0 | | | | | | | | 89.0 | |
| Actuated g/C Ratio | | 0.35 | 0.35 | | | | | | | | 0.61 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2238 | 553 | | | | | | | | 3906 | |
| v/s Ratio Prot | | c0.27 | | | | | | | | | c0.20 | |
| v/s Ratio Perm | | | 0.21 | | | | | | | | | |
| v/c Ratio | | 0.76 | 0.61 | | | | | | | | 0.32 | |
| Uniform Delay, d1 | | 42.1 | 39.2 | | | | | | | | 13.9 | |
| Progression Factor | | 0.57 | 0.47 | | | | | | | | 0.08 | |
| Incremental Delay, d2 | | 1.2 | 1.5 | | | | | | | | 0.0 | |
| Delay (s) | | 25.4 | 20.0 | | | | | | | | 1.2 | |
| Level of Service | | C | C | | | | | | | | A | |
| Approach Delay (s) | | 24.4 | | | 0.0 | | | 0.0 | | | 1.2 | |
| Approach LOS | | C | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 94.8% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.86 | | | | | | 0.86 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 6408 | | | | | | 6408 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 6408 | | | | | | 6408 | 1583 | | | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 50.0 | | | | | | 88.0 | 88.0 | | | |
| Effective Green, g (s) | | 51.0 | | | | | | 89.0 | 89.0 | | | |
| Actuated g/C Ratio | | 0.35 | | | | | | 0.61 | 0.61 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2238 | | | | | | 3906 | 965 | | | |
| v/s Ratio Prot | | c0.27 | | | | | | c0.49 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.39 | | | |
| v/c Ratio | | 0.76 | | | | | | 0.80 | 0.64 | | | |
| Uniform Delay, d1 | | 42.1 | | | | | | 21.7 | 18.3 | | | |
| Progression Factor | | 0.02 | | | | | | 0.38 | 0.42 | | | |
| Incremental Delay, d2 | | 1.0 | | | | | | 0.5 | 0.9 | | | |
| Delay (s) | | 1.6 | | | | | | 8.7 | 8.6 | | | |
| Level of Service | | A | | | | | | A | A | | | |
| Approach Delay (s) | | 1.6 | | | 0.0 | | | 8.7 | | | 0.0 | |
| Approach LOS | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.5 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.78 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 82.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: Jackrabbit Trail Parkway & NB Left U-turn

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰↰ | | | | | ↑↑↑↑ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | | | 3.0 |
| Lane Util. Factor | 0.97 | | | | | 0.86 |
| Frt | 1.00 | | | | | 1.00 |
| Flt Protected | 0.95 | | | | | 1.00 |
| Satd. Flow (prot) | 3433 | | | | | 6408 |
| Flt Permitted | 0.95 | | | | | 1.00 |
| Satd. Flow (perm) | 3433 | | | | | 6408 |
| Volume (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 1381 | 0 | 0 | 0 | 0 | 1519 |
| RTOR Reduction (vph) | 35 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 1346 | 0 | 0 | 0 | 0 | 1519 |
| Turn Type | | | | | | |
| Protected Phases | 1 7 | | | | | 3 5 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 50.0 | | | | | 80.0 |
| Effective Green, g (s) | 52.0 | | | | | 82.0 |
| Actuated g/C Ratio | 0.36 | | | | | 0.56 |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1223 | | | | | 3599 |
| v/s Ratio Prot | c0.39 | | | | | c0.24 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 1.10 | | | | | 0.42 |
| Uniform Delay, d1 | 47.0 | | | | | 18.4 |
| Progression Factor | 1.24 | | | | | 1.00 |
| Incremental Delay, d2 | 53.4 | | | | | 0.1 |
| Delay (s) | 111.6 | | | | | 18.5 |
| Level of Service | F | | | | | B |
| Approach Delay (s) | 111.6 | | 0.0 | | | 18.5 |
| Approach LOS | F | | A | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 62.8 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.86 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 6408 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 6408 | | |
| Volume (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 1 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 50.0 | | | 80.0 | | |
| Effective Green, g (s) | 52.0 | | | 82.0 | | |
| Actuated g/C Ratio | 0.36 | | | 0.56 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1223 | | | 3599 | | |
| v/s Ratio Prot | c0.04 | | | c0.56 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.11 | | | 1.00 | | |
| Uniform Delay, d1 | 31.5 | | | 32.0 | | |
| Progression Factor | 1.45 | | | 1.00 | | |
| Incremental Delay, d2 | 0.2 | | | 15.1 | | |
| Delay (s) | 45.8 | | | 47.1 | | |
| Level of Service | D | | | D | | |
| Approach Delay (s) | 45.8 | | | 47.1 | 0.0 | |
| Approach LOS | D | | | D | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 47.1 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 146.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 80.7% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
2: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱ |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | 3.0 |
| Lane Util. Factor | | | | | 0.86 | | | | | | 0.86 | 1.00 |
| Frt | | | | | 1.00 | | | | | | 1.00 | 0.85 |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (prot) | | | | | 6408 | | | | | | 6408 | 1583 |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | 1.00 |
| Satd. Flow (perm) | | | | | 6408 | | | | | | 6408 | 1583 |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 251 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 251 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 0 | 0 | 0 | 0 | 0 | 1268 | 251 |
| Turn Type | | | | | | | | | | | | Perm |
| Protected Phases | | | | | 6 | | | | | | 8 | |
| Permitted Phases | | | | | | | | | | | | 8 |
| Actuated Green, G (s) | | | | | 44.0 | | | | | | 58.0 | 58.0 |
| Effective Green, g (s) | | | | | 45.0 | | | | | | 59.0 | 59.0 |
| Actuated g/C Ratio | | | | | 0.41 | | | | | | 0.54 | 0.54 |
| Clearance Time (s) | | | | | 4.0 | | | | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | | | | 3.2 | | | | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | | | | 2621 | | | | | | 3437 | 849 |
| v/s Ratio Prot | | | | | c0.33 | | | | | | c0.20 | |
| v/s Ratio Perm | | | | | | | | | | | | 0.16 |
| v/c Ratio | | | | | 0.82 | | | | | | 0.37 | 0.30 |
| Uniform Delay, d1 | | | | | 28.8 | | | | | | 14.7 | 14.0 |
| Progression Factor | | | | | 0.04 | | | | | | 0.77 | 0.78 |
| Incremental Delay, d2 | | | | | 1.2 | | | | | | 0.1 | 0.2 |
| Delay (s) | | | | | 2.5 | | | | | | 11.4 | 11.1 |
| Level of Service | | | | | A | | | | | | B | B |
| Approach Delay (s) | | 0.0 | | | 2.5 | | | 0.0 | | | 11.3 | |
| Approach LOS | | A | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.56 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 82.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
3: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑↑↑ | ↱ | | ↑↑↑↑ | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | 3.0 | | 3.0 | | | | |
| Lane Util. Factor | | | | | 0.86 | 1.00 | | 0.86 | | | | |
| Frt | | | | | 1.00 | 0.85 | | 1.00 | | | | |
| Flt Protected | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (prot) | | | | | 6408 | 1583 | | 6408 | | | | |
| Flt Permitted | | | | | 1.00 | 1.00 | | 1.00 | | | | |
| Satd. Flow (perm) | | | | | 6408 | 1583 | | 6408 | | | | |
| Volume (vph) | 0 | 0 | 0 | 0 | 2140 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 2140 | 382 | 0 | 3120 | 0 | 0 | 0 | 0 |
| Turn Type | | | | | | Perm | | | | | | |
| Protected Phases | | | | | 6 | | | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | | | | |
| Actuated Green, G (s) | | | | | 44.0 | 44.0 | | 58.0 | | | | |
| Effective Green, g (s) | | | | | 45.0 | 45.0 | | 59.0 | | | | |
| Actuated g/C Ratio | | | | | 0.41 | 0.41 | | 0.54 | | | | |
| Clearance Time (s) | | | | | 4.0 | 4.0 | | 4.0 | | | | |
| Vehicle Extension (s) | | | | | 3.2 | 3.2 | | 8.0 | | | | |
| Lane Grp Cap (vph) | | | | | 2621 | 648 | | 3437 | | | | |
| v/s Ratio Prot | | | | | c0.33 | | | c0.49 | | | | |
| v/s Ratio Perm | | | | | | 0.24 | | | | | | |
| v/c Ratio | | | | | 0.82 | 0.59 | | 0.91 | | | | |
| Uniform Delay, d1 | | | | | 28.8 | 25.3 | | 23.0 | | | | |
| Progression Factor | | | | | 0.67 | 0.69 | | 0.05 | | | | |
| Incremental Delay, d2 | | | | | 1.3 | 0.9 | | 2.0 | | | | |
| Delay (s) | | | | | 20.6 | 18.4 | | 3.2 | | | | |
| Level of Service | | | | | C | B | | A | | | | |
| Approach Delay (s) | | 0.0 | | | 20.3 | | | 3.2 | | | 0.0 | |
| Approach LOS | | A | | | C | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.8 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.87 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 82.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | ↑↑↑↑ | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | 3.0 | 3.0 | |
| Lane Util. Factor | | | | 0.86 | 0.97 | |
| Frt | | | | 1.00 | 1.00 | |
| Flt Protected | | | | 1.00 | 0.95 | |
| Satd. Flow (prot) | | | | 6408 | 3433 | |
| Flt Permitted | | | | 1.00 | 0.95 | |
| Satd. Flow (perm) | | | | 6408 | 3433 | |
| Volume (vph) | 0 | 0 | 0 | 2140 | 382 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 2140 | 382 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 2140 | 382 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | | | 1 7 | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | | 40.0 | 54.0 | |
| Effective Green, g (s) | | | | 42.0 | 56.0 | |
| Actuated g/C Ratio | | | | 0.38 | 0.51 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | | | 2447 | 1748 | |
| v/s Ratio Prot | | | | c0.33 | c0.11 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | | 0.87 | 0.22 | |
| Uniform Delay, d1 | | | | 31.6 | 14.9 | |
| Progression Factor | | | | 1.00 | 1.66 | |
| Incremental Delay, d2 | | | | 4.7 | 0.0 | |
| Delay (s) | | | | 36.2 | 24.8 | |
| Level of Service | | | | D | C | |
| Approach Delay (s) | 0.0 | | | 36.2 | 24.8 | |
| Approach LOS | A | | | D | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 34.5 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | ↰↰ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | 3.0 | |
| Lane Util. Factor | | 0.86 | | | 0.97 | |
| Frt | | 1.00 | | | 1.00 | |
| Flt Protected | | 1.00 | | | 0.95 | |
| Satd. Flow (prot) | | 6408 | | | 3433 | |
| Flt Permitted | | 1.00 | | | 0.95 | |
| Satd. Flow (perm) | | 6408 | | | 3433 | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 379 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 379 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 377 | 0 |
| Turn Type | | | | | | |
| Protected Phases | | 1 7 | | | 3 5 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | 40.0 | | | 54.0 | |
| Effective Green, g (s) | | 42.0 | | | 56.0 | |
| Actuated g/C Ratio | | 0.38 | | | 0.51 | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | | 2447 | | | 1748 | |
| v/s Ratio Prot | | c0.27 | | | c0.11 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | 0.69 | | | 0.22 | |
| Uniform Delay, d1 | | 28.6 | | | 14.9 | |
| Progression Factor | | 1.00 | | | 1.67 | |
| Incremental Delay, d2 | | 1.7 | | | 0.0 | |
| Delay (s) | | 30.3 | | | 24.8 | |
| Level of Service | | C | | | C | |
| Approach Delay (s) | | 30.3 | 0.0 | | 24.8 | |
| Approach LOS | | C | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 29.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.42 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 65.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
6: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | ↱ | | | | | | | | ↑↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | | | | | | 3.0 | |
| Lane Util. Factor | | 0.86 | 1.00 | | | | | | | | 0.86 | |
| Frt | | 1.00 | 0.85 | | | | | | | | 1.00 | |
| Flt Protected | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (prot) | | 6408 | 1583 | | | | | | | | 6408 | |
| Flt Permitted | | 1.00 | 1.00 | | | | | | | | 1.00 | |
| Satd. Flow (perm) | | 6408 | 1583 | | | | | | | | 6408 | |
| Volume (vph) | 0 | 1699 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 379 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 352 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1268 | 0 |
| Turn Type | | | Perm | | | | | | | | | |
| Protected Phases | | 2 | | | | | | | | | 8 | |
| Permitted Phases | | | 2 | | | | | | | | | |
| Actuated Green, G (s) | | 44.0 | 44.0 | | | | | | | | 58.0 | |
| Effective Green, g (s) | | 45.0 | 45.0 | | | | | | | | 59.0 | |
| Actuated g/C Ratio | | 0.41 | 0.41 | | | | | | | | 0.54 | |
| Clearance Time (s) | | 4.0 | 4.0 | | | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.2 | 3.2 | | | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 2621 | 648 | | | | | | | | 3437 | |
| v/s Ratio Prot | | c0.27 | | | | | | | | | c0.20 | |
| v/s Ratio Perm | | | 0.22 | | | | | | | | | |
| v/c Ratio | | 0.65 | 0.54 | | | | | | | | 0.37 | |
| Uniform Delay, d1 | | 26.1 | 24.7 | | | | | | | | 14.7 | |
| Progression Factor | | 0.71 | 0.66 | | | | | | | | 0.00 | |
| Incremental Delay, d2 | | 0.5 | 0.8 | | | | | | | | 0.1 | |
| Delay (s) | | 18.9 | 17.1 | | | | | | | | 0.1 | |
| Level of Service | | B | B | | | | | | | | A | |
| Approach Delay (s) | | 18.6 | | | 0.0 | | | 0.0 | | | 0.1 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 11.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 56.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
7: Bell Road & Jackrabbit Trail Parkway

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↑↑↑↑ | | | | | | ↑↑↑↑ | ↱ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | | | | | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 0.86 | | | | | | 0.86 | 1.00 | | | |
| Frt | | 1.00 | | | | | | 1.00 | 0.85 | | | |
| Flt Protected | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 6408 | | | | | | 6408 | 1583 | | | |
| Flt Permitted | | 1.00 | | | | | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 6408 | | | | | | 6408 | 1583 | | | |
| Volume (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 621 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1699 | 0 | 0 | 0 | 0 | 0 | 3120 | 620 | 0 | 0 | 0 |
| Turn Type | | | | | | | | | Perm | | | |
| Protected Phases | | 2 | | | | | | 4 | | | | |
| Permitted Phases | | | | | | | | | 4 | | | |
| Actuated Green, G (s) | | 44.0 | | | | | | 58.0 | 58.0 | | | |
| Effective Green, g (s) | | 45.0 | | | | | | 59.0 | 59.0 | | | |
| Actuated g/C Ratio | | 0.41 | | | | | | 0.54 | 0.54 | | | |
| Clearance Time (s) | | 4.0 | | | | | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.2 | | | | | | 8.0 | 8.0 | | | |
| Lane Grp Cap (vph) | | 2621 | | | | | | 3437 | 849 | | | |
| v/s Ratio Prot | | c0.27 | | | | | | c0.49 | | | | |
| v/s Ratio Perm | | | | | | | | | 0.39 | | | |
| v/c Ratio | | 0.65 | | | | | | 0.91 | 0.73 | | | |
| Uniform Delay, d1 | | 26.1 | | | | | | 23.0 | 19.4 | | | |
| Progression Factor | | 0.02 | | | | | | 0.48 | 0.50 | | | |
| Incremental Delay, d2 | | 0.4 | | | | | | 2.0 | 2.3 | | | |
| Delay (s) | | 1.0 | | | | | | 13.1 | 12.0 | | | |
| Level of Service | | A | | | | | | B | B | | | |
| Approach Delay (s) | | 1.0 | | | 0.0 | | | 12.9 | | | 0.0 | |
| Approach LOS | | A | | | A | | | B | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.2 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 82.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
10: Jackrabbit Trail Parkway & NB Left U-turn

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | ↑↑ | | | | | | ↑↑↑↑ | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | | | | 3.0 | | | | | | 3.0 | |
| Lane Util. Factor | | | | | 0.95 | | | | | | 0.86 | |
| Frt | | | | | 1.00 | | | | | | 1.00 | |
| Flt Protected | | | | | 1.00 | | | | | | 1.00 | |
| Satd. Flow (prot) | | | | | 3539 | | | | | | 6408 | |
| Flt Permitted | | | | | 1.00 | | | | | | 1.00 | |
| Satd. Flow (perm) | | | | | 3539 | | | | | | 6408 | |
| Volume (vph) | 0 | 0 | 0 | 0 | 1381 | 0 | 0 | 0 | 0 | 0 | 1519 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 0 | 0 | 0 | 1381 | 0 | 0 | 0 | 0 | 0 | 1519 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 0 | 0 | 1381 | 0 | 0 | 0 | 0 | 0 | 1519 | 0 |
| Turn Type | | | | | | | | | | | | |
| Protected Phases | | | | | 1 7 | | | | | | 3 5 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | | | | 40.0 | | | | | | 54.0 | |
| Effective Green, g (s) | | | | | 42.0 | | | | | | 56.0 | |
| Actuated g/C Ratio | | | | | 0.38 | | | | | | 0.51 | |
| Clearance Time (s) | | | | | | | | | | | | |
| Vehicle Extension (s) | | | | | | | | | | | | |
| Lane Grp Cap (vph) | | | | | 1351 | | | | | | 3262 | |
| v/s Ratio Prot | | | | | c0.39 | | | | | | c0.24 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | | | | 1.02 | | | | | | 0.47 | |
| Uniform Delay, d1 | | | | | 34.0 | | | | | | 17.4 | |
| Progression Factor | | | | | 1.20 | | | | | | 1.00 | |
| Incremental Delay, d2 | | | | | 22.5 | | | | | | 0.1 | |
| Delay (s) | | | | | 63.2 | | | | | | 17.5 | |
| Level of Service | | | | | E | | | | | | B | |
| Approach Delay (s) | | 0.0 | | | 63.2 | | | 0.0 | | | 17.5 | |
| Approach LOS | | A | | | E | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 39.2 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 68.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | | | 3.0 | | |
| Lane Util. Factor | 0.97 | | | 0.81 | | |
| Frt | 1.00 | | | 1.00 | | |
| Flt Protected | 0.95 | | | 1.00 | | |
| Satd. Flow (prot) | 3433 | | | 7544 | | |
| Flt Permitted | 0.95 | | | 1.00 | | |
| Satd. Flow (perm) | 3433 | | | 7544 | | |
| Volume (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 140 | 0 | 0 | 3601 | 0 | 0 |
| Turn Type | | | | | | |
| Protected Phases | 1 7 | | | 3 5 | | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 40.0 | | | 54.0 | | |
| Effective Green, g (s) | 42.0 | | | 56.0 | | |
| Actuated g/C Ratio | 0.38 | | | 0.51 | | |
| Clearance Time (s) | | | | | | |
| Vehicle Extension (s) | | | | | | |
| Lane Grp Cap (vph) | 1311 | | | 3841 | | |
| v/s Ratio Prot | c0.04 | | | c0.48 | | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.11 | | | 0.94 | | |
| Uniform Delay, d1 | 21.9 | | | 25.4 | | |
| Progression Factor | 0.94 | | | 0.45 | | |
| Incremental Delay, d2 | 0.1 | | | 0.6 | | |
| Delay (s) | 20.8 | | | 11.9 | | |
| Level of Service | C | | | B | | |
| Approach Delay (s) | 20.8 | | | 11.9 | 0.0 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 12.2 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 70.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | ↑↑↑↑ | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 3.0 | 3.0 | | | |
| Lane Util. Factor | | 1.00 | 0.86 | | | |
| Frt | | 0.86 | 1.00 | | | |
| Flt Protected | | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | | 1611 | 6408 | | | |
| Flt Permitted | | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | | 1611 | 6408 | | | |
| Volume (vph) | 0 | 1 | 3601 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 0 | 1 | 3601 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 1 | 3601 | 0 | 0 | 0 |
| Turn Type | | custom | | | | |
| Protected Phases | | | 2 | | | |
| Permitted Phases | | 8 | | | | |
| Actuated Green, G (s) | | 46.0 | 56.0 | | | |
| Effective Green, g (s) | | 47.0 | 57.0 | | | |
| Actuated g/C Ratio | | 0.43 | 0.52 | | | |
| Clearance Time (s) | | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | | |
| Lane Grp Cap (vph) | | 688 | 3321 | | | |
| v/s Ratio Prot | | | c0.56 | | | |
| v/s Ratio Perm | | c0.00 | | | | |
| v/c Ratio | | 0.00 | 1.08 | | | |
| Uniform Delay, d1 | | 18.1 | 26.5 | | | |
| Progression Factor | | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | | 0.0 | 44.0 | | | |
| Delay (s) | | 18.1 | 70.5 | | | |
| Level of Service | | B | E | | | |
| Approach Delay (s) | 18.1 | | 70.5 | | 0.0 | |
| Approach LOS | B | | E | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 70.4 | HCM Level of Service | E |
| HCM Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 110.0 | Sum of lost time (s) | 6.0 |
| Intersection Capacity Utilization | 62.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# Appendix XVI
# Summary Cost

# SUMMARY COST

**Project Name: Perryville Parkway**
**Termini: I-10 to Indian School**
**Date:**

2007 SUMMARY COST ESTIMATES (Current Dollars)

| *COST CATEGORIES* | *Factors* | *No Build* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|---|
| *Construction* | | $0 | $15,272,300 | $0 |
| *Design (10% TO 15%)* | 12% | $0 | $1,832,700 | $0 |
| *Construction Management* | 15% | $0 | $2,290,800 | $0 |
| *Right-of-Way* | | $0 | $9,200,000 | $0 |
| *Utility Relocation* | | $0 | $1,000,000 | $0 |
| *Administration (8% TO 13%)* | 10% | $0 | $1,527,200 | $0 |
| ***Total*** | | **$0** | **$31,123,000** | **$0** |

PRELIMINARY SUMMARY COST ESTIMATES (Adjusted for Inflation)

Assumed Annual Inflation Rate = 2.90%
Assumed Number of Years = 5

| | | | |
|---|---|---|---|
| *Adjusted Construction Cost* | $0 | $17,619,000 | $0 |
| *Design* | $0 | $2,114,300 | $0 |
| *Construction Management* | $0 | $2,642,800 | $0 |
| *Right-of-Way* | $0 | $10,613,600 | $0 |
| *Utility Relocation* | $0 | $1,153,700 | $0 |
| *Administration* | $0 | $1,761,900 | $0 |
| ***Adjusted Total*** | $0 | $35,905,300 | $0 |

# 2006 CAR Construction Cost Worksheet
## Road Construction

Project Name: Perryville Parkway
Termini: I-10 to Indian School
Date:

| *Alternative:* | | | | |
|---|---|---|---|---|
| *Item Description* | *Unit* | *Quantity* | *Unit Cost* | *Total* |
| N.P.D.E.S. | Lump Sum | 1 | $8,600.00 | $8,600 |
| Community Relations | Allowance | 1 | $12,000.00 | $12,000 |
| Engineer's Field Office | Lump Sum | 1 | $36,000.00 | $36,000 |
| Roadway Excavation | C YD | 81,500 | $5.90 | $480,850 |
| Borrow Excavation (if anticipated) | C YD | 165,500 | $9.50 | $1,572,250 |
| Channel & Retention Basin Excavation | C YD | | $8.00 | $0 |
| Subgrade Preparation | SQ YD | 110,000 | $2.60 | $286,000 |
| New Asphalt Concrete Pavement (see Pavement sheet) | SQ YD | | $24.65 | $0 |
| New Rubberized Asphalt Pavement (see Pavement sheet) | SQ YD | 110,000 | $24.95 | $2,744,500 |
| Asphalt Rubber Overlay (see Pavement sheet) | SQ YD | | $5.95 | $0 |
| Chip Seal on AC Pavement (see Pavement sheet) | SQ YD | | $1.95 | $0 |
| Double Chip Seal on Aggregate Base (see Pavement sheet) | SQ YD | | $3.80 | $0 |
| Pavement Sawcut | LF | | $1.26 | $0 |
| Concrete Single Curb | LF | | $8.80 | $0 |
| Concrete Curb & Gutter | LF | 46,476 | $11.30 | $525,179 |
| Concrete Sidewalk Ramp Std Det 231, Type "A" | EA | 36 | $1,850.00 | $66,600 |
| Concrete Sidewalk Std Det 230 | SQ YD | 15,333 | $39.00 | $597,987 |
| Concrete Driveway with 5' Wings, Std Det 250 | SQ YD | 883 | $50.00 | $44,150 |
| Traffic Signing & Striping - 2 lanes | LF | | $2.18 | $0 |
| Traffic Signing & Striping - 5 lanes | LF | | $4.07 | $0 |
| Traffic Signing & Striping - 7 lanes | LF | 11,500 | $4.50 | $51,750 |
| Traffic Signal, Full Intersection | EA | 6.0 | $280,000.00 | $1,680,000 |
| Interconnect/Traffic Signals | LF | 23,000 | $14.59 | $335,570 |
| Traffic Signal, Future "Box-in" | EA | 4 | $9,300.00 | $37,200 |
| Catch Basin | EA | | $2,100.00 | $0 |
| Scupper | EA | | $3,300.00 | $0 |
| Drywell | EA | | $26,000.00 | $0 |
| Storm Drain System (retention basin option) | Mile | 2.2 | $700,000.00 | $1,540,000 |
| 18" CMP and smaller | LF | | $65.00 | $0 |
| 24" CMP | LF | | $91.00 | $0 |
| 30" CMP | LF | | $116.00 | $0 |
| 36" CMP | LF | | $130.00 | $0 |
| 48"CMP | LF | | $169.00 | $0 |
| 18" & 24" RGRCP, Class III | LF | | $79.00 | $0 |
| 30" & 36" RGRCP, Class III | LF | | $123.00 | $0 |
| 42" & 48" RGRCP, Class III | LF | | $168.00 | $0 |
| 54" & 60" RGRCP, Class III | LF | | $269.00 | $0 |
| 54" & 60" Storm Drain/Irrigation Manhole | EA | | $3,900.00 | $0 |
| Headwall (MAG details) | EA | | $3,250.00 | $0 |
| Irrigation Junction Box (MAG details) | EA | | $2,950.00 | $0 |
| Concrete Slip Form Irrigation Ditch | LF | | $28.00 | $0 |
| Earth Irrigation Ditch/Special Drainage Ditch, 6' Top | LF | | $14.00 | $0 |
| Box Culvert (see Structure sheet) | LS | | $0.00 | $0 |
| Irrigation Structure with Gates | EA | | $1,500.00 | $0 |
| Bridge < 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Bridge > 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Guardrail without Approach End Section | LF | | $35.00 | $0 |
| Guardrail Approach End Section, New ADOT Type | EA | | $2,400.00 | $0 |
| Median Fine Grading, Pre-emergent, & D.G. | SQ YD | 86,777 | $19.10 | $1,657,441 |
| 8' Masonry Soundwall | LF | | $91.00 | $0 |
| Concrete Soundwall | SQ YD | | $275.00 | $0 |
| | Subtotal | | | $11,676,077 |
| Removal of Existing Improvements @ 2% | Lump Sum | 1 | $233,522.00 | $233,522 |
| Mobilization/Demobilization @ 4% | Lump Sum | 1 | $467,043.00 | $467,043 |
| Traffic Control @ 3% | Lump Sum | 1 | $350,282.00 | $350,282 |
| | | | | |
| | | | | |
| | | | | |
| SUBTOTAL Construction | | | | $12,726,924 |
| | | | | |
| | Contingency | | 20% | $2,545,385 |
| | | | | |
| | TOTAL | | | $15,272,300 |

# SUMMARY COST

**Project Name: Perryville Parkway**
**Termini: Indian School to Jackrabbit**
**Date:**

## 2007 SUMMARY COST ESTIMATES (Current Dollars)

| *COST CATEGORIES* | *Factors* | *No Build* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|---|
| *Construction* | | $0 | $20,986,200 | $0 |
| *Design (10% TO 15%)* | 12% | $0 | $2,518,300 | $0 |
| *Construction Management* | 15% | $0 | $3,147,900 | $0 |
| *Right-of-Way* | | $0 | $17,508,000 | $0 |
| *Utility Relocation* | | $0 | $1,000,000 | $0 |
| *Administration (8% TO 13%)* | 10% | $0 | $2,098,600 | $0 |
| ***Total*** | | **$0** | **$47,259,000** | **$0** |

## PRELIMINARY SUMMARY COST ESTIMATES (Adjusted for Inflation)

Assumed Annual Inflation Rate = 2.90%
Assumed Number of Years = 5

| | | | |
|---|---|---|---|
| *Adjusted Construction Cost* | $0 | $24,210,900 | $0 |
| *Design* | $0 | $2,905,300 | $0 |
| *Construction Management* | $0 | $3,631,600 | $0 |
| *Right-of-Way* | $0 | $20,198,200 | $0 |
| *Utility Relocation* | $0 | $1,153,700 | $0 |
| *Administration* | $0 | $2,421,100 | $0 |
| ***Adjusted Total*** | $0 | $54,520,800 | $0 |

# 2006 CAR Construction Cost Worksheet
## Road Construction

Project Name: Perryville Parkway
Termini: Indian School to Jackrabbit
Date:

| *Alternative:* | | | | |
|---|---|---|---|---|
| *Item Description* | *Unit* | *Quantity* | *Unit Cost* | *Total* |
| N.P.D.E.S. | Lump Sum | 1 | $8,600.00 | $8,600 |
| Community Relations | Allowance | 1 | $12,000.00 | $12,000 |
| Engineer's Field Office | Lump Sum | 1 | $36,000.00 | $36,000 |
| Roadway Excavation | C YD | 86,500 | $5.90 | $510,350 |
| Borrow Excavation (if anticipated) | C YD | 175,600 | $9.50 | $1,668,200 |
| Channel & Retention Basin Excavation | C YD | | $8.00 | $0 |
| Subgrade Preparation | SQ YD | 175,155 | $2.60 | $455,403 |
| New Asphalt Concrete Pavement (see Pavement sheet) | SQ YD | | $24.65 | $0 |
| New Rubberized Asphalt Pavement (see Pavement sheet) | SQ YD | 175,155 | $24.95 | $4,370,117 |
| Asphalt Rubber Overlay (see Pavement sheet) | SQ YD | | $5.95 | $0 |
| Chip Seal on AC Pavement (see Pavement sheet) | SQ YD | | $1.95 | $0 |
| Double Chip Seal on Aggregate Base (see Pavement sheet) | SQ YD | | $3.80 | $0 |
| Pavement Sawcut | LF | | $1.26 | $0 |
| Concrete Single Curb | LF | | $8.80 | $0 |
| Concrete Curb & Gutter | LF | 63,510 | $11.30 | $717,663 |
| Concrete Sidewalk Ramp Std Det 231, Type "A" | EA | 28 | $1,850.00 | $51,800 |
| Concrete Sidewalk Std Det 230 | SQ YD | 24,155 | $39.00 | $942,045 |
| Concrete Driveway with 5' Wings, Std Det 250 | SQ YD | 1,480 | $50.00 | $74,000 |
| Traffic Signing & Striping - 2 lanes | LF | | $2.18 | $0 |
| Traffic Signing & Striping - 5 lanes | LF | | $4.07 | $0 |
| Traffic Signing & Striping - 7 lanes | LF | 19,300 | $4.50 | $86,850 |
| Traffic Signal, Full Intersection | EA | 4.0 | $280,000.00 | $1,120,000 |
| Interconnect/Traffic Signals | LF | 24,400 | $14.59 | $355,996 |
| Traffic Signal, Future "Box-in" | EA | 5 | $9,300.00 | $46,500 |
| Catch Basin | EA | | $2,100.00 | $0 |
| Scupper | EA | | $3,300.00 | $0 |
| Drywell | EA | | $26,000.00 | $0 |
| Storm Drain System (retention basin option) | Mile | 3.6 | $700,000.00 | $2,520,000 |
| 18" CMP and smaller | LF | | $65.00 | $0 |
| 24" CMP | LF | | $91.00 | $0 |
| 30" CMP | LF | | $116.00 | $0 |
| 36" CMP | LF | | $130.00 | $0 |
| 48"CMP | LF | | $169.00 | $0 |
| 18" & 24" RGRCP, Class III | LF | | $79.00 | $0 |
| 30" & 36" RGRCP, Class III | LF | | $123.00 | $0 |
| 42" & 48" RGRCP, Class III | LF | | $168.00 | $0 |
| 54" & 60" RGRCP, Class III | LF | | $269.00 | $0 |
| 54" & 60" Storm Drain/Irrigation Manhole | EA | | $3,900.00 | $0 |
| Headwall (MAG details) | EA | | $3,250.00 | $0 |
| Irrigation Junction Box (MAG details) | EA | | $2,950.00 | $0 |
| Concrete Slip Form Irrigation Ditch | LF | | $28.00 | $0 |
| Earth Irrigation Ditch/Special Drainage Ditch, 6' Top | LF | | $14.00 | $0 |
| Box Culvert (see Structure sheet) | LS | 1 | $993,899.00 | $993,899 |
| Irrigation Structure with Gates | EA | | $1,500.00 | $0 |
| Bridge < 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Bridge > 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Guardrail without Approach End Section | LF | | $35.00 | $0 |
| Guardrail Approach End Section, New ADOT Type | EA | | $2,400.00 | $0 |
| Median Fine Grading, Pre-emergent, & D.G. | SQ YD | 108,644 | $19.10 | $2,075,100 |
| 8' Masonry Soundwall | LF | | $91.00 | $0 |
| Concrete Soundwall | SQ YD | | $275.00 | $0 |
| | Subtotal | | | $16,044,524 |
| Removal of Existing Improvements @ 2% | Lump Sum | 1 | $320,890.00 | $320,890 |
| Mobilization/Demobilization @ 4% | Lump Sum | 1 | $641,781.00 | $641,781 |
| Traffic Control @ 3% | Lump Sum | 1 | $481,336.00 | $481,336 |
| | | | | |
| | | | | |
| | | | | |
| SUBTOTAL Construction | | | | $17,488,531 |
| | | | | |
| | Contingency | | 20% | $3,497,706 |
| | | | | |
| | TOTAL | | | $20,986,200 |

Project Name: Perryville Pkwy
Termini: Indian School to Jackrabbit
Date:

## BOX CULVERT COST CALCULATIONS

| TYPE OF ROAD | BOX LENGTH (ft) | BOX DESCRIPTION | BOX WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks) | 88.58 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 94.49 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | | | | 12581 | SQ FT | $79.00 | $993,899.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 52.49 | | 0 | 0 | SQ FT | $52.00 | $0.00 |
| | | | | | | | $993,899.00 |

* Top surface area of box.

** Includes cost of standard wing walls and bridge barrier. For special construction review unit cost with MCDOT bridge section.

*** 16 m box with approval only. Generally a non-section line, low volume location.

## BRIDGE COST CALCULATIONS

| TYPE OF ROAD | BRIDGE LENGTH (ft) | DESCRIPTION | BRIDGE WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks ) | 0 | | 88.58 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 0 | | 94.49 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | 0 | | 104.33 | 0 | SQ FT | $107.00 | $0.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 0 | | 52.49 | 0 | SQ FT | $79.00 | $0.00 |
| | | | | | | <100' Long | $0.00 |
| | | | | | | >=100' Long | $0.00 |

* Top surface area of bridge.

** Cost includes bridge railings, barriers, approach slabs, piers, and other items used in bridge construction.
Note: Show cost of channel excavation and other bridge site work on Road Construction Sheet.

*** 16 m bridge with approval only. Generally a non-section line, low volume location.

# SUMMARY COST

Project Name: Perryville Parkway
Termini: Jackrabbit to Northern
Date:

## 2007 SUMMARY COST ESTIMATES (Current Dollars)

| *COST CATEGORIES* | *Factors* | *No Build* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|---|
| *Construction* | | $0 | $18,741,600 | $0 |
| *Design (10% TO 15%)* | 12% | $0 | $2,249,000 | $0 |
| *Construction Management* | 15% | $0 | $2,811,200 | $0 |
| *Right-of-Way* | | $0 | $12,700,000 | $0 |
| *Utility Relocation* | | $0 | $1,000,000 | $0 |
| *Administration (8% TO 13%)* | 10% | $0 | $1,874,200 | $0 |
| ***Total*** | | **$0** | **$39,376,000** | **$0** |

## PRELIMINARY SUMMARY COST ESTIMATES (Adjusted for Inflation)

Assumed Annual Inflation Rate = 2.90%
Assumed Number of Years = 5

| | | | |
|---|---|---|---|
| *Adjusted Construction Cost* | $0 | $21,621,400 | $0 |
| *Design* | $0 | $2,594,600 | $0 |
| *Construction Management* | $0 | $3,243,200 | $0 |
| *Right-of-Way* | $0 | $14,651,400 | $0 |
| *Utility Relocation* | $0 | $1,153,700 | $0 |
| *Administration* | $0 | $2,162,200 | $0 |
| ***Adjusted Total*** | $0 | $45,426,500 | $0 |

# 2006 CAR Construction Cost Worksheet
## Road Construction

Project Name: Perryville Parkway
Termini: Jackrabbit to Northern
Date:

| *Alternative:* | | | | |
|---|---|---|---|---|
| *Item Description* | *Unit* | *Quantity* | *Unit Cost* | *Total* |
| N.P.D.E.S. | Lump Sum | 1 | $8,600.00 | $8,600 |
| Community Relations | Allowance | 1 | $12,000.00 | $12,000 |
| Engineer's Field Office | Lump Sum | 1 | $36,000.00 | $36,000 |
| Roadway Excavation | C YD | 90,000 | $5.90 | $531,000 |
| Borrow Excavation (if anticipated) | C YD | 182,800 | $9.50 | $1,736,600 |
| Channel & Retention Basin Excavation | C YD | | $8.00 | $0 |
| Subgrade Preparation | SQ YD | 124,556 | $2.60 | $323,846 |
| New Asphalt Concrete Pavement (see Pavement sheet) | SQ YD | | $24.65 | $0 |
| New Rubberized Asphalt Pavement (see Pavement sheet) | SQ YD | 124,556 | $24.95 | $3,107,672 |
| Asphalt Rubber Overlay (see Pavement sheet) | SQ YD | | $5.95 | $0 |
| Chip Seal on AC Pavement (see Pavement sheet) | SQ YD | | $1.95 | $0 |
| Double Chip Seal on Aggregate Base (see Pavement sheet) | SQ YD | | $3.80 | $0 |
| Pavement Sawcut | LF | | $1.26 | $0 |
| Concrete Single Curb | LF | | $8.80 | $0 |
| Concrete Curb & Gutter | LF | 51,514 | $11.30 | $582,108 |
| Concrete Sidewalk Ramp Std Det 231, Type "A" | EA | 12 | $1,850.00 | $22,200 |
| Concrete Sidewalk Std Det 230 | SQ YD | 16,933 | $39.00 | $660,387 |
| Concrete Driveway with 5' Wings, Std Det 250 | SQ YD | 975 | $50.00 | $48,750 |
| Traffic Signing & Striping - 2 lanes | LF | | $2.18 | $0 |
| Traffic Signing & Striping - 5 lanes | LF | | $4.07 | $0 |
| Traffic Signing & Striping - 7 lanes | LF | 12,700 | $4.50 | $57,150 |
| Traffic Signal, Full Intersection | EA | 2.0 | $280,000.00 | $560,000 |
| Interconnect/Traffic Signals | LF | 25,400 | $14.59 | $370,586 |
| Traffic Signal, Future "Box-in" | EA | 5 | $9,300.00 | $46,500 |
| Catch Basin | EA | 85 | $2,100.00 | $178,500 |
| Scupper | EA | | $3,300.00 | $0 |
| Drywell | EA | | $26,000.00 | $0 |
| Storm Drain System (retention basin option) | Mile | 0.0 | $700,000.00 | $0 |
| 18" CMP and smaller | LF | | $65.00 | $0 |
| 24" CMP | LF | | $91.00 | $0 |
| 30" CMP | LF | | $116.00 | $0 |
| 36" CMP | LF | | $130.00 | $0 |
| 48"CMP | LF | | $169.00 | $0 |
| 18" & 24" RGRCP, Class III | LF | | $79.00 | $0 |
| 30" & 36" RGRCP, Class III | LF | 16,900 | $123.00 | $2,078,700 |
| 42" & 48" RGRCP, Class III | LF | | $168.00 | $0 |
| 54" & 60" RGRCP, Class III | LF | | $269.00 | $0 |
| 54" & 60" Storm Drain/Irrigation Manhole | EA | | $3,900.00 | $0 |
| Headwall (MAG details) | EA | | $3,250.00 | $0 |
| Irrigation Junction Box (MAG details) | EA | | $2,950.00 | $0 |
| Concrete Slip Form Irrigation Ditch | LF | | $28.00 | $0 |
| Earth Irrigation Ditch/Special Drainage Ditch, 6' Top | LF | | $14.00 | $0 |
| Box Culvert (see Structure sheet) | LS | 1 | $2,196,200.00 | $2,196,200 |
| Irrigation Structure with Gates | EA | | $1,500.00 | $0 |
| Bridge < 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Bridge > 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Guardrail without Approach End Section | LF | | $35.00 | $0 |
| Guardrail Approach End Section, New ADOT Type | EA | | $2,400.00 | $0 |
| Median Fine Grading, Pre-emergent, & D.G. | SQ YD | 92,755 | $19.10 | $1,771,621 |
| 8' Masonry Soundwall | LF | | $91.00 | $0 |
| Concrete Soundwall | SQ YD | | $275.00 | $0 |
| | Subtotal | | | $14,328,420 |
| Removal of Existing Improvements @ 2% | Lump Sum | 1 | $286,568.00 | $286,568 |
| Mobilization/Demobilization @ 4% | Lump Sum | 1 | $573,137.00 | $573,137 |
| Traffic Control @ 3% | Lump Sum | 1 | $429,853.00 | $429,853 |
| | | | | |
| | | | | |
| | | | | |
| SUBTOTAL Construction | | | | $15,617,978 |
| | | | | |
| | Contingency | | 20% | $3,123,596 |
| | | | | |
| | TOTAL | | | $18,741,600 |

Structures

Project Name: Perryville Pkwy
Termini: Jackrabbit to Northern
Date:

## BOX CULVERT COST CALCULATIONS

| TYPE OF ROAD | BOX LENGTH (ft) | BOX DESCRIPTION | BOX WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks) | 88.58 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 94.49 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | | | | 27800 | SQ FT | $79.00 | $2,196,200.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 52.49 | | 0 | 0 | SQ FT | $52.00 | $0.00 |
| | | | | | | | $2,196,200.00 |

* Top surface area of box.

** Includes cost of standard wing walls and bridge barrier. For special construction review unit cost with MCDOT bridge section.

*** 16 m box with approval only. Generally a non-section line, low volume location.

## BRIDGE COST CALCULATIONS

| TYPE OF ROAD | BRIDGE LENGTH (ft) | DESCRIPTION | BRIDGE WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks ) | 0 | | 88.58 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 0 | | 94.49 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | 0 | | 104.33 | 0 | SQ FT | $107.00 | $0.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 0 | | 52.49 | 0 | SQ FT | $79.00 | $0.00 |
| | | | | | | <100' Long | $0.00 |
| | | | | | | >=100' Long | $0.00 |

* Top surface area of bridge.

** Cost includes bridge railings, barriers, approach slabs, piers, and other items used in bridge construction.
Note: Show cost of channel excavation and other bridge site work on Road Construction Sheet.

*** 16 m bridge with approval only. Generally a non-section line, low volume location.

# SUMMARY COST

Project Name: Perryville Parkway
Termini: Northern to Peoria
Date:

## 2007 SUMMARY COST ESTIMATES (Current Dollars)

| *COST CATEGORIES* | *Factors* | *No Build* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|---|
| *Construction* | | $0 | $16,448,100 | $0 |
| *Design (10% TO 15%)* | 12% | $0 | $1,973,800 | $0 |
| *Construction Management* | 15% | $0 | $2,467,200 | $0 |
| *Right-of-Way* | | $0 | $7,280,000 | $0 |
| *Utility Relocation* | | $0 | $1,000,000 | $0 |
| *Administration (8% TO 13%)* | 10% | $0 | $1,644,800 | $0 |
| ***Total*** | | **$0** | **$30,813,900** | **$0** |

## PRELIMINARY SUMMARY COST ESTIMATES (Adjusted for Inflation)

Assumed Annual Inflation Rate = 2.90%
Assumed Number of Years = 5

| | | | |
|---|---|---|---|
| *Adjusted Construction Cost* | $0 | $18,975,500 | $0 |
| *Design* | $0 | $2,277,100 | $0 |
| *Construction Management* | $0 | $2,846,300 | $0 |
| *Right-of-Way* | $0 | $8,398,600 | $0 |
| *Utility Relocation* | $0 | $1,153,700 | $0 |
| *Administration* | $0 | $1,897,500 | $0 |
| ***Adjusted Total*** | $0 | $35,548,700 | $0 |

# 2006 CAR Construction Cost Worksheet
## Road Construction

Project Name: Perryville Parkway
Termini: Northern to Peoria
Date:

*Alternative:*

| *Item Description* | *Unit* | *Quantity* | *Unit Cost* | *Total* |
|---|---|---|---|---|
| N.P.D.E.S. | Lump Sum | 1 | $8,600.00 | $8,600 |
| Community Relations | Allowance | 1 | $12,000.00 | $12,000 |
| Engineer's Field Office | Lump Sum | 1 | $36,000.00 | $36,000 |
| Roadway Excavation | C YD | 64,500 | $5.90 | $380,550 |
| Borrow Excavation (if anticipated) | C YD | 131,000 | $9.50 | $1,244,500 |
| Channel & Retention Basin Excavation | C YD | | $8.00 | $0 |
| Subgrade Preparation | SQ YD | 86,667 | $2.60 | $225,334 |
| New Asphalt Concrete Pavement (see Pavement sheet) | SQ YD | | $24.65 | $0 |
| New Rubberized Asphalt Pavement (see Pavement sheet) | SQ YD | 86,667 | $24.95 | $2,162,342 |
| Asphalt Rubber Overlay (see Pavement sheet) | SQ YD | | $5.95 | $0 |
| Chip Seal on AC Pavement (see Pavement sheet) | SQ YD | | $1.95 | $0 |
| Double Chip Seal on Aggregate Base (see Pavement sheet) | SQ YD | | $3.80 | $0 |
| Pavement Sawcut | LF | | $1.26 | $0 |
| Concrete Single Curb | LF | | $8.80 | $0 |
| Concrete Curb & Gutter | LF | 36,876 | $11.30 | $416,699 |
| Concrete Sidewalk Ramp Std Det 231, Type "A" | EA | 24 | $1,850.00 | $44,400 |
| Concrete Sidewalk Std Det 230 | SQ YD | 12,133 | $39.00 | $473,187 |
| Concrete Driveway with 5' Wings, Std Det 250 | SQ YD | 699 | $50.00 | $34,950 |
| Traffic Signing & Striping - 2 lanes | LF | | $2.18 | $0 |
| Traffic Signing & Striping - 5 lanes | LF | | $4.07 | $0 |
| Traffic Signing & Striping - 7 lanes | LF | 9,100 | $4.50 | $40,950 |
| Traffic Signal, Full Intersection | EA | 4.0 | $280,000.00 | $1,120,000 |
| Interconnect/Traffic Signals | LF | 18,200 | $14.59 | $265,538 |
| Traffic Signal, Future "Box-In" | EA | 4 | $9,300.00 | $37,200 |
| Catch Basin | EA | 61 | $2,100.00 | $128,100 |
| Scupper | EA | | $3,300.00 | $0 |
| Drywell | EA | | $26,000.00 | $0 |
| Storm Drain System (retention basin option) | Mile | 0.0 | $700,000.00 | $0 |
| 18" CMP and smaller | LF | | $65.00 | $0 |
| 24" CMP | LF | | $91.00 | $0 |
| 30" CMP | LF | | $116.00 | $0 |
| 36" CMP | LF | | $130.00 | $0 |
| 48"CMP | LF | | $169.00 | $0 |
| 18" & 24" RGRCP, Class III | LF | | $79.00 | $0 |
| 30" & 36" RGRCP, Class III | LF | 12,100 | $123.00 | $1,488,300 |
| 42" & 48" RGRCP, Class III | LF | | $168.00 | $0 |
| 54" & 60" RGRCP, Class III | LF | | $269.00 | $0 |
| 54" & 60" Storm Drain/Irrigation Manhole | EA | | $3,900.00 | $0 |
| Headwall (MAG details) | EA | | $3,250.00 | $0 |
| Irrigation Junction Box (MAG details) | EA | | $2,950.00 | $0 |
| Concrete Slip Form Irrigation Ditch | LF | | $28.00 | $0 |
| Earth Irrigation Ditch/Special Drainage Ditch, 6' Top | LF | | $14.00 | $0 |
| Box Culvert (see Structure sheet) | LS | 1 | $1,239,115.00 | $1,239,115 |
| Irrigation Structure with Gates | EA | | $1,500.00 | $0 |
| Bridge < 100' (see Structure sheet) | LS | 1 | $1,936,700.00 | $1,936,700 |
| Bridge > 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Guardrail without Approach End Section | LF | | $35.00 | $0 |
| Guardrail Approach End Section, New ADOT Type | EA | | $2,400.00 | $0 |
| Median Fine Grading, Pre-emergent, & D.G. | SQ YD | 67,044 | $19.10 | $1,280,540 |
| 8' Masonry Soundwall | LF | | $91.00 | $0 |
| Concrete Soundwall | SQ YD | | $275.00 | $0 |
| | Subtotal | | | $12,575,005 |
| Removal of Existing Improvements @ 2% | Lump Sum | 1 | $251,500.00 | $251,500 |
| Mobilization/Demobilization @ 4% | Lump Sum | 1 | $503,000.00 | $503,000 |
| Traffic Control @ 3% | Lump Sum | 1 | $377,250.00 | $377,250 |
| | | | | |
| | | | | |
| SUBTOTAL Construction | | | | $13,706,755 |
| | | | | |
| | Contingency | | 20% | $2,741,351 |
| | | | | |
| | TOTAL | | | $16,448,100 |

Project Name: Perryville Pkwy
Termini: Northern to Peoria
Date:

## BOX CULVERT COST CALCULATIONS

| TYPE OF ROAD | BOX LENGTH (ft) | BOX DESCRIPTION | BOX WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks) | 88.58 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 94.49 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | | | | 15685 | SQ FT | $79.00 | $1,239,115.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 52.49 | | 0 | 0 | SQ FT | $52.00 | $0.00 |
| | | | | | | | $1,239,115.00 |

* Top surface area of box.

** Includes cost of standard wing walls and bridge barrier. For special construction review unit cost with MCDOT bridge section.

*** 16 m box with approval only. Generally a non-section line, low volume location.

## BRIDGE COST CALCULATIONS

| TYPE OF ROAD | BRIDGE LENGTH (ft) | DESCRIPTION | BRIDGE WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks ) | 0 | | 88.58 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 0 | | 94.49 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | 0 | | | 18100 | SQ FT | $107.00 | $1,936,700.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 0 | | 52.49 | 0 | SQ FT | $79.00 | $0.00 |
| | | | | | | <100' Long | $1,936,700.00 |
| | | | | | | >=100' Long | $0.00 |

* Top surface area of bridge.

** Cost includes bridge railings, barriers, approach slabs, piers, and other items used in bridge construction.
Note: Show cost of channel excavation and other bridge site work on Road Construction Sheet.

*** 16 m bridge with approval only. Generally a non-section line, low volume location.

# SUMMARY COST

Project Name: Perryville Parkway
Termini: Peoria to Waddell
Date:

## 2007 SUMMARY COST ESTIMATES (Current Dollars)

| *COST CATEGORIES* | *Factors* | *No Build* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|---|
| *Construction* | | $0 | $25,312,800 | $0 |
| *Design (10% TO 15%)* | 12% | $0 | $3,037,500 | $0 |
| *Construction Management* | 15% | $0 | $3,796,900 | $0 |
| *Right-of-Way* | | $0 | $11,440,000 | $0 |
| *Utility Relocation* | | $0 | $1,000,000 | $0 |
| *Administration (8% TO 13%)* | 10% | $0 | $2,531,300 | $0 |
| ***Total*** | | **$0** | **$47,118,500** | **$0** |

## PRELIMINARY SUMMARY COST ESTIMATES (Adjusted for Inflation)

Assumed Annual Inflation Rate = 2.90%
Assumed Number of Years = 5

| | | | |
|---|---|---|---|
| *Adjusted Construction Cost* | $0 | $29,202,300 | $0 |
| *Design* | $0 | $3,504,200 | $0 |
| *Construction Management* | $0 | $4,380,300 | $0 |
| *Right-of-Way* | $0 | $13,197,800 | $0 |
| *Utility Relocation* | $0 | $1,153,700 | $0 |
| *Administration* | $0 | $2,920,300 | $0 |
| ***Adjusted Total*** | $0 | $54,358,600 | $0 |

# 2006 CAR Construction Cost Worksheet
## Road Construction

**Project Name: Perryville Parkway**
**Termini: Peoria to Waddell**
**Date:**

| *Alternative:* | | | | |
|---|---|---|---|---|
| *Item Description* | *Unit* | *Quantity* | *Unit Cost* | *Total* |
| N.P.D.E.S. | Lump Sum | 1 | $8,600.00 | $8,600 |
| Community Relations | Allowance | 1 | $12,000.00 | $12,000 |
| Engineer's Field Office | Lump Sum | 1 | $36,000.00 | $36,000 |
| Roadway Excavation | C YD | 101,400 | $5.90 | $598,260 |
| Borrow Excavation (if anticipated) | C YD | 205,800 | $9.50 | $1,955,100 |
| Channel & Retention Basin Excavation | C YD | | $8.00 | $0 |
| Subgrade Preparation | SQ YD | 139,333 | $2.60 | $362,266 |
| New Asphalt Concrete Pavement (see Pavement sheet) | SQ YD | | $24.65 | $0 |
| New Rubberized Asphalt Pavement (see Pavement sheet) | SQ YD | 139,333 | $24.95 | $3,476,358 |
| Asphalt Rubber Overlay (see Pavement sheet) | SQ YD | | $5.95 | $0 |
| Chip Seal on AC Pavement (see Pavement sheet) | SQ YD | | $1.95 | $0 |
| Double Chip Seal on Aggregate Base (see Pavement sheet) | SQ YD | | $3.80 | $0 |
| Pavement Sawcut | LF | | $1.26 | $0 |
| Concrete Single Curb | LF | | $8.80 | $0 |
| Concrete Curb & Gutter | LF | 57,948 | $11.30 | $654,812 |
| Concrete Sidewalk Ramp Std Det 231, Type "A" | EA | 24 | $1,850.00 | $44,400 |
| Concrete Sidewalk Std Det 230 | SQ YD | 19,066 | $39.00 | $743,574 |
| Concrete Driveway with 5' Wings, Std Det 250 | SQ YD | 1,098 | $50.00 | $54,900 |
| Traffic Signing & Striping - 2 lanes | LF | | $2.18 | $0 |
| Traffic Signing & Striping - 5 lanes | LF | | $4.07 | $0 |
| Traffic Signing & Striping - 7 lanes | LF | 14,300 | $4.50 | $64,350 |
| Traffic Signal, Full Intersection | EA | 4.0 | $280,000.00 | $1,120,000 |
| Interconnect/Traffic Signals | LF | 28,600 | $14.59 | $417,274 |
| Traffic Signal, Future "Box-in" | EA | 5 | $9,300.00 | $46,500 |
| Catch Basin | EA | 95 | $2,100.00 | $199,500 |
| Scupper | EA | | $3,300.00 | $0 |
| Drywell | EA | | $26,000.00 | $0 |
| Storm Drain System (retention basin option) | Mile | 0.0 | $700,000.00 | $0 |
| 18" CMP and smaller | LF | | $65.00 | $0 |
| 24" CMP | LF | | $91.00 | $0 |
| 30" CMP | LF | | $116.00 | $0 |
| 36" CMP | LF | | $130.00 | $0 |
| 48"CMP | LF | | $169.00 | $0 |
| 18" & 24" RGRCP, Class III | LF | | $79.00 | $0 |
| 30" & 36" RGRCP, Class III | LF | 19,100 | $123.00 | $2,349,300 |
| 42" & 48" RGRCP, Class III | LF | | $168.00 | $0 |
| 54" & 60" RGRCP, Class III | LF | | $269.00 | $0 |
| 54" & 60" Storm Drain/Irrigation Manhole | EA | | $3,900.00 | $0 |
| Headwall (MAG details) | EA | | $3,250.00 | $0 |
| Irrigation Junction Box (MAG details) | EA | | $2,950.00 | $0 |
| Concrete Slip Form Irrigation Ditch | LF | | $28.00 | $0 |
| Earth Irrigation Ditch/Special Drainage Ditch, 6' Top | LF | | $14.00 | $0 |
| Box Culvert (see Structure sheet) | LS | 1 | $3,737,332.00 | $3,737,332 |
| Irrigation Structure with Gates | EA | | $1,500.00 | $0 |
| Bridge < 100' (see Structure sheet) | LS | 1 | $1,459,480.00 | $1,459,480 |
| Bridge > 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Guardrail without Approach End Section | LF | | $35.00 | $0 |
| Guardrail Approach End Section, New ADOT Type | EA | | $2,400.00 | $0 |
| Median Fine Grading, Pre-emergent, & D.G. | SQ YD | 105,355 | $19.10 | $2,012,281 |
| 8' Masonry Soundwall | LF | | $91.00 | $0 |
| Concrete Soundwall | SQ YD | | $275.00 | $0 |
| | Subtotal | | | $19,352,287 |
| Removal of Existing Improvements @ 2% | Lump Sum | 1 | $387,046.00 | $387,046 |
| Mobilization/Demobilization @ 4% | Lump Sum | 1 | $774,091.00 | $774,091 |
| Traffic Control @ 3% | Lump Sum | 1 | $580,569.00 | $580,569 |
| | | | | |
| | | | | |
| SUBTOTAL Construction | | | | $21,093,993 |
| | Contingency | | 20% | $4,218,799 |
| | TOTAL | | | $25,312,800 |

Project Name: Perryville Pkwy
Termini: Peoria to Waddell
Date:

## BOX CULVERT COST CALCULATIONS

| TYPE OF ROAD | BOX LENGTH (ft) | BOX DESCRIPTION | BOX WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks) | 88.58 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 94.49 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | | | | 47308 | SQ FT | $79.00 | $3,737,332.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 52.49 | | 0 | 0 | SQ FT | $52.00 | $0.00 |
| | | | | | | | $3,737,332.00 |

* Top surface area of box.

** Includes cost of standard wing walls and bridge barrier. For special construction review unit cost with MCDOT bridge section.

*** 16 m box with approval only. Generally a non-section line, low volume location.

## BRIDGE COST CALCULATIONS

| TYPE OF ROAD | BRIDGE LENGTH (ft) | DESCRIPTION | BRIDGE WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks ) | 0 | | 88.58 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 0 | | 94.49 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | 0 | | | 13640 | SQ FT | $107.00 | $1,459,480.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 0 | | 52.49 | 0 | SQ FT | $79.00 | $0.00 |
| | | | | | | <100' Long | $1,459,480.00 |
| | | | | | | >=100' Long | $0.00 |

* Top surface area of bridge.

** Cost includes bridge railings, barriers, approach slabs, piers, and other items used in bridge construction.
Note: Show cost of channel excavation and other bridge site work on Road Construction Sheet.

*** 16 m bridge with approval only. Generally a non-section line, low volume location.

# SUMMARY COST

Project Name: Perryville Parkway
Termini: Waddell to Bell
Date:

## 2007 SUMMARY COST ESTIMATES (Current Dollars)

| *COST CATEGORIES* | *Factors* | *No Build* | *Alternative 1* | *Alternative 2* |
|---|---|---|---|---|
| *Construction* | | $0 | $15,417,100 | $0 |
| *Design (10% TO 15%)* | 12% | $0 | $1,850,100 | $0 |
| *Construction Management* | 15% | $0 | $2,312,600 | $0 |
| *Right-of-Way* | | $0 | $7,520,000 | $0 |
| *Utility Relocation* | | $0 | $1,000,000 | $0 |
| *Administration (8% TO 13%)* | 10% | $0 | $1,541,700 | $0 |
| ***Total*** | | **$0** | **$29,641,500** | **$0** |

## PRELIMINARY SUMMARY COST ESTIMATES (Adjusted for Inflation)

Assumed Annual Inflation Rate = 2.90%
Assumed Number of Years = 5

| | | | |
|---|---|---|---|
| *Adjusted Construction Cost* | $0 | $17,786,100 | $0 |
| *Design* | $0 | $2,134,400 | $0 |
| *Construction Management* | $0 | $2,667,900 | $0 |
| *Right-of-Way* | $0 | $8,675,500 | $0 |
| *Utility Relocation* | $0 | $1,153,700 | $0 |
| *Administration* | $0 | $1,778,600 | $0 |
| ***Adjusted Total*** | $0 | $34,196,200 | $0 |

# 2006 CAR Construction Cost Worksheet
## Road Construction

Project Name: Perryville Parkway
Termini: Waddell to Bell
Date:

| *Alternative:* | | | | |
|---|---|---|---|---|
| *Item Description* | *Unit* | *Quantity* | *Unit Cost* | *Total* |
| N.P.D.E.S. | Lump Sum | 1 | $8,600.00 | $8,600 |
| Community Relations | Allowance | 1 | $12,000.00 | $12,000 |
| Engineer's Field Office | Lump Sum | 1 | $36,000.00 | $36,000 |
| Roadway Excavation | C YD | 66,600 | $5.90 | $392,940 |
| Borrow Excavation (if anticipated) | C YD | 135,300 | $9.50 | $1,285,350 |
| Channel & Retention Basin Excavation | C YD | | $8.00 | $0 |
| Subgrade Preparation | SQ YD | 92,444 | $2.60 | $240,354 |
| New Asphalt Concrete Pavement (see Pavement sheet) | SQ YD | | $24.65 | $0 |
| New Rubberized Asphalt Pavement (see Pavement sheet) | SQ YD | 92,444 | $24.95 | $2,306,478 |
| Asphalt Rubber Overlay (see Pavement sheet) | SQ YD | | $5.95 | $0 |
| Chip Seal on AC Pavement (see Pavement sheet) | SQ YD | | $1.95 | $0 |
| Double Chip Seal on Aggregate Base (see Pavement sheet) | SQ YD | | $3.80 | $0 |
| Pavement Sawcut | LF | | $1.26 | $0 |
| Concrete Single Curb | LF | | $8.80 | $0 |
| Concrete Curb & Gutter | LF | 38,144 | $11.30 | $431,027 |
| Concrete Sidewalk Ramp Std Det 231, Type "A" | EA | 12 | $1,850.00 | $22,200 |
| Concrete Sidewalk Std Det 230 | SQ YD | 12,533 | $39.00 | $488,787 |
| Concrete Driveway with 5' Wings, Std Det 250 | SQ YD | 722 | $50.00 | $36,100 |
| Traffic Signing & Striping - 2 lanes | LF | | $2.18 | $0 |
| Traffic Signing & Striping - 5 lanes | LF | | $4.07 | $0 |
| Traffic Signing & Striping - 7 lanes | LF | 9,400 | $4.50 | $42,300 |
| Traffic Signal, Full Intersection | EA | 4.0 | $280,000.00 | $1,120,000 |
| Interconnect/Traffic Signals | LF | 18,800 | $14.59 | $274,292 |
| Traffic Signal, Future "Box-in" | EA | 4 | $9,300.00 | $37,200 |
| Catch Basin | EA | 63 | $2,100.00 | $132,300 |
| Scupper | EA | | $3,300.00 | $0 |
| Drywell | EA | | $26,000.00 | $0 |
| Storm Drain System (retention basin option) | Mile | 0.0 | $700,000.00 | $0 |
| 18" CMP and smaller | LF | | $65.00 | $0 |
| 24" CMP | LF | | $91.00 | $0 |
| 30" CMP | LF | | $116.00 | $0 |
| 36" CMP | LF | | $130.00 | $0 |
| 48"CMP | LF | | $169.00 | $0 |
| 18" & 24" RGRCP, Class III | LF | | $79.00 | $0 |
| 30" & 36" RGRCP, Class III | LF | 12,500 | $123.00 | $1,537,500 |
| 42" & 48" RGRCP, Class III | LF | | $168.00 | $0 |
| 54" & 60" RGRCP, Class III | LF | | $269.00 | $0 |
| 54" & 60" Storm Drain/Irrigation Manhole | EA | | $3,900.00 | $0 |
| Headwall (MAG details) | EA | | $3,250.00 | $0 |
| Irrigation Junction Box (MAG details) | EA | | $2,950.00 | $0 |
| Concrete Slip Form Irrigation Ditch | LF | | $28.00 | $0 |
| Earth Irrigation Ditch/Special Drainage Ditch, 6' Top | LF | | $14.00 | $0 |
| Box Culvert (see Structure sheet) | LS | 1 | $2,076,910.00 | $2,076,910 |
| Irrigation Structure with Gates | EA | | $1,500.00 | $0 |
| Bridge < 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Bridge > 100' (see Structure sheet) | LS | | $0.00 | $0 |
| Guardrail without Approach End Section | LF | | $35.00 | $0 |
| Guardrail Approach End Section, New ADOT Type | EA | | $2,400.00 | $0 |
| Median Fine Grading, Pre-emergent, & D.G. | SQ YD | 68,400 | $19.10 | $1,306,440 |
| 8' Masonry Soundwall | LF | | $91.00 | $0 |
| Concrete Soundwall | SQ YD | | $275.00 | $0 |
| | Subtotal | | | $11,786,778 |
| Removal of Existing Improvements @ 2% | Lump Sum | 1 | $235,736.00 | $235,736 |
| Mobilization/Demobilization @ 4% | Lump Sum | 1 | $471,471.00 | $471,471 |
| Traffic Control @ 3% | Lump Sum | 1 | $353,603.00 | $353,603 |
| | | | | |
| | | | | |
| | | | | |
| SUBTOTAL Construction | | | | $12,847,588 |
| | | | | |
| | Contingency | | 20% | $2,569,518 |
| | | | | |
| | TOTAL | | | $15,417,100 |

Project Name: Perryvilla Pkwy
Termini: Waddell to Bell
Date:

## BOX CULVERT COST CALCULATIONS

| TYPE OF ROAD | BOX LENGTH (ft) | BOX DESCRIPTION | BOX WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks) | 88.58 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 94.49 | | 0 | 0 | SQ FT | $79.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | | | | 26290 | SQ FT | $79.00 | $2,076,910.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 52.49 | | 0 | 0 | SQ FT | $52.00 | $0.00 |
| | | | | | | | $2,076,910.00 |

* Top surface area of box.

** Includes cost of standard wing walls and bridge barrier. For special construction review unit cost with MCDOT bridge section.

*** 16 m box with approval only. Generally a non-section line, low volume location.

## BRIDGE COST CALCULATIONS

| TYPE OF ROAD | BRIDGE LENGTH (ft) | DESCRIPTION | BRIDGE WIDTH (ft) | TOP SFC AREA* | UNIT | COST** | TOTAL COST |
|---|---|---|---|---|---|---|---|
| URBAN MINOR ARTERIAL OR LESS (27 m or 88.58' for 5 lanes & 2 sidewalks ) | 0 | | 88.58 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MINOR ARTERIAL W/ BIKE LANES (28.8 m or 94.49' for 5 lanes, 2 B/L's & 2 S/W's) | 0 | | 94.49 | 0 | SQ FT | $107.00 | $0.00 |
| URBAN MAJOR ARTERIAL (31.8 m or 104.33' for 7 lanes & 2 S/W's) | 0 | | | 0 | SQ FT | $107.00 | $0.00 |
| SPECIAL LOW VOLUME ROAD CONDITION*** (16 m or 52.49' for 2 lanes with shoulders) | 0 | | 52.49 | 0 | SQ FT | $79.00 | $0.00 |
| | | | | | | <100' Long | $0.00 |
| | | | | | | >=100' Long | $0.00 |

* Top surface area of bridge.

** Cost includes bridge railings, barriers, approach slabs, piers, and other items used in bridge construction.
Note: Show cost of channel excavation and other bridge site work on Road Construction Sheet.

*** 16 m bridge with approval only. Generally a non-section line, low volume location.

# Appendix XVII
# Meeting Minutes

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 19, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 11, 2007 Stakeholder Meeting-Utilities

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, Cheryl Toy gave an overview of the project and its purpose.

***APS-Paul Richards***

Paul Richards informed the group that Arizona Public Service (APS) has two ongoing projects in the vicinity of the Jackrabbit Trail project corridor-West Valley North and West Valley South Power Line and Substation Projects. The West Valley North Project runs north from the Olive Avenue-303 intersection to Cactus Road and then west to one half-mile east of the Jackrabbit Trail/195$^{th}$ Avenue alignment. It continues north to Beardsley Road and then to the Northwest Regional Landfill site. Thus, within the project corridor, the transmission line will run parallel to the Jackrabbit Trail alignment between Cactus and Bell roads. The planned line crosses the McMicken Dam Corridor with power lines over the dam and towers in the right-of-way. This project is in the design stage right now and in the process of acquiring right-of-way. With a service year for 2009, the construction for this project will begin in the middle of 2008.

The West Valley South Power Line and Substation Project consists of a 230kV transmission line along Perryville alignment between Broadway and Indian School Roads. The line then continues along Indian School Road for a mile and a quarter before turning east along Cotton Lane alignment. It turns further east along Loop 303 at Bethany Home Road and continues north until Olive Avenue. The construction for this line is scheduled to start in January 2007 and should be completed by June 2007. This project will tie in with the existing 69 kV transmission line along McDowell Road.

***FCDMC-Larry Lambert and Valerie Swick***

Larry Lambert and Valerie Swick gave an overview of the FCDMC projects in and around the Jackrabbit Project corridor. The Wittmann Area Drainage Master Plan covers the area north of the McMicken Dam until the Hieroglyphic Mountains within the Trilby Watershed. Currently, alternatives for regional drainage and McMicken Dam are being explored as part of this study. Kelli Sertich is the Project Manager and should be contacted for more information on this ADMP and the McMicken Dam Project. Javier Guana, Andes Engineering, mentioned that it might be possible to get some preliminary information about the project by summer 2007.

Larry Lambert walked the attendees through the second main FCDMC project in the area-the Loop 303 Corridor/ White Tanks Area Drainage Master Plan. The entire area south of the Wittmann project lies within the boundaries of the completed White Tanks ADMP, and specific projects are now being implemented as part of the ADMP. The following are the specific projects:

1. *FRS#3 North Inlet Channel Project*

   This project includes two channels both east and west of the Beardsley Canal between Northern and Olive Avenues. The existing channel does not have enough R/W for channeling flow into FRS #3. The northern structure of the North Inlet Channel is to be completed by June 2007. Bobby Ohler serves as the PM on this project with Kirkham Michael as the consultants. Since all of the channels are natural and unlined, the FCDMC has been working in coordination with Zanjero Trails community to incorporate their plans as well.

2. *The southern portion of North Inlet Channel* which extends from Northern Avenue to FRS #3 will be combined with the final phase of FRS #3 and the construction will begin in 2009.

3. *Improvements to FRS #3*

   Larry Lambert serves as the PM on this project. This project has two phases of which Phase I is under construction and will be completed by 2007. Phase II will be completed by the end of calendar year 2008. URS is serving as the consultant on this project.

4. *White Tanks #4 Project*

   This project extends from Bethany Home Road to FRS #4, north of Van Buren Road. There are three sub-parts to this project:

   i. *Channel between FRS #3 and 4*

**Attendees**

Cheryl Toy, MCDOT
Robert Sachs, FCDMC
Linda Sciarro, Maricopa County Public Works
Valerie Swick, FCDMC
Larry Lambert, FCDMC
Paul Richards, APS
A. Frances Ackerman, Gannet Fleming
Javier Guana, Andes Engineering/ DMJM Harris
Kammy Horne, DMJM Harris
Jackie Pfeiffer, DMJM Harris
Stephen Luk, DMJM Harris
Rodney Bragg, DMJM Harris
Greg Jacoby, DMJM Harris
Mansi Sachdev, DMJM Harris

Currently, two alternatives are being explored for this project. There are significant problems for R/W between Bethany Home Road and Indian School Road. FCDMC has acquired R/W between Indian School and I-10. Both of the alternatives propose handling of the base flow from FRS #3 and carrying it over to FRS #4. Main factors under consideration are R/W and associated cost. An IPR is being held at FCDMC on February 6, 2007 to discuss these issues.

FRS #3 is going to remain a dam and Larry Lambert should be contacted for more information on any FCDMC project between Northern and Southern Avenues. Valerie Swick should be copied on any correspondence as well.

Larry Lambert discussed certain critical issues with the McMicken Dam and the FRS #3. He informed the group that FRS #3 is located in a fissure risk zone with the emergency spillway located on the Jackrabbit Trail section line. Since the dam also lies in a fissure risk zone, the option of placing the alignment on the Jackrabbit section line will lead to further complications.

Valerie Swick mentioned that she had surveyed the corridor recently between Camelback and Missouri roads and the actual corridor is built on the east side of the section line. Thus, the end of the pavement on Jackrabbit Trail is the actual section line.

ii. *Improvements to FRS #4* - this project is still in the planning stage

iii. *Outlet Channel to Gila River*- this project is still in the planning stage

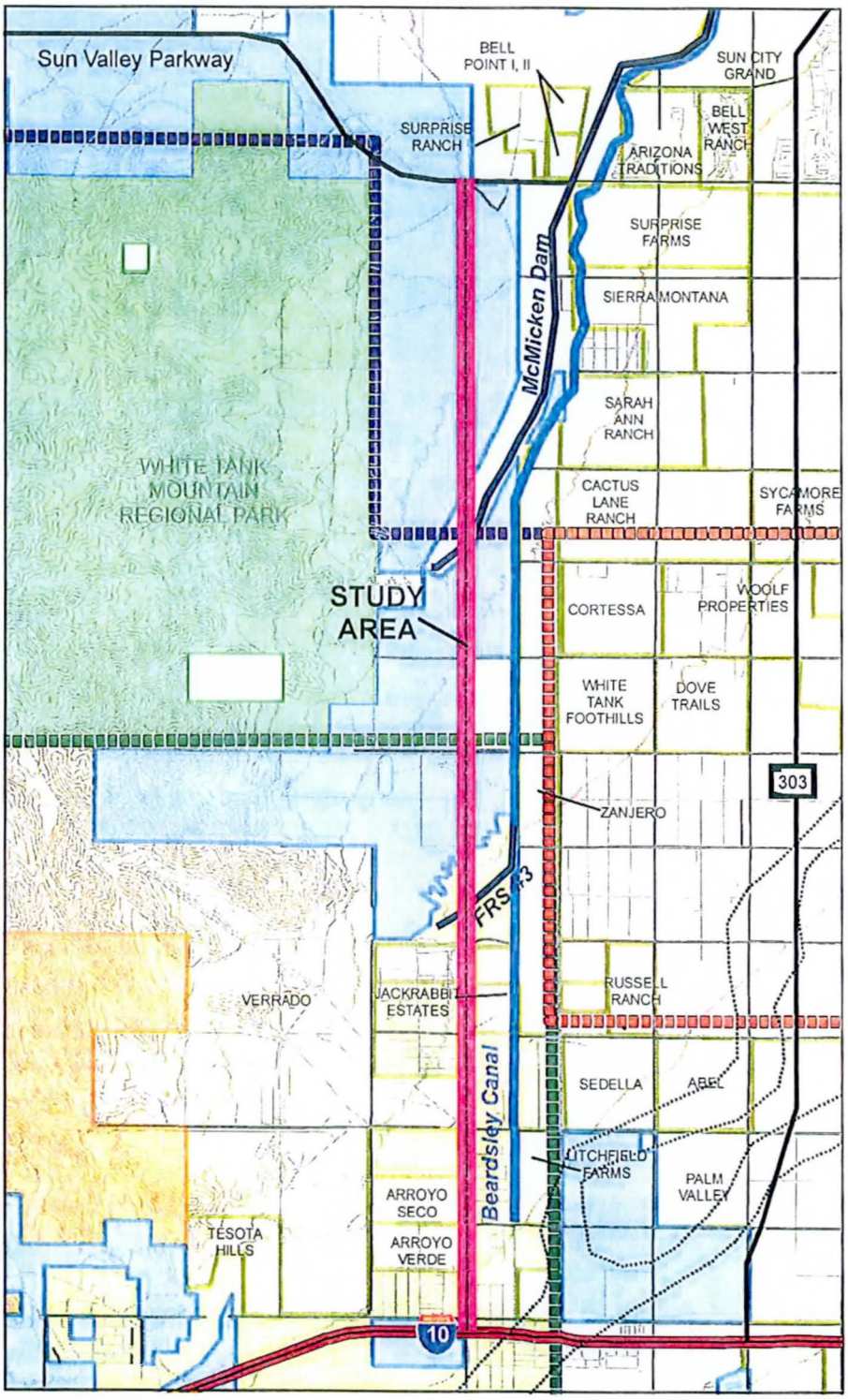
Larry Lambert mentioned that the research conducted for the ADMPs will be documented at the FCDMC Library. He also apprised the members that some cultural sites are present east of the Beardsley Canal, between Olive and Northern Avenues.

Kammy Horne encouraged members to discuss other issues pertaining to their agency's utilities and the project corridor. Paul Richards offered to provide the preliminary engineering and construction drawings on West Valley South and West valley North Power Line and Substation Projects in PDF format. He suggested that Bobby Ohler should be contacted for more information on the low voltage line.

Paul Richards also brought to attendees' notice that the State Power Line Siting Commission had conducted an environmental review for both these power line projects. Some species and habitats were found near the White Tanks Mountains. In addition to this, property ownership has changed several times in the West Valley North project area and the application made to the Siting Commission has these issues outlined in it. The Arizona Corporation Commission can be contacted to obtain a copy of the application and he would be happy to provide the case numbers for these projects.

Larry Lambert emphasized that the Jackrabbit Trail Project should work in coordination with the Maricopa County Trail System and Chris Coover should be consulted for the same. The corridor between McMicken Dam, FRS #3 and 4 is part of the Trail System Master Plan for Maricopa County.

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate 10 to Bell Road*




**Legend**

- Major Roads
- Highways
- Freeway
- Canal
- Topography (100' contours)
- Noise Contours
- State Land
- BLM
- Regional Park
- Planned or Existing Developments
- Buckeye Municipal Planning Area
- Glendale Municipal Planning Area
- Surprise Municipal Planning Area

N W E S

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Miles

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

| | |
|---|---|
| Date: | January 17, 2007 |
| To: | Cheryl Toy, Project Manager, MCDOT |
| From: | Kammy Horne, Project Manager, DMJM Harris |
| Re: | Jackrabbit Trail Access Control and CIS |
| Subject: | January 17, 2007 Stakeholder Meeting-City of Surprise |
| Attendees: | See attached list |

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, Cheryl Toy gave an overview of the project and its purpose. Kammy Horne continued with an overview of the handouts. Kammy made a request to Randy Overmyer for the APS environmental study report. Randy reported that Randall Simpson from URS is the Project Manager on the study, and he (Randy) could try to get a hold of the GIS data for the northwest area. The Arizona Corporation Commission (ACC) has approved the corridor. An APS line runs on a 120' easement on the alignment north of Cactus to facilitate maintenance and construction. The Arizona State Land Department (ASLD) did not wish their holding to be bisected by the power line so they supported an alignment half mile to the east of 191st Avenue, one mile west of the Loop 303. The Surprise Parkway is 240-foot wide with a 60-foot median. There have been discussions with APS to run their line through the center of the median taking care of siting and vision related issues. The preferred alignment for the North West Valley transmission line runs north from Olive Avenue-303 intersection to Cactus Road and then west to one half-mile east of the Jackrabbit Trail/195th Avenue alignment. It continues north to Beardsley Road and then to the Northwest Regional Landfill site. It then goes west paralleling the existing 500 kV power line corridor till 243rd avenue and then jogs north towards the CAP.

Randy Overmyer informed that an engineering design review is on its way to decide the spacing of poles in the median so that it does not come in the way of traffic operations. John McNamara inquired if the EIS was available to gather some background information on the project and if any other transmission lines were planned. Randy Overmyer offered to provide Mike Dewitt's contact number to John McNamara to get more information about APS' plans in that corridor. He informed the attendees that Jackrabbit is designated as a parkway north of Peoria Avenue in the City of Surprise Transportation Plan as well. Randy Overmyer also expressed that the City of Surprise would be amenable if Jackrabbit Trail follows the same route as the APS line and jogs from 195th alignment to 191st as a possible alignment alternative. West of the Loop 303, if Peoria and Bell were taken as screen lines, in the absence of Jackrabbit Trail with only 303 and the other arterials, Dysart Road would be 140,000 over capacity in 2030. Prasada is bringing in approximately 10 million square feet of retail use and the segment values on the intersections around the development are in the 40-70,000 range. Prasada will have about 5000-6000 homes, a medical complex, a shopping mall and an auto mall with over 29 dealers.

Randy Overmyer explained that the screen line concept will help to accommodate the intense traffic, provide relief to Loop 303 in the design year and take in the volume coming in from Buckeye. Jackrabbit Trail will be able to distribute that traffic with access on Greenway, Waddell and other mile roads.

Kammy Horne requested Randy Overmyer to provide contact information of the developers within the jurisdiction of the City of Surprise and relevant to the project corridor. She also requested for information on the development status, GIS information on these, any updates to the City of Surprise General Plan and the Transportation Plan. Randy Overmyer informed that there were minimal changes in the area. He informed that a rural subdivision, Waddell Hacienda, north of Waddell Road, between Citrus Road and the canal, is a county island and the residents were extremely aggrieved when Prasada came in. Waddell Road was upgraded to a major arterial. However, it was changed to a minor arterial west of Citrus after insistence from Waddell Hacienda. It is classified as a principal arterial according to the county.

Randy Overmyer explained that the City of Surprise is working on a regional Roadway Impact fee and is currently being revised to present it to the council. This fee would be in the order of $5,300 per unit to fund all regional transportation facilities within the City of Surprise, but would not include arterials. If approved, this will be the only transportation impact fee and will be targeted towards special projects that have regional significance. Bob Maki informed that currently there are other impact fees which go to the public works but none for transportation specifically. He also brought to light that the City of Surprise has periodical interactions with MCDOT and one of the major concerns was the future of Peoria Avenue from the Jackrabbit Trail area to Dysart Road regarding right-of-way needs. Currently it is extremely difficult to get to Loop 303 from Citrus Road on Peoria Avenue. Bob Woodring at MCDOT is looking at all the other roadways for similar situations where it is difficult to get R/W from property owners.

Randy Overmyer pointed out that a piece of land between Northern and Peoria Avenues, from Perryville Road to the White Tanks Mountains falls under no planning jurisdiction. City of Surprise had expressed interest to Zanjero Trails to annex this land. Currently, in the Zanjero Trails plan, Perryville Road ends at Sweetwater, half mile between Cactus and Waddell roads.

John McNamara inquired if any possible alternative was suggested. Randy Overmyer emphasized the importance of coordination with the Flood Control District. Cheryl Toy informed that the project team was in touch with Larry Lambert and his team at the Flood Control District.

Kammy Horne inquired about a point of contact at Waddell Hacienda. Vineetha Kartha told that she was the single point of contact with the development. Dan Marum suggested that it would be best to contact them through the City of Surprise. Vineetha Kartha offered to initiate the contact process.

Dan Marum emphasized that this study will retain the integrity of the network and this is the message that should be sent out to all the stakeholders. The message to the public should stress that effort is being made to bridge the gap between MAG and county corridor studies and that the two initiatives are consistent with each other. Dan Marum also offered to look into the functional classifications of the county and the city, and test them for consistency.

Randy Overmyer explained that there were drainage issues in the area north of Greenway Road. In addition, the Northwest Regional Landfill site is also present south of the Deer Valley Road and 195th Avenue intersection. This landfill site would probably have a life span of at least ten years from now. Dan Marum expressed his concerns that it would be difficult to get a 200 feet R/W for Jackrabbit Trail as it is expensive to relocate property.

Kammy Horne discussed the possible dates for a Project Advisory Committee (PAC) meeting and the first Public Involvement Meeting. She also discussed the mechanism to bring in Hassayampa Roadway Framework Study to these meetings. John McNamara emphasized the importance of explaining the relationship between the two studies. He explained that Hassayampa was an area wide transportation study from a 50,000-foot level looking at a build out stage in 2050 and Jackrabbit Trail was a corridor study. Both these studies have an understanding that the Hassayampa Roadway Framework Study would end well in advance with its recommendations. Randy Overmyer suggested that the key milestones from the Hassayampa study should be reflected on the Jackrabbit project schedule. John McNamara emphasized again that there should be an understanding that Hassayampa is not driving the Jackrabbit Trail Corridor Study. The research done for Jackrabbit Trail Corridor Study could determine the location of the corridor in the Hassayampa study. Randy Overmyer also brought to notice that Jackrabbit Trail has been designated as a parkway since December 2005.

Kammy Horne inquired if the second PAC meeting could be held at Surprise. Cheryl Toy offered to contact either Vineetha Kartha or randy Overmyer to organize this.

**Attendees**

Cheryl Toy, MCDOT
Randal Overmyer, City of Surprise
Bob Maki, City of Surprise
Vineetha Kartha, City of Surprise
John McNamara, DMJM Harris
Kammy Horne, DMJM Harris
Dan Marum, Wilson and Co./DMJM Harris
Mansi Sachdev, DMJM Harris

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**City of Surprise**

**Thursday, January 17, 2006**
**9:00 a.m. to 10:00 a.m.**
**City of Surprise, 12425 W. Bell Road, Suite D-100**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Kammy Horne | Kammy_Horne@DMJM-Harris.com | 602 337 2508 |
| Mansi Saeheu | mansi.saeheu@dmjmharris.com | 602-337-2652 |
| Randall Overmyer | Randall.Overmyer@surpriseaz.com | 623.875.4246 |
| Vineetha Kartha | vineetha.kartha@surpriseaz.com | 623-594-5762 |
| DAN MARUM | dan.marum@wilson.co.com | 480-893-8860 |
| Cheryl Tay | cheryltay@mail.maricopa.gov | (602)506-6172 |
| JOHN MCNAMARA | john.mcnamara@dmjmharris.com | (602)337-2587 |
| Bob Maki | robert.maki@surpriseaz.com | 623-583-6025 |

Jackrabbit Trail Meeting Minutes
MCDOT Yavapai Conference Room
January 18, 2007 @ 2:30PM
Meeting with Beautiful Arizona Estates

Attendees:

Cheryl Toy, MCDOT
Kammy Horne, DMJM Harris
Mansi Sachdev, DMJM Harris
Jean Gray Huerta, Beautiful Arizona Estates
Sue Clover, Beautiful Arizona Estates
John Lynch, Beautiful Arizona Estates/Western Power Association

BAE residents inquired about MCDOT's public participation process, specifically the review of comment cards. Cheryl explained that all comment cards, letters, e-mails and summarized conversations were retained and copies appeared in the appendix of the final report. Cheryl agreed to ask Roberta to also respond to this question.

BAE residents have several major concerns:

- Neighborhood access
- Flooding along Medlock
- Areas below grade?
- A left-turn lane at Medlock
- Median/signal installation
- Access control? Ingress/egress?
- Equestrians
- Lighting, request low-level, environmentally friendly lighting. Do not want light pollution to prevent star visibility
- There are approximately 290 lots in BAE
- BAE has no HOA
- Look beyond the 300' radius requirement for public participation
- Inclusion of other subdivisions: Litchfield Heights, Meddlebrook Arizona
- Plant/animal habitat preservation
- Do not want a kV line at Jackrabbit Road & Thomas Road

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**Beautiful Arizona Estates' Homeowners**

**Thursday, January 18, 2006**
**1:30 p.m. to 2:30 p.m.**
**MCDOT Navajo and Yavapai Conference Rooms**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Kammy Horne | Kammy.Horne@dmjmharris.com | 602 337 2518 |
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| Jean Gray | huerta_robert_jean@yahoo.com | 623-853-0980 |
| JOHN LYNCH | JBLYNCH1@ATT.NET | 602 615 1392 |
| SUE CLOVER | SUEBASSPLAYER@MSN.COM | 623-853-1882 |
| Cheryl Tay | cheryltay@mail.maricopa.gov | (602) 506-6172 |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: February 1, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 18, 2007 Stakeholder Meeting-MCDOT

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, Cheryl Toy gave an overview of the project and its purpose.

Bob Woodring spoke about the intersection of Van Buren and Jackrabbit Trail. There are four southbound lanes and three northbound lanes. Verrado's circulation plan extends Camelback Road to Jackrabbit Trail. No arterials north of Camelback Road currently have Beardsley Canal crossings. Olive Avenue will be the only one with a crossing over the canal. Zanjero Trails will seek zoning approval next week. Bob Woodring also informed that Jackrabbit Estates had a 65 feet R/W and BAE had 55 feet with a 50 feet drainage easement. Jackrabbit Trail does not line up currently with the access at BAE on Camelback Road. There is a high school at the corner of Peoria Avenue and Perryville Road. Canyon Views, being developed by Maracay Homes is still in the conceptual planning stage. Cortessa and White Tanks are in the platting stages. Bob Woodring offered to provide information on various contacts for these developments. Kammy Horne inquired if the issue of canal crossings was not being discussed with these developments. Bob Woodring clarified that sub division regulations state the improvement of

perimeter roads and these developments end at the R/W. The county would negotiate in future on such issues.

Be sure to take Verrado and the Maricopa County Regional Trail System Plan into account on the Jackrabbit study. Chris Coover told that Segment 35 of the Regional Trail System goes through the corridor and he offered to provide the information to the project team. Chris Coover emphasized that any changes to the Flood Control Structures will have implications on the trail system. He mentioned that the trail running from Verrado to the FCD structure will be built by Verrado. There are two trails that will intersect with each other on Indian School Road and Jackrabbit Trail. Cheryl Toy explained the funding prioritization method for these trails.

Kammy Horne inquired about the scenic corridor studies along Olive Avenue and McMicken Dam. Renne Probst explained that these studies consisted of advisory guidelines and are not enforceable in nature.

Dave Wolfson inquired as to what is the horizon for the model that will be used and if MAG's model would be affected by this modeling. What are Wilson & Company's thoughts on this? What socio-economic and what network numbers will be used in the study? Rodney Bragg explained that Jackrabbit CIS would look at a 2025-2030 timeframe whereas Hassayampa is looking at a build out stage in 2050. He also emphasized that this project would not preclude the recommendations made by the Hassayampa framework study. Renee suggested that Cheryl should schedule a separate meeting to discuss these issues. Cheryl will also contact Tim Goodrich, from Maracay Homes, regarding what ROW Buckeye will require for Canyon Views.

Kammy Horne inquired if there were any political issues to be kept in mind amongst the developer community in the area. Bob Woodring mentioned that Waddell Hacienda is the only contentious development as of now. In addition, Perryville Road ends at the mid-section north of Cactus Road.

This meeting was held to collect any data pertinent to the Jackrabbit Trail Corridor Study. Limited MCDOT staff attendance negatively impacted the meeting's purpose.

**Attendees**

Dave Wolfson, MCDOT
Cheryl Toy, MCDOT
Renee Probst, MCDOT
Samir Hatab, MCDOT
Bob Woodring, MCDOT
Chris Coover, Maricopa County Parks and Recreation
Rodney Bragg, DMJM Harris
Greg Jacoby, DMJM Harris
Kammy Horne, DMJM Harris
Mansi Sachdev, DMJM Harris

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**MCDOT**

**Thursday, January 18, 2006**
**10:00 a.m. to 11:30 a.m.**
**MCDOT Apache Conference Room**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Kammy Horne | Kammy.Horne@DMJMHarris.com | 602 337 2518 |
| Mansi Saehdev | mansi.saehdev@dmjmharris.com | 602-337-2652 |
| DAVID WOLFSON | DaveWolfson@mail.maricopa.gov | 602 506 6950 |
| GREG JACOBY | Greg.Jacoby@DMJMHARRIS.com | 602-337-2635 |
| Rodney Bragg | Rodney.bragg@dmjmharris.com | 602-337-2617 |
| Cheryl Tay | cheryltay@mail.maricopa.gov | (602) 506-6172 |
| Samir Hatab | samirhatab@mail.maricopa.gov | (602) 506-2867 |
| Renee Probst | reneeprobst@mail.maricopa.gov | (602) 506-8622 |
| Bob WOODRING | bobwoodring@mail.maricopa.gov | 602-506-1766 |
| Chris | | |
| | | |
| | | |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 19, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 19, 2007 Stakeholder Meeting-City of Glendale

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, Cheryl Toy gave an overview of the project and its purpose.

Bob began by reporting that the Glendale General Plan amendment is underway, and there are currently no plans to extend the municipal planning area (MPA) west of Perryville. For more information contact Tom Ritz, Glendale Senior Planner. The consultant selection for the Glendale Transportation System Plan will occur on February 6, 2007. The recommendation is that all mile grid arterials be classified as 6-lane principal arterials. This classification change will affect MAG's transportation model. Bob Darr informed that this change will be reflected in MAG's network but will take about 18-24 months. The widening of 59th Avenue to 6-lanes is currently in the Planning phase. The design year is dependent on development; the City wants to encourage the developers to build the adjacent half-streets. A draft report is anticipated in about nine months. The Northern Parkway is planned to come west out to the Loop 303. There was a discussion about the standards for a parkway and Bob Darr expressed his interest to coordinate the details with the Northern Parkway project.

John McNamara told that the MAG Hassayampa study is 50% complete and that Jackrabbit Trail would be modeled both as a parkway and an arterial.

Bob Darr provided some information about planned developments within the boundaries of City of Glendale. Turning Leaf development between Northern and Olive Avenues west of the Loop 303 is in the planning stages. Woolf Properties are planning Element Homes, another 728-acre development, between Glendale and Olive Avenues. City of Glendale is working with the Flood Control District to build the channel along Loop 303, north of Northern Avenue. The draft EA for Northern Parkway will be ready in one month. URS Corp is the consultant on the EA.
Bob Darr informed the attendees that currently the developers are going to Litchfield Sewer District and to private providers since the City does not have lines. In large developments, septic tanks are proposed. These developers directly contact APS for power lines and supply.

**Attendees**

Bob Darr, City of Glendale
Cheryl Toy, MCDOT
Kammy Horne, DMJM Harris
Mansi Sachdev, DMJM Harris
John McNamara, DMJM Harris

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**City of Glendale**

**Thursday, January 19, 2006**
**2:30 pm to 3:30 pm**
**MDCOT Conference Rooms Navajo and Yavapai**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602 337 2652 |
| Cheryl Tay | cheryltay@mail.maricopa.gov | (602) 506-6172 |
| Bob DARR | rdarr@ | |
| Kammy Horne | kammy.horne@dmjmharris.com | 602 337-2518 |
| John McNamara | john.mcnamara@dmjmharris.com | (602) 357-2587 |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: February 1, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 22, 2007 Stakeholder Meeting-ADOT

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, John McNamara gave an overview of the project and its purpose. He informed that the ASLD is keen on developing land both east and west of the White Tank Mountain Regional Park. John also explained that the Flood Control District is an active role player in the project and the future of McMicken Dam will have a bearing on the corridor alternatives. John McNamara then gave an overview of the Hassayampa Roadway Framework Study's status. He explained that the modeling for Jackrabbit Trail would come out of Hassayampa for consistency.

Floyd Roherich gave an overview of the ADOT projects in the area. He told that Mike Bruder was the ADOT Valley PM for this project. HDR is the consultant on board for this study and the environmental documents are under preparation. STAN funding is available from Sarival Avenue to Verrado Way. Initial project limits were from I-17 to Citrus Road. The project will go to design/build this summer in conjunction with the I-17 project.

Rodney Bragg informed that MCDOT had done a DCR for the SR-303 system TI, change of access request report to FHWA and environmental documents. Floyd Roherich informed that

the section from Indian School Road to MC-85 had been completed and approved. The STAN project was later added to this and approval is expected within a month. Floyd Roherich offered to provide all this information and related studies to Kammy Horne/Mansi Sachdev. John McNamara requested Floyd Roherich to put DMJM Harris on the meeting invitees list for future meetings on I-10. Floyd Roehrich informed that the cities of Goodyear and Avondale have discussed about funding issues for acceleration but no decision has been taken yet. They would like to go beyond one lane in each direction. Flyod Roherich told that the STAN money is only being used for widening purposes. Widening will be done till the median and reserve the rest of the median for rail transit. Currently only one HOV lane has been provided.

John McNamara informed that Parsons Brinckerhoff was doing the DCR for SR 303 system TI to SR 801. Rodney Bragg informed that URS Corp prepared the DCR for MCDOT from Indian School Road to MC-85. Floyd Roherich mentioned that if the URS DCR were approved then, this present Parson's study would only look at the system TI. He also offered to provide the URS corridor study on SR 801 within the City of Avondale. Floyd Roherich told that he would be the ADOT's representative on PAC.

**Attendees**

Floyd Roherich, ADOT
John McNamara, DMJM Harris
Rodney Bragg, DMJM Harris
Greg Jacoby, DMJM Harris
Mansi Sachdev, DMJM Harris

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**ADOT**

**Monday, January 22, 2006**
**2:30 pm to 3:30 pm**
**MDCOT Conference Rooms Navajo and Yavapai**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Floyd Roehrich | froehrich@azdot.gov | (602) 712-7559 |
| Rodney Bragg | rodney.bragg@dmjmharris.com | (602) 337.2617 |
| GREG JACOBY | greg.jacoby@dmjmharris.com | 602-337-2635 |
| MANSI SACHDEV | mansi.sachdeva@dmjmharris.com | 602-337-2652 |
| JOHN MCNAMARA | john.mcnamara@dmjmharris.com | 602 337-2587 |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 31, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 26, 2007 Stakeholder Meeting-City of Glendale

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, Cheryl Toy gave an overview of the project and its purpose. Kammy Horne continued with an overview of the handouts. Kammy Horne explained that the study is in its initiation phase and the project team is trying to gather baseline information to populate the existing conditions map. Cheryl Toy gave the tentative dates for the first PAC and Public Involvement meetings to be held on March 7 and March 20, 2007 respectively.

Suparna Dasgupta gave an update on the planned developments within the Town of Buckeye. She told that Arroyo Seco had completed annexation and no development was taking place in Canyon Views currently. Woody Scoutten informed that a 22-acre commercial development was coming up at the northeast corner of Indian School and Jackrabbit Trail. The Southeast corner of the same intersection has commercial land use with the possibility of multi-family residential over 15 acres. Cheryl Toy inquired about the R/W that was requested from Canyon Views. Woody Scoutten informed that 70 feet was the minimum R/W. He also provided information about a shopping center being planned by Champion Partners at the Northwest corner of McDowell Road and Jackrabbit Trail. Cheryl Toy inquired if the Town of Buckeye would be

interested in participating in a meeting with the large homeowners and developers in the area after February 9, 2007. John McNamara explained that this will be a focus group meeting to introduce the project to the neighborhoods. Town of Buckeye expressed its desire to be a part of such a meeting. Suparna Dasgupta offered to provide updated information on the planned developments. Woody Scoutten informed that with the exception of Verrado, other developments were either in the annexation or zoning stages. He offered to provide the plats for Verrado. Suparna Dasgupta offered to check the status of the Champion Partners development.

Kammy Horne inquired if the project team should be aware of certain political issues in the area amongst the developers. Suparna Dasgupta told that the Town of Buckeye requires a development under Planned Community (PC) zoning to have a certain percentage of employment element in their plans. Canyon Views, though zoned as PC did not fulfill this criteria and thus was asked to show that adequate employment was being generated by the developments in the vicinity. The Town had suggested rezoning from PC to Planned Residential (PR) in which case, employment element would not be required. However, the Mayor of the Town of Buckeye insisted that Canyon Views should remain under the PC zoning and accommodate a commercial/employment element in their Community Master Plan.

John McNamara discussed the possibility of this project infusing more commercial development in the area. Currently, the only commercial development in the pipeline was at Indian School Road.

Suparna Dasgupta informed that Canyon Views had agreed to provide large lot single-family units near the Beautiful Arizona Estates boundary after BAE protested. Ms. Dasgupta told that Arroyo Seco, a planned development under single-family residential zoning was extending the sewer line up to Indian School Road on Jackrabbit Trail alignment. She also told the attendees that the Town of Buckeye would be very interested in the future of Jackrabbit Trail south of the I-10 as well.

Woody Scoutten explained that Tesota Hills was now called Sienna Hills and are now grading. McDowell Road is the only access to this approved master planned community. Arroyo Verde's annexation has also been approved. He was of the opinion that Arroyo Verde and Arroyo Seco had been combined but offered to verify the information. _____ Vista, another mater planned community in the area, is in the final design stage and is waiting for the next stage of the Sundance Wastewater Treatment Plant

Kammy Horne inquired if the Town of Buckeye was looking into acquiring the piece of land north of Northern Avenue. Woody Scoutten informed that the Town had had discussions with canyon Views about Jackrabbit Trail swinging around FRS #3 which would completely cut out their northeast corner. He stressed on the importance of deciding the footprint of this corridor. Mr. Scoutten mentioned that I-10/Jackrabbit interchange would have to be reconstructed since the flood control channel runs directly parallel to the corridor. It is a 100-feet channel that becomes a 2 lane asphalt channel and runs directly under the I-10. Woody Scoutten also mentioned that Verrado's plats indicate sufficient room to build a box culvert.

John McNamara mentioned that one of the alignment alternatives for Jackrabbit Trail could look at building the corridor on top of the FCD Structures. This alternative would have a cost factor associated with it but the adjacent properties would not be disturbed. Kammy Horne mentioned that the future of McMicken Dam was still undecided and was being discussed. John McNamara suggested that the alternatives should look at accommodating the dam as well as suggest

alignments in its absence. In the event of the dam not being there, the alternatives will have to accommodate another structure.

Thomas Chlebanowski inquired as to how parkways intersect with parkways. He also mentioned that the Palo Verde Nuclear Generating Station Emergency Plan should be taken into account. John McNamara agreed and emphasized the importance of this plan for both Hassayampa Study and Jackrabbit Trail CIS.

Cheryl Toy inquired if the Town would be interested in hosting a PAC meeting. Suparna Dasgupta offered to coordinate on this.

## Attendees

Suparna Dasgupta, Town of Buckeye
Thomas Chlebanowski, Town of Buckeye
Woody Scoutten, Town of Buckeye
Cheryl Toy, MCDOT
Kammy Horne, DMJM Harris
Mansi Sachdev, DMJM Harris
John McNamara, DMJM Harris

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**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
~~MCDOT~~ MAG & BUCKEYE

**Friday, January 26, 2006**
**10:30 a.m. to 11:30 a.m.**
**MCDOT Navajo and Yavapai Conference Rooms**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Kammy Horne | KammyHorne@DMJMHarris.com | 602 337 2518 |
| Mansi Saunder | mansi.saunder@dmjmharris.com | 602-337-2652 |
| John McNamara | john.mcnamara@dmjmharris.com | 602 977-2987 |
| WOODY SCOUTEN | WOODY@SCOUTEN.COM | 623-547-4661 |
| Supan Dasgupta | sdasgupta@buckeyeaz.gov | 623-349-6204 |
| Cheryl Toy | cheryltoy@mail.maricopa.gov | (602)506-6172 |
| THOMAS CHLEBANOWSKI | tchlebanowski@buckeyeaz.gov | 623-349-6804 |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 29, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 29, 2007 Stakeholder Meeting-City of Goodyear

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, an overview of the project and its purpose was provided.

A request was made to the City of Goodyear to provide zoning and planned development status information to the project team.

**Attendees**

Luke Albert, City of Glendale
Cheryl Toy, MCDOT
Kammy Horne, DMJM Harris
John McNamara, DMJM Harris

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**City of Goodyear**

**Thursday, January 29, 2006**
**2:00 pm to 3:00 pm**
**MDCOT Conference Rooms Navajo and Yavapai**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Kammy Horne | Kammy.Horne@dmjmharris.com | 337258 |
| John McNamara | john.mcnamara@dmjmharris.com | (602) 371-2557 |
| LUKE ALBERT | LUKE.ALBERT@GOODYEARAZ.GOV | 623-882-7519 |
| Cheryl Tay | cheryl.tay@mail.maricopa.gov | (602)506-6172 |
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DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## MEETING MINUTES

Date: April 15, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: February 2, 2007 Stakeholder Meeting-Arizona State Land Department (ASLD)

Attendees: See attached list

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, an overview of the project and its purpose was provided.

Gordon Taylor stated that he would be the stakeholder representative for ASLD.

A discussion was held on the "Draft Westside Study Area Conceptual Plan" for the State Trust Land. ASLD may be able to provide the GIS copy of the map if necessary. Gordon Taylor noted the originally considered Jackrabbit Trail alignment on the Conceptual Plan. He stated that ASLD would prefer that if an alignment bisects their land, that it is done in such a way that each portion could be reasonably sold based on the size of the remaining parcel. The ASLD land within the Jackrabbit Trail study area does not have a disposition/auction schedule. There are some portions, however, that are currently being leased.

**Attendees**

Gordon Taylor, ASLD
Cheryl Toy, MCDOT
Kammy Horne, DMJM Harris

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**STAKEHOLDER MEETINGS**
**ASLD**

**Friday, February 2, 2007**
**3:00 pm to 4:00 pm**
**1616 W. Adams Street, Room 325**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Kammy Horne | Kammy.Horne@dmjmharris.com | 602 337-2518 |
| Gordon Taylor | gteylor@asld.az.gov | 602-542-2647 |
| Cheryl Tay | cheryltay@mail.maricopa.gov | (602) 506-6172 |
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DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

| | |
|---|---|
| Date: | February 1, 2007 |
| To: | Cheryl Toy, Project Manager, MCDOT |
| From: | Kammy Horne, Project Manager, DMJM Harris |
| Re: | Jackrabbit Trail Access Control and CIS |
| Subject: | January 30, 2007 Stakeholder Meeting-Conference Call with Luke Air Force Base |
| Attendees: | See attached list |

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

Following a round of introductions of the meeting attendees, Cheryl Toy gave an overview of the project and its purpose. Bob Dubsky informed that LAFB would not have any conflict with this project. Cheryl Toy offered to send the project information materials and an area map to Bob Dubsky.

Kammy Horne inquired the method by which the air force base extends facilities. Bob Dubsky told that the base assess if any new facilities are inside the noise contours and accident potential zones. He explained the various accident potential zones:

- Clear Zone- 3000 feet long and wide extending from the runway
- Accident potential Zone 1- extends 7000 feet from the clear zone, limited construction and no residential activity permitted
- Accident Potential Zone 2- extends 15,000 feet from Zone 1, business, commercial activity permitted, no residential activity

Bob Dubsky told that the County provides these zones and noise contours. The base also works with APS on their power line corridors and siting projects. John McNamara informed that most of the Jackrabbit Trail alternatives would be outside the noise contours.

**Attendees**

Cheryl Toy, MCDOT
Bob Dubsky, LAFB
John McNamara, DMJM Harris
Kammy Horne, DMJM Harris
Mansi Sachdev, DMJM Harris

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: March 7, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Kammy Horne, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: March 7, 2007 PAC Meeting #1

Attendees: See attached sign-in sheet
In addition to those mentioned in the sign-in sheet, the following members were also present-

Mike Dewitt, APS
Samir Hatab, MCDOT
John McNamara, DMJM Harris

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Study Purpose, Objectives and Need

The purpose of the study is to provide a future footprint of the corridor and establish the facility type, number of lanes, right-of-way and corridor alignment. The study will also provide an implementation timeframe and phasing to accommodate future travel demands. Study objectives concentrate on assessing the constraints and potential impacts by existing and proposed developments, drainage features, utilities and

environmental issues. The study also aims at gaining consensus amongst municipal partners to achieve design consistency and preserve the corridor for future development. Study need arises out of the strategic location of the corridor as a major regional north-south arterial east of the White Tanks and west of the SR-303L. Citrus Road is discontinuous between Waddell Road and Bell Road, , and Cotton Lane is constrained within a 110 foot R/W by recent development between Greenway Road and Bell Road. Thus, this study will evaluate the need for a north-south corridor east of the White Tank Mountains and west of SR 303L..

## III. Project Milestones, Schedule and Overview

The Notice-To-Proceed was given in late November 2006 and the study was initiated in December 2006. The study is divided into nine tasks and two phases; Phase I-Planning Evaluations and Phase II-Operations and Design Evaluations. The Data Collection and Forecasting task spans from January 2006 to August 2007 along side the Alternatives Development and Evaluation task. Three rounds of Project Advisory Committee meetings and Public Meetings are planned in the months of March, July-August and October-November 2007 as a part of the Public Involvement Task. Quality Assurance and Documentation Tasks continue until December 2007. The Draft Final Report is scheduled in end-October 2007 and the Final Report at the end of November 2007.

The study process involves a three step-involvement plan, which leads to the preparation of a phased implementation plan of the selected alternative and access management plan. The three steps are-

i) Develop a stakeholder database
ii) Develop alternatives with stakeholder input
iii) Develop implementation plan with the stakeholders whereby major design features are finalized and a funding plan is developed

For the alternatives selection, a tiered evaluation process will be adopted. This would begin with a universe of alternatives and would narrow down to one preferred alternative after a rigorous screening process and analysis.

## IV. Key information from Stakeholder Interviews

A series of stakeholder meetings were conducted and facilitated by DMJM Harris in the months of January and February 2007. Key issues and discussion points from these meetings have been tabulated in the attached matrix. In addition, to gain a better understanding of the existing conditions of the corridor, several completed and ongoing studies were consulted. Attached is a list of the studies reviewed.

## V. Existing Conditions Overview

For the purpose of organization and better understanding, the existing conditions section was broken into four sub-sections: existing developments, future developments, & drainage and utilities. The corridor was also divided into four segments for the same purpose.

From I-10 to Indian School Road, four master planned communities exist on the west side of Jackrabbit Trail at different stages in the planning process. The east side has mostly large-lot residential development with two master planned communities along Perryville Road. From Indian School Road to Orangewood Avenue, a number of

planned communities exit both east and west of the corridor, Zanjero Trails and Verrado being the most prominent respectively. There is no existing development adjacent to the Jackrabbit section line from Bethany Home Road to Bell Road except for the Sonoran Ridge Estates subdivision which is located east of the section line between Northern Avenue and Olive Avenue. Land west of the section line is owned by the Arizona State Land Department and is currently undeveloped. North of Peoria Avenue until Bell Road, master planned communities exist east of the Beardsley Canal within the City of Surprise Metropolitan Planning Area.

Future zoning was obtained from Maricopa County. In the segment from I-10 to Indian School Road, land east of the corridor is zoned for residential use with two pockets of commercial use at the intersection of Jackrabbit Trail with I-10 and Indian School Road. Similar pattern is observed as we move north between Indian School Road and Orangewood Avenue with residential use proposed in undeveloped pockets of land. In last two segments spanning from Orangewood Avenue all the way up to Bell Road, land uses west of the Jackrabbit Trail Section Line are being planned by the Arizona State Land Department.

From I-10 to Indian School Road, White Tanks Flood Retardant Structure (FRS) #4 inlet channel traverses along the west side of the Jackrabbit section line and consists of sections of lined and unlined channel. Maricopa Water District's Beardsley Canal runs north from Thomas Road along the 191$^{st}$ Avenue alignment all the way up to Bell Road. In the next segment, the White Tanks FRS #4 inlet channel runs till Bethany Home Road. A training dike runs east-west from the Beardsley Canal and crosses over the Jackrabbit Trail Section Line along Bethany Home Road. The White Tanks FRS #3 is also present in this segment and swings from the Jackrabbit Trail Section Line to the Beardsley Canal. The FRS #3 inlet channel runs from the north end of FRS #3 all the way up to Northern Avenue along the west side of the Beardsley Canal. In the next segment, the north inlet channel of the White Tanks FRS #3 runs along the canal from Northern Avenue to Olive Avenue. This segment also has the McMicken Dam crossing the Jackrabbit Trail Section Line at Peoria Avenue alignment. The last segment has the McMicken Dam and the Beardsley Canal running all the way up to the northern project limits.

There are numerous existing and future power line corridors operated by Arizona Public Service (APS). In the first segment, a 69kV transmission line runs along McDowell Road. As a part of the APS' West Valley South project, the preferred 230 kV alignment runs along the Perryville alignment from I-10 all the way up to Indian School and then swings eastward. In the last segment, the preferred alignment of the 230kV power line of the West Valley North project runs westward along Cactus and turns north, about half mile east of the Jackrabbit Trail Section Line alignment. The Arizona Corporate Commission's Siting Committee has designated a 4000 foot wide corridor (1000 feet west and 3000 feet east of the Jackrabbit Trail Section Line) for this power line. Thus, the section line alignment is within the proposed power line corridor.

Some of the key issues are as follows-

i) Existing and future development for right-of-way availability
ii) Compatibility with Hassayampa Roadway Framework Study, Surprise & Buckeye General Plans & Maricopa County Trails Plan
iii) Travel demand modeling and regional connectivity

iv) Existing and future flood control structures
v) Planned power line corridors
vi) Coordination with the ASLD's planning and schedule for disposition of their land

## VI. Review of Public Meeting Information

The first public meeting for scoping will be held on Tuesday, March 20, 2007 at Willow Canyon High School in Surprise between 5 PM to 7PM.

## VII. Next Steps

The next steps in the study include the forthcoming public meeting followed by the travel demand modeling. Existing and future conditions will be documented over the coming months. A tiered development and evaluation of the alternatives will also be conducted.

The alternatives evaluation will include corridor location evaluations as well as typical section evaluations. It is envisioned that the corridor typical section will include between two and four travel lanes in each direction within 130 to 200 feet of R/W. The first tier of corridor location evaluation will include very wide generalized corridors and will include a limited number of critical evaluation criteria. The typical section evaluation will primarily be driven by the travel demand modeling scenarios.

## VIII. Discussion

Following this, PAC members discussed the carrying capacity of a parkway. Tim Oliver (MCDOT Planning) mentioned that from the preliminary alternative analysis of the I-10/Hassayampa Roadway Framework Study, a 6-8 lane parkway concept may need to be considered in order to accommodate the future north-south travel demand.

Larry Lambert (FCDMC) brought to notice that the final recommendation for the FCDMC channel between White Tanks #3 and #4 would be given by the end of March 2007. The Wittmann ADMP will also be completed by the end of this year.

Suparna Dasgupta (Town of Buckeye) inquired if the Town of Buckeye should be informing the developers that Jackrabbit Trail could be developed into a 6-8 lane parkway. Tim Oliver (MCDOT Planning) indicated that the need for such a facility will be analyzed and the feasibility to accommodate this type of facility will be evaluated by this study.

Randy Overmyer (City of Surprise) mentioned that it would be challenging to continue a parkway-type section all the way to Interstate-10. He emphasized that Jackrabbit Trail is planned by Surprise to be developed as a parkway since it would be carrying a tremendous amount of traffic from Sun Valley Parkway/Bell Road. Jackrabbit Trail is planned to collect and distribute this traffic over a number of east-west streets. This distribution of east-west traffic immediately east of the White Tanks may only be necessary between Bell Road and Northern Avenue. In this case, it may not be necessary to maintain a parkway section south of Northern Avenue.

Jackrabbit Trail: I-10 to Bell Road, Access Management & Corridor Improvement Study
Wednesday, March 7, 2007
Project Advisory Committee (PAC) Meeting #1

| Initials | Name | Organization | Title | Telephone | Post Address | E-mail Address |
|---|---|---|---|---|---|---|
| | Albert, Luke | City of Goodyear | City Traffic Engineer | (623) 882-7519 | 120 E. Wetsern Avenue<br>P.O. Box 5100<br>Goodyear 85338 | luke.albert@goodyearaz.gov |
| RLB | Bragg, Rodney | DMJM Harris | Engineer, QAQC | (602) 337-2617 | 2777 E. Camelback Road<br>Suite 200<br>Phoenix 85016 | Rodney.Bragg@dmjmharris.com |
| | Brown, Keith | City of Goodyear | Assistant City Engineer | (623) 882-7956 | 190 N. Litchfield Road<br>Goodyear 85338 | kbrown@goodyearaz.gov |
| | Cain, Chris | Maricopa Water District | Assistant Project Engineer | (623) 546-8266 | 14825 W. Grand Avenue<br>Surprise, AZ 85374 | chrisc@mwdaz.com |
| | Chlebanowski, Thomas | Town of Buckeye | Planner | (623) 349-6804 | 508 Monroe Avenue<br>Buckeye 85326 | Tchlebanowski@buckeyeaz.gov |
| CC | Coover, Chris | MC Parks & Rec | Maricopa Trail PM | (602) 506-8719 | 234 N. Central Avenue, Suite 6400<br>Phoenix 85004 | ccoover@mail.maricopa.gov |
| | Coronado, Severiano | MCDOT Operations | MCDOT Ops | (602) 506-8292 | 2901 W. Durango Street<br>Phoenix 85009 | coronados@mail.maricopa.gov |
| | Crowe, Roberta | MCDOT CGR | MCDOT PIO | (602) 506-8003 | 2901 W. Durango Street<br>Phoenix 85009 | RobertaCrowe@mail.maricopa.gov |
| | Darr, Bob | City of Glendale | Transportation Planning Manager | (623) 930-2942 | 5800 W. Glenn Drive #315<br>Glendale 85301 | rdarr@glendaleaz.com |
| GD | Davies, Gregory | MCDOT Planning | Senior Planner | (602) 506-7742 | 2901 W. Durango Street<br>Phoenix 85009 | GregoryDavies@mail.maricopa.gov |
| SD | Dasgupta, Suparna | Town of Buckeye | Planner Plng Manager | (623) 349-6204 | ~~508 Monroe Avenue~~ PO. Box Apache Rd.<br>Buckeye 85326 | Sdasgupta@buckeyeaz.gov |
| | Dewitt, Mike | APS | Transmission Sitings | (602) 493-4448 | P.O. Box 53933<br>Attn: Mail Station 4030<br>Phoenix 85072 | michael.dewitt@aps.com |
| | Dubsky, Bob | Luke Air Force Base | LAFB Community Relations | (623) 856-6195 | 56 Fighter Wing Community Initiatives<br>14185 W. Falcon Street<br>Luke Air Force Base 85309 | robert.dubsky@luke.af.mil |
| | Durkee, Dean | Gannett Fleming | Engineering Manager | (602) 553-8817<br>Extension 228 | 4722 N. 24th Street<br>Suite 250<br>Phoenix 85016 | ddurkee@gfnet.com |
| | Greenslade, Michael | Flood Control | Dam Safety Engineer | (602) 506-5426 | 2801 W. Durango Street<br>Phoenix 85009 | mdg@mail.maricopa.gov |
| | Grover, Allan | City of Glendale | Transportation Planner. | (623) 930-2945 | 5800 W. Glenn Drive #315<br>Glendale 85301 | |
| | Guana, Javier | Andes Engineering | Principal | (602) 374-7119 | 11811 N. Tatum Boulevard<br>Suite 3090<br>Phoenix 85028 | jguana@andes.us |
| | Hatab, Samir | MCDOT Engineering | MCDOT Engineering Designer | (602) 506-2867 | 2901 W. Durango Street<br>Phoenix 85009 | samirhatab@mail.maricopa.gov |
| BH | Hazlett, Bob | MAG | Planner | (602) 254-6300 | 302 N. First Avenue<br>Phoenix 85003 | bhazlett@mag.maricopa.gov |
| | Hicks, Jay | EDAW | Vice President/Principal | (602) 393-3791 | 455 N. 3rd Street, Suite 272<br>Phoenix 85004 | jay.hicks@edaw.com |
| | Holm, Matt | MC P&D | Planner | (602) 506-7162 | 501 N. 44th Street<br>Phoenix 85008 | Matthew.Holm@mail.maricopa.gov |
| KH | Horne, Kammy | DMJM Harris | Project Manager | (602) 337-2518 | 2777 E. Camelback Road<br>Suite 200<br>Phoenix 85016 | kammy.horne@dmjmharris.com |
| | Kogl, Michele | MCDOT Engineering | MCDOT Development Services Branch Manager | (602) 506-4611 | 2901 W. Durango Street<br>Phoenix 85009 | michelekogl@mail.maricopa.gov |
| | Kresich, Dianne | ADOT | Senior Planner | (602) 712-7961 | 206 S. 17th Avenue<br>Mail Drop 310B<br>Phoenix 85007 | dkresich@azdot.gov |
| LL | Lambert, Larry | FCDMC | Senior Engineer | (602) 502-6110 | 2801 W. Durango Street<br>Phoenix 85009 | lkl@mail.maricopa.gov |
| | Luk, Stephen | DMJM Harris | Utility Engineer | (602) 337- | 2777 E. Camelback Road<br>Suite 200<br>Phoenix 85016 | stephen.luk@dmjmharris.com |
| | Maki, Bob | City of Surprise | City Engineer | (623) 583-6025 | 12425 W. Bell Rd, Ste D-100<br>Surprise 85374 | robert.maki@surpriseaz.com |
| DM | Marum, Dan | Wilson & Company | Transportation Planning Manager | (480) 893-8860 | 9633 S. 48th Street, Suite 290<br>Phoenix 85044 | Dmarum@wilsonco.com |
| | McNamara, John | DMJM Harris | Project Director | (602) 337-2587 | 2777 E. Camelback Road<br>Suite 200<br>Phoenix 85016 | john.mcnamara@dmjmharris.com |
| TO | Oliver, Tim | MCDOT Planning | MCDOT Planning Branch Manager | (602) 506-3994 | 2901 W. Durango Street<br>Phoenix 85009 | TimOliver@mail.maricopa.gov |
| RO | Overmyer, Randy | City of Surprise | Transportation Planner | (623) 875-4246 | 12425 W. Bell Rd, Ste D-100<br>Surprise 85374 | randall.overmyer@surpriseaz.com |
| RP | Probst, Renee | MCDOT Planning | MCDOT Senior Planner | (602) 506-8622 | 2901 W. Durango Street<br>Phoenix 85009 | reneeprobst@mail.maricopa.gov |
| | Ramirez, Dave | City of Goodyear | City Engineer | (623) 882-7954 | 190 N. Litchfield Road<br>Goodyear 85338 | dramirez@goodyearaz.gov |

Jackrabbit Trail: I-10 to Bell Road, Access Management & Corridor Improvement Study
Wednesday, March 7, 2007
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| | | | | | | |
|---|---|---|---|---|---|---|
| | Richards, Paul | APS | Transmission Sitings | (602) 371-6186 | 2043 W. Cheryl Drive<br>M.S. 3040<br>Phoenix 85021 | Paul.Richards@aps.com |
| | Roehrich, Floyd | ADOT | Planner | (602) 712-7559 | 205 S. 17th Avenue<br>Mail Drop 615E<br>Phoenix 85007 | froehrich@azdot.gov |
| | Sabatini, Mike | MCDOT Planning | Transportation Planning Division Manager | (602) 506-8628 | 2901 W. Durango Street<br>Phoenix 85009 | MikeSabatini@mail.maricopa.gov |
| | Sachs, Rob | MCDOT ROW | ROW Agent | (602) 506-4744 | 2801 W. Durango Street<br>Phoenix 85009 | res@mail.maricopa.gov |
| | Sciarro, Linda | MCDOT ROW | ROW Agent (back up) | (602) 506-4893 | 2801 W. Durango Street<br>Phoenix 85009 | LindaSciarro@mail.maricopa.gov |
| | Scoutten, Woody (Dave Hedlund) | W.C. Scoutten, Inc. for Town of Buckeye | Acting Town Engineer | (623) 547-4661 ext. 222 | 1646 N. Litchfield Road<br>Suite 235<br>Goodyear 85338-1211 | dave@scoutten.com<br>woody@scoutten.com |
| | Swart, Nicolaas | MCDOT Traffic | Traffic Engineering Branch Manager | (602) 506-0599 | 2901 W. Durango Street<br>Phoenix 85009 | nicolaasswart@mail.maricopa.gov |
| | Swick, Valerie | Flood Control | Project Manager | (602) 506-2929 | 2801 W. Durango Street<br>Phoenix 85009 | vas@mail.maricopa.gov |
| | Taylor, Gordon | AZ State Land Dept. | Planner | (602) 542-2647 | 1616 W. Adams Street<br>Phoenix 85007 | gtaylor@land.az.gov |
| | Toy, Cheryl | MCDOT Planning | MCDOT Senior Planner (Project Manager) | (602) 506-6172 | 2901 W. Durango Street<br>Phoenix 85009 | cheryltoy@mail.maricopa.gov |
| | Wolfson, Dave | MCDOT Planning | MCDOT Senior Planning Analyst | (602) 506-6950 | 2901 W. Durango Street<br>Phoenix 85009 | DaveWolfson@mail.maricopa.gov |
| | Zorba, Michael | A DYE Design | Environmental Planner | | | |

Woodring, Bob MCDOT Planner 6025061766 bobwoodring@mail.maricopa.gov
Kartha Vinetha Sasidharan Planner 623-5945762 vinetha.kartha@swsprings.gov
DARR, Robert Glendale Trans. Planner 623-930-2942 rdarr@glendale.az.com
JACOBY, GREG DMJM + HARRIS 602-337-2635
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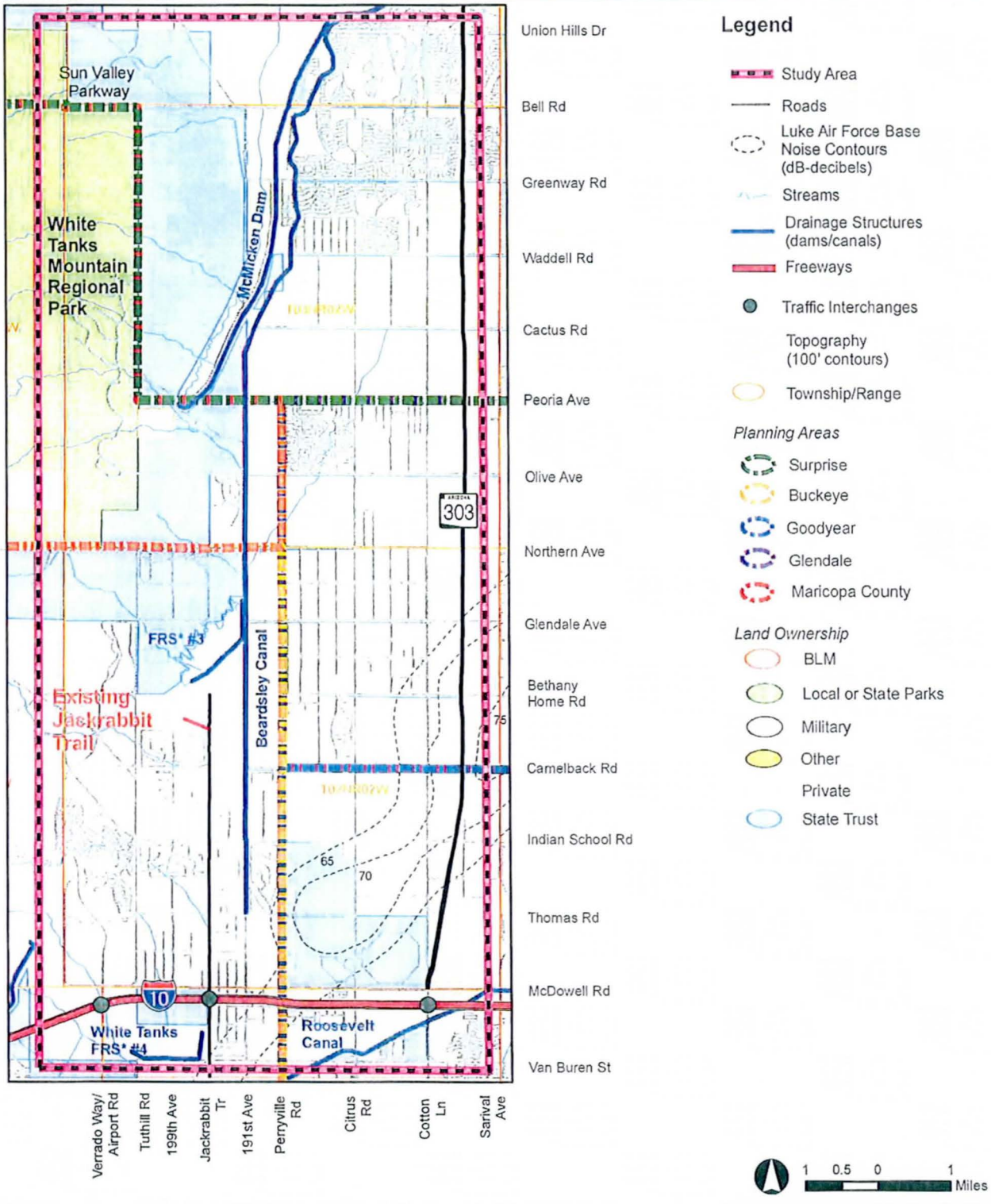
Maguire, David LSI 602 841 1945 dmaguire@landsolutionsinc.com

## Study Area Base Map




*FRS stands for Flood Retardant Structure

*Source: Maricopa County Department of Transportation*

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Stakeholder Involvement Matrix**
**March 7, 2007**

| Stakeholder | Attendees | Main Discussion Points | Issues/Concerns | Follow-up |
|---|---|---|---|---|
| **City of Glendale**<br>January 19, 2007 | 1. Cheryl Toy<br>2. Bob Darr<br>3. John McNamara<br>4. Kammy Horne<br>5. Mansi Sachdev | 1. No plans of extension of the Glendale planning area west of Perryville Road<br>2. Consultant for the Glendale Transportation System Plan to be selected on February 6, 2007<br>3. Recommendation-all mile grid arterials be classified as 6-lane principal arterials<br>4. Northern Parkway is planned to come west out to the Loop 303. Draft EA will be ready in a month's time; URS Corp Consultant<br>5. City building the channel along Loop 303, north of Northern Avenue with FCDMC<br>6. New Planned Developments<br>• Turning Leaf-corner of Olive and Northern<br>• Woolf Properties' Element Homes-between Glendale and Olive Avenues<br>7. Developers are going to Litchfield Sewer District and private providers since the City does not have sewer lines in the area | 1. Incorporate the latest planned developments and their status on JRT maps | No follow-up required |
| **City of Goodyear**<br>January 29, 2007 | 1. Cheryl Toy<br>2. Luke Albert<br>3. John McNamara<br>4. Kammy Horne | 1. Explained the project and discussed coordination mechanisms with the City of Goodyear for future interaction | 1. Incorporate the latest planned developments and their status on JRT maps | Contacted Luke Albert for GIS data on planned developments and zoning |
| **Town of Buckeye**<br>**MAG**<br>January 26, 2007 | 1. Cheryl Toy<br>2. Suparna Dasgupta<br>3. Thomas Chlebanowski<br>4. Woody Scoutten<br>5. Kammy Horne<br>6. John McNamara<br>7. Mansi Sachdev | 1. Commercial Developments planned along Jackrabbit Trail at Indian School Road and McDowell Road<br>2. Except Verrado, all other planned developments in annexation/zoning stage<br>3. Canyon Views' progress stalled due to zoning requirement issues<br>4. Arroyo Seco extending sewer line upto JRT<br>5. Possible alternative-JRT swinging west of the FRS#3 would have implications on the north east corner of Canyon Views<br>6. A two-lane asphalt roadway and FCDMC channel runs under the I-10 at the I-10/JRT interchange. Its likely that the interchange will have to be reconstructed<br>7. Alternative alignment-build JRT on top of the FCD structures; considerable bearing on cost, but no acquisition of property would be required<br>8. Alternatives to accommodate both the presence and absence of McMicken Dam<br>9. Incorporation of Palo Verde Nuclear Generating Station 10-mile emergency planning zone and barricade location map | 1. Incorporate the latest planned developments and their status on JRT maps<br>2. FCDMC Channel at I-10/JRT TI | Contact Woody Scoutten for plats |
| **City of Surprise**<br>January 17, 2007 | 1. Cheryl Toy<br>2. Randy Overmyer<br>3. Vineetha Kartha<br>4. Bob Maki<br>5. Dan Marum<br>6. John McNamara<br>7. Kammy Horne<br>8. Mansi Sachdev | 1. Randy Overmyer to provide GIS data from APS' West Valley North in coordination with Randall Simpson, URS<br>2. APS line runs on a 120' easement, north of Cactus, discussions with Surprise to run it through the 60 foot median on Surprise Parkway<br>3. West Valley North preferred alignment lies within the JRT project corridor<br>4. Randy Overmyer to give Mike Dewitt, APS contact information in order to access the EIS of the project<br>5. Surprise amenable to JRT following the same alignment as the APS power line<br>6. Prasada bringing in 10 million square feet of residential development, a medical center, an auto-mall and 5000-6000 homes<br>7. Waddell Hacienda, rural sub-division on a county island-contentious development due to the classification of Waddell Road as a major arterial. Project Team to contact the development through City of Surprise<br>8. Discussion on City's regional Roadway Impact Fee<br>9. R/W issues on Peoria Avenue; difficulty to acquire R/W from property owners<br>10. No-man's land between Northern and Peoria Avenues, from Perryville Road to the White Tanks Mountains<br>11. Consistency between functional classifications of city and county<br>12. Northwest Regional Landfill south of the Deer Valley Road and 195th Avenue intersection | 1. Big developments like Prasada would have a significant bearing on traffic patterns and intersection characteristics<br>2. R/W issues<br>3. Incorporate the latest planned developments and their status on JRT maps | No follow-up required |

| Stakeholder | Attendees | Main Discussion Points | Issues/Concerns | Follow-up |
|---|---|---|---|---|
| **ASLD**<br>February 2, 2007 | 1. Kammy Horne<br>2. Cheryl Toy<br>3. Gordon Taylor | 1. Conceptual Plan for residential development; working with City of Surprise-Scott Chesney<br>2. No scheduled auction for properties<br>3. Roadway not to divide ASLD land into small properties posing problems for the future sale of the land<br>4. JRT is not a continuous roadway on the ASLD conceptual plan | 1. Division of ASLD properties by proposed JRT alignment | No follow-up required |
| **ADOT**<br>January 22, 2007 | 1. Floyd Roehrich<br>2. John McNamara<br>3. Rodney Bragg<br>4. Mansi Sachdev | 1. ADOT studies near the project area-<br>i. I-10 widening with STAN Funding from Sarival Avenue to Verrado Way<br>ii. DCR for MCDOT from Indian School Road to MC-85 along SR-303 by URS<br>iii. Change of Access Report-FHWA<br>iv. DCR for SR-303 System TI to SR 801<br>v. SR 801 Study in Avondale done by URS<br><br>2. Floyd Roehrich offered to provide these studies to Kammy/Mansi | 1. Coordination with the ADOT studies on I-10, JRT/ I-10 TI | No follow-up required |
| **FCDMC**<br>January 11, 2007 | 1. Cheryl Toy<br>2. Robert Sachs<br>3. Valerie Swick<br>4. Larry Lambert<br>5. Frances Ackerman<br>6. Paul Richards<br>7. Linda Sciarro<br>8. Rodney Bragg<br>9. Greg Jacoby<br>10. Kammy Horne<br>11. Jackie Pfeiffer<br>12. Mansi Sachdev | 1. Two ongoing ADMPs-<br><br>i. Wittmann ADMP- covers the area north of the McMicken Dam until the Hieroglyphic Mountains. Currently, alternatives for regional drainage and McMicken dam are being explored<br>ii. Loop 303 Corridor/ White Tanks Area Drainage Master Plan- entire area south of the Wittmann project lies within the boundaries of the completed White Tanks ADMP. Currently, specific projects within this ADMP are being implemented<br><br>2. Specific projects under White Tanks ADMP-<br><br>i. FRS #3 North Inlet Channel-northern structure of the channel to be completed by June 2007. Natural channels present and thus coordination with Zanjero Trails is sought. Bobby Garza is the PM<br>ii. South Part of North Inlet Channel-extends from Northern Avenue to FRS #3.; Construction to begin in 2009<br>iii. Improvements to FRS #3- first phase under construction and will be completed by 2007. Phase II to be completed by 2008<br>iv. White Tanks #4- five different alternatives divided into two different basic designs-<br>• *First design concept*- handle the discharge from WT #3 until the channel reaches Indian School Road. Channel from Indian School to I-10 would be designed for the discharge from White Tanks 3 plus the intervening 100-year flows from south of Indian School. The channel would not intercept and collect intervening flows between Bethany Home Road and Indian School. One alternative is an open channel and the other is an underground pipe or box structure.<br>• *Second design concept*-route discharge from WT#3 and collect 100-year flows downstream of WT #3. Several alternatives for this design with the difference being in the type of channel-"natural" channel, a hardened channel (lined type channel), or a combination channel<br><br>3. Emergency or auxiliary spillway at White Tanks FRS No. 3 is located to the west of the Jackrabbit Trail road alignment and discharge flows east. The spillway flow, under full probable maximum flood is estimated to be in excess of 25,000 cfs. This flow is much greater than the 100-year event<br>4. FRS #3 and McMicken Dam located in fissure risk zone | 1. Alternatives for McMicken Dam and regional drainage<br>2. Drawings/ Studies on the four specific White Tanks ADMP projects<br>3. White Tanks #3 auxiliary spillway and its flows to be incorporated | Wittmann ADMP, Project Manager, Kelli Sertich to be contacted for McMicken Dam alternatives<br><br>Larry Lambert to be contacted for White Tanks ADMP |
| **APS**<br><br>January 11, 2007 | Occurred jointly with the FCDMC Meeting on January 11, 2007 | 1. Two ongoing projects-<br>i. West Valley North and West Valley South Power Line and Substation Projects<br><br>2. West Valley North's preferred alignment runs parallel to JRT between Cactus and Bell Road and crosses McMicken Dam.<br>3. Project in design phase; construction to begin in mid-2008<br>4. West Valley South consists of a 230kV transmission line along Perryville alignment between Broadway and Indian School Roads<br>5. Construction started in January 2007 and should be completed by June 2007 | 1. Preferred alignments of both projects within the JRT project limits<br>2. Coordination with APS on footprint of power lines | Steve Luk is in touch with Paul Richards. However, we have been unable to get any data/studies from APS till now |

| Stakeholder | Attendees | Main Discussion Points | Issues/Concerns | Follow-up |
|---|---|---|---|---|
| MCDOT<br>January 18, 2007 | 1. Cheryl Toy<br>2. Kammy Horne<br>3. David Wolfson<br>4. Samir Hatab<br>5. Renee Probst<br>6. Bob Woodring<br>7. Greg Jacoby<br>8. Rodney Bragg<br>9. Chris Coover<br>10. Mansi Sachdev | 1. None of the roads except Olive Avenue, north of Camelback cross over the Beardsley Canal<br>2. Jackrabbit Estates had a 65 feet R/W and BAE had 55 feet with a 50 feet drainage easement. Jackrabbit Trail does not line up currently with the access at BAE on Camelback Road<br>3. Canyon Views is in conceptual planning stages; Cortessa and White Tanks are in platting stages<br>4. Incorporate the Maricopa County Trail system; Segment 35 lies within the JRT project limits<br>5. Discussion on horizon year and traffic model to be used for JRT | 1. R/W issues with planned developments<br>2. Beardsley canal crossings<br>3. Maricopa County Trail system | Ongoing discussions regarding travel modeling and other project issues |
| Luke Air Force Base<br>January 30, 2007 | 1. Bob Dubsky<br>2. John McNamara<br>3. Kammy Horne<br>4. Cheryl Toy<br>5. Mansi Sachdev | 1. No issues; willing to coordinate with the project team | | |

## Jackrabbit Trail Access Control and CIS
## List of Previous and Ongoing Studies

1. **West Valley South Power Line and Substation Project**
   *Date Completed:* December 2003
   *Lead Agency:* APS
   *Author:* URS Corporation

2. **West Valley North Power Line and Substation Project**
   *Date Completed:* May 2005
   *Lead Agency:* APS
   *Author:* URS Corporation

3. **Buckeye Conceptual Planning**
   *Date Completed:* June 2000
   *Lead Agency:* Arizona State Land Department (ASLD)
   *Author:* BRW, Inc.

4. **Maricopa County Eye to the Future – White Tank/Grand Avenue Area Plan**
   *Date Completed:* 2000
   *Lead Agency:* Maricopa County
   *Author:* Maricopa County Planning and Development Department

5. **Maricopa County Regional Trail System Plan**
   *Date Completed:* August 2004
   *Lead Agency:* Maricopa County
   *Author:* Maricopa County Trail Commission

6. **East-West Mobility Study**
   *Date Completed:* May 2002
   *Lead Agency:* MAG
   *Author:* Entranco, Inc.

7. **High-Capacity Transit Study**
   *Date Completed:* May 2003
   *Lead Agency:* MAG
   *Author:* IBI Group

8. **Southwest Area Transportation Study**
   *Date Completed:* September 2003
   *Lead Agency:* MAG
   *Author:* Wilbur Smith Associates

9. **MAG Regional Transportation Plan (RTP)**
   *Date Completed:* November 2003
   *Lead Agency:* MAG
   *Author:* URS; MAG Transportation Policy Committee

10. **Surprise Transportation Plan**
    *Date Completed:* December 2005
    *Lead Agency:* City of Surprise
    *Author:* Surprise Transportation Commission

11. **MAG RTP 2006 Update**
    *Date Completed*: March 2006
    *Lead Agency*: MAG
    *Author*: MAG Transportation Policy Committee

12. **Maricopa County Eye to the Future – Olive Avenue Scenic Corridor Guidelines**
    *Lead Agency*: Maricopa County
    *Author*: Maricopa County Planning and Development Department

13. **Sun Valley Parkway Corridor Study**
    *Lead Agency*: MCDOT
    *Author*: Parsons Brinckerhoff

14. **Northern Avenue Parkway DCR**
    *Lead Agency*: MCDOT
    *Author*: URS Corporation

15. **Buckeye Airport Master Plan**
    *Lead Agency*: Town of Buckeye
    *Author*: Coffman Associates

16. **West Side Study Area Conceptual Plan, White Tanks**
    *Lead Agency*: ASLD
    *Author*: ASLD

17. **Buckeye Sun Valley Parkway Area Drainage Master Study (ADMS)**
    *Lead Agency*: FCDMC
    *Author*: FCDMC

18. **Loop 303 Corridor/White Tanks ADMP**
    *Lead Agency*: FCDMC
    *Author*: URS, Logan Simpson Design

19. **Wittman ADMP**
    *Lead Agency*: FCDMC
    *Author*: Entellus

20. **Maricopa County Eye to the Future – McMicken Dam Scenic Corridor Guidelines**
    *Lead Agency*: Maricopa County
    *Author*: Maricopa County Planning and Development Department

21. **White Tanks Flood Retarding Structure No. 3 Project**
    *Lead Agency*: FCDMC
    *Author*: FCDMC

22. **Buckeye General Plan Update**
    *Lead Agency*: Town of Buckeye
    *Author*: Partners for Strategic Action

23. **Goodyear General Plan**
    *Lead Agency*: City of Goodyear
    *Author*: URS Corporation

24. **Surprise General Plan**
    *Lead Agency:* City of Surprise
    *Author:* Partners for Strategic Action

25. **Glendale General Plan**
    *Lead Agency:* City of Glendale
    *Author:* Community Sciences Corporation

26. **Earth Fissure Investigation Report McMicken Dam 2003 and 2004**
    *Lead Agency:* FCDMC
    *Author:* Amec Earth and Environmental, Inc.

27. **I-10 Median Widening DCR, SR85 to 303L**
    *Date Completed.* March 2006
    *Lead Agency:* ADOT
    *Author:* HDR

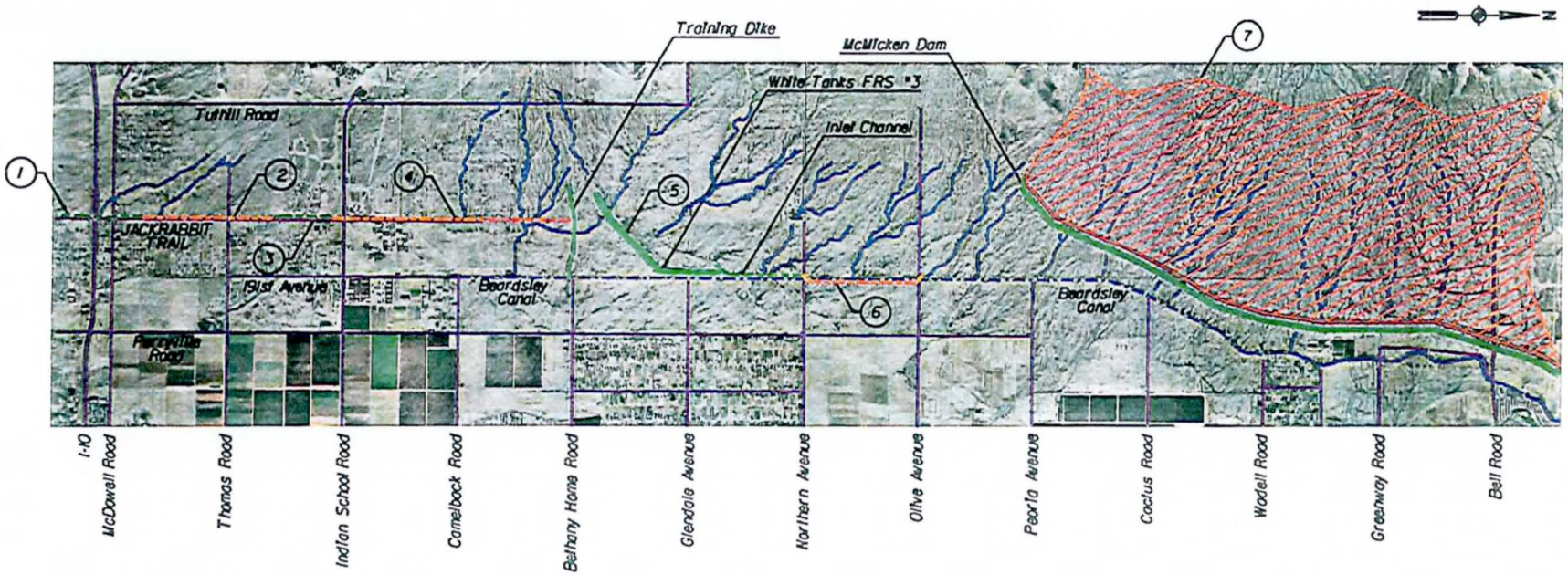
28. **SR303L, MC 85 to Indian School Rd DCR**
    *Date Completed.* December 2002
    *Lead Agency:* MCDOT
    *Author:* HDR

29. **SR303L/I-10 Interchange, Phase 1 Design**
    *Lead Agency:* ADOT
    *Author:* PBQD

30. **Jackrabbit Trail Corridor Improvement Study, Germann Rd to Indian School Rd**
    *Date Completed.* January 2001
    *Lead Agency:* MCDOT
    *Author:* DMJM

31. **Jackrabbit Trail DCR, Yuma Rd to Thomas Rd**
    *Date Completed.* January 2004
    *Lead Agency:* MCDOT
    *Author:* AMEC

32. **I-10/Hassayamapa Valley Roadway Framework Study**
    *Date Completed.* Ongoing
    *Lead Agency:* Maricopa Association of Governments
    *Author:* DMJM Harris




## Current Flood Control District of Maricopa County Projects

1. *Segment of White Tanks FRS #4 Inlet Channel*
   *Existing Channel - Lined, No Improvements Expected*
   *Project Status: Included In Predesign Project*

2. *Segment of White Tanks FRS #4 Inlet Channel*
   *New Channel - Unlined*
   *Project Status: Conceptual Design*

3. *Segment of White Tanks FRS #4 Inlet Channel*
   *Existing Channel - Unlined, No Improvements Expected*
   *Project Status: Included In Predesign Project*

4. *Segment of White Tanks FRS #4 Inlet Channel*
   *New Channel or Conduit - May Include Detention Basins*
   *Project Status: Conceptual Design*

5. *White Tanks FRS #3*
   *Structural Improvements and Exst. Inlet Channel Improvements*
   *Project Status: Under Construction*

6. *White Tanks FRS #3 North Inlet Channel, Northern Ave. to Olive Ave.*
   *New Channel, Box Culverts and Erosion Protection*
   *Project Status: Under Design*

7. *Wittmann Area Drainage Master Plan*
   *Study Area - May Include Modifications to McMicken Dam*
   *Project Status: Preliminary Alternatives Evaluation*

DRAINAGE FEATURES

Jackrabbit Trail, I-10 to Bell Road
Access Control and Corridor Improvement Study

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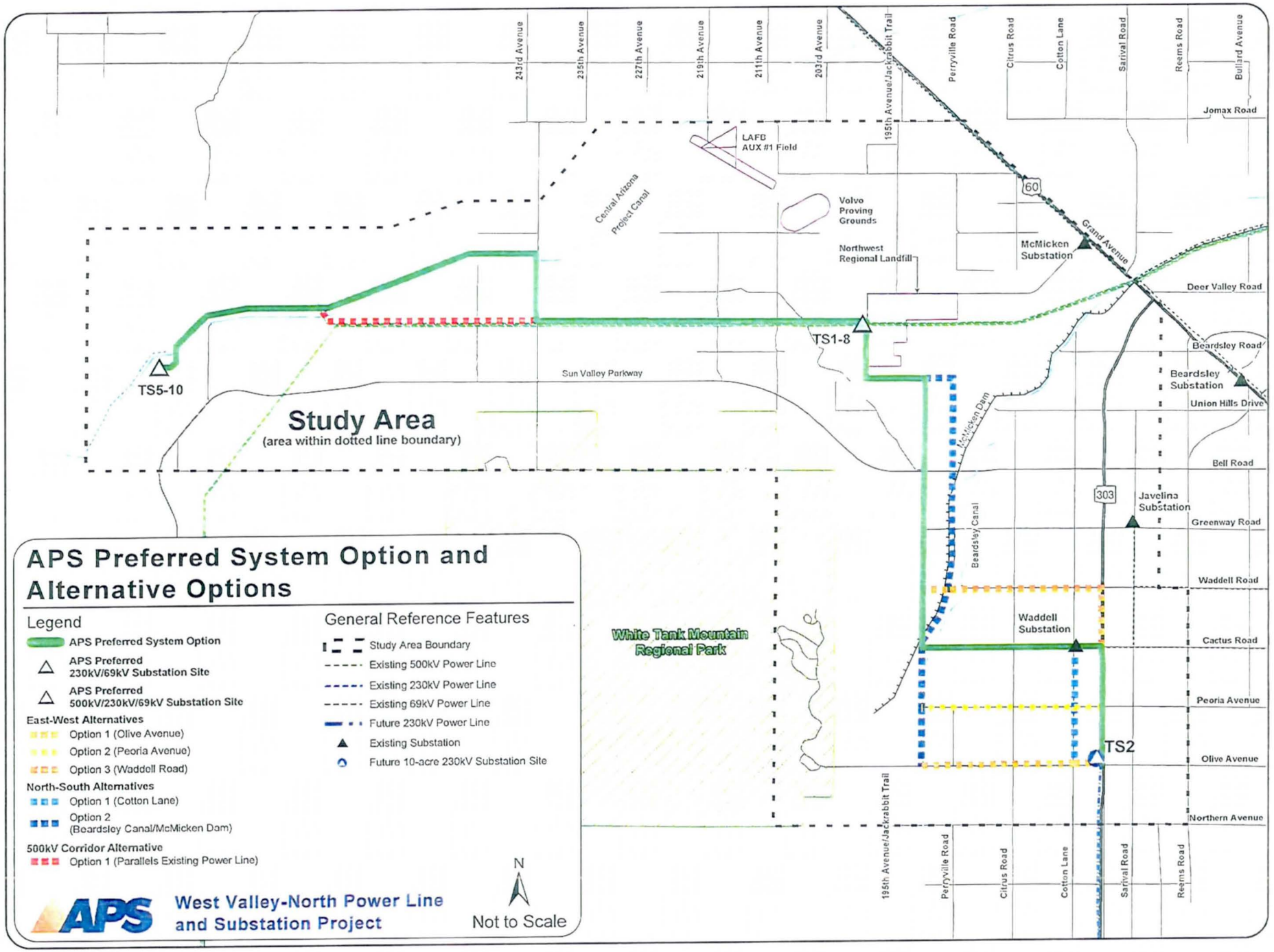
243rd Avenue
235th Avenue
227th Avenue
219th Avenue
211th Avenue
203rd Avenue
195th Avenue/Jackrabbit Trail
Perryville Road
Citrus Road
Cotton Lane
Sarival Road
Reems Road
Bullard Avenue
Jomax Road
LAFB
AUX #1 Field
Central Arizona
Project Canal
Volvo
Proving
Grounds
Northwest
Regional Landfill
60
Grand Avenue
McMicken
Substation
Deer Valley Road
TS1-8
TS5-10
Sun Valley Parkway
Beardsley Road
Beardsley
Substation
Union Hills Drive
McMicken Dam
Bell Road
303
Javelina
Substation
Greenway Road
Beardsley Canal
Waddell Road
Waddell
Substation
Cactus Road
White Tank Mountain
Regional Park
Peoria Avenue
TS2
Olive Avenue
Northern Avenue
Study Area
(area within dotted line boundary)
APS Preferred System Option and
Alternative Options
Legend
APS Preferred System Option
APS Preferred
230kV/69kV Substation Site
APS Preferred
500kV/230kV/69kV Substation Site
East-West Alternatives
Option 1 (Olive Avenue)
Option 2 (Peoria Avenue)
Option 3 (Waddell Road)
North-South Alternatives
Option 1 (Cotton Lane)
Option 2
(Beardsley Canal/McMicken Dam)
500kV Corridor Alternative
Option 1 (Parallels Existing Power Line)
General Reference Features
Study Area Boundary
Existing 500kV Power Line
Existing 230kV Power Line
Existing 69kV Power Line
Future 230kV Power Line
Existing Substation
Future 10-acre 230kV Substation Site
APS
West Valley-North Power Line
and Substation Project
N
Not to Scale

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: June 25, 2007

To: Cheryl Toy, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: June 14, 2007 PAC Meeting #2

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Summary of Public Meetings held in March 2007

John McNamara gave an overview of the public meetings that were held in March 2007. The public felt that Jackrabbit Trail alignment should be preserved as a green belt to maintain the existing desert habitat and rural lifestyle. In addition, many people believed that the focus on Jackrabbit Trail was misdirected since there were other more pressing and "needy" transportation corridors. Thus, other alternate alignments should be evaluated and focus should be shifted to east/west routes connecting to Jackrabbit Trail. The public expressed its desire to preserve the integrity of the White Tanks Regional Park. Emphasis was also laid on developing infrastructure prior to permitting more development in the region. It was also discussed if the need for constructing new corridors could be eliminated by reducing the permissible density of development.

## III. Travel Demand Model Methodology

For travel demand modeling, it was discussed to develop 'hybrid' socio-economic input data and MCDOT would be responsible for running the model using this 'hybrid' data. This model would be utilized in the phasing of the project and also to demonstrate 'need' for an enhanced facility along the Jackrabbit Trail section line for the next public meeting. The model results from the MAG I-10/Hassyampa Roadway Framework Study will be used for the ultimate footprint of the facility.

## IV. Overview of Tier 1 Screening Process

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Based on the above-mentioned criteria, four main considerations were kept in mind while selecting the geographical zones through which potential alternatives could be drawn. These considerations were-

i. Topographical concerns
ii. Proximity to environmental resources
iii. Public acceptance during the scoping process
iv. High-level planning-where to locate corridor in order to serve the community in the best possible manner and avoid circuitous routing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained. These zones span from the Tuthill Road alignment till half mile east of 191$^{st}$ Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment

- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Tier 2 Screening Process and Next Steps

Based on the zone analysis from Tier 1 Screening Process, three potential alternative corridors were identified for the next level of evaluation. However, these were broad conceptual corridors that did not represent the actual footprint in any manner. (See attached figure)

Draft Tier 2 Evaluation criteria is as follows-

- Right-of-way required
- General impact to community
- General impact to future planned developments & developable land
- Public acceptance
- Cost
- Engineering complexity & constructability
- Drainage/Flood control
- Public transportation planning policy
- Corridor footprint/ Design consistency
- Potential environmental impacts

Please see attachment for a detailed description of each of these criteria.

The next steps in the process are as follows-

i. Incorporate stakeholder input on evaluation criteria and alternatives
ii. Conduct Tier 2 evaluation
iii. Travel demand modeling

## VI. Other Items/ Open Discussion

The study need has to be demonstrated using the modeling before the next public meeting. The PAC also needs to decide the next PAC meeting date and the tentative schedule for the next public meeting.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Project Advisory Committee Meeting II**

***June 14, 2007: 10:00 AM***
***City of Surprise Classroom***
***12425 W. Bell Road***
***Surprise, AZ 85374***

**SIGN-IN SHEET**

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|---|---|---|
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| Tim Oliver | TimOliver@mail.maricopa.gov | 602-506-3994 |
| Bob Dubsky | robert.dubsky@luke.af.mil | 623 856-6195 |
| Mike DeWitt | Michael.DeWitt@APS.com | 623-493-4446 |
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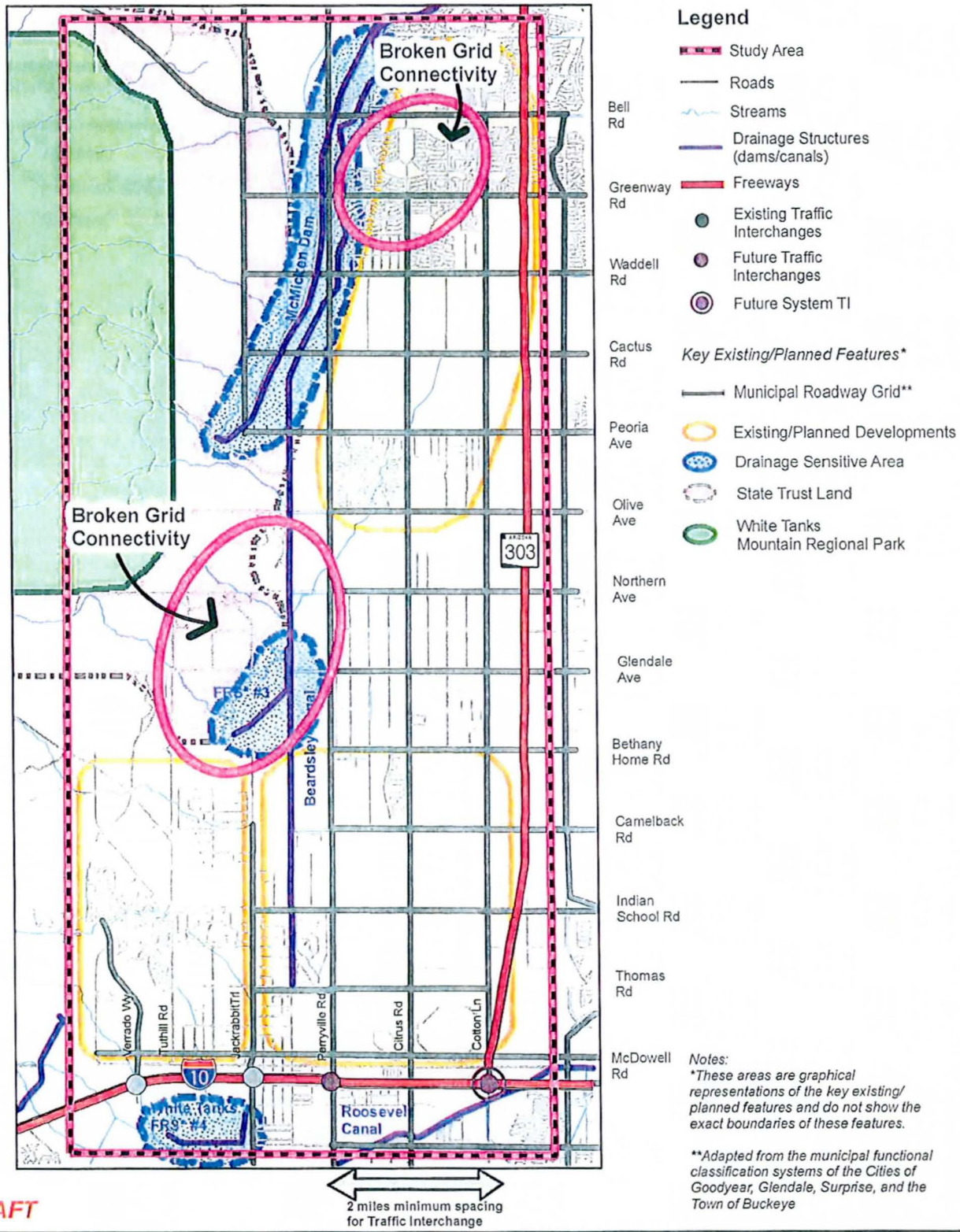
| Linda Sciarro | Lindasciarro@mail.maricopa.gov | (602) 506-4893 |
| Rob Sachs | RES@Mail.Maricopa.GOV | 602-506-4174 |
| DAN MARUM | dan.marum@wilsonco.com | 480-893-8860 |
| MICHAEL ZOPPA | michael@adyedesign.com | 602-234-2111 |
| JOHN MCNAMARA | john.mcnamara@dmjmharris.com | 602 337-2587 |

## Considerations for Tier 1 Evaluation of Alternatives




*Notes:*
**These areas are graphical representations of the key existing/ planned features and do not show the exact boundaries of these features.*

***Adapted from the municipal functional classification systems of the Cities of Goodyear, Glendale, Surprise, and the Town of Buckeye*

DRAFT

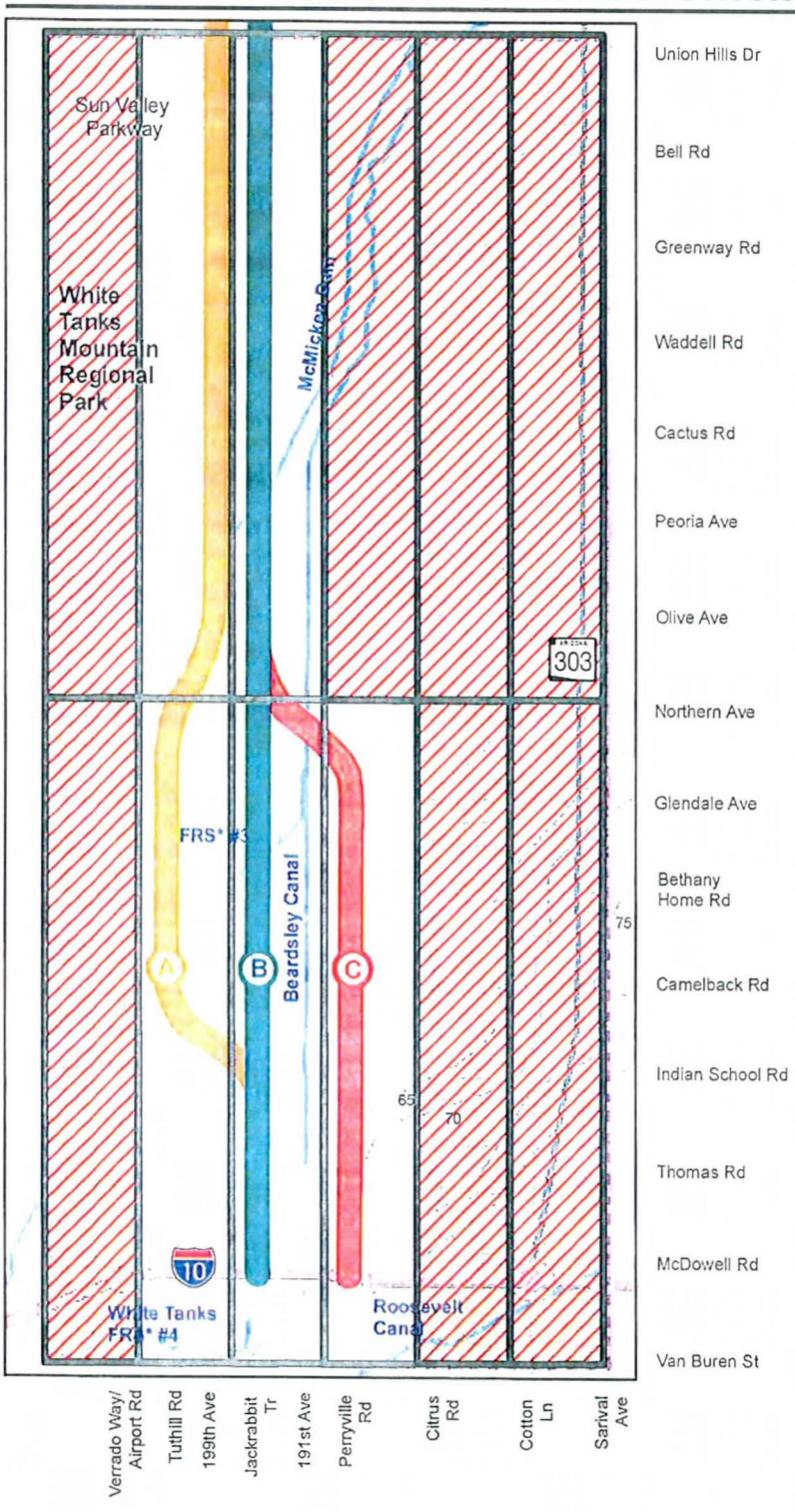
1 0.5 0 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise - Town of Buckeye*
*- City of Goodyear*
*- City of Glendale*

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

*June 2007*

# Tier 2: Potential Alternative Corridors in Selected Zones




**Legend**

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

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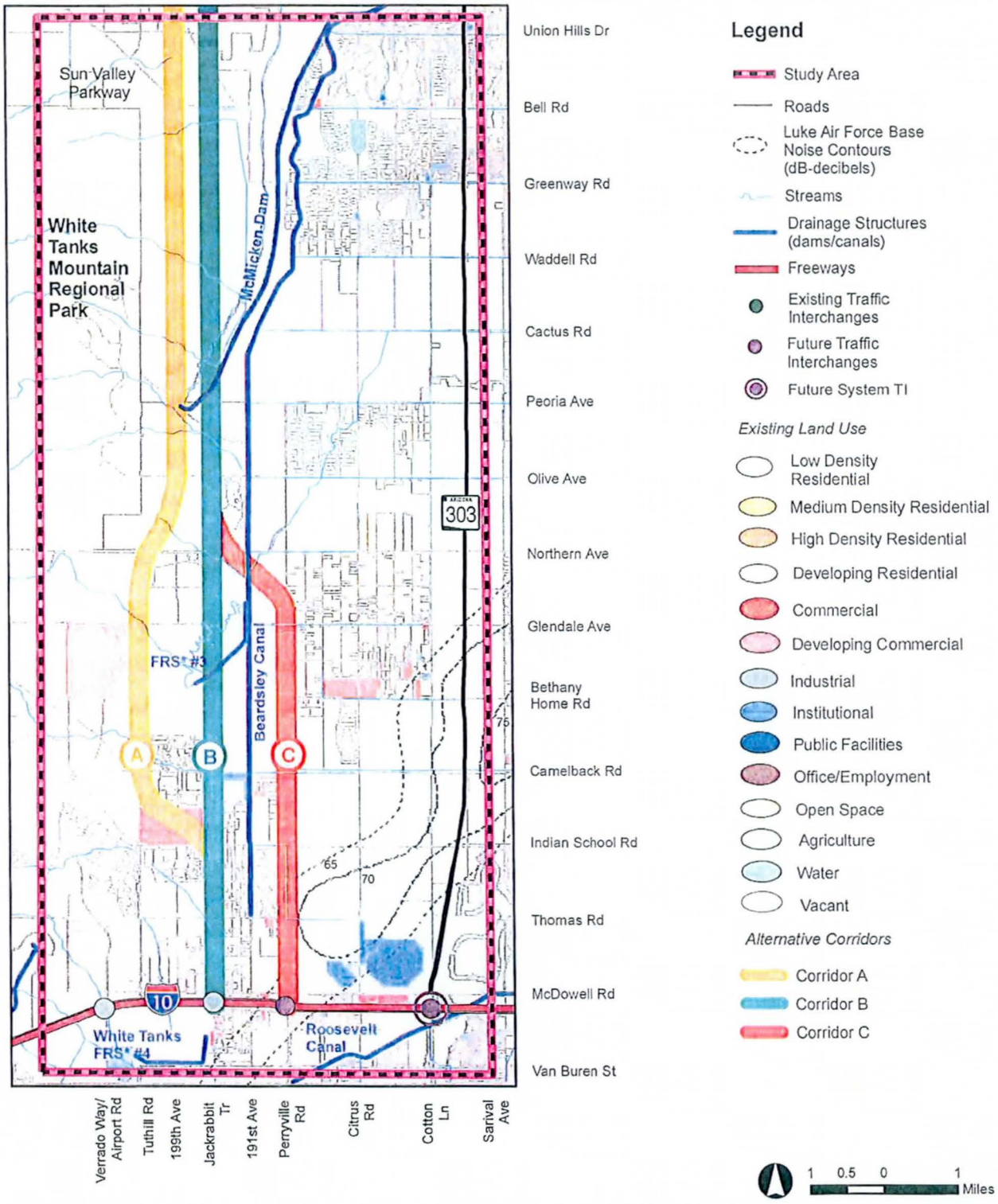
*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

June 2007

# Tier 2: Potential Alternative Corridors

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*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

June 2007

DMJM HARRIS | AECOM

JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025, Work Order No. TT005

Evaluation of Tier 1 Alternative Zones
Critical Flaw Criteria Analysis Summary Matrix

| Criteria | Zones | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | North | | | | | | South | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| *Would a roadway corridor within this zone be compatible with existing & future land use?* | Maybe | Maybe | Yes | No | No | No | No | Maybe | Maybe | Maybe | No | No |
| *Would a roadway corridor within this zone be compatible with existing & planned drainage/flood control facilities?* | Yes | Yes | Maybe | No | Yes | Yes | Yes | Maybe | Maybe | Yes | Yes | Yes |
| *Would a roadway corridor within this zone be compatible with environmental related resources?* | No | Maybe | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes |
| *Would a roadway corridor within this zone be compatible with adopted agency/jurisdictional transportation plans?* | Maybe | Yes | Yes | Yes | No | No | No | Maybe | Yes | Maybe | No | No |
| *Conclusion* | **Eliminated** | **Retained** | **Retained** | **Eliminated** | **Eliminated** | **Eliminated** | **Eliminated** | **Retained** | **Retained** | **Retained** | **Eliminated** | **Eliminated** |

*DRAFT*

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

## Tier 2 Draft Evaluation Criteria

**Right-of-way required**: An assessment of the amount and value of the right-of-way that would need to be acquired for roadway alternatives, in relation to other alternatives under consideration for the segment.

**General impact to community**: An estimate of the overall effect (other than right-of-way and environmental impacts) of proposed alternatives on the communities most directly affected. Specific impacts include traffic safety, access to employers or activity centers, economic development and aesthetics. The impacts considered under this criterion may be either positive or negative.

**General impact to future planned developments and developable land**: An estimate of the overall effect (other than right-of-way and environmental impacts) of the roadway alternatives on planned developments and/or land that is currently under the jurisdiction of the Arizona State Land Department. The impacts considered under this criterion may be either positive or negative.

**Public acceptance**: Estimated breadth and depth of community support for and acceptance of the alternative, based on input from municipal staff, stakeholders, homeowner associations, and the public.

**Cost**: A non-quantitative estimate of relative construction and right-of-way cost compared with other Tier 2 alternatives for the segment.

**Engineering complexity and constructability**: A general assessment of engineering complications, exclusive of cost considerations, that could arise from construction of the roadway.

**Drainage/Flood Control**: This includes potential impacts from the proposed roadway alternatives to both existing Maricopa County Flood Control District Facilities as well as to future improvements. This also includes potential impacts to natural drainage features in the study area.

**Public Transportation Planning Policy**: The degree to which implementation of the proposed roadway alternatives is compatible with adopted agency/jurisdictional transportation plans including considerations for the spacing of traffic interchanges along Interstate 10.

**Corridor footprint/design consistency**: The degree to which an alternative is consistent with the design characteristics-especially the cross-section that will best serve anticipated traffic volumes.

**Potential Environmental Impacts**: Potential project impacts on the social, ecological, and cultural environment in the study area. This includes the potential impacts to the White Tanks Mountain Regional Park.

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

***November 6, 2007: 2 PM to 4 PM***
***Buckeye Community Senior Center***
***201 E. Centre Avenue, Buckeye AZ 85326***

## MEETING MINUTES

Date: November 6, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: November 6, 2007

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet
Following a round of introductions of the meeting attendees, Jennifer Toth, gave an overview of the project and its purpose.

### II. Study/Alternative Screening Process

The purpose of the study is to provide a future footprint of the corridor and establish the facility type, number of lanes, right-of-way and corridor alignment. The study will also provide an implementation timeframe and phasing to accommodate future travel demands. Study objectives concentrate on assessing the constraints and potential impacts by existing and proposed developments, drainage features, utilities and environmental issues.

The study process involves a three step-involvement plan, which leads to the preparation of a phased implementation plan of the selected alternative and access management plan. The three steps are-

i) Develop a stakeholder database
ii) Develop alternatives with stakeholder input
iii) Develop implementation plan with the stakeholders whereby major design features are finalized and a funding plan is developed

For the alternatives selection, a tiered evaluation process will be adopted. This would begin with a universe of alternatives and would narrow down to one preferred alternative after a rigorous screening process and analysis.

## III. Traffic Volume/Cut-Line Analysis

In order to conduct the Traffic Volumes/Cut-Line Analysis, the following available model data sources were used-

i) MAG 2030 Regional Socioeconomic Model
ii) Enhanced Year 2026 MCDOT Northwest Valley Corridor Studies Model
iii) MAG Buildout Travel Demand Assessment (I-10/Hassayampa Valley Roadway Framework Study)

Cut-lines are theoretical lines across facilities and the sum of volumes and capacities is used to determine if a cut-line is failing. Under the Northwest Valley Model, only one cut-line that runs on Bell Road is failing and the rest are all under capacity. On the other hand, under buildout conditions, all cutlines but one are failing. A Parkway facility is critical in northern portion of study corridor and specially under buildout conditions.

## IV. Tier 1 Evaluation

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained.

These zones span from the Tuthill Road alignment till half mile east of 191st Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Summary of Meetings with Key Stakeholders

The project team met with the FCDMC, ASLD and Land Solutions, Inc. to discuss the Tier 1 and Tier 2 Evaluations and get their feedback on proposed corridor alternatives.

- Flood Control District of Maricopa County (FCDMC)

Coordination meeting with the FCDMC revealed that the department was planning on running the White Tanks # 3 Outlet Channel on the east side of Jackrabbit Trail from Bethany Home to Camelback Road. The channel will swing west between Camelback and Indian School Roads but the exact location remains to be determined. MCDOT and FCDMC could have an opportunity for a partnership to share channel and roadway corridor. FRS #3 Outlet has been completed and decommissioning of the McMicken Dam. The FCDMC reiterated their concern to preserve the functional intent of their structures.

- Arizona State Land Department (ASLD)

The ASLD preferred a corridor that left maximum developable land and curved around the southern tip of McMicken Dam.

- Land Solutions Inc. (Zanjero Trails)

Land Solutions, Inc. is designing the Zanjero Trails master planned community in the project area and their main concern is on the width of the facility and the amount of traffic going through the community. They would prefer if the corridor completely avoids the community.

## VI. Summary of Public Meetings held in March 2007

The following were the main issues and concerns raised at the public meetings held in March 2007.

- Jackrabbit Trail alignment should be preserved as green belt (to maintain existing desert habitat and rural lifestyle)
- Focus on Jackrabbit Trail is misdirected -- other more pressing and "needy" transportation corridors should be the study focus
- Evaluate alternate alignments and leave Jackrabbit Trail as is
- Focus on SR-303 instead of Jackrabbit Trail

- Leave White Tanks Park alone
- Wild game crossings need to be accommodated
- Safety within the White Tanks Park would be an issue if a high-capacity facility is developed close to the park
- Noise pollution as a result of this corridor to be mitigated
- Reduce allowed development and density (eliminate need)
- Need more east/west routes connecting to Jackrabbit Trail
- Construct infrastructure prior to permitting more development

VII. **Tier 2 Corridor Segments and Evaluation**

Rodney Bragg led the discussion of the four segments Tier 2 evaluated. Slight revisions were made at the last PAC meeting to the segments which accommodate the Forecast Regional Travel Demand. Each segment has four planned corridors. Three corridors were discussed with ASLD and MCDOT, where slight revisions were made.

It is planned that a typical corridor will include between two and four travel lanes in each direction within 130 to 200 feet of R/W. Corridor A, Jackrabbiit should swing west by Verrado High School, on the west side of Canyon View to avoid flood control structures. Corridor B, section line, Corridor C on the west side of Beardsley for approximately 1-mile, over FRS #3, on the west side of McMicken Dam, Corridor D can be found on the north of FRS #3 and could swing east onto ASLD (Prision. It was expressed that these corridors are not alignments. The 4 segments of the study were also discussed and the findings are:

i. Segment 1(I-10 to Indian School Road)
   - Avoid existing and planned developments.
   - Some of the scoring may change if ASLD decides that the land could not be sold.
   - Avoid Flood Control Structures.

ii. Segment 2 (Indian School Road to Northern Avenue)
   - Fire Station- temporary
   - DMB modular
   - Politically influential subdivision here
   - Tuthill Alignment and Berm at Verrado Tuthill Dike
   - Avoid Flood Control Structures.
   - Make sure enough structures allowed for feemovement of water, and the Flood Control District is looking at a 500-year event.

iii. Segment 3 (Northern Avenue to Peoria Avenue)
   - Place corridor as far west as possible with connection to preferred corridor in adjacent segments.

iv. Segment 4(Peoria Avenue to Bell Road)
   - Maximize development of ASLD area and preserve the functional intent of McMicken Dam.
   - Brighten Fill in pending area.

VIII. **Next steps**
- Public Meeting-November 13, 2007
- Finalize Tier 2 Evaluation

- Develop Roadway Alignment and Design Features
- Next SAC and Public Meetings-Early 2008
- Draft Report- Spring 2008

## IX. Discussion

Discussion took place between stakeholders on connecting Northern Avenue to Jackrabbit Trail as part of the Hassayampa Study. This decision would lead to more constraints than opportunities. The study for Perryville TI will take place in 2009. Maybe the data from that study could be used as part of the Jackrabbit Trail study. The stakeholder group also discussed Tier 2 evaluations, developing roadway alignment and design elements and upcoming public meetings. There was discussion about the impact to existing land uses definition, and weighted criteria and ranking during the studies, there should be priorities on criteria as well as corridors. The group also decided that there should be a meeting with Verrado and DMB, about the impacts to the Beardsley Canal.

# Maricopa County
# Department of Transportation

DMJM HARRIS | AECOM

## Jackrabbit Trail Access Control and Corridor Improvement Study
## Interstate-10 to Bell Road

**Stakeholder Advisory Committee Meeting #3**

*November 6, 2007: 2 PM to 4 PM*
*Buckeye Community Senior Center*
*201 E. Centre Avenue, Buckeye AZ 85326*

**SIGN-IN SHEET**

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| MICHAEL ZORBA | Michael@adyedesign.com | 602.234.2111 |
| David Maguire | dmaguire@landsolutionsinc.com | 623 412 3355 |
| RUBEN OJEDA | ROJEDA@LAND.AZ.GOV | (602) 542-2648 |
| EDWARD DIETRICH | edietrich@land.az.gov | (602) 542-2653 |
| Randall Overmyer | Randall.Overmyer@surpriseaz.com | 623.222.3290 |
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| Name | E-Mail | Phone No. |
| --- | --- | --- |
| ~~Deborah Crane MCO~~ | | |
| MANSI SACHDEV | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| Rodney Bragg | rodney.bragg@dmjmharris.com | 602-337-2617 |
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# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

## Tier 2 Evaluation Criteria

**Right-of-way**: An assessment of the amount and value of the right-of-way that would need to be acquired for corridor alternatives, in relation to other alternatives under consideration for the segment.

**Compatibility with Existing Developments**: An estimate of the overall effect (other than right-of-way and environmental considerations) of proposed corridor alternatives on the existing developments most directly affected. Key considerations include the proximity to existing developments and potential displacements.

**Compatibility with Planned Future Developments**: An estimate of the overall effect (other than right-of-way and environmental considerations) of the corridor alternatives on planned developments and/or land that is currently under the jurisdiction of the Arizona State Land Department.

**Public Acceptability**: Estimated breadth and depth of community support for and acceptance of the corridor alternative, based on input from municipal staff, stakeholders, homeowner associations, and the public.

**Cost**: A non-quantitative estimate of relative construction compared with other Tier 2 corridor alternatives for the segment. Key considerations include corridor length and structure costs associated with Flood Retardant Structure (FRS) and canal crossings.

**Engineering Complexity and Constructability**: A general assessment of engineering complications, exclusive of cost considerations, that could arise from construction of the roadway. Key considerations include roadway geometry, permitting requirements, and fissure zones.

**Drainage/Flood Control**: This includes potential impacts from the proposed corridor alternatives to both existing Flood Control District of Maricopa County (FCDMC) facilities as well as to future improvements. This also includes potential impacts to natural drainage features in the study area.

**Long-term Regional and Local Planning Policy**: The degree to which implementation of the proposed corridor alternatives is compatible with agency/jurisdictional transportation plans and policies including considerations for the spacing of traffic interchanges along Interstate 10.

# Jackrabbit Trail Access Control and Corridor Improvement Study

## Meeting Agenda Contd.

- Summary of Public Meetings held in March 2007
- Tier 2 Corridor Segments and Evaluation Criteria
- Tier 2 Evaluation
- Next Steps
- Questions

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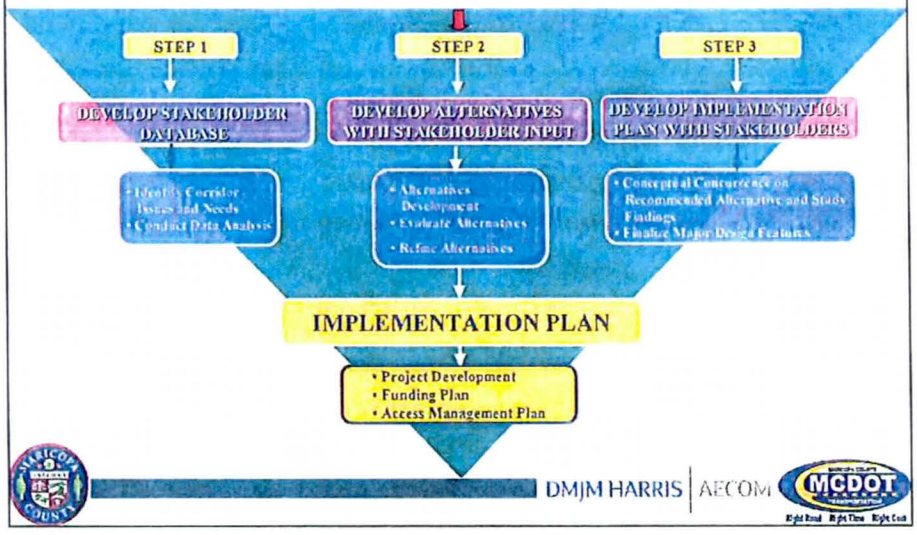
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Study Process

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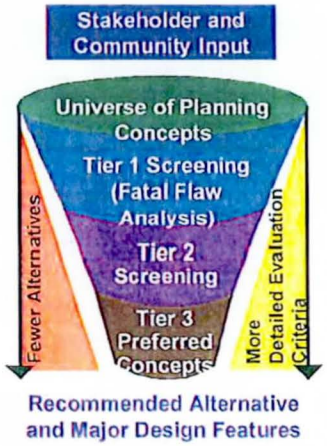
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Alternative Screening Process




Recommended Alternative and Major Design Features

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis

- Available model data being used:
  - MAG 2030 Regional Socioeconomic Model
  - Enhanced Year 2026 MCDOT Northwest Valley Corridor Studies Model
  - MAG Buildout Travel Demand Assessment (I-10/Hassayampa Valley Roadway Framework Study)
- Cut-lines are theoretical lines across facilities
- Sum of volumes and capacities to determine if a cut-line is failing

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Study Area Socioeconomic Projections

| | Socioeconomic Data and Forecast Source | | | | |
|---|---|---|---|---|---|
| | 2005[1] | 2015[2] | 2030[3] | Northwest Valley[4] | Buildout[5] |
| Total Population | 30,359 | 80,092 | 146,336 | 221,965 | 252,173 |
| Population Per Square Mile[6] | 394 | 1,040 | 1,900 | 2,882 | 3,274 |
| Total Employment | 4,794 | 22,458 | 54,591 | 59,833 | 89,800 |
| Employment Per Square Mile[6] | 62 | 291 | 709 | 777 | 1,166 |

Notes:
1 Maricopa Association of Governments, 2003
2 Maricopa Association of Governments, August 17, 2007
3 Maricopa Association of Governments, June 19, 2007
4 MCDOT Northwest Valley Corridor Studies Model Influence Area. May 2007 (Enhanced Year 2026 conditions)
5 Maricopa Association of Governments, September, 2006
6 Approximately 77 square miles in model influence area

*Source: Wilson & Company, September 2007*

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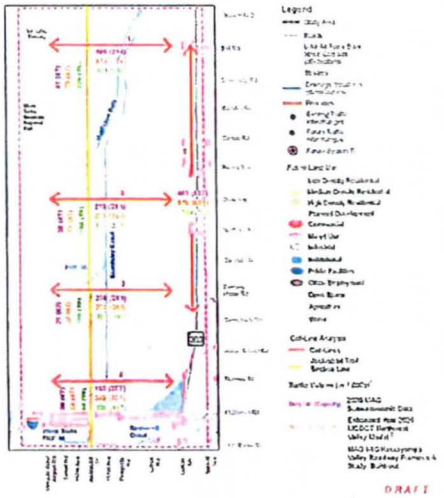
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis



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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis Findings

| Cut-Line | 2030[1] | Northwest Valley Model[2] | Buildout[3] |
|---|---|---|---|
| 1 | Under | Over | Over |
| 2 | Under | Under | Over |
| 3 | Under | Under | Over |
| 4 | Under | Under | Under |
| 5 | Under | Under | Over |

Notes:
1. Maricopa Association of Governments, June 19, 2007
2. MCDOT Northwest Valley Corridor Studies Model Influence Area May 2007 (Enhanced Year 2026 conditions)
3. Maricopa Association of Governments, September, 2006
4. Approximately 77 square miles in model influence area

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis Findings

- Cut-line 1 fails Enhanced 2026 and Buildout conditions
- Four out of five cut-lines fail under Buildout conditions
- Parkway facility critical in northern portion of study corridor
- Clear need for a parkway facility to accommodate Buildout Travel Demand

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 1: Zone Screening Criteria

- ***Land Use:*** Compatibility with existing & future land use
- ***Drainage/Flood Control:*** Compatibility with existing & planned facilities
- ***Environment:*** Impacts to resources
- ***Public Transportation Planning Policy***: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

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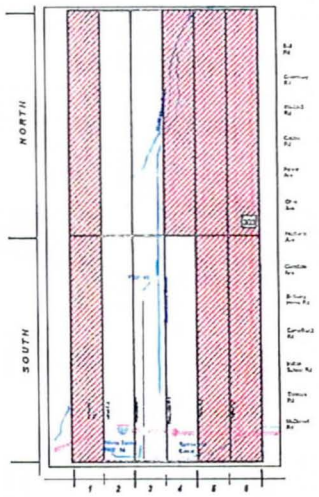
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 1: Zone Screening




Zones eliminated from further consideration

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 1 Evaluation: Critical Issues

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptability
- State Land Holdings
- Existing and Planned Development

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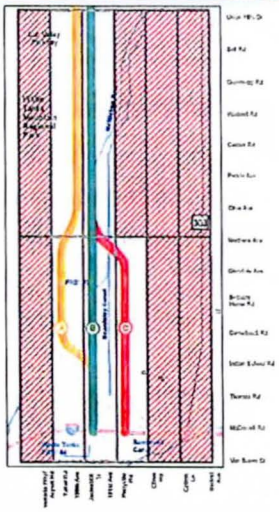
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Corridor Screening



Zones eliminated from further consideration

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Meetings with Key Stakeholders

*Flood Control District of Maricopa County (FCDMC)*

- White Tanks # 3 Outlet Channel planned to run on the east side of Jackrabbit Trail from Bethany Home to Camelback Road
- Channel to swing west between Camelback & Indian School Roads - location TBD
- Potential partnership to share channel & roadway corridor
- FRS #3 Outlet completed
- Decommissioning of southern end of McMicken Dam
- ***Preserve functional intent of structures***

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Meetings with Key Stakeholders

*Arizona State Land Department (ASLD)*

- Corridor that ***leaves maximum developable land & curves around the southern tip of McMicken Dam*** is preferable

*Land Solutions Inc. (Zanjero Trails)*

- Concerns expressed on width of facility & amount of traffic crossing the development
- ***Avoid corridor through the development***

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Public Meetings held in March 2007

*Public Comments*

- Jackrabbit Trail alignment should be preserved as green belt (to maintain existing desert habitat & rural lifestyle)
- Focus on Jackrabbit Trail is misdirected -- other more pressing & "needy" transportation corridors should be the study focus
- Evaluate alternate alignments and leave Jackrabbit Trail as is
- Focus on SR-303 instead of Jackrabbit Trail

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Public Meetings held in March 2007

*Public Comments*

- Leave White Tanks Park alone
- Wild game crossings need to be accommodated
- Safety within the White Tanks Park would be an issue if a high-capacity facility is developed close to the park
- Noise pollution as a result of this corridor to be mitigated
- Reduce allowed development & density (eliminate need)
- Need more east/west routes connecting to Jackrabbit Trail
- Construct infrastructure prior to permitting more development

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 2 Evaluation Criteria

- Right-of-way
- Compatibility with Existing Developments
- Compatibility with Planned Future Developments
- Public Acceptability
- Cost

Continued...



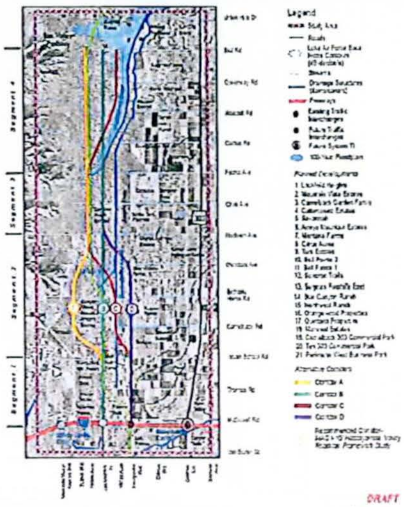
## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 2 Evaluation Criteria Contd.

- Engineering Complexity & Constructability
- Drainage/Flood control
- Long-term Regional & Local Transportation Policy
- Accommodation of Forecast Travel Demand
- Environmental Considerations

## Jackrabbit Trail Access Control and Corridor Improvement Study

**Tier 2: Corridor Segments**



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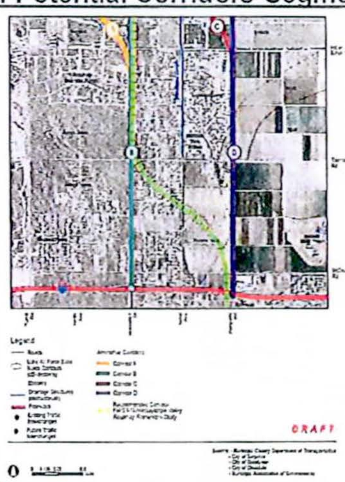
## Jackrabbit Trail Access Control and Corridor Improvement Study

**Tier 2: Potential Corridors-Segment 1**



| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ [illegible] |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ [illegible] |
| 4 | Public Acceptability | | | | |
| 5 | Cost | | ○ [illegible] | | ○ [illegible] |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ [illegible] |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ [illegible] |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ [illegible] |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Potential Corridors-Segment 2

| No. | Criteria | Segment 2: Indian School Rd. to Northern Ave. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | ● [illegible] | ◑ [illegible] | ● [illegible] | ◑ [illegible] |
| 2 | Compatibility with Existing Developments | ◑ [illegible] | ● [illegible] | ○ [illegible] | ◑ [illegible] |
| 3 | Compatibility with Planned Future Developments | ● [illegible] | ◑ [illegible] | ◑ [illegible] | ● [illegible] |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ◑ [illegible] | ● [illegible] | ● [illegible] | ◑ [illegible] |
| 6 | Engineering Complexity & Constructability | ◑ [illegible] | ◑ [illegible] | ● [illegible] | ◑ [illegible] |
| 7 | Drainage/Flood Control | ◑ [illegible] | ● [illegible] | ● [illegible] | ◑ [illegible] |
| 8 | Long-Term Regional and Local Transportation Policy | ◑ [illegible] | ○ [illegible] | ◑ [illegible] | ● [illegible] |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | ○ | ○ |
| 10 | Environmental Considerations | ○ [illegible] | ◑ [illegible] | ● [illegible] | ◑ [illegible] |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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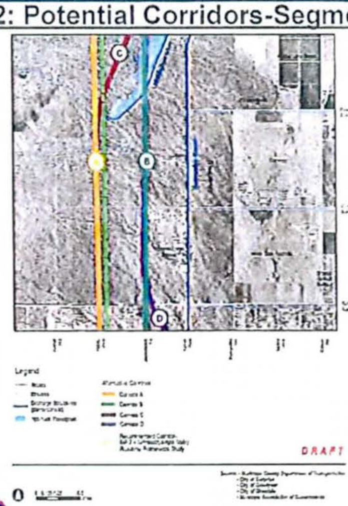
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Potential Corridors-Segment 3




| No. | Criteria | Segment 3: Northern Ave. to Peoria Ave. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | ◑ | ◑ | | |
| 2 | Compatibility with Existing Developments | ○ | ● [illegible] | | |
| 3 | Compatibility with Planned Future Developments | ○ | ◑ [illegible] | | |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ○ | ○ | | |
| 6 | Engineering Complexity & Constructability | ◑ [illegible] | ● [illegible] | | |
| 7 | Drainage/Flood Control | ○ | ● [illegible] | | |
| 8 | Long-Term Regional and Local Transportation Policy | ◑ [illegible] | ○ [illegible] | | |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | | |
| 10 | Environmental Considerations | ● [illegible] | ● [illegible] | | |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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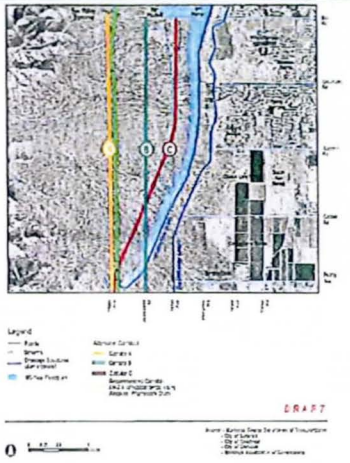
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Potential Corridors-Segment 4




| No. | Criteria | Segment 4: Powerline Alignment | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation to the alternatives within the segment | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | ● | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | ● | ◑ | ○ | |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ○ | ● | ◑ | |
| 6 | Engineering Complexity & Constructability | ◑ | ● | ◑ | |
| 7 | Drainage/ Flood Control | ○ | ● | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | ○ | ○ | ◑ | |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | ○ | |
| 10 | Environmental Considerations | ● | ◑ | ○ | |
| | Recommendations | | | | |

○ Less Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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Right Road Right Time Right Cost


# Jackrabbit Trail Access Control and Corridor Improvement Study


## Tier 2: Evaluation Findings

### Segment 1 & 2

- Avoid existing and planned developments

### Segment 3

- Place corridor as far west as possible with connection to preferred corridor in adjacent segments

### Segment 4

- Maximize development of ASLD area and preserve the functional intent of McMicken Dam


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Right Road Right Time Right Cost

## Jackrabbit Trail Access Control and Corridor Improvement Study

### Next Steps

- Public Meeting-November 13, 2007
- Finalize Tier 2 Evaluation
- Develop Roadway Alignment & Design Features
- Next SAC & Public Meetings-Early 2008
- Draft Report- Spring 2008

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Questions?

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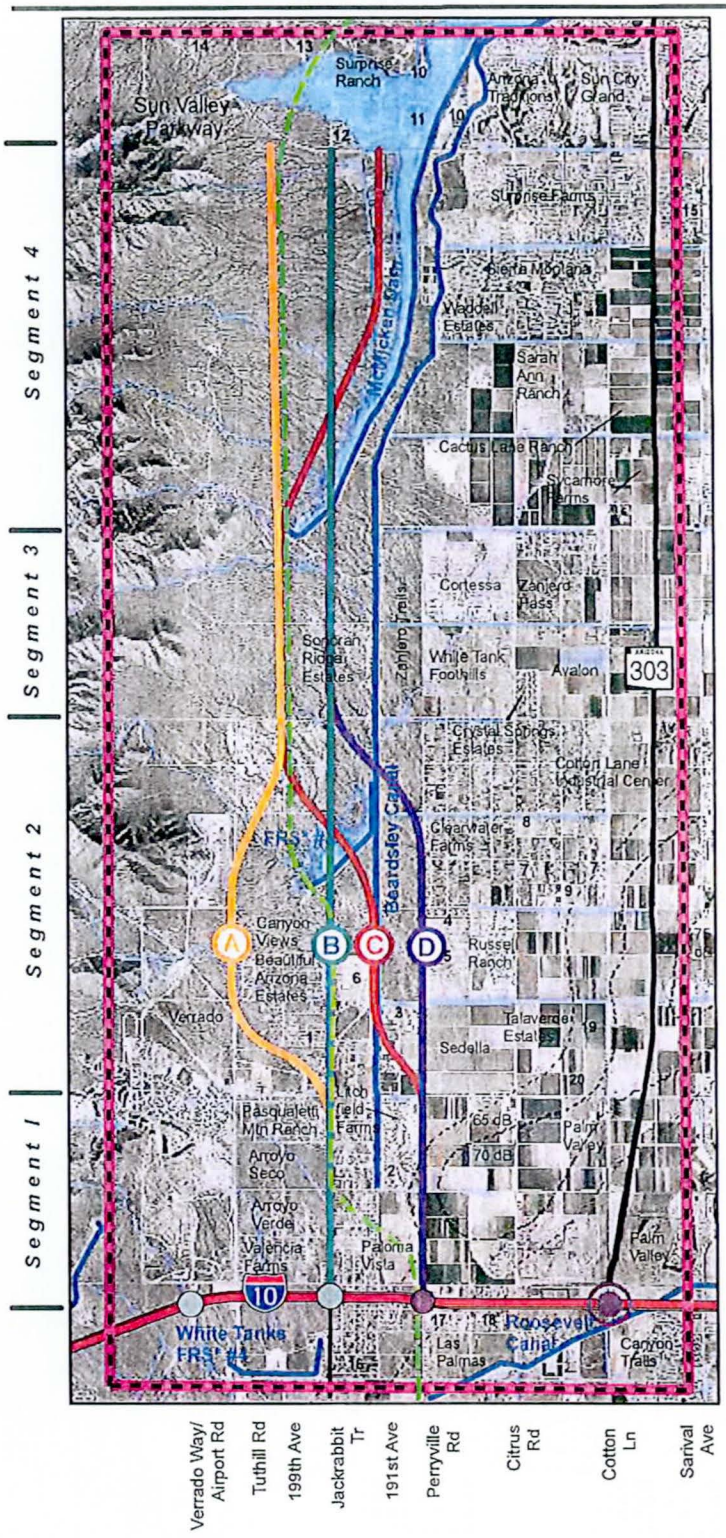
# Tier 2: Potential Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI
- 100-Year Floodplain

*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D

Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

**DRAFT**

*FRS stands for Flood Retardant Structure

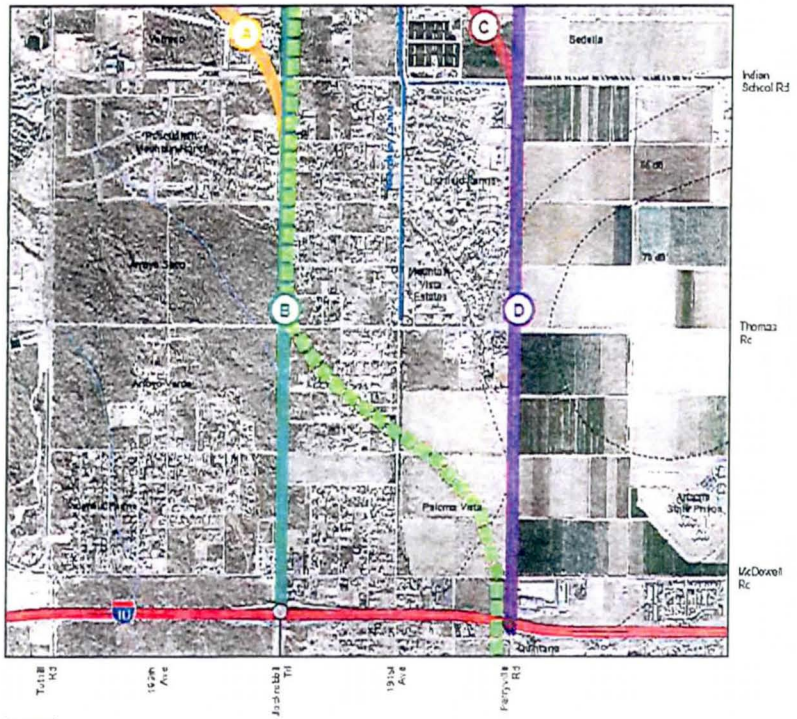
*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*
*- Maricopa Association of Governments*

1 0.5 0 1 Miles

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

October 2007

# Tier 2: Segment 1




Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

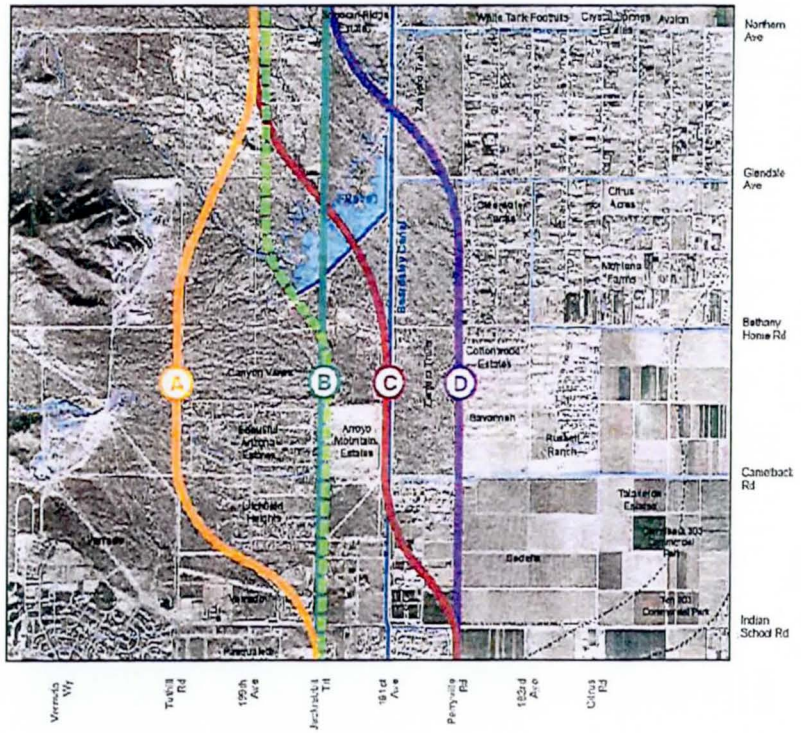
| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) |
| 4 | Public Acceptability | | | | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact proximity to State lands) |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*
*- Maricopa Association of Governments*

# Tier 2: Segment 2




**Legend**

- Roads
- Luke Air Force Base Noise Contours (38-decibels)
- Streams
- Drainage Structures (dam/canals)
- 100-Year Floodplain

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

| No. | Criteria | Segment 2: Indian School Rd. to Northern Ave. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) |
| 2 | Compatibility with Existing Developments | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) |
| 3 | Compatibility with Planned Future Developments | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) |
| 6 | Engineering Complexity & Constructability | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed Intersections) |
| 7 | Drainage/ Flood Control | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) |
| 8 | Long-Term Regional and Local Transportation Policy | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | ○ | ○ |
| 10 | Environmental Considerations | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

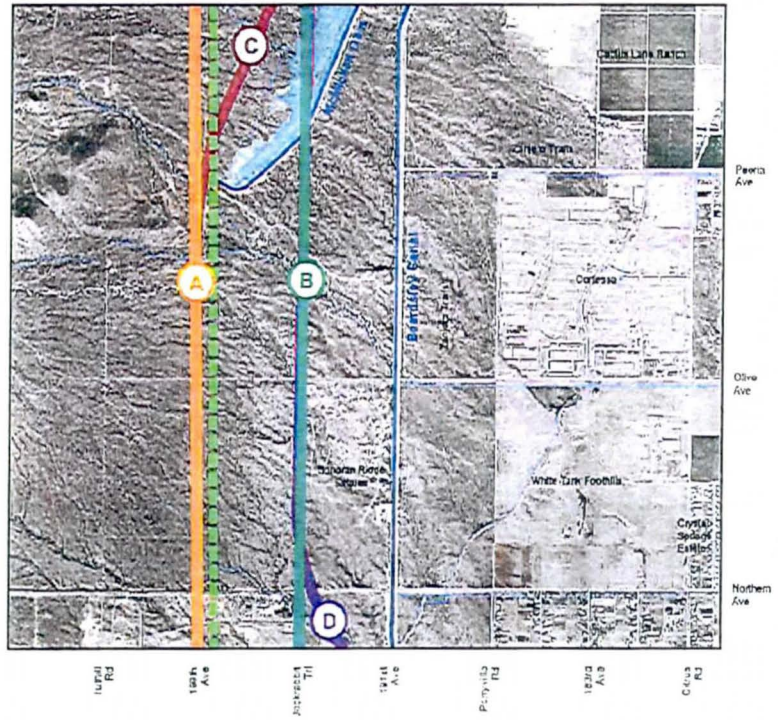
0 .25 .5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*
*- Maricopa Association of Governments*

# Jackrabbit Trail Access Control and Corridor Improvement Study

## *Interstate-10 to Bell Road*

# Tier 2: Segment 3



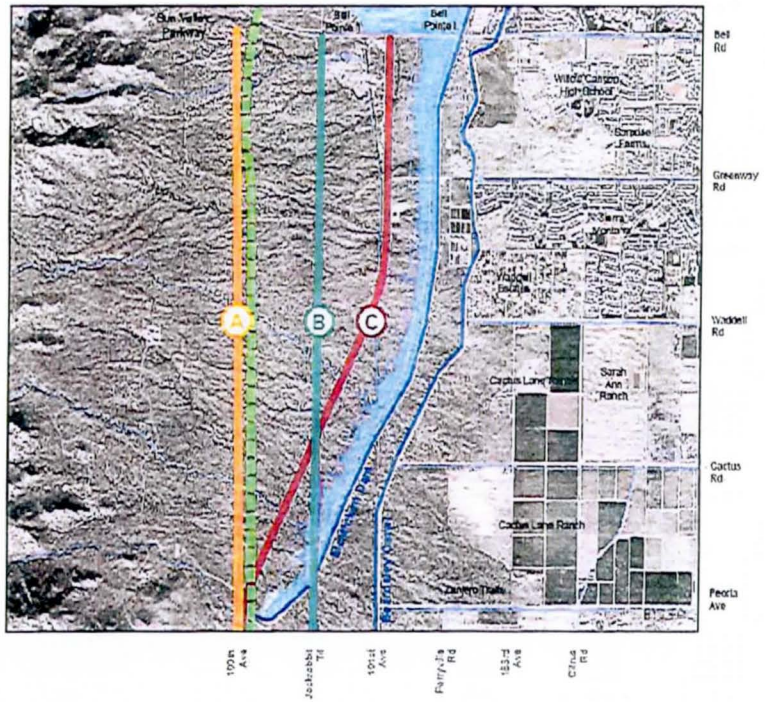

| No. | Criteria | Segment 3: Northern Ave. to Peoria Ave. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | ◑ | ◑ | | |
| 2 | Compatibility with Existing Developments | ○ | ● (Sonoran Ridge Estates) | | |
| 3 | Compatibility with Planned Future Developments | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ○ | ○ | | |
| 6 | Engineering Complexity & Constructability | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | |
| 7 | Drainage/ Flood Control | ○ | ● (McMicken Dam crossing) | | |
| 8 | Long-Term Regional and Local Transportation Policy | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | | |
| 10 | Environmental Considerations | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*
*- Maricopa Association of Governments*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

# Tier 2: Segment 4




Legend

- Roads
- Streams
- Drainage Structures (dams/canals)
- 100-Year Floodplain

Alternative Corridors

- Corridor A
- Corridor B
- Corridor C
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

| No. | Criteria | Segment 4: Peoria Ave. to Bell Rd. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Bell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | ○ | |
| 10 | Environmental Considerations | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ○ (Game crossing) | |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

C 0.25 0.5 1 Miles

Source: - Maricopa County Department of Transportation
- City of Surprise
- City of Goodyear
- City of Glendale
- Maricopa Association of Governments

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# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

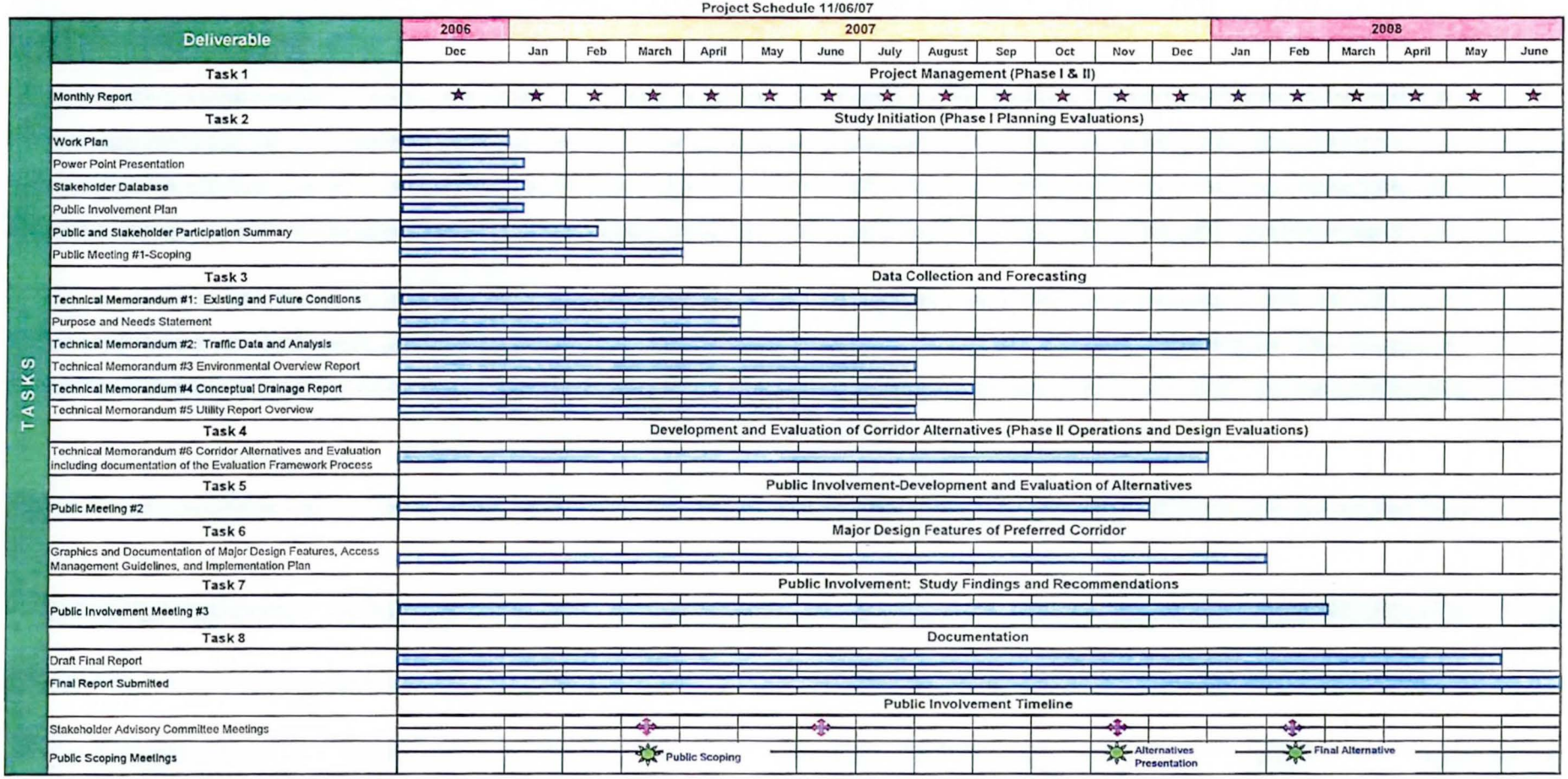
## Proposed Study Schedule

| | |
|---|---|
| Notice to Proceed | November 2006 |
| Study Kick-off & Study Initiation | December 2006 |
| Data Collection & Forecasting Phase | Jan.-Aug. 2007 |
| Stakeholder Advisory Committee Meeting #1 | March 7, 2007 |
| Property Owners Focus Group Meeting | March 13, 2007 |
| Public Meeting #1 (Scoping) | March 20, 2007 |
| Alternatives Development & Evaluation Phase | Jan.-Dec. 2007 |
| Stakeholder Advisory Committee Meeting #2 | June 14, 2007 |
| Stakeholder Advisory Committee Meeting #3 | November 6, 2007 |
| Public Meeting #2 (Alternatives Analysis) | November 13, 2007 |
| Stakeholder Advisory Committee Meeting #4 | February 2008 |
| Public Meeting #3 (Findings & Recommendations) | February 2008 |
| Draft Final Report | May 2008 |
| Final Report Submission | June 2008 |

Jackrabbit Trail Access Control and Corridor Improvement Study

*Interstate-10 to Bell Road*

Project Schedule 11/06/07



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# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## Stakeholder Advisory Committee Meeting #3-Agenda

*November 6, 2007: 2 PM to 4 PM*
*Buckeye Community Senior Center*
*201 E. Centre Avenue, Buckeye AZ 85326*

- Introductions
- Study Alternative Screening Process
- Traffic Volume/Cut-Line Analysis
  - Study Area Socioeconomic Projections
- Tier 1 Evaluation
  - Zone Screening Criteria
  - Critical Issues
- Summary of Meetings with Key Stakeholders-FCDMC, ASLD, Developments, etc
- Summary of Public Meetings held in March 2007
- Tier 2 Corridor Segments and Evaluation Criteria
- Tier 2 Evaluation
  - Findings
- Next Steps
- Questions

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JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

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Evaluation of Tier 2 Corridors

| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | | Segment 2: Indian School Rd. to Northern Ave. | | | | Segment 3: Northern Ave. to Peoria Ave. | | | | Segment 4: Peoria Ave. to Bell Rd. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) | ◑ | ◑ | | | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) | ○ | ● (Sonoran Ridge Estates) | | | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | | | | | | | | | | | | | | | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) | ○ | ○ | | | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed intersections) | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) | ○ | ● (McMicken Dam crossing) | | | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Bell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | ○ | ○ | ○ | |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact; proximity to State lands) | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ○ (Game crossing) | |
| | Recommendations | | | | | | | | | | | | | | | | |

○ Least Significant Impact (Most Desirable)  ◑ Moderate Impact  ● Most Significant Impact (Least Desirable)

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**JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD**
**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

***March 5, 2008: 2 PM to 3:30 PM***
***MCDOT Apache Conference Room***
***2901 W. Durango***
***Phoenix, Arizona 85009***

## MEETING MINUTES

Date: November 6, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: March 5, 2008

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet
Following a round of introductions of the meeting attendees, Rodney Bragg, gave an overview of the status of the project, and the next steps.

### II. Study Process/Alternative Screening

Background information was given on the study its purpose, Tier 1 and Tier 2, and the alternative screening process for the Jackrabbit Trail Access Control and CIS.

### III. Summary of Tier 1 and Tier 2 Evaluation

There was a recommendation by Kass Scudy at the beginning of the meeting for a parkway east of White Tanks. The Tier 1 overview included network discontinuity, and connecting facilities along Jackrabbit Trail. There are critical issues for those

who live and work along Jackrabbit Trail. Those issues are to connect I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment, avoiding the White Tanks Mountain Regional Park and the adherence to jurisdictional transportation planning policy.

The Tier 2 segments were broken down. The Tier 2 matrix has been based on publically held meetings held in January 2008. There are a large number of developments proposed by Zanjero Trails, in segment 1. The matrix was revised based on recommendations, from the public: Segment 1 and 2 should avoid existing and planned developments. In segment 3 Place corridors as far west as possible with connection to preferred corridor in adjacent segments, and Maximize development of ASLD area and preserve the functional intent of McMicken Dam.

The Study Process is to establish the facility type, number of lanes, right-of-way, and corridor alignment required to safely accommodate forecast travel demands.

## IV. Summary of Public Meeting in November 2007

During the Public Meetings held in November 2007, Public Comments include:

- Don't put a 'highway' through our backyards
- 'Highway' will bring down the property values
- Improve east-west arterials and connect them to Jackrabbit Trail first
- When will Bethany Home and Camelback Roads be connected?
- Focus on SR-303 and I-10 instead of Jackrabbit Trail
- Preserve White Tanks Park and accommodate wild game crossings
- High capacity facility along Perryville would impact Scott Libby Elementary School
- Verrado not in favor of Alternative A adjacent to their property; significant taking issues
- Minimize impact to flood control structures i.e. FRS #3 and McMicken Dam
- Move traffic parallel to Jackrabbit Trail as east as possible to the existing development in Segments 1 and 2

## V. Summary of Meetings with Key Stakeholders

i. Arizona State Land Department (ASLD)
- Ensure access to State Land property east of Perryville Road
- Sweep around FRS #3 and use Alternative #1
- Support corridor alignment in the north as it leaves adequate developable land and curves around the southern tip of McMicken Dam

ii. Department of Corrections (AZ State Prison at Perryville)
- No immediate plans of expansion westwards
- Support alignment along Perryville Road

iii. Flood Control District of Maricopa County (FCDMC)
- FRS #3 (Flood Retardant Structure #3) Rehabilitation Project Phase 1 under construction
- Earth fissure risk zones
- Emergency spillway and 2000' wide flood reservoir
- Subsidence around FRS #3 and McMicken Dam Partnering opportunity with MCDOT on the FRS #3 Outlet Channel
- Support Alternative 1 around FRS #3 with less potential structural impact

iv. Maricopa Water District (MWD)

- Realignment or encasing of the canal is feasible but not desired
- Zanjero Trails Master Plan

v. Litchfield Park Elementary School District #79
- Circulation on existing Perryville Road with new facility
- Access to new facility and Thomas Road
- Support proposed improvements

## VI. Preferred Alignment Concept

*See Tier 3 Preferred Alignment PDF for locations*

Comparison of Alternatives to cross FRS #3

i. Alternative 1
- Minimizes impacts to FRS #3
- Lower design costs; less earthwork
- Greater ROW impacts to planned developments
- Crosses Bedrock Wash
- Tighter roadway geometry and longer alignment

ii. Alternative 2
- Crosses FRS #3 and approximately 2,000' wide floodpool
- Higher design costs; raises road approx. 20 feet
- Permitting issues from ADWR and NRCS
- Minimizes impact to planned developments
- Flatter roadway geometry

## VII. Drainage Features

Coordination with FCDMC: Javier Guana, expressed that there are concerns regarding FRS #3 and impacts to the emergency spillway and subsidence. The FRS channel runs along the Jackrabbit trail along the east side. Crossing the FRS #3 raises concerns about hydrologic impacts. There are thee crossing options, and each option was discussed at stakeholder meetings. The Beardsley Canal current crossing is through bridges. The School district concern is about access and frontage. Option 3 was discussed and would impact the height of the roadway to implement parkway design. There is only 200 ft. between the Beardsley Canal and FRS #3. There is no room for any other arrangement. Northern Ave. would have had to be moved farther north. There is no ability to serve or access future or existing land uses. This option would not be feasible. Alternative 2 would have long term maintenance costs.

- There is an 80 year design event used for design of facilities, to keep residents away from areas that could potentially flood. There will be main crossings at Unolla, and Waterman Wash.

- Update from MCDOT: Currently using a design criteria and standards for a parkway facility. A 200-foot footprint and medians. At Camelback Rd. and Missouri Ave. 280 foot footprint at Beardsley Canal. The 200-300-foot footprint is to accommodate power poles and utility easement.

## VIII. Traffic Volumes Analysis

There was an overview of available models that are being used for Traffic Volumes/Cut-Line Analysis. Dan Marum went over the three different forecast years that were analyzed: 2030 MAG, 2026 northwest, and Hass vs. Study. The performance of alternative system crossing the cut line is not enough capacity along the cutline for both zones. Four out of five cut lines fail buildout. Relating to buildout

and parkway is warranted along with the north south corridor: North of 1-10 to Bell and west of SR 303, not on the parkway if section line, if a high capacity is provided off the section line and on the arterial streets.

## IX. Preferred Alignment

Rodney Bragg went over key features for the preferred alignment. The facility will divert north-south traffic from adjacent facilities and reduce congestion in the northern segment of the corridor. There should be emergency spillways, preserve the flood control structures with limited impact, use alternative channels, and compatibility to be coordinated on large impacts. Coordinate with Surprise on the treatment of Jackrabbit trail north of Bell Rd. Non-section line and curvilinear alignment helps mitigate network discontinuity. Rodney also discussed with the group next steps of preferred alignment. Will be to look at Bell Road/Jackrabbit Trail Parkway Intersection and I-10/Jackrabbit Trail Parkway Intersection as well as address any arterial connections and concerns.

## X. Next Steps

i. Public Meeting- March 12, 2008
ii. Technical Memorandum #6- March 2008
iii. Draft Report in May 2008 including-
- Design Features of Preferred Alignment
- Access Management
- Phasing and Implementation

iv. Final Report- June 2008

## XI. Discussion

The stakeholder group discussed the current status of the Jackrabbit Trail studies and the next steps that need to be taken by the group, such as a public meeting, technical reports, access management, and the Final Report that is due June 2008 Drainage is an issue for the stakeholder group, and options were evaluate to avoid impact to local channels. Washes behind the dam, and flood control structure access were also a concern to the stakeholder group. The area around the White Tanks should be considered because the White Tanks is an alluvial wash with fine deposits, home to animals, such as mule deer. The AGFD just completed a study from that area on mule deer migration; environmentally sensitive areas should be considered and avoided. There is also a county policy about counts that should be looked at for100-year counts and the impacts. There was concern on obtaining right-of-way. ASLD should negotiate the sale of easement, and disposition the developer acquires the easement.

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**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Advisory Committee Meeting #4**

***March 5, 2008: 2 PM to 3:30 PM***
***MCDOT Apache Conference Room***
***2901 W. Durango***
***Phoenix, Arizona 85009***

**SIGN-IN SHEET**

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| Joe Schmitz | Joe.Schmitz@goodyearaz.gov | 623 882 7982 |

# Jackrabbit Trail Access Control and Corridor Improvement Study

## Stakeholder Advisory Committee Meeting #3
## November 6, 2007

DMJM HARRIS | AECOM

# Jackrabbit Trail Access Control and Corridor Improvement Study

## Meeting Agenda

- Introductions
- Study Process
- Alternative Screening Process
- Traffic Volume/ Cut-Line Analysis
- Tier 1 Evaluation
- Summary of Meetings with Key Stakeholders

Continued...

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Meeting Agenda Contd.

- Summary of Public Meetings held in March 2007
- Tier 2 Corridor Segments and Evaluation Criteria
- Tier 2 Evaluation
- Next Steps
- Questions

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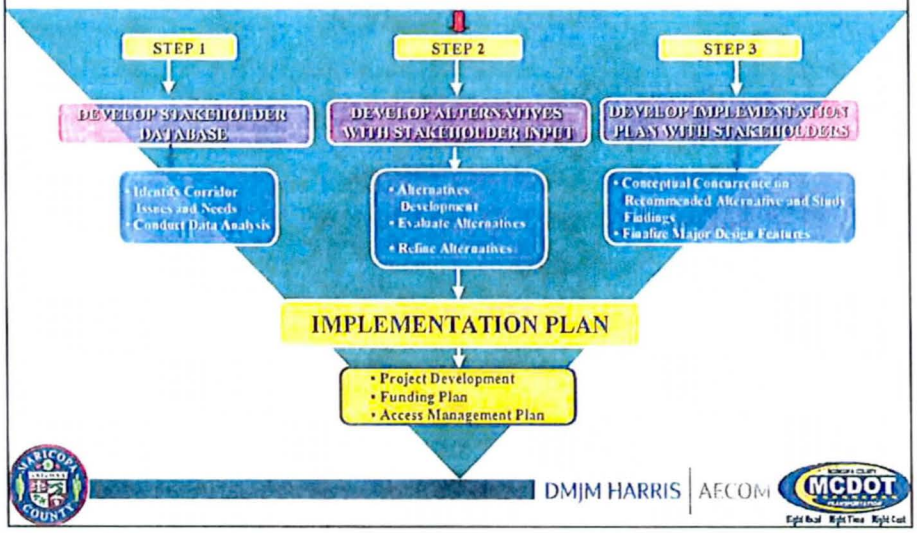
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Study Process

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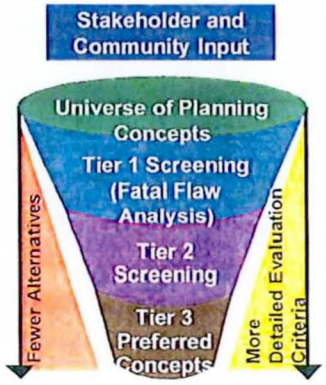
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Alternative Screening Process

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis

- Available model data being used:
  - MAG 2030 Regional Socioeconomic Model
  - Enhanced Year 2026 MCDOT Northwest Valley Corridor Studies Model
  - MAG Buildout Travel Demand Assessment (I-10/Hassayampa Valley Roadway Framework Study)
- Cut-lines are theoretical lines across facilities
- Sum of volumes and capacities to determine if a cut-line is failing

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Study Area Socioeconomic Projections

| | Socioeconomic Data and Forecast Source | | | | |
|---|---|---|---|---|---|
| | 2005[1] | 2015[2] | 2030[3] | Northwest Valley[4] | Buildout[5] |
| Total Population | 30,359 | 80,092 | 146,336 | 221,965 | 252,173 |
| Population Per Square Mile[6] | 394 | 1,040 | 1,900 | 2,882 | 3,274 |
| Total Employment | 4,794 | 22,458 | 54,591 | 59,833 | 89,800 |
| Employment Per Square Mile[6] | 62 | 291 | 709 | 777 | 1,166 |

Notes:
1 Maricopa Association of Governments, 2003
2 Maricopa Association of Governments, August 17, 2007
3 Maricopa Association of Governments, June 19, 2007
4 MCDOT Northwest Valley Corridor Studies Model Influence Area May 2007 (Enhanced Year 2026 conditions)
5 Maricopa Association of Governments, September, 2006
6 Approximately 77 square miles in model influence area

*Source: Wilson & Company, September 2007*

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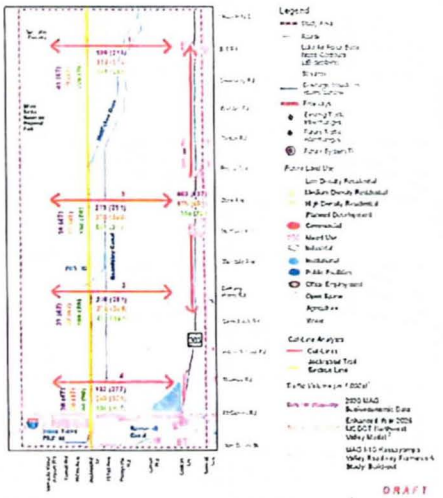
# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis



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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis Findings

| Cut-Line | 2030[1] | Northwest Valley Model[2] | Buildout[3] |
|---|---|---|---|
| 1 | Under | Over | Over |
| 2 | Under | Under | Over |
| 3 | Under | Under | Over |
| 4 | Under | Under | Under |
| 5 | Under | Under | Over |

Notes:
1. Maricopa Association of Governments, June 19, 2007
2. MCDOT Northwest Valley Corridor Studies Model Influence Area: May 2007 (Enhanced Year 2026 conditions)
3. Maricopa Association of Governments, September, 2006
4. Approximately 77 square miles in model influence area

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Traffic Volumes/Cut-Line Analysis Findings

- Cut-line 1 fails Enhanced 2026 and Buildout conditions
- Four out of five cut-lines fail under Buildout conditions
- Parkway facility critical in northern portion of study corridor
- Clear need for a parkway facility to accommodate Buildout Travel Demand

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 1: Zone Screening Criteria

- ***Land Use:*** Compatibility with existing & future land use
- ***Drainage/Flood Control:*** Compatibility with existing & planned facilities
- ***Environment:*** Impacts to resources
- ***Public Transportation Planning Policy***: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

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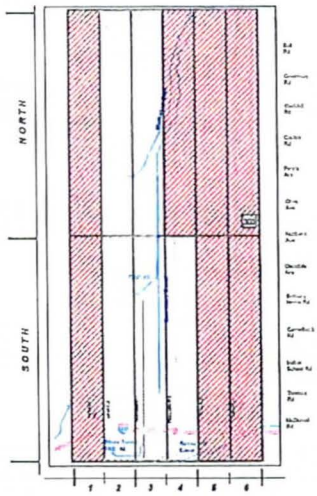
## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 1: Zone Screening




Zones eliminated from further consideration

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 1 Evaluation: Critical Issues

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptability
- State Land Holdings
- Existing and Planned Development

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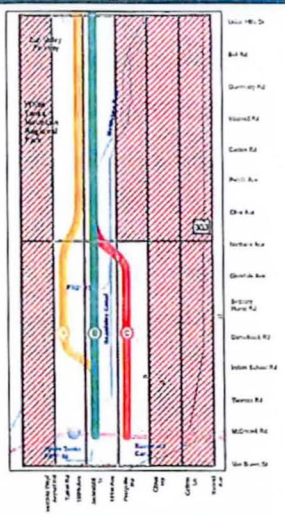
## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 2: Corridor Screening



Zones eliminated from further consideration

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Meetings with Key Stakeholders

*Flood Control District of Maricopa County (FCDMC)*

- White Tanks # 3 Outlet Channel planned to run on the east side of Jackrabbit Trail from Bethany Home to Camelback Road
- Channel to swing west between Camelback & Indian School Roads - location TBD
- Potential partnership to share channel & roadway corridor
- FRS #3 Outlet completed
- Decommissioning of southern end of McMicken Dam
- ***Preserve functional intent of structures***

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Meetings with Key Stakeholders

*Arizona State Land Department (ASLD)*

- Corridor that ***leaves maximum developable land & curves around the southern tip of McMicken Dam*** is preferable

*Land Solutions Inc. (Zanjero Trails)*

- Concerns expressed on width of facility & amount of traffic crossing the development
- ***Avoid corridor through the development***

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Public Meetings held in March 2007

*Public Comments*

- Jackrabbit Trail alignment should be preserved as green belt (to maintain existing desert habitat & rural lifestyle)
- Focus on Jackrabbit Trail is misdirected -- other more pressing & "needy" transportation corridors should be the study focus
- Evaluate alternate alignments and leave Jackrabbit Trail as is
- Focus on SR-303 instead of Jackrabbit Trail

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Summary of Public Meetings held in March 2007

*Public Comments*

- Leave White Tanks Park alone
- Wild game crossings need to be accommodated
- Safety within the White Tanks Park would be an issue if a high-capacity facility is developed close to the park
- Noise pollution as a result of this corridor to be mitigated
- Reduce allowed development & density (eliminate need)
- Need more east/west routes connecting to Jackrabbit Trail
- Construct infrastructure prior to permitting more development

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 2 Evaluation Criteria

- Right-of-way
- Compatibility with Existing Developments
- Compatibility with Planned Future Developments
- Public Acceptability
- Cost

Continued...

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Tier 2 Evaluation Criteria Contd.

- Engineering Complexity & Constructability
- Drainage/Flood control
- Long-term Regional & Local Transportation Policy
- Accommodation of Forecast Travel Demand
- Environmental Considerations

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# Jackrabbit Trail Access Control and Corridor Improvement Study

**Tier 2: Corridor Segments**

DRAFT

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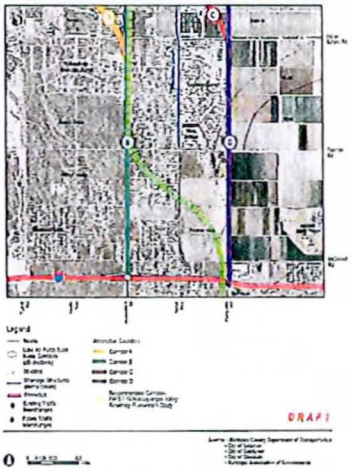
# Jackrabbit Trail Access Control and Corridor Improvement Study

**Tier 2: Potential Corridors-Segment 1**



DRAFT

| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation to other alternatives within the segment | | ● | | ● |
| 2 | Compatibility with Existing Developments | | ◑ (Existing development on both sides of corridor) | | ◑ (Existing development on one side) |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (Open land on both sides of corridor) |
| 4 | Public Acceptability | | | | |
| 5 | Cost | | ○ (Minimum impact) | | ○ (Minimum impact) |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Crosses over Indian School Rd. and Flood Control Channel) |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shares ROW with Flood Control Channel) | | ◑ (Parallels I-10 for 1.5 miles) |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Low impact on biological & cultural) |
| | Recommendations | | | | |

○ Least Significant Impact (Least Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Potential Corridors-Segment 2

| No. | Criteria | Segment 2: Indian School Rd. to Northern Ave. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation to other alternatives within the segment | ◑ | ◑ | ● | ◑ |
| 2 | Compatibility with Existing Developments | ◑ | ● | ○ | ◑ |
| 3 | Compatibility with Planned Future Developments | ● | ◑ | ◑ | ● |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ◑ | ● | ● | ◑ |
| 6 | Engineering Complexity & Constructability | ◑ | ◑ | ● | ◑ |
| 7 | Drainage/ Flood Control | ◑ | ● | ● | ◑ |
| 8 | Long-Term Regional and Local Transportation Policy | ◑ | ○ | ◑ | ● |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | ○ | ○ |
| 10 | Environmental Considerations | ○ | ◑ | ● | ◑ |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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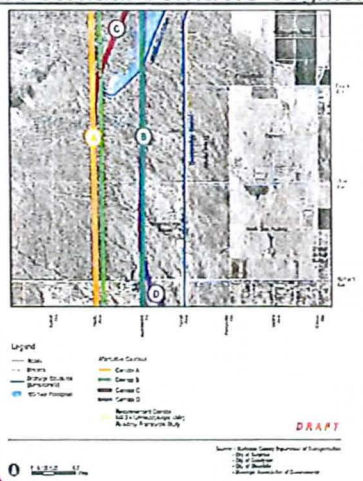
Right Road Right Time Right Cost

# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Potential Corridors-Segment 3




| No. | Criteria | Segment 3: Northern Ave. to Peoria Ave. | | | |
|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation to other alternatives within the segment | ◑ | ◑ | | |
| 2 | Compatibility with Existing Developments | ○ | ● | | |
| 3 | Compatibility with Planned Future Developments | ○ | ◑ | | |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ○ | ○ | | |
| 6 | Engineering Complexity & Constructability | ◑ | ● | | |
| 7 | Drainage/ Flood Control | ○ | ● | | |
| 8 | Long-Term Regional and Local Transportation Policy | ◑ | ○ | | |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | | |
| 10 | Environmental Considerations | ● | ● | | |
| | Recommendations | | | | |

○ Least Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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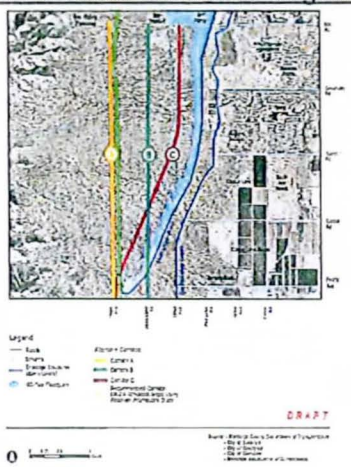
Right Road Right Time Right Cost

# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Potential Corridors-Segment 4




| No. | Criteria | Corridor A | Corridor B | Corridor C | Corridor D |
|---|---|---|---|---|---|
| 1 | ROW required to be acquired in relation to other alternatives within the segment | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Development | ● | ◑ | ○ | |
| 3 | Compatibility with Planned Future Development | ● | ◑ | ○ | |
| 4 | Public Acceptability | | | | |
| 5 | Cost | ○ | ● | ◑ | |
| 6 | Engineering Complexity & Constructability | ◑ | ● | ◑ | |
| 7 | Drainage/ Flood Control | ○ | ● | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | ○ | ○ | ◑ | |
| 9 | Accommodation of Forecast Regional Travel Demand | ○ | ○ | ○ | |
| 10 | Environmental Considerations | ● | ◑ | ○ | |
| | Recommendations | | | | |

○ Less Significant Impact (Most Desirable) ◑ Moderate Impact ● Most Significant Impact (Least Desirable)

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# Jackrabbit Trail Access Control and Corridor Improvement Study

## Tier 2: Evaluation Findings

### Segment 1 & 2

- Avoid existing and planned developments

### Segment 3

- Place corridor as far west as possible with connection to preferred corridor in adjacent segments

### Segment 4

- Maximize development of ASLD area and preserve the functional intent of McMicken Dam

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Next Steps

- Public Meeting-November 13, 2007
- Finalize Tier 2 Evaluation
- Develop Roadway Alignment & Design Features
- Next SAC & Public Meetings-Early 2008
- Draft Report- Spring 2008

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## Jackrabbit Trail Access Control and Corridor Improvement Study

### Questions?

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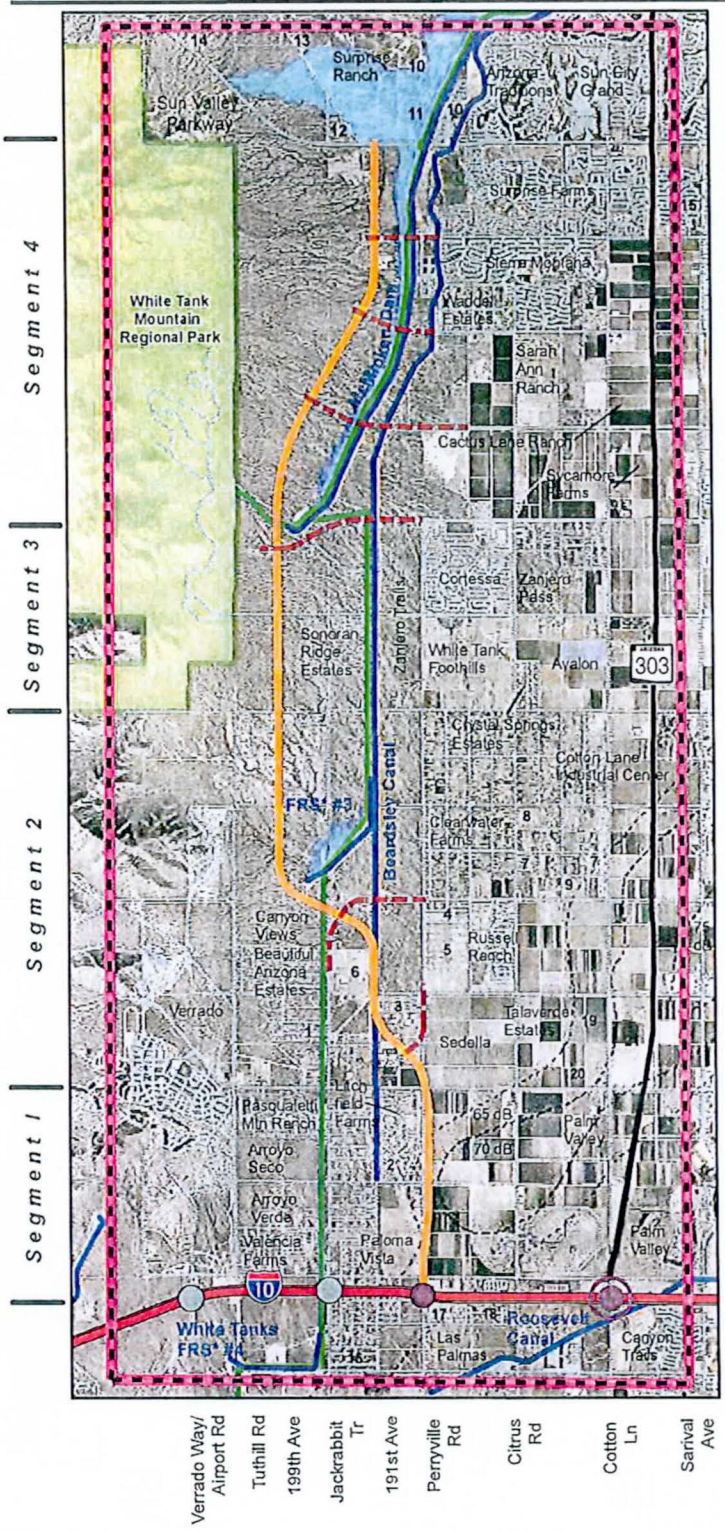
# Preferred Corridor Alignment




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Drainage Structures (dams/canals)
- Freeways
- State Highway
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI
- 100-Year Floodplain
- Local or State Parks
- County Trail Priority 1

*Preferred Alternative*

- Preferred Alignment Concept
- Potential Arterial Realignments

*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

**FRS stands for Flood Retardant Structure*

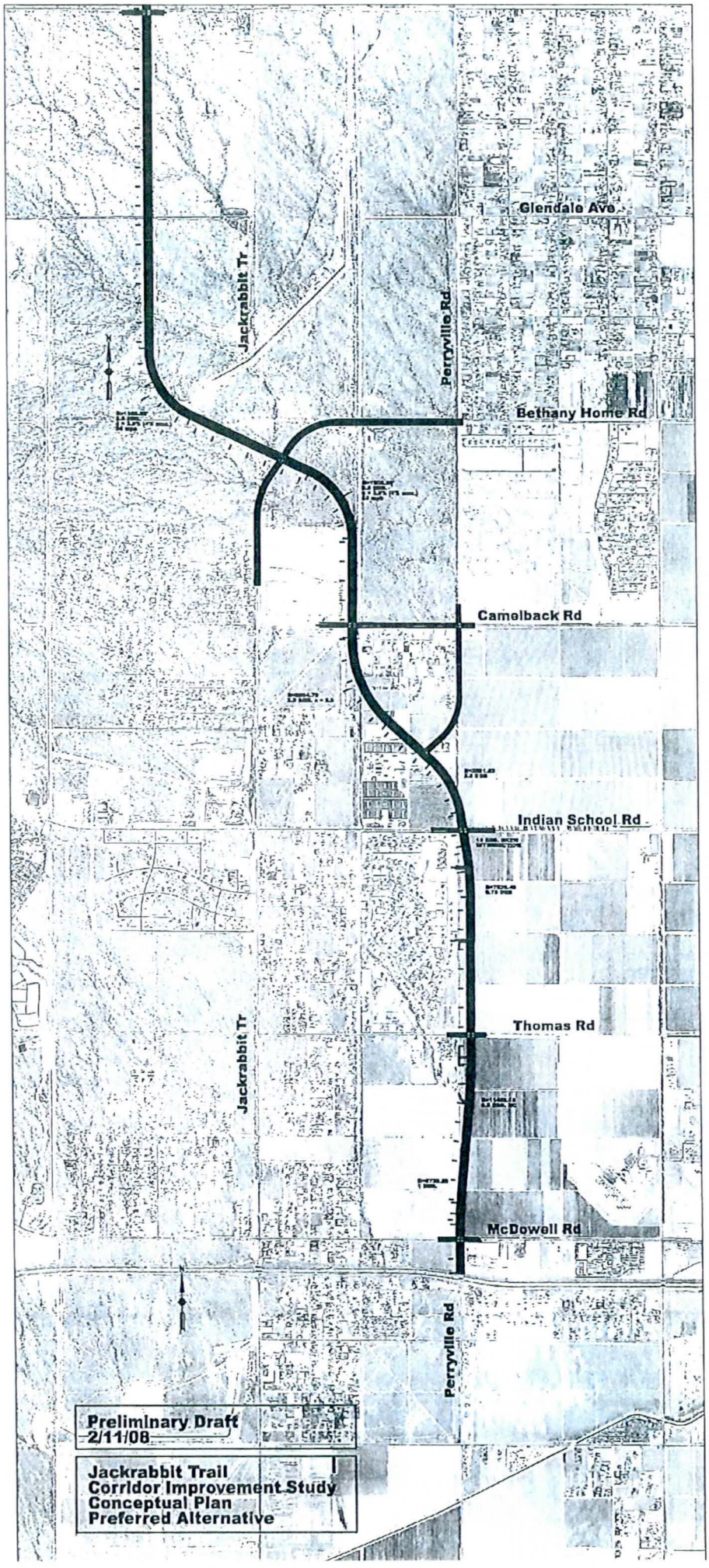
**DRAFT**

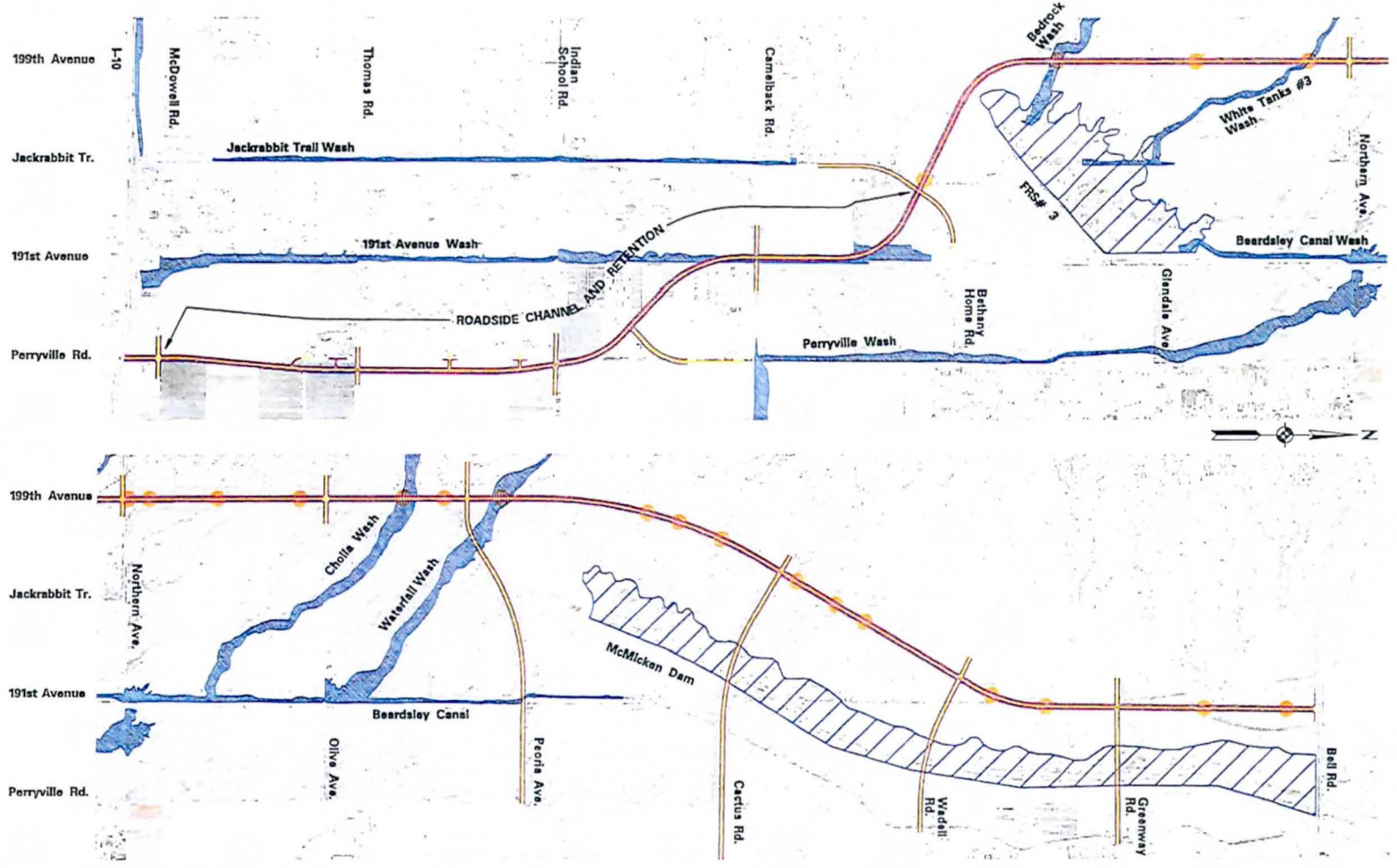
1 0.5 0 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*
*- Maricopa County Regional Trails System Plan (2004)*

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

February 2008


Glendale Ave
Jackrabbit Tr
Perryville Rd
Bethany Home Rd
Camelback Rd
Indian School Rd
Thomas Rd
Jackrabbit Tr
McDowell Rd
Perryville Rd
Preliminary Draft
2/11/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative

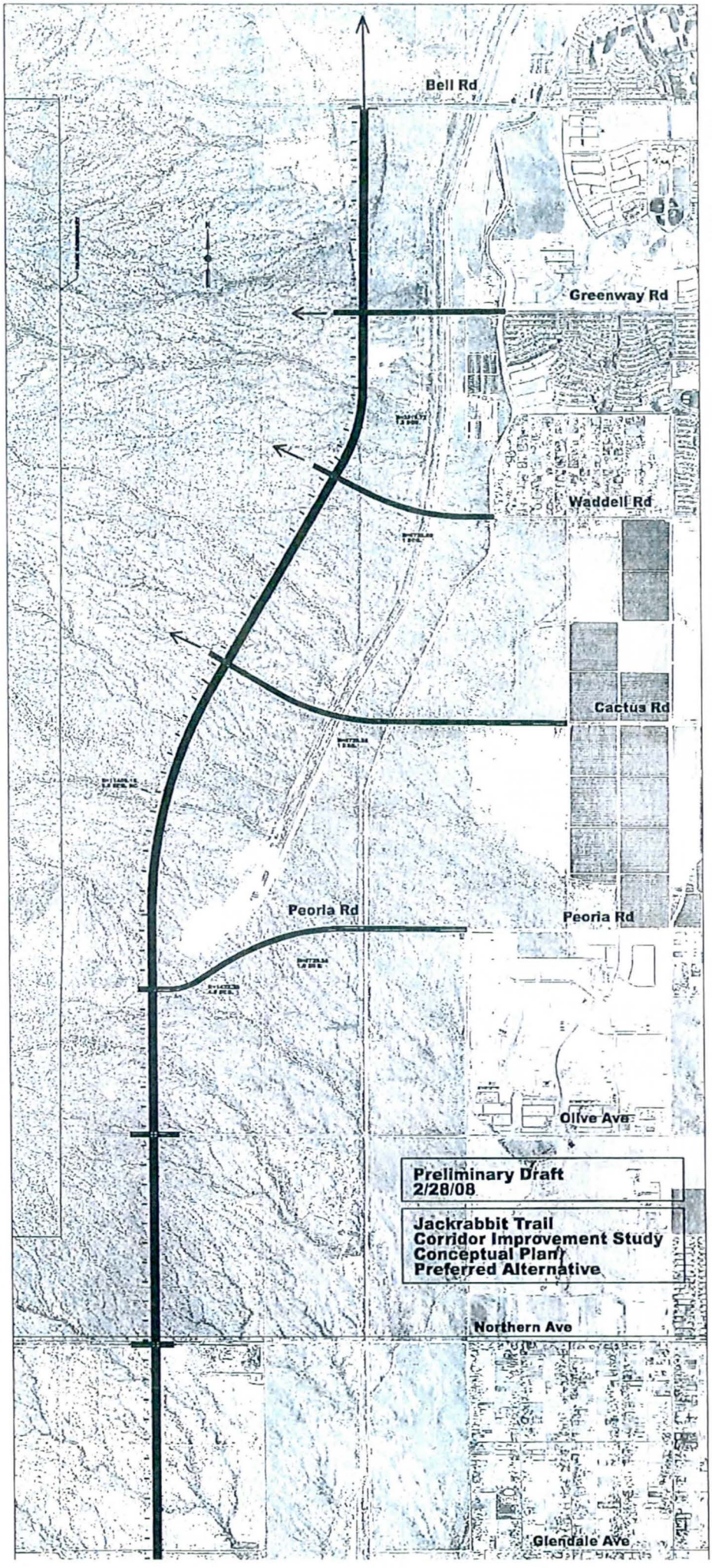



# DRAINAGE FEATURES
Along Preferred Alternative

Jackrabbit Trail, I-10 to Bell Road
Access Control and Corridor Improvement Study

Andes Engineering

2/23/2006 3:23:53 PM
J:\ACES\Cad\SVRD\ECTS\0626 Jackrabbit Trail\Figures\Preferred Alternative Map.dgn


Bell Rd
Greenway Rd
Waddell Rd
Cactus Rd
Peoria Rd
Peoria Rd
Olive Ave
Northern Ave
Glendale Ave
Preliminary Draft
2/28/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan/
Preferred Alternative

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# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## Stakeholder Advisory Committee Meeting #4-Agenda

*March 5, 2008: 2 PM to 3:30 PM*
*MCDOT Apache Conference Room*
*2901 W. Durango*
*Phoenix, Arizona 85009*

- Introductions
- Study Process
- Alternative Screening Process
- Summary of Tier 1 and Tier 2 Evaluation
- Summary of Public Meeting in November 2007
- Summary of Meetings with Key Stakeholders
- Preferred Alignment Concept
- Drainage Features
- Traffic Volumes Analysis
- Next Steps
    - Public Meeting- March 12, 2008
    - Technical Memorandum #6- March 2008
    - Draft Report in May 2008 including-
        - Design Features of Preferred Alignment
        - Access Management
        - Phasing & Implementation
        - Final Report- June 2008
- Questions

Evaluation of Tier 2 Corridors

DRAFT

| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | | Segment 2: Indian School Rd. to Northern Ave. | | | | Segment 3: Northern Ave. to Peoria Ave. | | | | Segment 4: Peoria Ave. to Bell Rd. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) | ◑ | ◑ | | | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) | ○ | ● (Sonoran Ridge Estates) | | | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side ) | ● (Existing development & future development) | ● (Existing development on both sides of corridor) | ● (FRS #3) | ◑ | ◑ (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● | ◑ | ○ | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) | ○ | ○ | | | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed intersections) | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) | ○ | ● (McMicken Dam crossing) | | | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Bell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | ○ | ○ | ○ | |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact; proximity to State lands) | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ◑ (Game crossing) | |
| | Recommendations | Place corridor as east as possible of the existing developments | | | | Place corridor as east as possible of the existing developments | | | | Place corridor as far west as possible with connection to preferred corridor to south | | | | Place corridor west of McMicken Dam and west of flood pool (Alt. C) | | | |

○ Least Significant Impact (Most Desirable)  ◑ Moderate Impact  ● Most Significant Impact (Least Desirable)

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: October 16, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: Stakeholder Workshop on Tier 2 Alternatives Evaluation

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Purpose of Meeting

The purpose of the meeting was to get updates from the various stakeholders, namely, City of Surprise, Town of Buckeye and the Flood Control District of Maricopa County (FCDMC) on their various projects and status of planned developments. In addition, consensus on Tier 2 evaluation of alternatives was also sought.

### III. Stakeholder Updates

The stakeholders were requested to provide updates on the various planned developments and projects within their jurisdiction.

*Buckeye*

Woody Scoutten provided the following information on the planned developments within the Town of Buckeye-

- Canyon Views at the intersection of Bethany Home and Jackrabbit Trail is in rezoning stage. On the northeast corner of the site, a small retail center is zoned with frontage on Jackrabbit Trail.
- Arroyo Seco and Arroyo Verde are in the pre-application process
- Along the
- Mixed use residential is proposed at the northeast corner of Indian School Road and Jackrabbit Trail. A retail shopping center is proposed at the southeast corner of the intersection.
- Verrado is in the final platting stage along the high school. Only some areas have their final plats ready.
- Pre-application was furnished for a 20-acre shopping center at the south east corner of I-10 and jackrabbit almost a year ago

## IV. Traffic Volumes

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Based on the above-mentioned criteria, four main considerations were kept in mind while selecting the geographical zones through which potential alternatives could be drawn. These considerations were-

i. Topographical concerns
ii. Proximity to environmental resources
iii. Public acceptance during the scoping process
iv. High-level planning-where to locate corridor in order to serve the community in the best possible manner and avoid circuitous routing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained.

These zones span from the Tuthill Road alignment till half mile east of 191st Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Overview of Tier 2 Screening Process

Based on the zone analysis from Tier 1 Screening Process, three potential alternative corridors were identified for the next level of evaluation. However, these were broad conceptual corridors that did not represent the actual footprint in any manner. (See attached figure)

Draft Tier 2 Evaluation criteria is as follows-

- Right-of-way required
- General impact to community
- General impact to future planned developments & developable land
- Public acceptance
- Cost
- Engineering complexity & constructability
- Drainage/Flood control
- Public transportation planning policy
- Corridor footprint/ Design consistency
- Potential environmental impacts

Please see attachment for a detailed description of each of these criteria.

The next steps in the process are as follows-

i. Incorporate stakeholder input on evaluation criteria and alternatives
ii. Conduct Tier 2 evaluation
iii. Travel demand modeling

## VI. Tier 2 Screening Criteria

The study need has to be demonstrated using the modeling before the next public meeting. The PAC also needs to decide the next PAC meeting date and the tentative schedule for the next public meeting.

## VII. Corridor Analysis By Segment

## VIII. Next Steps

a. PAC Meeting
b. Public Meeting

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**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

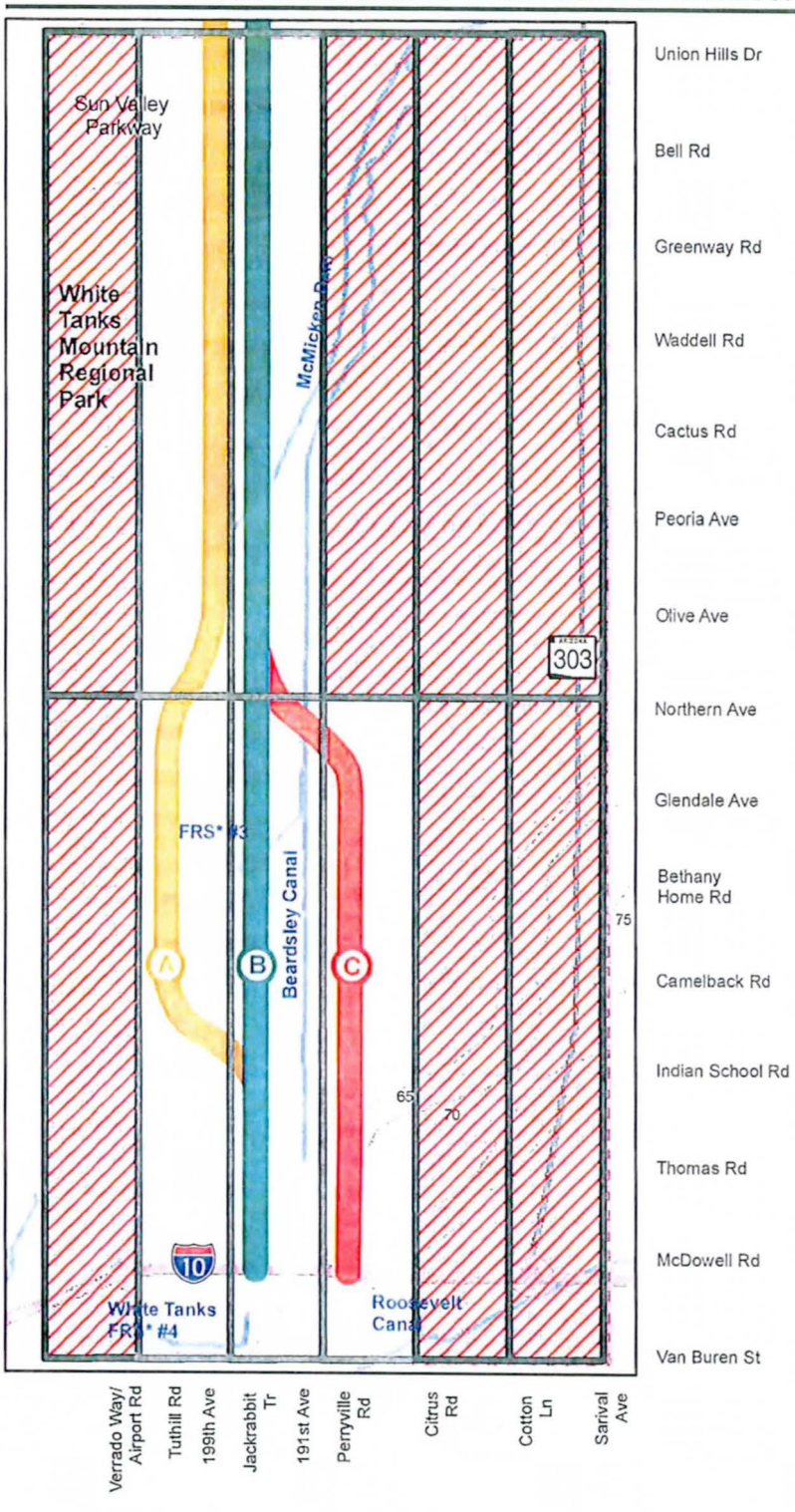
**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| Jennifer Toth | jennifer.livingston@dmjmharris.com | 602-337-2516 |
| ERNEST RUBI | ERNESTRUBI@MAIL.MARICOPA.GOV | 602-606-1049 |
| WOODY SCOUTTEN | WOODY@SCOUTTEN.COM | 623-547-4661 |
| JAVIER GUANA | jguana@ourdes.us | 602-374-7119 |
| Valerie Swick | vas@mail.maricopa.gov | (602) 506-2929 |
| Rodney Bragg | rodney.bragg@dmjmharris.com | (602) 337-2617 |
| Randy Overmyer | Randall.Overmyer@surpriseaz.com | 480.225.2309 |
| DAN MARUM | Wilson & Company dan.marum@wilsonco.com | 602 283-2702 |
| JOHN MCNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

# Tier 2: Potential Alternative Corridors in Selected Zones




**Legend**

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

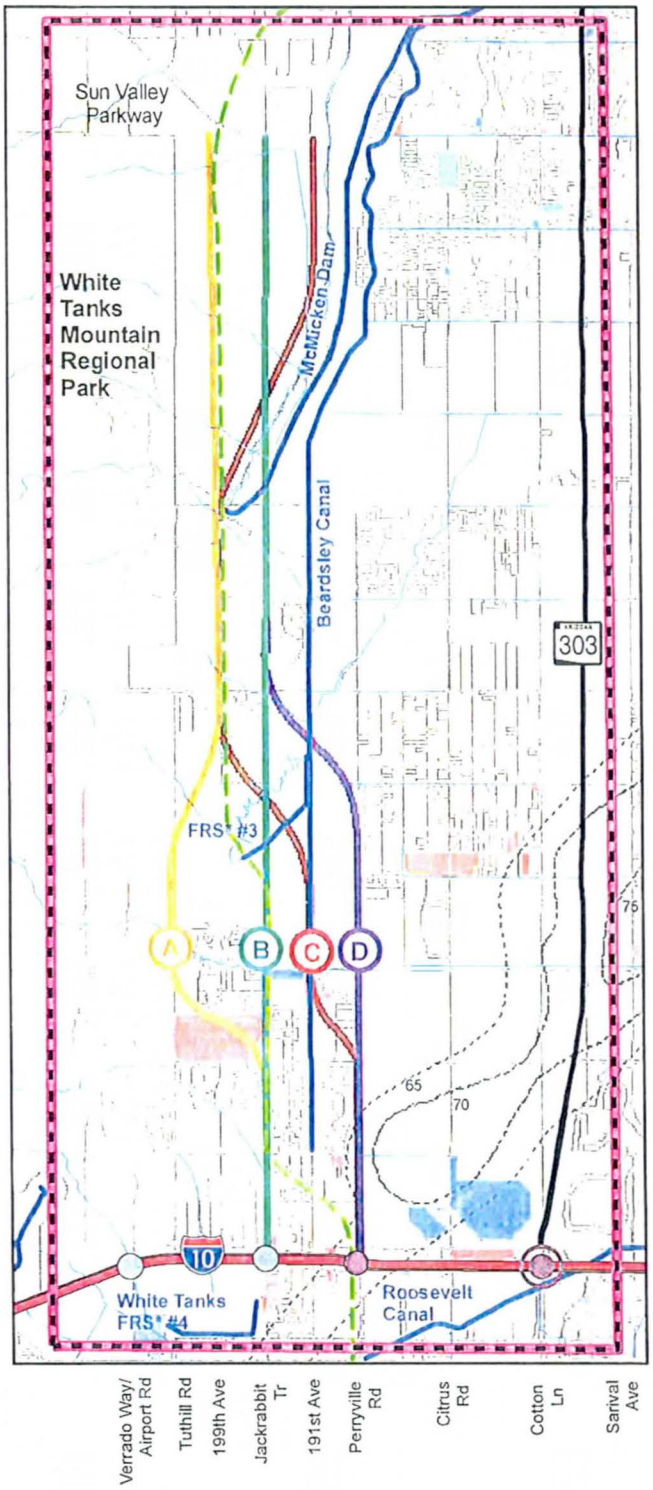
DRAFT

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*June 2007*

# Tier 2: Potential Alternative Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Existing Land Use*

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Developing Residential
- Commercial
- Developing Commercial
- Industrial
- Institutional
- Public Facilities
- Office/Employment
- Open Space
- Agriculture
- Water
- Vacant

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- MAG I-10/ Hassayampa Valley Roadway Framework Study

DRAFT

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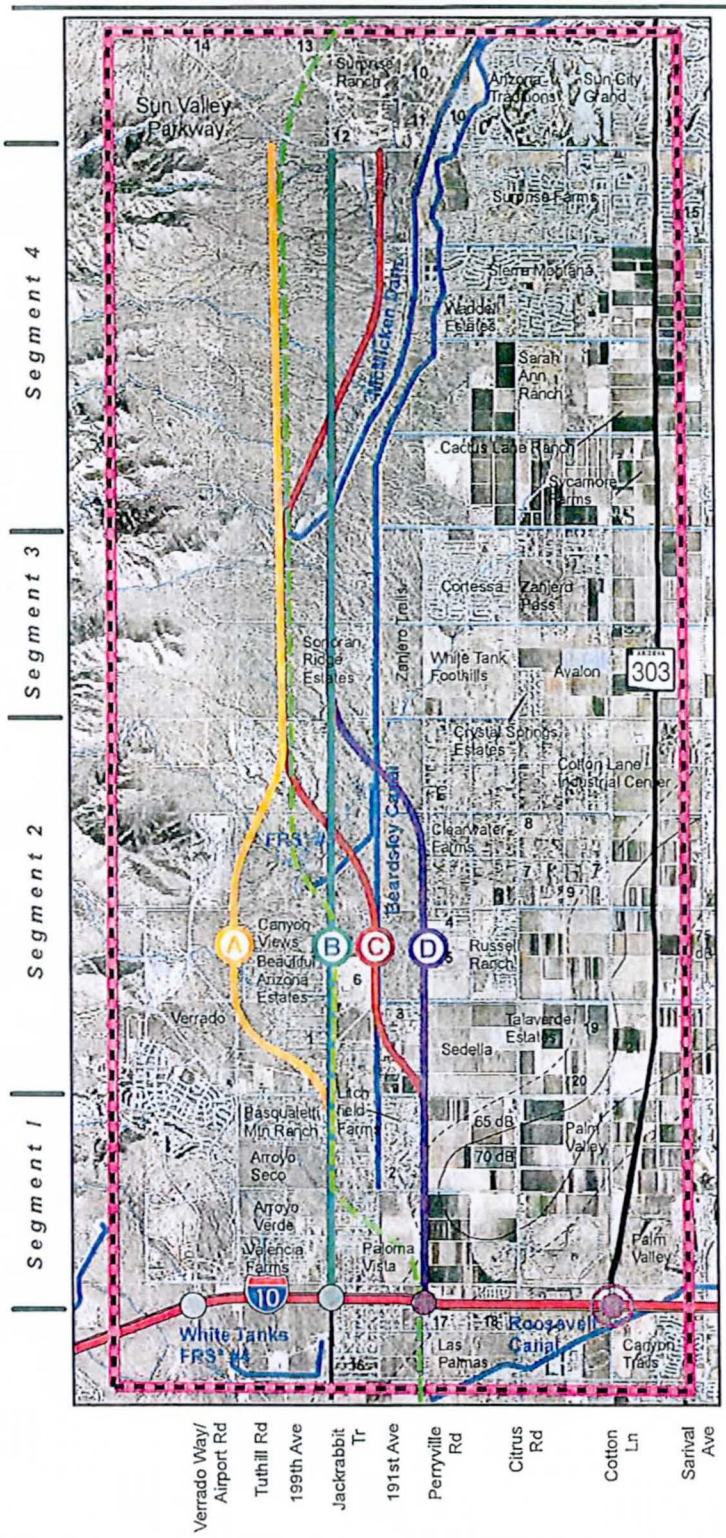
1 0.5 0 1 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*October 2007*

# Tier 2: Potential Alternative Corridor Analysis

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*Planned Developments*

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3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
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20. Ten 303 Commercial Park
21. Perimeter West Business Park

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Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

*FRS stands for Flood Retardant Structure

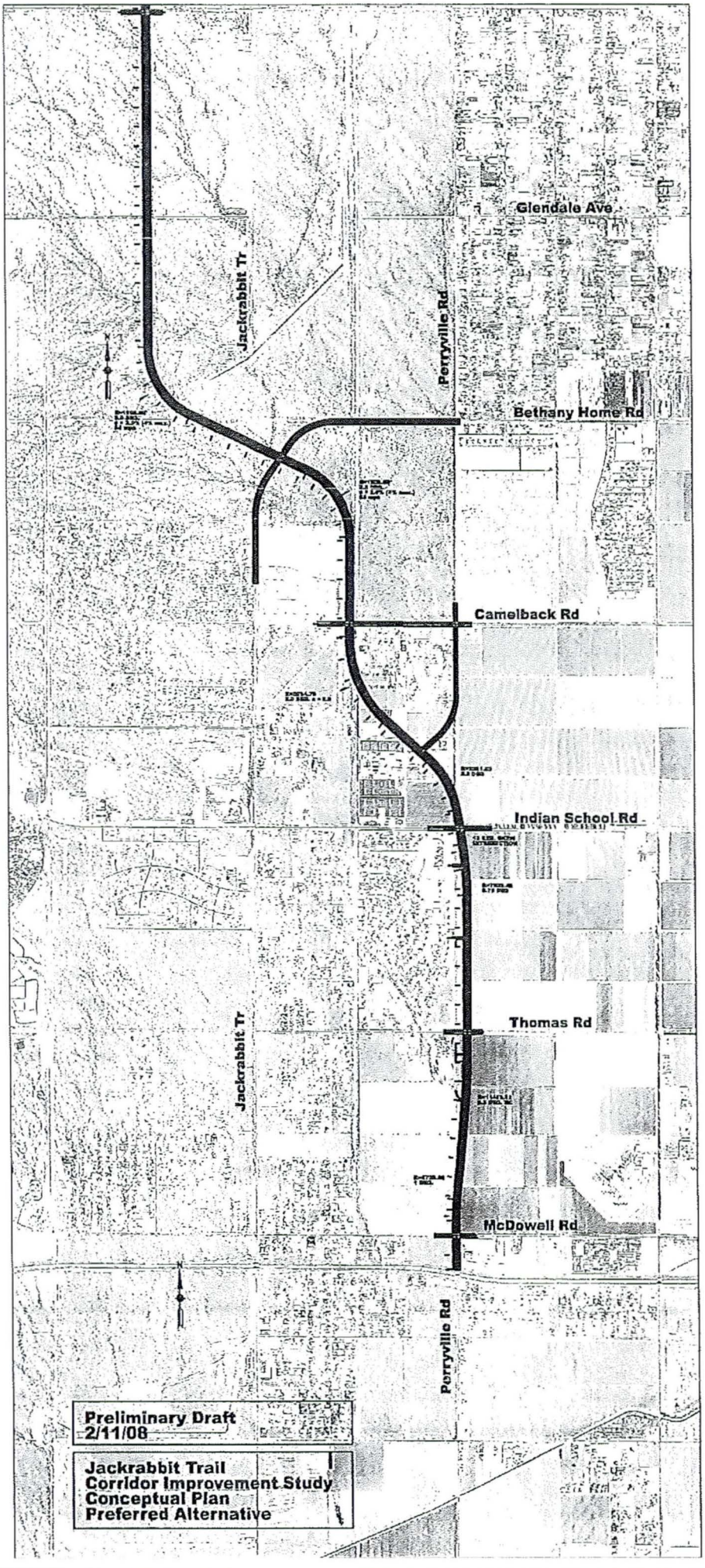
**Source: - Maricopa County Department of Transportation**
**- City of Surprise**
**- City of Goodyear**
**- City of Glendale**

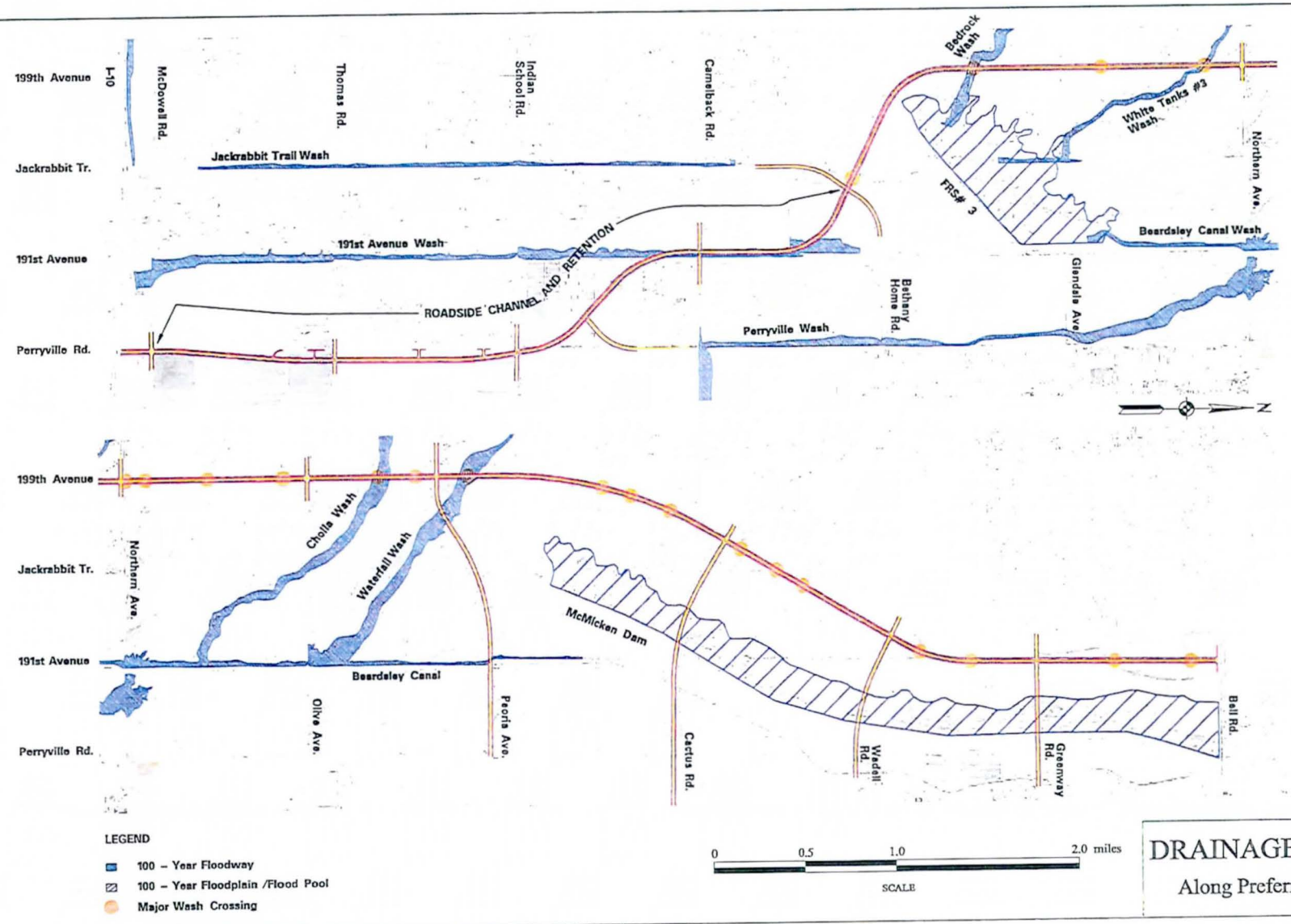
DRAFT

1 0.5 0 1 Miles

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

October 2007


Glendale Ave
Jackrabbit Tr
Perryville Rd
Bethany Home Rd
Camelback Rd
Indian School Rd
Thomas Rd
Jackrabbit Tr
McDowell Rd
Perryville Rd
Preliminary Draft
2/11/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative




# DRAINAGE FEATURES
## Along Preferred Alternative

Jackrabbit Trail, I-10 to Bell Road
Access Control and Corridor Improvement Study

Andes Engineering

2/25/2008 3:33:53 PM
J:\PROJECTS\2005\05-0165 Jackrabbit Trail\Figures\Preferred Alternative Map.dgn

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## Stakeholder Advisory Committee Meeting #4-Agenda

*March 5, 2008: 2 PM to 3:30 PM*
*MCDOT Apache Conference Room*
*2901 W. Durango*
*Phoenix, Arizona 85009*

- Introductions
- Study Process
- Alternative Screening Process
- Summary of Tier 1 and Tier 2 Evaluation
- Summary of Public Meeting in November 2007
- Summary of Meetings with Key Stakeholders
- Preferred Alignment Concept
- Drainage Features
- Traffic Volumes Analysis
- Next Steps
    - Public Meeting- March 12, 2008
    - Technical Memorandum #6- March 2008
    - Draft Report in May 2008 including-
        - Design Features of Preferred Alignment
        - Access Management
        - Phasing & Implementation
        - Final Report- June 2008
- Questions

DRAFT

## Evaluation of Tier 2 Corridors

| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | | Segment 2: Indian School Rd. to Northern Ave. | | | | Segment 3: Northern Ave. to Peoria Ave. | | | | Segment 4: Peoria Ave. to Bell Rd. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) | ◑ | ◑ | | | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) | ○ | ● (Sonoran Ridge Estates) | | | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side ) | ● (Existing development & future development) | ● (Existing development on both sides of corridor) | ● (FRS #3) | ◑ | ◑ (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● | ◑ | ○ | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) | ○ | ○ | | | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed intersections) | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) | ○ | ● (McMicken Dam crossing) | | | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Bell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | ○ | ○ | ○ | |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact; proximity to State lands) | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ◑ (Game crossing) | |
| | Recommendations | Place corridor as east as possible of the existing developments | | | | Place corridor as east as possible of the existing developments | | | | Place corridor as far west as possible with connection to preferred corridor to south | | | | Place corridor west of McMicken Dam and west of flood pool (Alt. C) | | | |

○ Least Significant Impact (Most Desirable)  ◑ Moderate Impact  ● Most Significant Impact (Least Desirable)

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: October 16, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: Stakeholder Workshop on Tier 2 Alternatives Evaluation

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Purpose of Meeting

The purpose of the meeting was to get updates from the various stakeholders, namely, City of Surprise, Town of Buckeye and the Flood Control District of Maricopa County (FCDMC) on their various projects and status of planned developments. In addition, consensus on Tier 2 evaluation of alternatives was also sought.

### III. Stakeholder Updates

The stakeholders were requested to provide updates on the various planned developments and projects within their jurisdiction.

*Buckeye*

Woody Scoutten provided the following information on the planned developments within the Town of Buckeye-

- Canyon Views at the intersection of Bethany Home and Jackrabbit Trail is in rezoning stage. On the northeast corner of the site, a small retail center is zoned with frontage on Jackrabbit Trail.
- Arroyo Seco and Arroyo Verde are in the pre-application process
- Along the
- Mixed use residential is proposed at the northeast corner of Indian School Road and Jackrabbit Trail. A retail shopping center is proposed at the southeast corner of the intersection.
- Verrado is in the final platting stage along the high school. Only some areas have their final plats ready.
- Pre-application was furnished for a 20-acre shopping center at the south east corner of I-10 and jackrabbit almost a year ago

## IV. Traffic Volumes

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Based on the above-mentioned criteria, four main considerations were kept in mind while selecting the geographical zones through which potential alternatives could be drawn. These considerations were-

i. Topographical concerns
ii. Proximity to environmental resources
iii. Public acceptance during the scoping process
iv. High-level planning-where to locate corridor in order to serve the community in the best possible manner and avoid circuitous routing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained.

These zones span from the Tuthill Road alignment till half mile east of 191st Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Overview of Tier 2 Screening Process

Based on the zone analysis from Tier 1 Screening Process, three potential alternative corridors were identified for the next level of evaluation. However, these were broad conceptual corridors that did not represent the actual footprint in any manner. (See attached figure)

Draft Tier 2 Evaluation criteria is as follows-

- Right-of-way required
- General impact to community
- General impact to future planned developments & developable land
- Public acceptance
- Cost
- Engineering complexity & constructability
- Drainage/Flood control
- Public transportation planning policy
- Corridor footprint/ Design consistency
- Potential environmental impacts

Please see attachment for a detailed description of each of these criteria.

The next steps in the process are as follows-

i. Incorporate stakeholder input on evaluation criteria and alternatives
ii. Conduct Tier 2 evaluation
iii. Travel demand modeling

## VI. Tier 2 Screening Criteria

The study need has to be demonstrated using the modeling before the next public meeting. The PAC also needs to decide the next PAC meeting date and the tentative schedule for the next public meeting.

## VII. Corridor Analysis By Segment

## VIII. Next Steps

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| Jennifer Toth | jennifer.livingston@dmjmharris.com | 602-337-2516 |
| ERNEST RUBI | ERNESTRUBI @ MAIL. MARICOPA.GOV | 602-606-1049 |
| WOODY SCOUTTEN | WOODY@SCOUTTEN.COM | 623-547-4661 |
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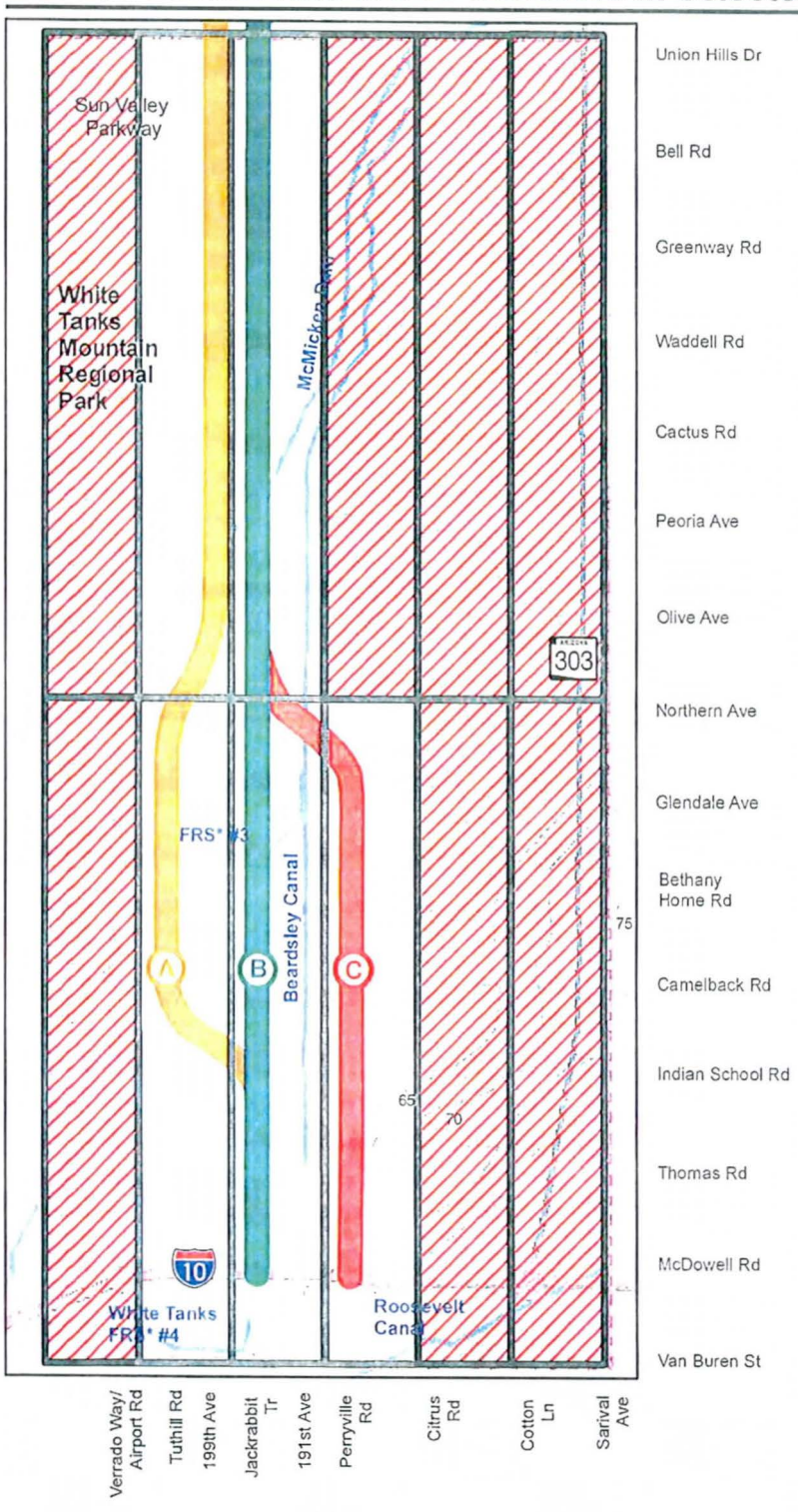
# Tier 2: Potential Alternative Corridors in Selected Zones




**Legend**

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

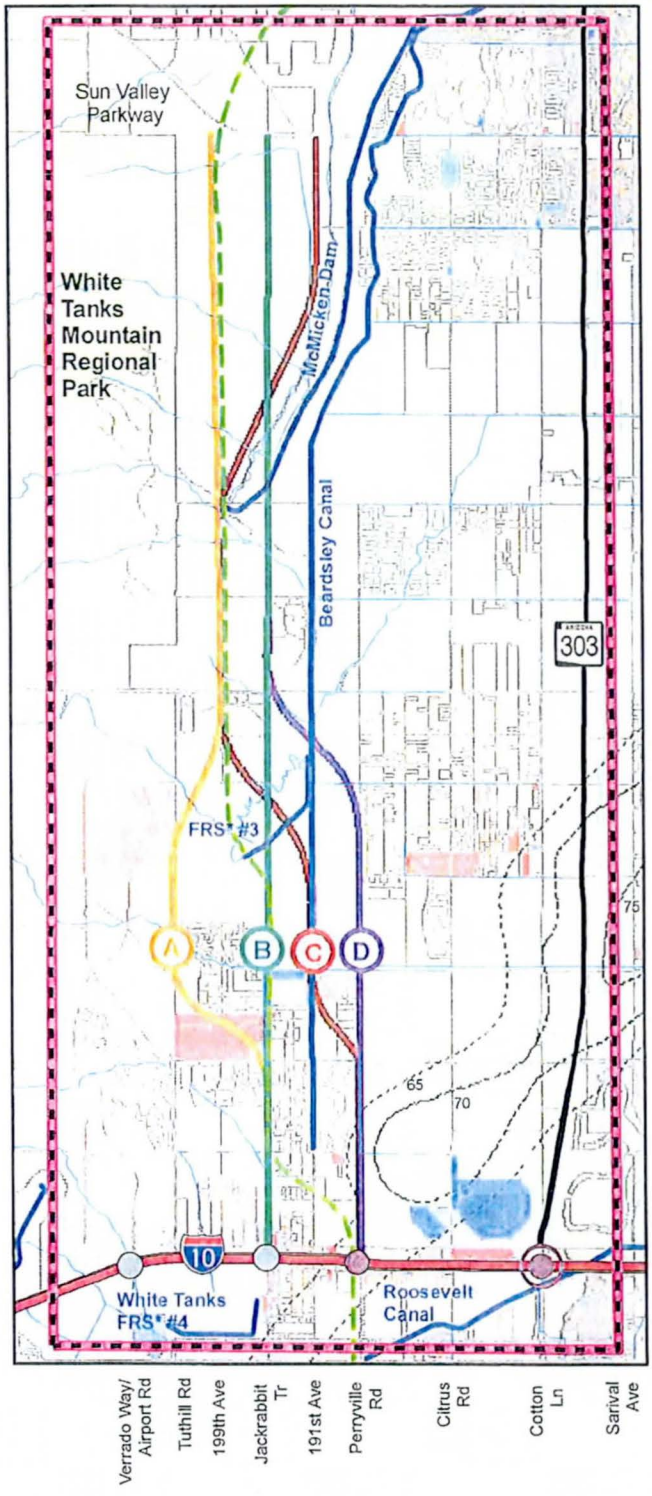
DRAFT

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

June 2007

# Tier 2: Potential Alternative Corridors

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DRAFT

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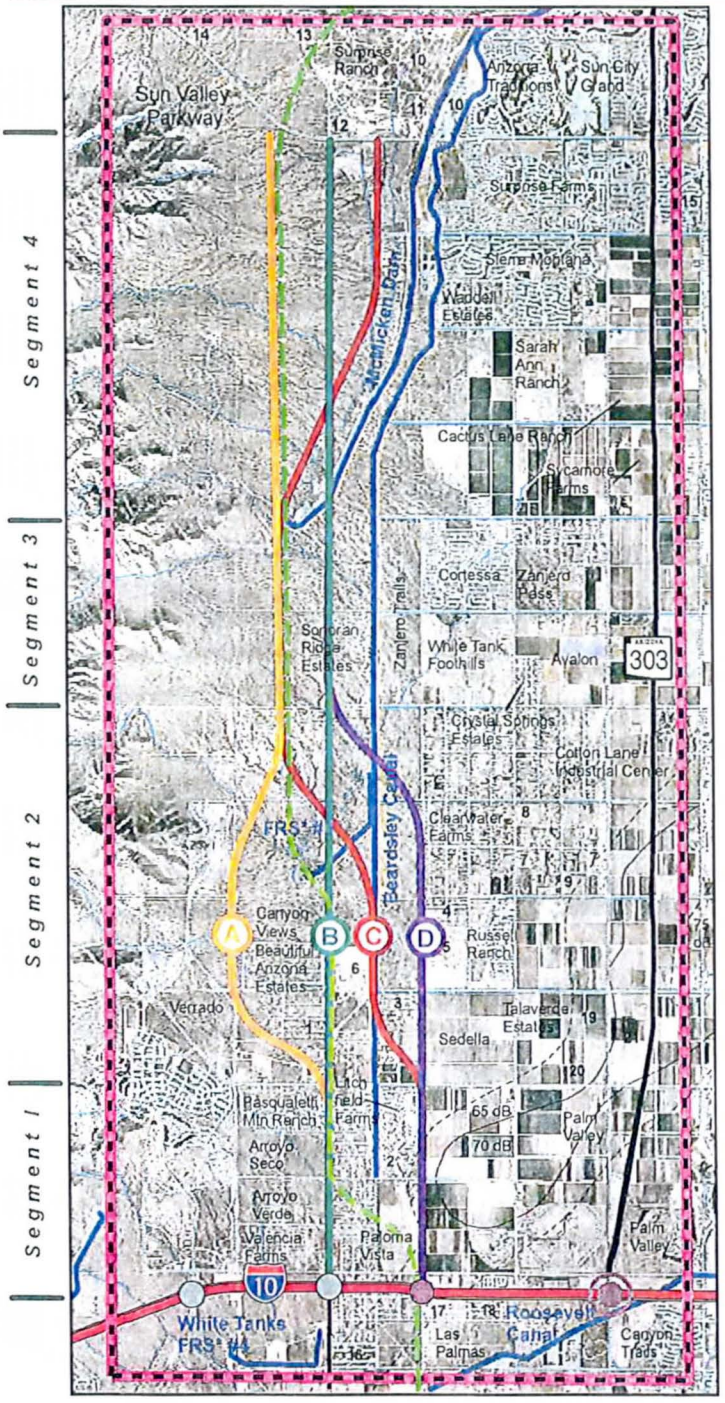
**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis

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**Source: - Maricopa County Department of Transportation**
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**- City of Goodyear**
**- City of Glendale**

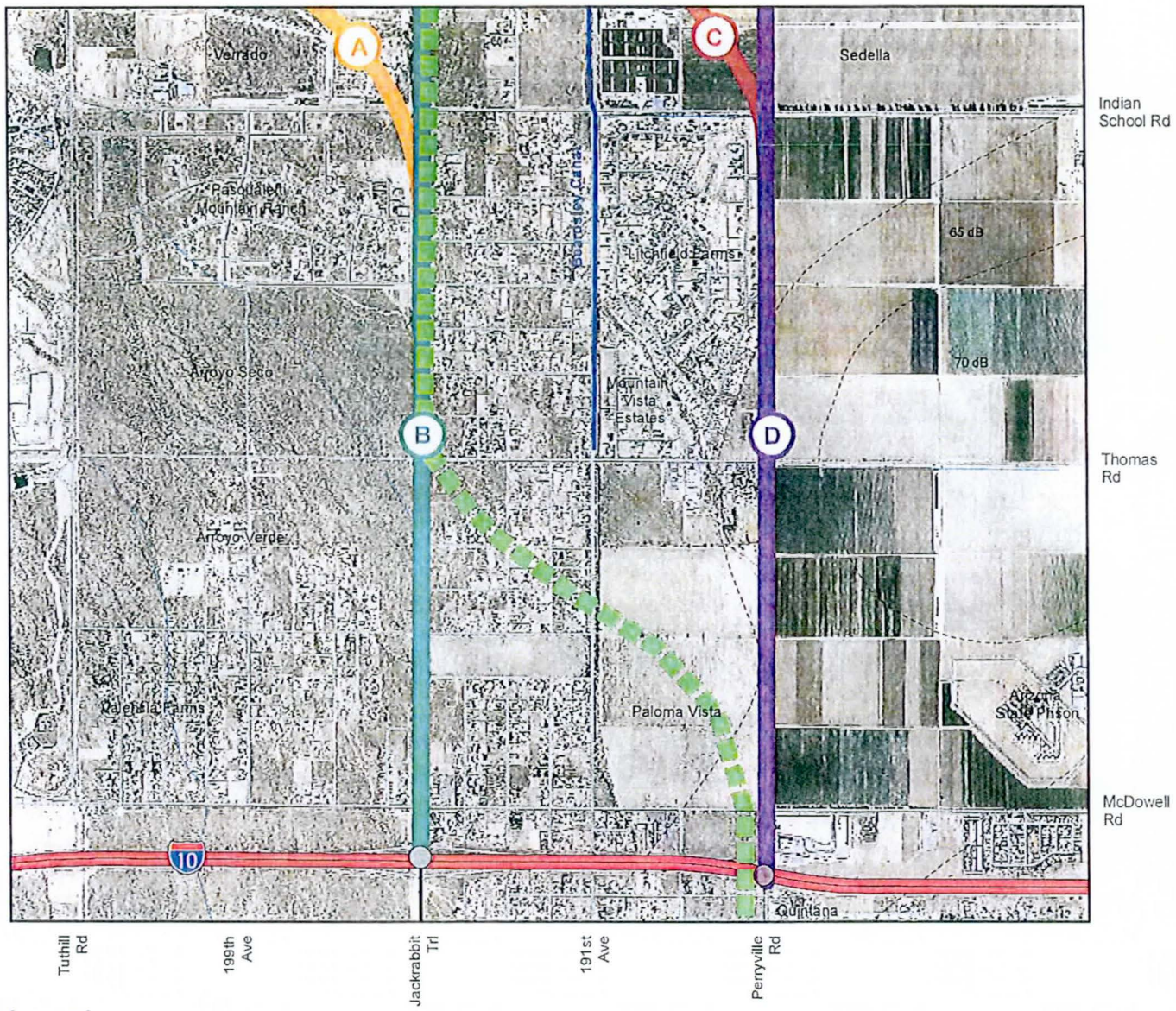
DRAFT

1 0.5 0 1 Miles

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 1

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DRAFT

0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
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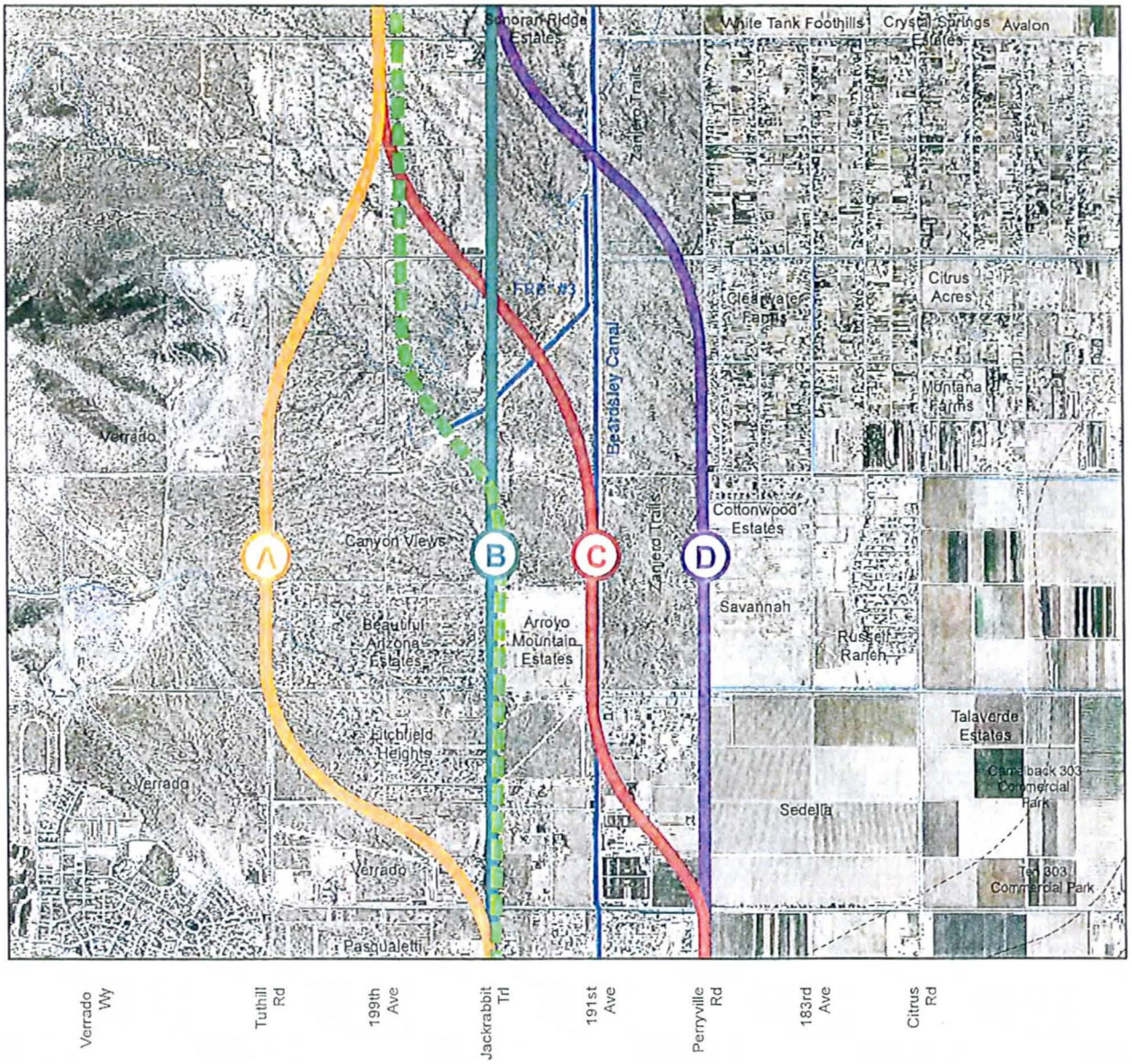
**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 2

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DRAFT

0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
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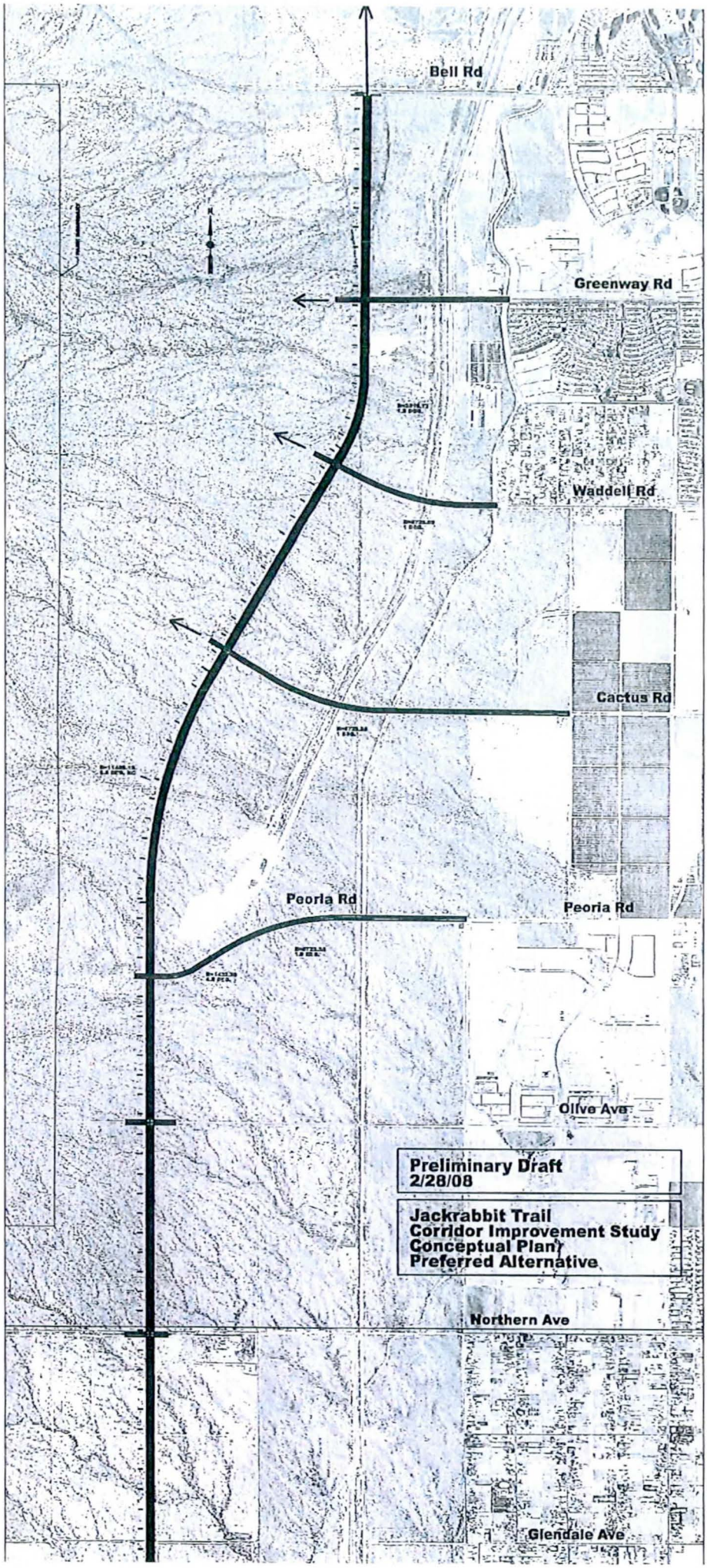
**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007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Preliminary Draft
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Conceptual Plan
Preferred Alternative

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
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DMJM HARRIS | AECOM

JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

Evaluation of Tier 2 Corridors

DRAFT

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) | ◑ | ◑ | | | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) | ○ | ● (Sonoran Ridge Estates) | | | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side ) | ● (Existing development & future development) | ● (Existing development on both sides of corridor) | ● (FRS #3) | ◑ | ◑ (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● | ◑ | ○ | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) | ○ | ○ | | | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed intersections) | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) | ○ | ● (McMicken Dam crossing) | | | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Bell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | ○ | ○ | ○ | |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact; proximity to State lands) | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ◑ (Game crossing) | |
| | Recommendations | Place corridor as east as possible of the existing developments | | | | Place corridor as east as possible of the existing developments | | | | Place corridor as far west as possible with connection to preferred corridor to south | | | | Place corridor west of McMicken Dam and west of flood pool (Alt. C) | | | |

○ Least Significant Impact (Most Desirable)  ◑ Moderate Impact  ● Most Significant Impact (Least Desirable)

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: October 16, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: Stakeholder Workshop on Tier 2 Alternatives Evaluation

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Purpose of Meeting

The purpose of the meeting was to get updates from the various stakeholders, namely, City of Surprise, Town of Buckeye and the Flood Control District of Maricopa County (FCDMC) on their various projects and status of planned developments. In addition, consensus on Tier 2 evaluation of alternatives was also sought.

### III. Stakeholder Updates

The stakeholders were requested to provide updates on the various planned developments and projects within their jurisdiction.

*Buckeye*

Woody Scoutten provided the following information on the planned developments within the Town of Buckeye-

- Canyon Views at the intersection of Bethany Home and Jackrabbit Trail is in rezoning stage. On the northeast corner of the site, a small retail center is zoned with frontage on Jackrabbit Trail.
- Arroyo Seco and Arroyo Verde are in the pre-application process
- Along the
- Mixed use residential is proposed at the northeast corner of Indian School Road and Jackrabbit Trail. A retail shopping center is proposed at the southeast corner of the intersection.
- Verrado is in the final platting stage along the high school. Only some areas have their final plats ready.
- Pre-application was furnished for a 20-acre shopping center at the south east corner of I-10 and jackrabbit almost a year ago

## IV. Traffic Volumes

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Based on the above-mentioned criteria, four main considerations were kept in mind while selecting the geographical zones through which potential alternatives could be drawn. These considerations were-

i. Topographical concerns
ii. Proximity to environmental resources
iii. Public acceptance during the scoping process
iv. High-level planning-where to locate corridor in order to serve the community in the best possible manner and avoid circuitous routing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained.

These zones span from the Tuthill Road alignment till half mile east of 191st Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Overview of Tier 2 Screening Process

Based on the zone analysis from Tier 1 Screening Process, three potential alternative corridors were identified for the next level of evaluation. However, these were broad conceptual corridors that did not represent the actual footprint in any manner. (See attached figure)

Draft Tier 2 Evaluation criteria is as follows-

- Right-of-way required
- General impact to community
- General impact to future planned developments & developable land
- Public acceptance
- Cost
- Engineering complexity & constructability
- Drainage/Flood control
- Public transportation planning policy
- Corridor footprint/ Design consistency
- Potential environmental impacts

Please see attachment for a detailed description of each of these criteria.

The next steps in the process are as follows-

i. Incorporate stakeholder input on evaluation criteria and alternatives
ii. Conduct Tier 2 evaluation
iii. Travel demand modeling

## VI. Tier 2 Screening Criteria

The study need has to be demonstrated using the modeling before the next public meeting. The PAC also needs to decide the next PAC meeting date and the tentative schedule for the next public meeting.

## VII. Corridor Analysis By Segment

## VIII. Next Steps

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

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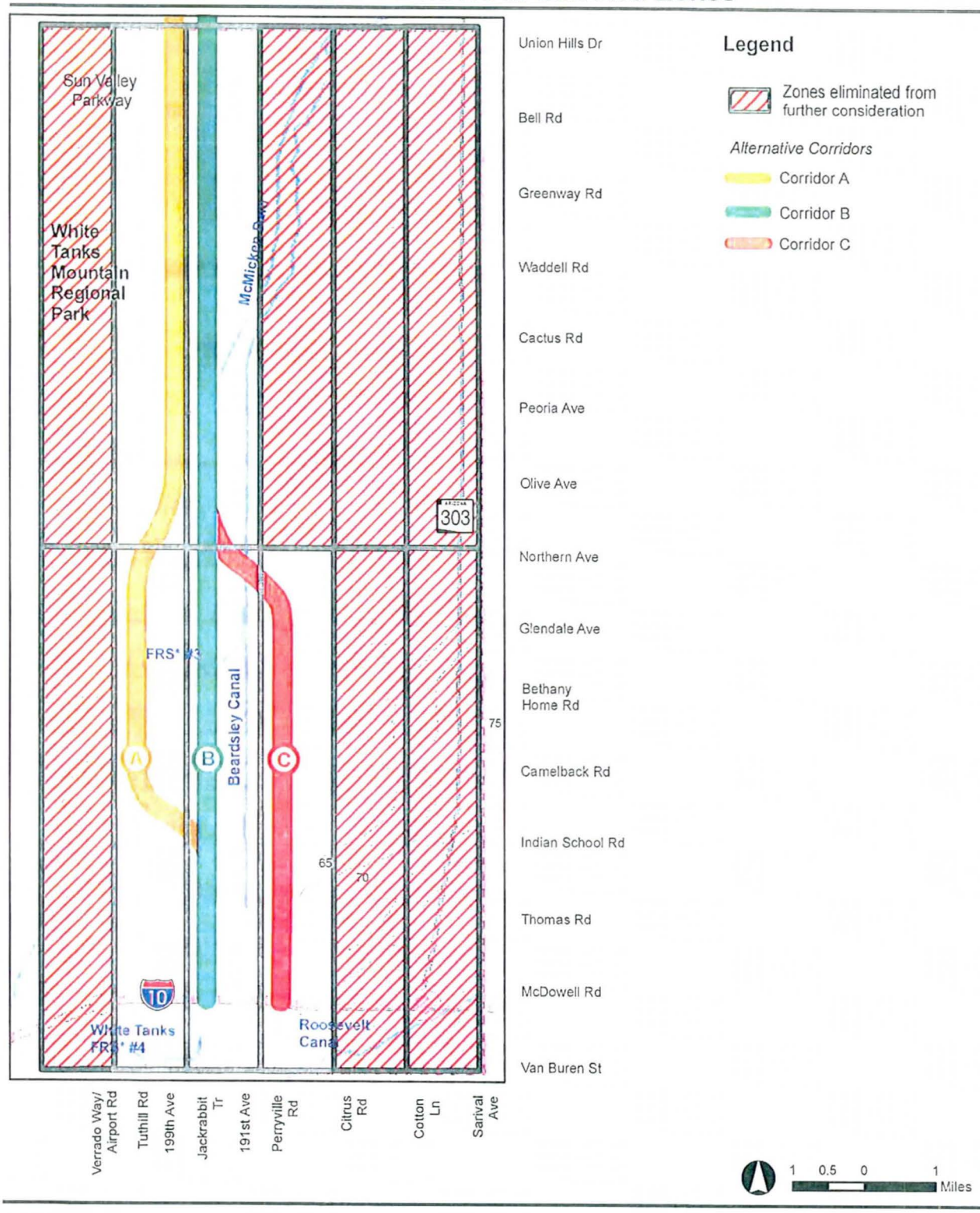
| Randy Overmyer | Randall.overmyer@surpriseaz.com | 480.225.2309 |
| DAN MARUM | Wilson & Company dan.marum@wilsonco.com | 602 283-2702 |
| JOHN MCNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

# Tier 2: Potential Alternative Corridors in Selected Zones



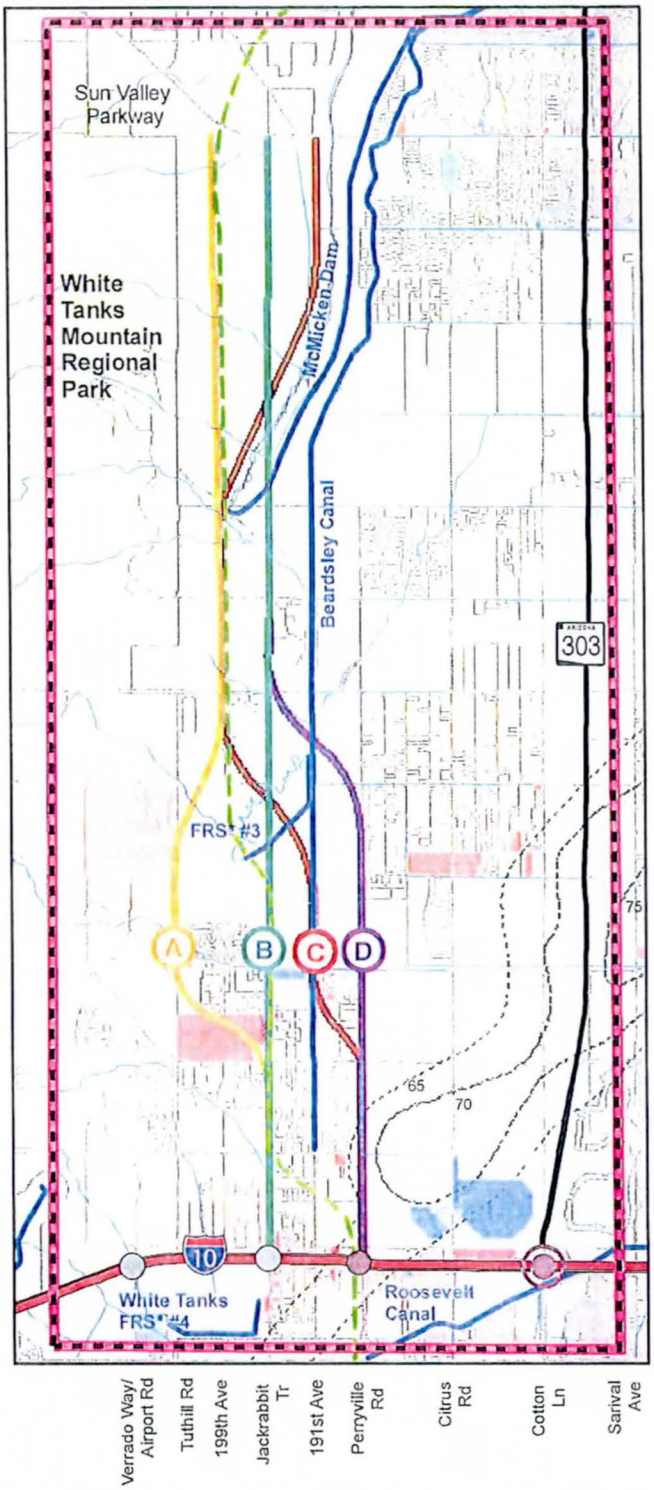

DRAFT

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

June 2007

# Tier 2: Potential Alternative Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Existing Land Use*

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Developing Residential
- Commercial
- Developing Commercial
- Industrial
- Institutional
- Public Facilities
- Office/Employment
- Open Space
- Agriculture
- Water
- Vacant

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- MAG I-10/ Hassayampa Valley Roadway Framework Study

DRAFT

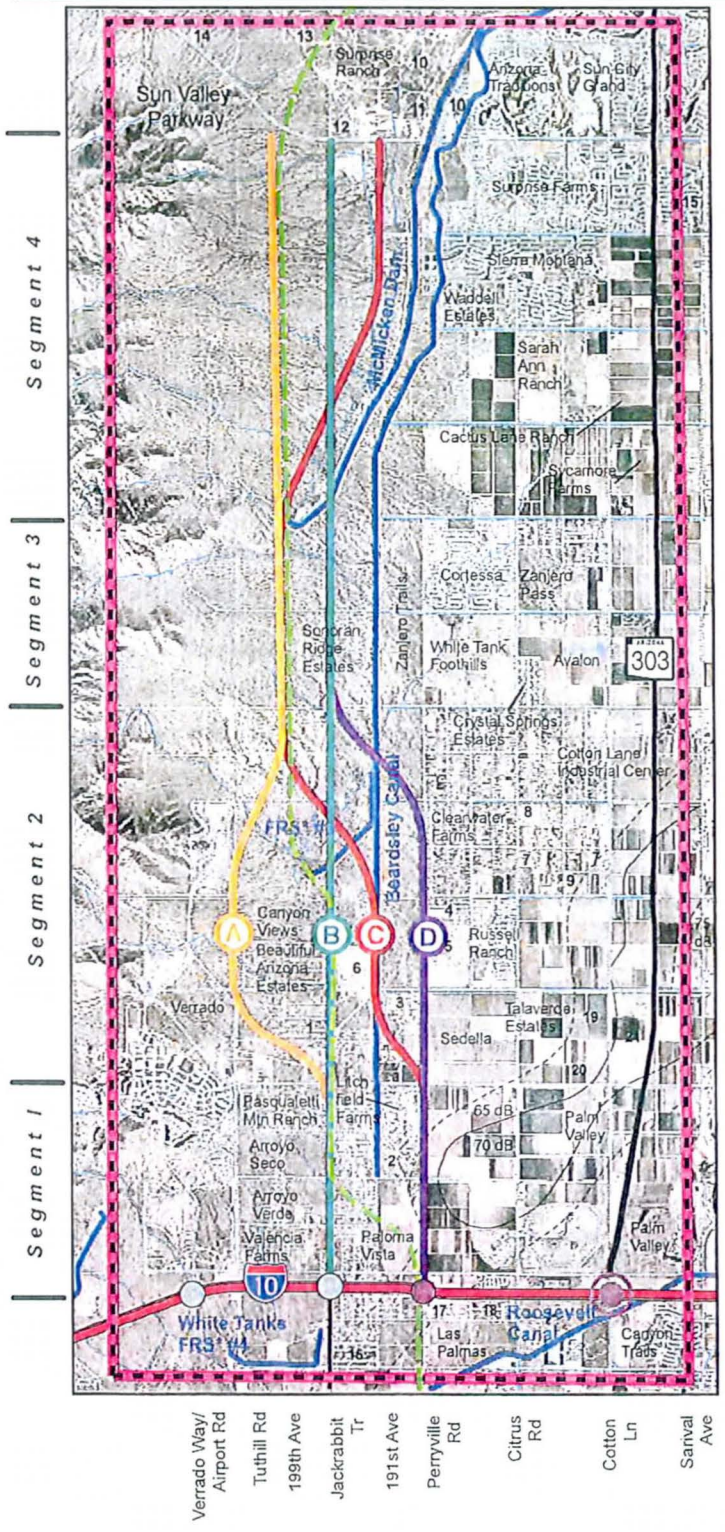
*FRS stands for Flood Retardant Structure

1 0.5 0 1 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*October 2007*

# Tier 2: Potential Alternative Corridor Analysis




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D

Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

*FRS stands for Flood Retardant Structure

**DRAFT**

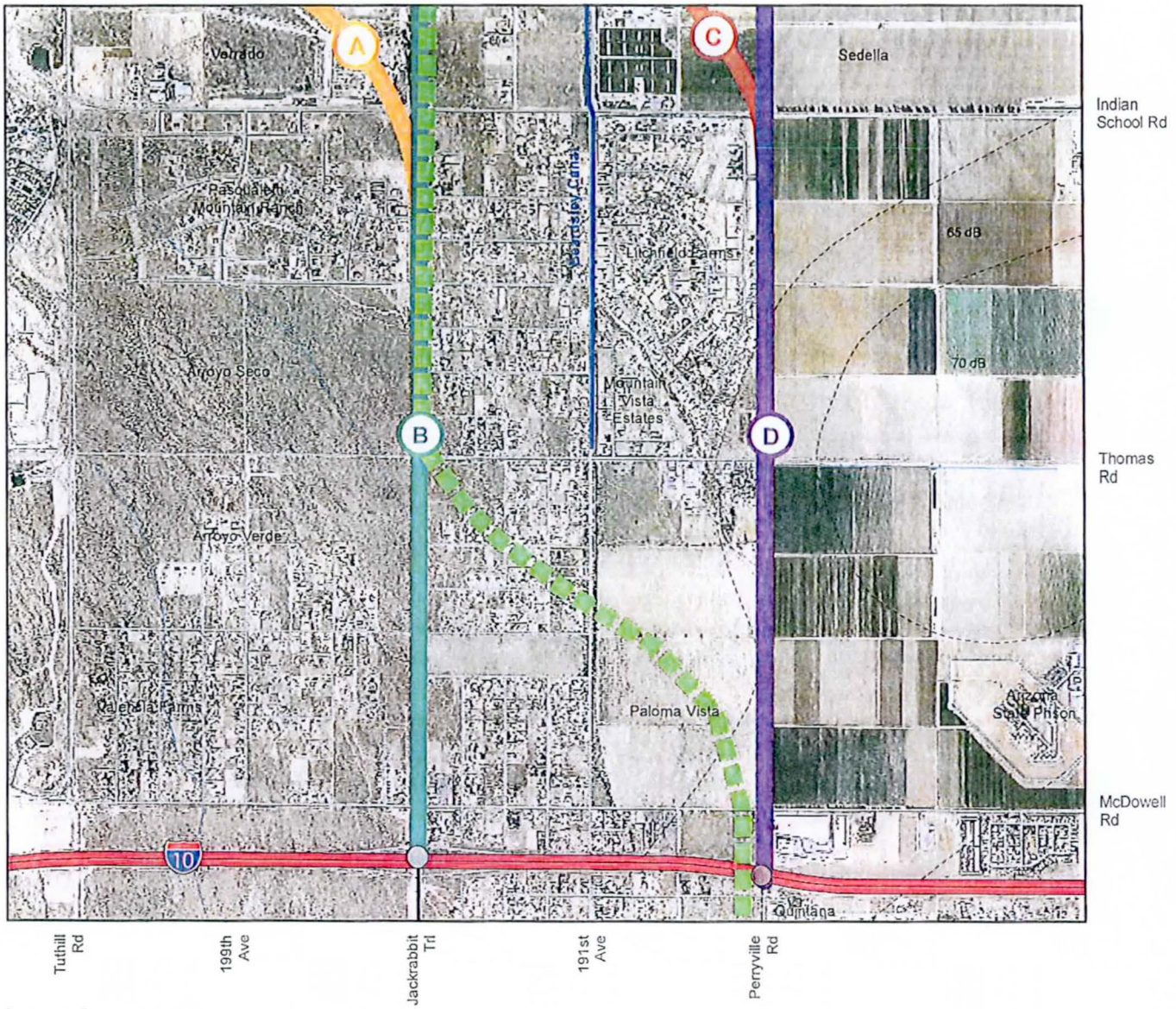
1 0.5 0 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 1




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

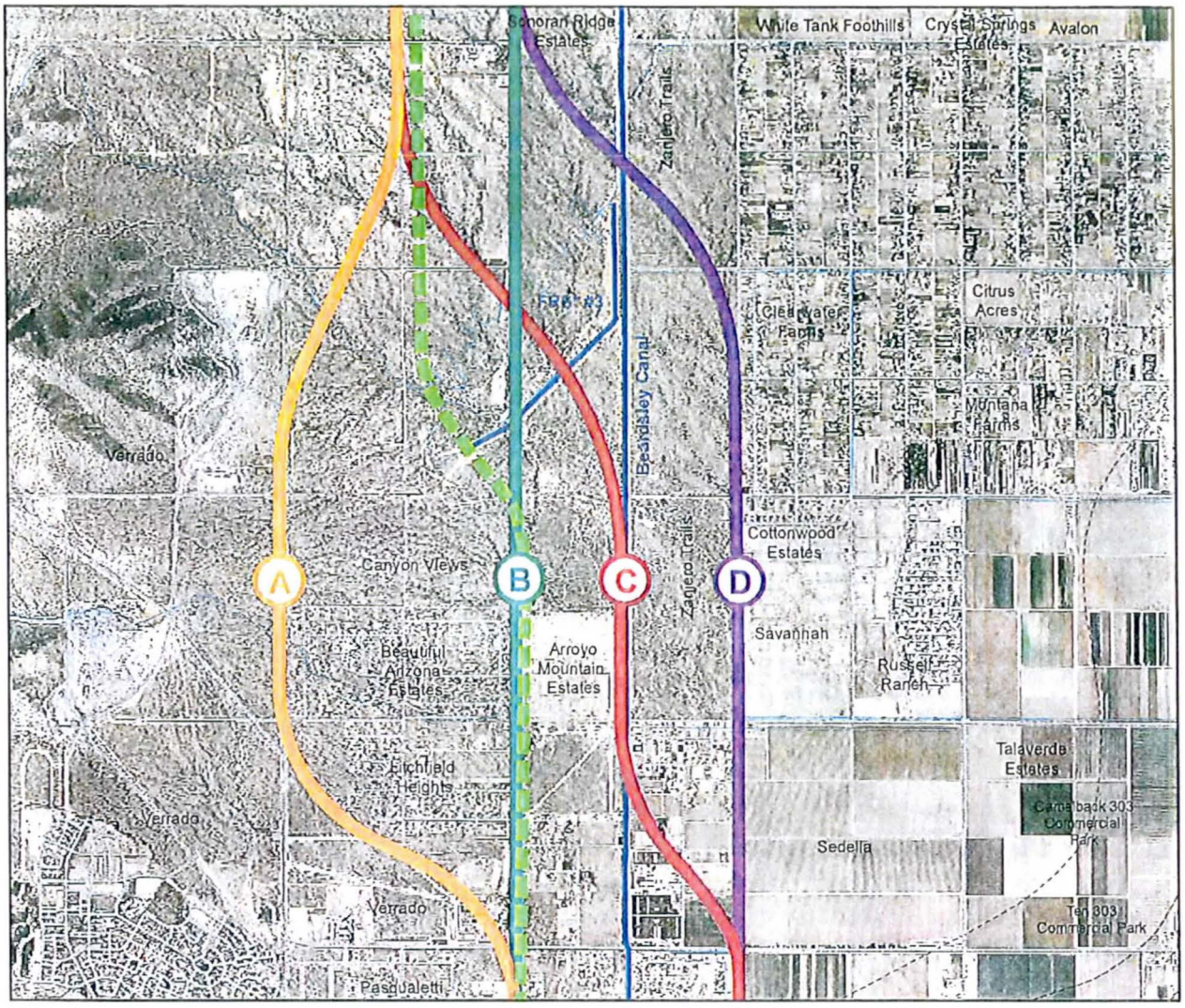
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 2




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

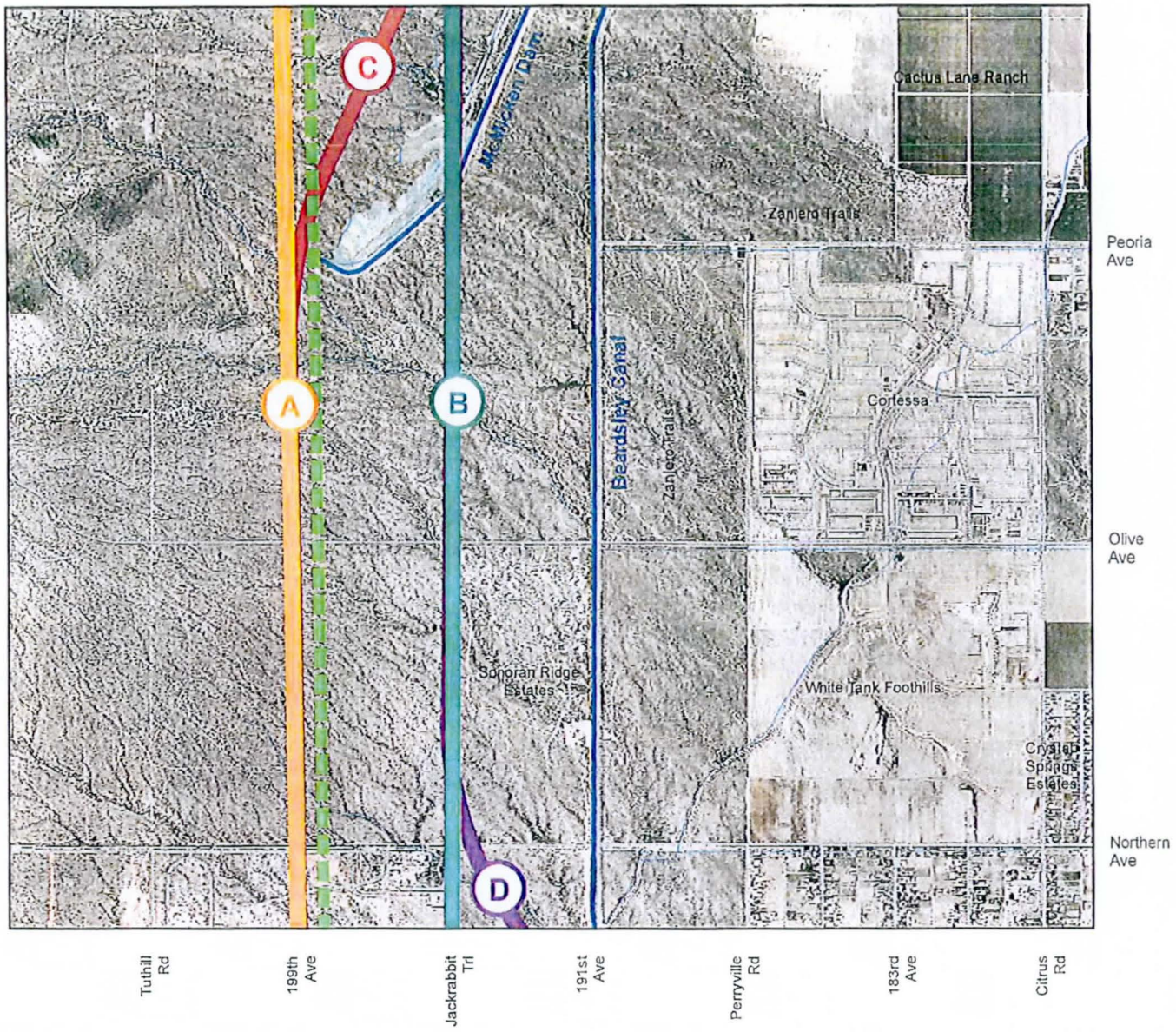
0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 3




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D

Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

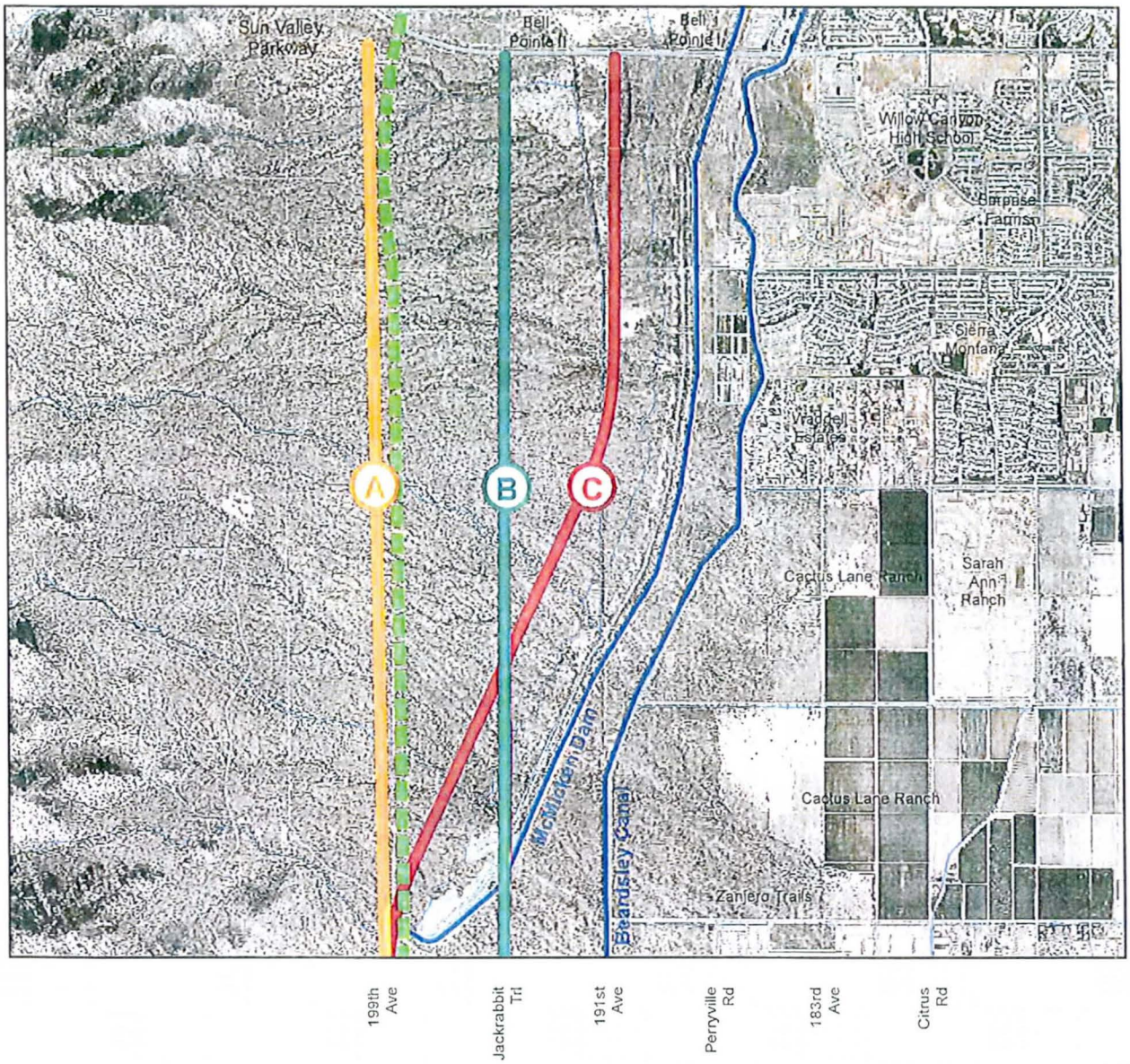
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 4




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 15, 2008

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 14, 2008, Alternatives Evaluation Stakeholder Meeting with Maricopa Water District (MWD) and Flood Control District of Maricopa County (FCDMC)

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meeting that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept and described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Rodney Bragg stated that the preferred alignment crosses the Beardsley Canal at one location- just south of Camelback Road. Glen Vortherms, MWD stated that the project team should contact Dave Maguire from Land Solutions Inc. to incorporate the plans for Zanjero Trails. Mike Greenslade, FCDMC apprised the project team about the status of the FRS #3 Rehabilitation Project and stated that the Phase 1 of the project was under construction and Phase two was in 60% design stage anticipated to be completed by October 2008. He also informed that the Alternatives C and D as shown on the map would be crossing potential earth fissure risk zones, and Alternatives B & C would cut off the reservoir from the emergency spillway. He emphasized that the team's drainage analysis would have to mitigate these issues. The FCDMC modeling indicates that these areas have the potential to develop earth fissure zones, though they are not there at present. Mike Greenslade also informed the attendees subsidence has also occurred at both FRS #3 and McMicken Dam.

Rodney Bragg inquired if there was any work being done on the FRS #3 outlet channel. Valerie Swick informed the attendees that the appraisers were currently looking at the prospects of acquiring the first row of lots along the west side of Jackrabbit Trail to settle the right-of-way issues, the report for which is expected by the end of February to mid-march 2008 timeframe. Mike Greenslade also informed the team the Maricopa County Parks and Recreation Department was planning a trailhead staging area at the south end of the McMicken Dam and reiterated the importance of avoiding conflict between pedestrian, equestrian and vehicular movements. He also indicated that the alternative for the dam would be available by March-April 2008 and could present MCDOT with a partnering opportunity. He also indicated that the district was aware of the City of Surprise Transportation Plan and realized that sometime in the future the east-west arterial streets would have to cross over the dam. Mike Greenslade also mentioned that the area has significant archaeological sites.

Mike Greenslade expressed his concerns about the parkway facility crossing the FRS #3 and stated that the south option would have less potential impact to the structure and that would be to FCDMC. Rodney Bragg also stated that the current horizontal curves drawn for the preferred alternative just barely meet the parkway design speed. He also inquired if the MWD had any concerns regarding canal crossings. MWD expressed that a bridge crossing should be used whenever the canal has to be crossed. Javier Guana inquired if the bridge crossing had to be at-grade. Glen Vortherms stated that that was entirely dependent on the

design but the freeboard operation and maintenance would need to be met. Javier Guana also inquired if there would be any objections if the alignment of the Beardsley Canal was modified or encased. Glen Vortherms stated that the alignment modification could be considered but not desirable and encasing would bring in maintenance issues. Bob Darr inquired how the western extension of Northern Avenue would tie in with this network. Rodney Bragg stated that all section lines would connect and tie into the Jackrabbit Trail facility. He also mentioned that based on this discussion, the south option of Alternative C seemed to be the path of least resistance. Mike Greenslade concurred and also reiterated the chances for a partnering opportunity since this study would tie in very well with the channel design and also with the McMicken Dam. Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 14, 2008: 1 PM to 3 PM***
***Maricopa Water District***
***14825 W. Grand Avenue***
***Surprise, AZ 85374***

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**SIGN-IN SHEET**

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| Mike Greenslade | mdg@mail.maricopa.gov | 602-506-5426 |

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| Jennifer Toth | jennifer.livingston@dmjmharris.com | 602-337-2516 |
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| JOHN MCNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 15, 2008

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 14, 2008, Alternatives Evaluation Stakeholder Meeting with Maricopa Water District (MWD) and Flood Control District of Maricopa County (FCDMC)

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meeting that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept and described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Rodney Bragg stated that the preferred alignment crosses the Beardsley Canal at one location- just south of Camelback Road. Glen Vortherms, MWD stated that the project team should contact Dave Maguire from Land Solutions Inc. to incorporate the plans for Zanjero Trails. Mike Greenslade, FCDMC apprised the project team about the status of the FRS #3 Rehabilitation Project and stated that the Phase 1 of the project was under construction and Phase two was in 60% design stage anticipated to be completed by October 2008. He also informed that the Alternatives C and D as shown on the map would be crossing potential earth fissure risk zones, and Alternatives B & C would cut off the reservoir from the emergency spillway. He emphasized that the team's drainage analysis would have to mitigate these issues. The FCDMC modeling indicates that these areas have the potential to develop earth fissure zones, though they are not there at present. Mike Greenslade also informed the attendees subsidence has also occurred at both FRS #3 and McMicken Dam.

Rodney Bragg inquired if there was any work being done on the FRS #3 outlet channel. Valerie Swick informed the attendees that the appraisers were currently looking at the prospects of acquiring the first row of lots along the west side of Jackrabbit Trail to settle the right-of-way issues, the report for which is expected by the end of February to mid-march 2008 timeframe. Mike Greenslade also informed the team the Maricopa County Parks and Recreation Department was planning a trailhead staging area at the south end of the McMicken Dam and reiterated the importance of avoiding conflict between pedestrian, equestrian and vehicular movements. He also indicated that the alternative for the dam would be available by March-April 2008 and could present MCDOT with a partnering opportunity. He also indicated that the district was aware of the City of Surprise Transportation Plan and realized that sometime in the future the east-west arterial streets would have to cross over the dam. Mike Greenslade also mentioned that the area has significant archaeological sites.

Mike Greenslade expressed his concerns about the parkway facility crossing the FRS #3 and stated that the south option would have less potential impact to the structure and that would be to FCDMC. Rodney Bragg also stated that the current horizontal curves drawn for the preferred alternative just barely meet the parkway design speed. He also inquired if the MWD had any concerns regarding canal crossings. MWD expressed that a bridge crossing should be used whenever the canal has to be crossed. Javier Guana inquired if the bridge crossing had to be at-grade. Glen Vortherms stated that that was entirely dependent on the

design but the freeboard operation and maintenance would need to be met. Javier Guana also inquired if there would be any objections if the alignment of the Beardsley Canal was modified or encased. Glen Vortherms stated that the alignment modification could be considered but not desirable and encasing would bring in maintenance issues. Bob Darr inquired how the western extension of Northern Avenue would tie in with this network. Rodney Bragg stated that all section lines would connect and tie into the Jackrabbit Trail facility. He also mentioned that based on this discussion, the south option of Alternative C seemed to be the path of least resistance. Mike Greenslade concurred and also reiterated the chances for a partnering opportunity since this study would tie in very well with the channel design and also with the McMicken Dam. Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 14, 2008: 1 PM to 3 PM***
***Maricopa Water District***
***14825 W. Grand Avenue***
***Surprise, AZ 85374***

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**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| MANSI SACHDEV | mansi.sachdev@dmjmharris.com | 602-323-2652 |
| DAVID DEGERNESS | DJDEMAIL.MARICOPA.GOV | 602-506-4730 |
| Valerie Swick | vas@mail.maricopa.gov | 602-506-2929 |
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| Don Breeding | donb@mwdaz.com | 623-546-8266 |
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| Rodney Bragg | rodney.bragg@dmjmharris.com | 602-337-2617 |
| Allen Zimmerman | azimmerm@azcorrections.gov | 602/509-0104 |
| BRIAN ROSE | brose@buckeyeaz.gov | 623-349-6208 |
| Mike Greenslade | mdg@mail.maricopa.gov | 602-506-5426 |

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| Jennifer Toth | jennifer.livingston@dmjmharris.com | 602-337-2516 |
| ERNEST RUBI | ERNESTRUBI@MAIL.MARICOPA.GOV | 602-606-1049 |
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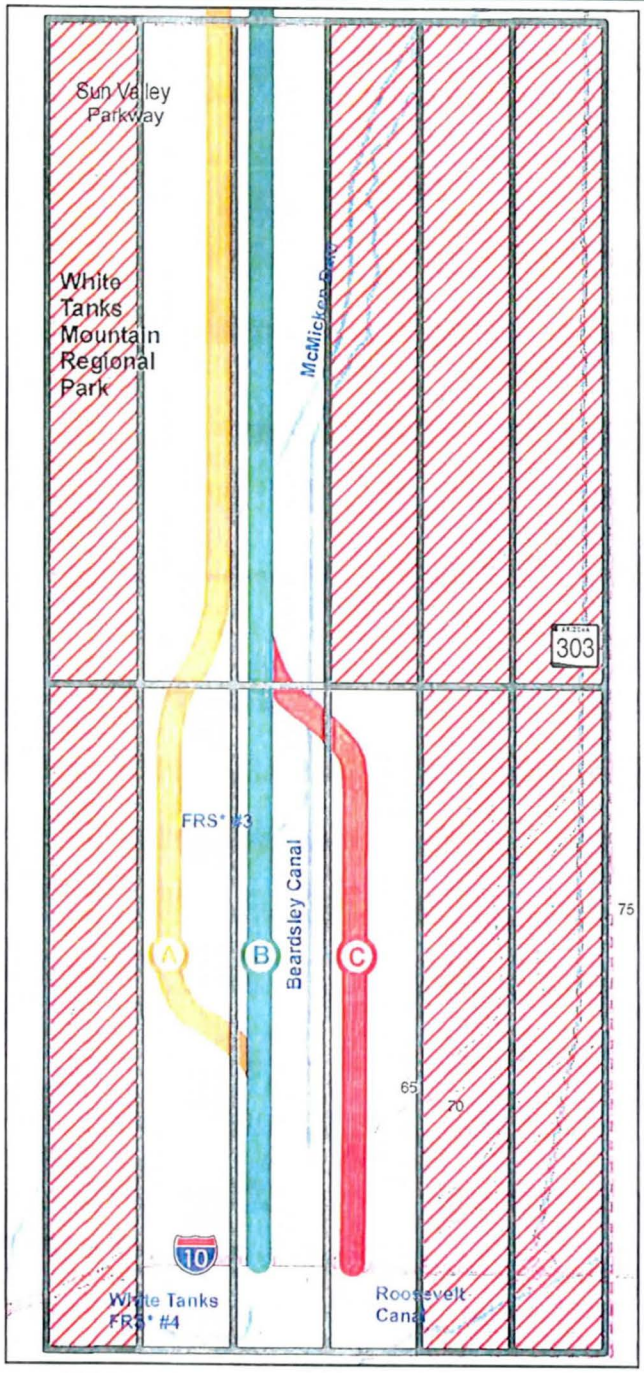
| Valerie Swick | vas@mail.maricopa.gov | (602) 506-2929 |
| Rodney Bragg | rodney.bragg@dmjmharris.com | (602) 337-2617 |
| Randy Overmyer | Randall.overmyer@surpriseaz.com | 480.225.2309 |
| DAN MARUM | Wilson & Company dan.marum@wilsonco.com | 602 283-2702 |
| JOHN McNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

# Tier 2: Potential Alternative Corridors in Selected Zones




## Legend

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

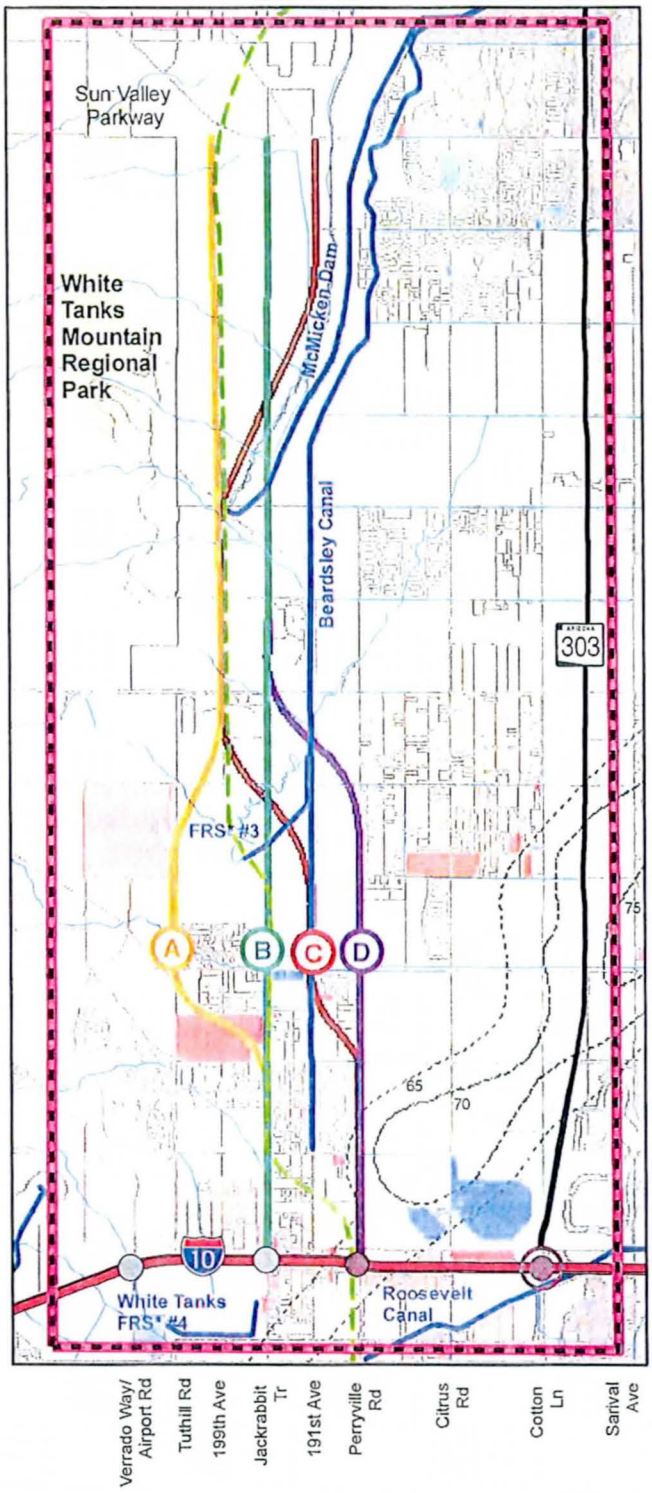
DRAFT

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

June 2007

# Tier 2: Potential Alternative Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Existing Land Use*

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Developing Residential
- Commercial
- Developing Commercial
- Industrial
- Institutional
- Public Facilities
- Office/Employment
- Open Space
- Agriculture
- Water
- Vacant

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- MAG I-10/ Hassayampa Valley Roadway Framework Study

**DRAFT**

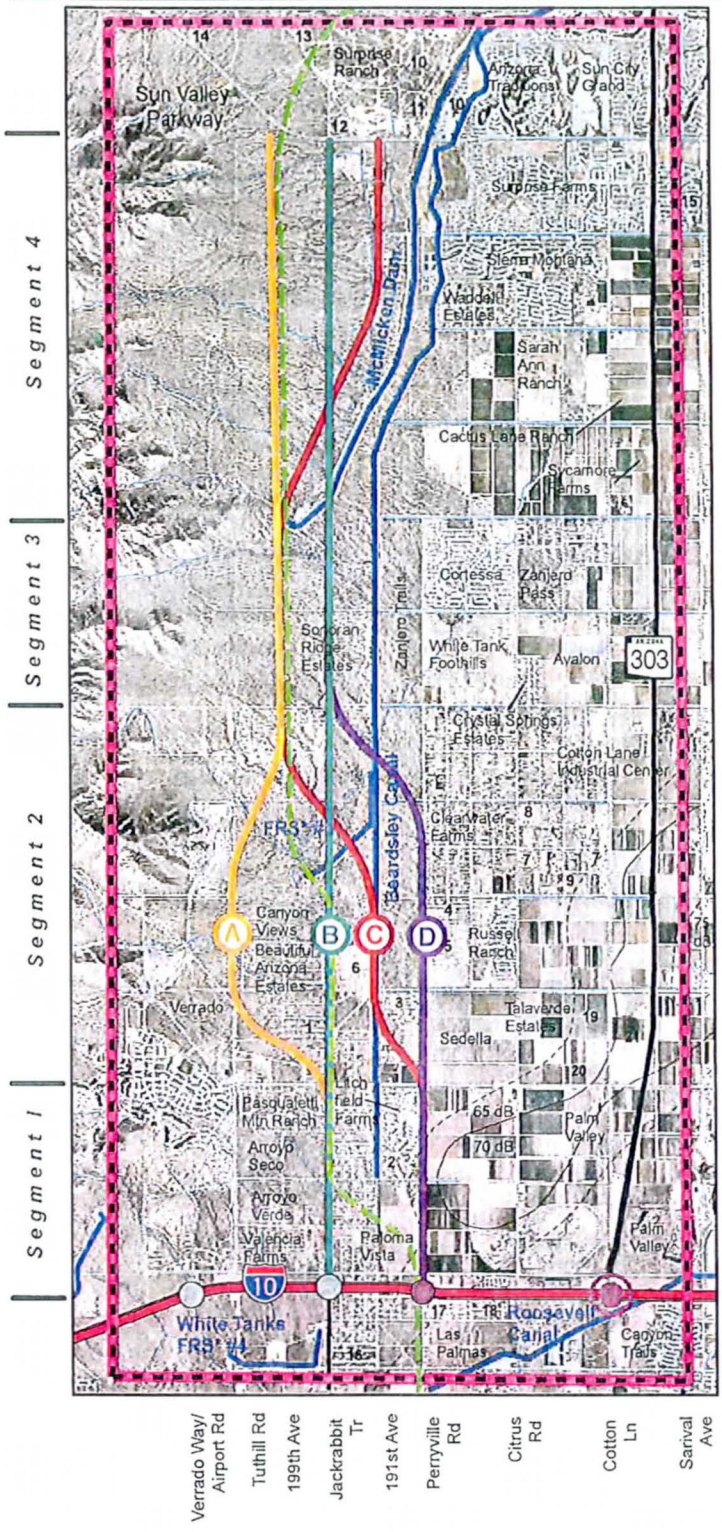
*FRS stands for Flood Retardant Structure

1 0.5 0 1 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*October 2007*

# Tier 2: Potential Alternative Corridor Analysis

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*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D

Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

**DRAFT**

1 0.5 0 1 Miles

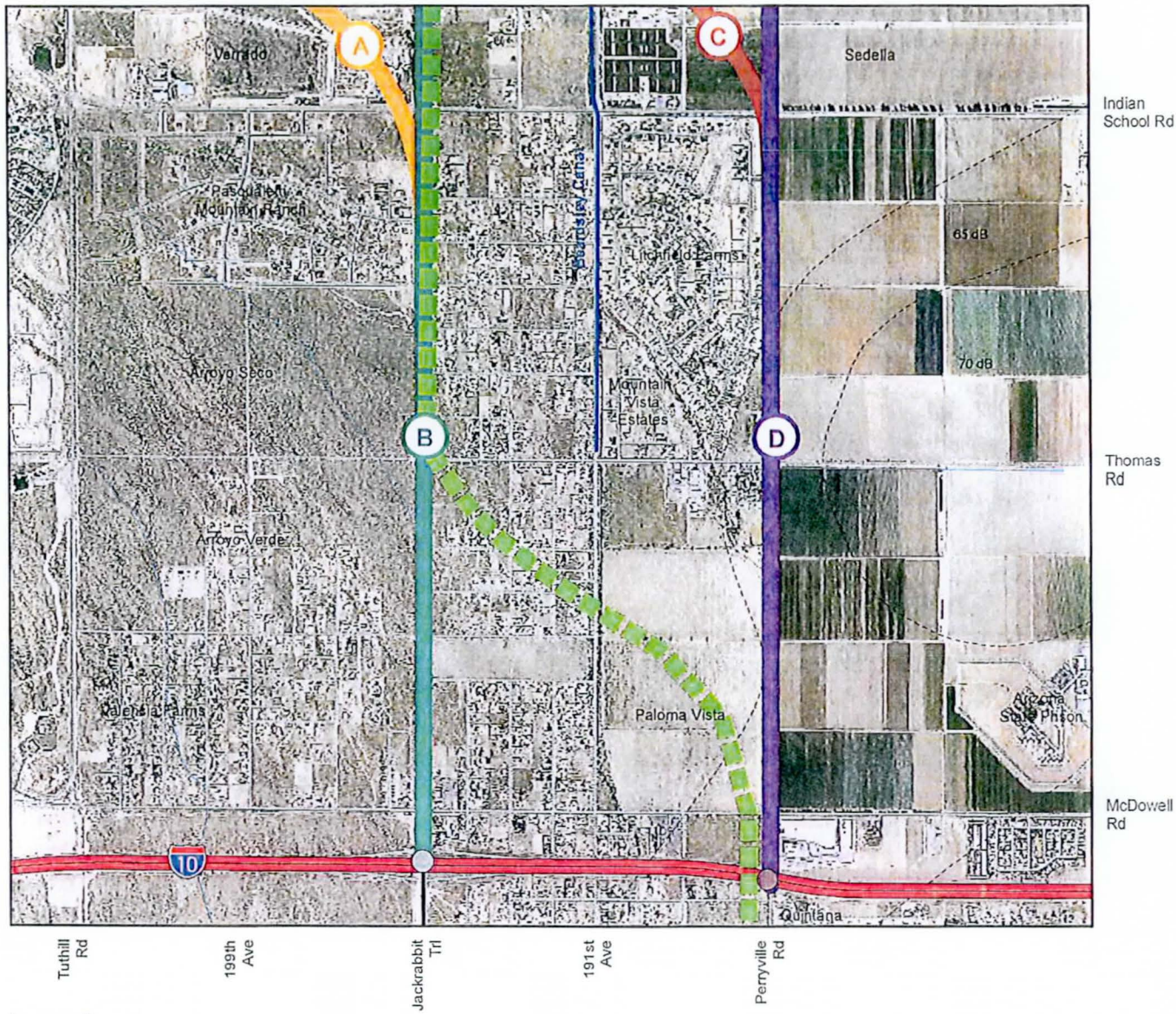
*FRS stands for Flood Retardant Structure

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

## Jackrabbit Trail Access Control and Corridor Improvement Study
### *Interstate-10 to Bell Road*

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 1

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*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

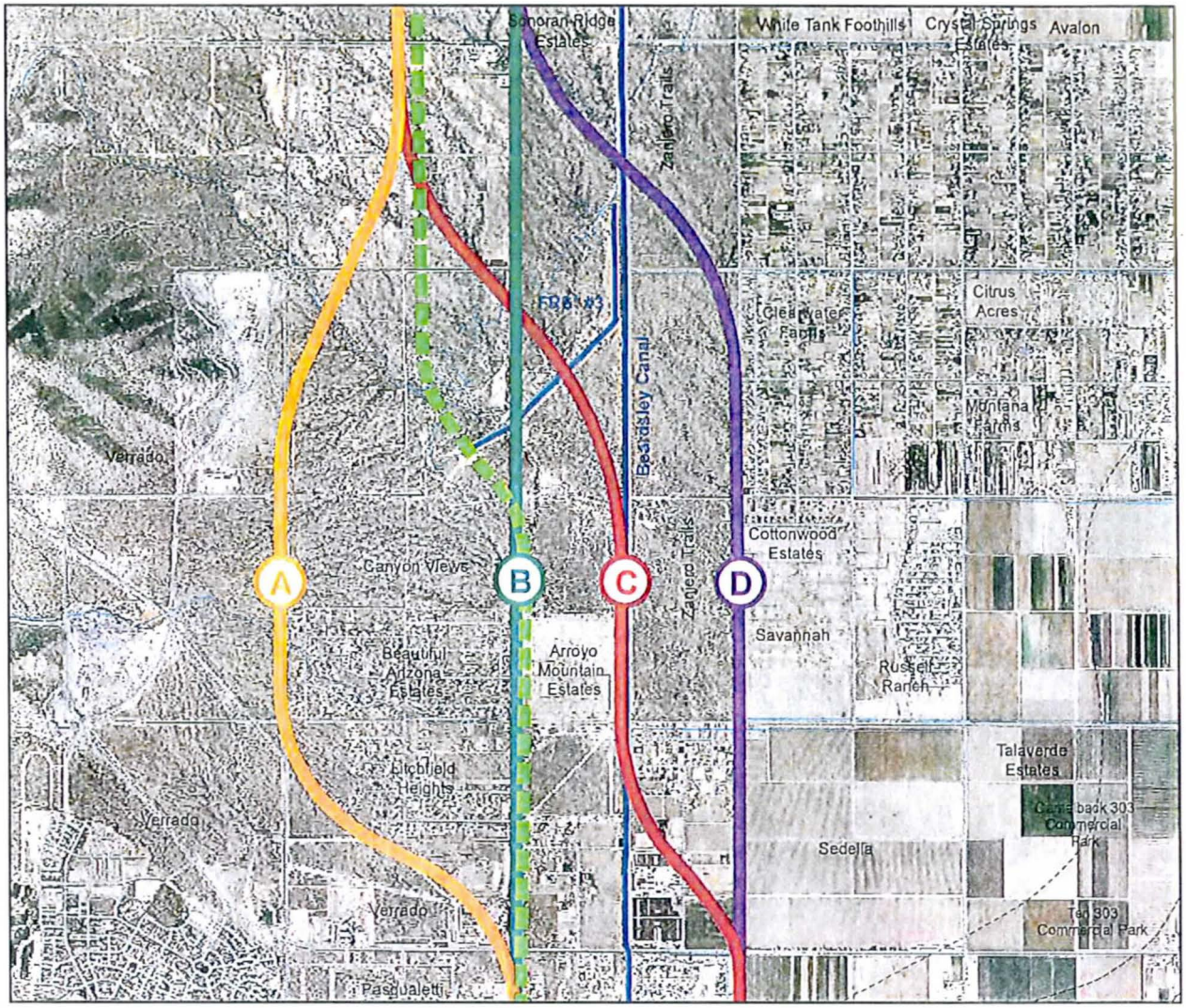
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 2




## Legend

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- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

**DRAFT**

0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
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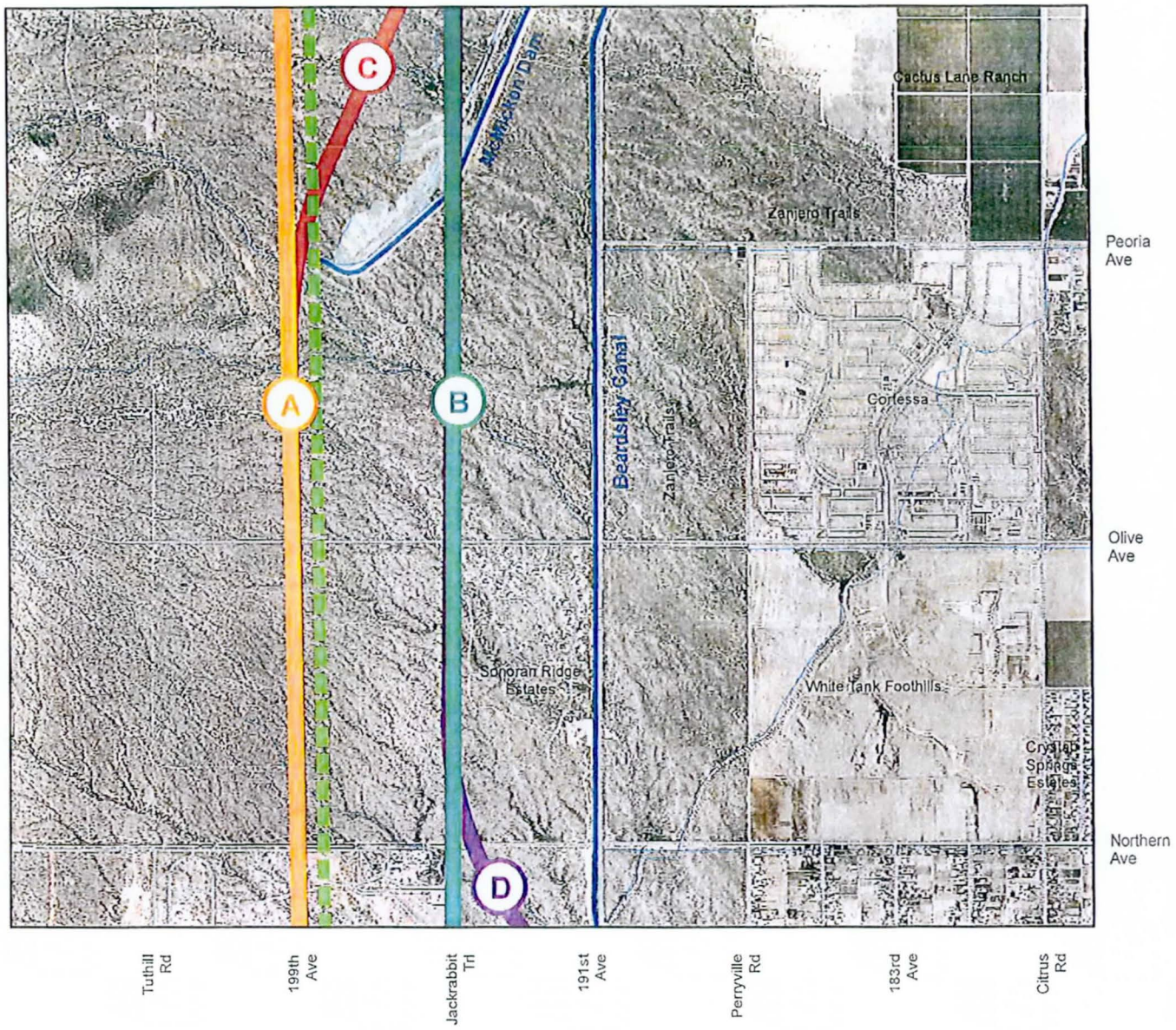
# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 3

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DRAFT

0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
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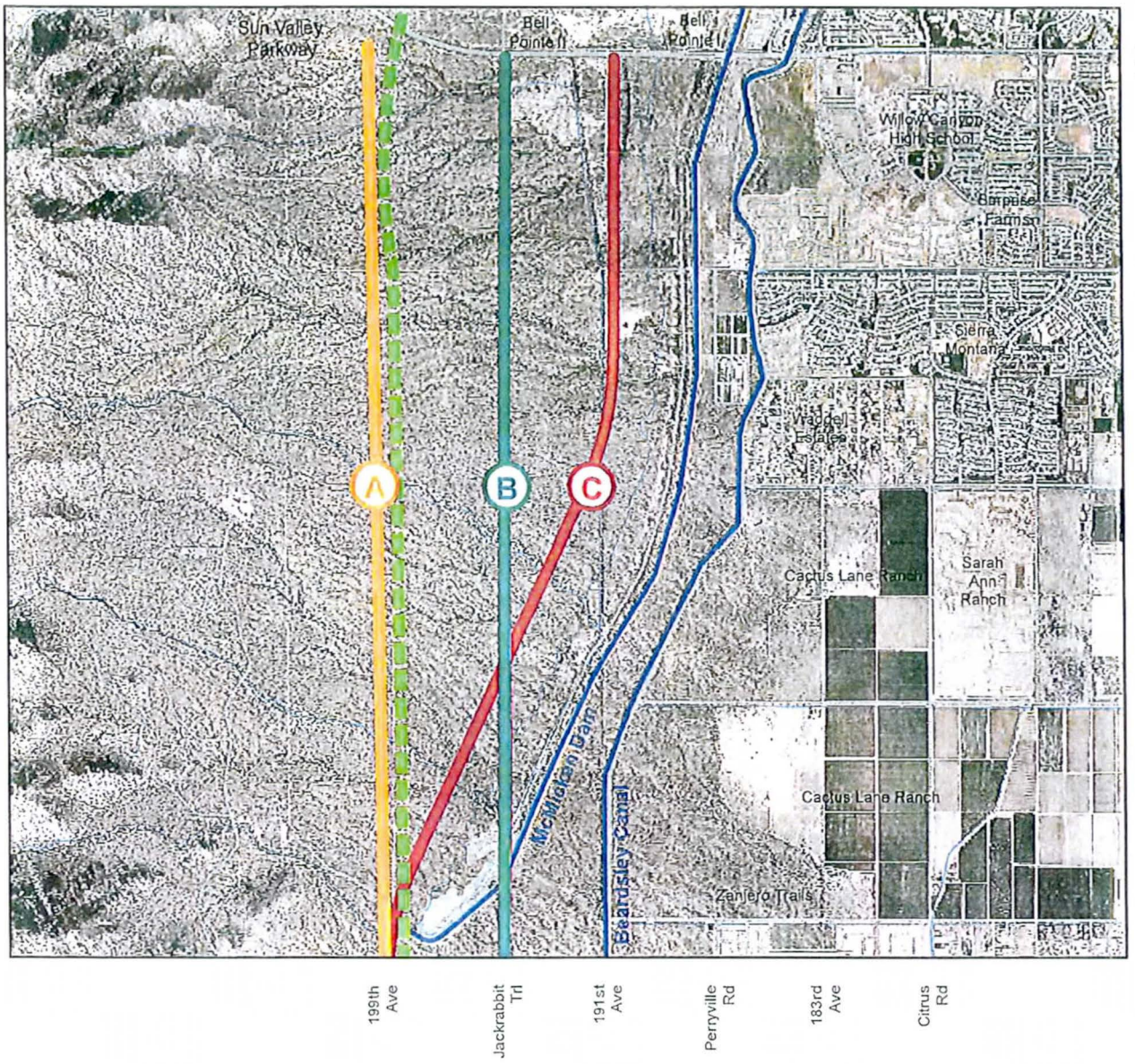
**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 4




## Legend

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DRAFT

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**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

| | |
|---|---|
| Date: | January 15, 2008 |
| To: | Ernest Rubi, Project Manager, MCDOT |
| From: | Jennifer Livingston, Project Manager, DMJM Harris |
| Re: | Jackrabbit Trail Access Control and CIS |
| Subject: | January 14, 2008, Alternatives Evaluation Stakeholder Meeting with Maricopa Water District (MWD) and Flood Control District of Maricopa County (FCDMC) |
| Attendees: | See attached sign-in sheet |

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### III. Discussion on Preferred Alternative

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DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

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*14825 W. Grand Avenue*
*Surprise, AZ 85374*

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| Veronica Valenzuela | veronicav@mwdaz.com | 623-546-8266 |
| Chris Cain | Chrisc@mwdaz.com | 623/546-8266 |
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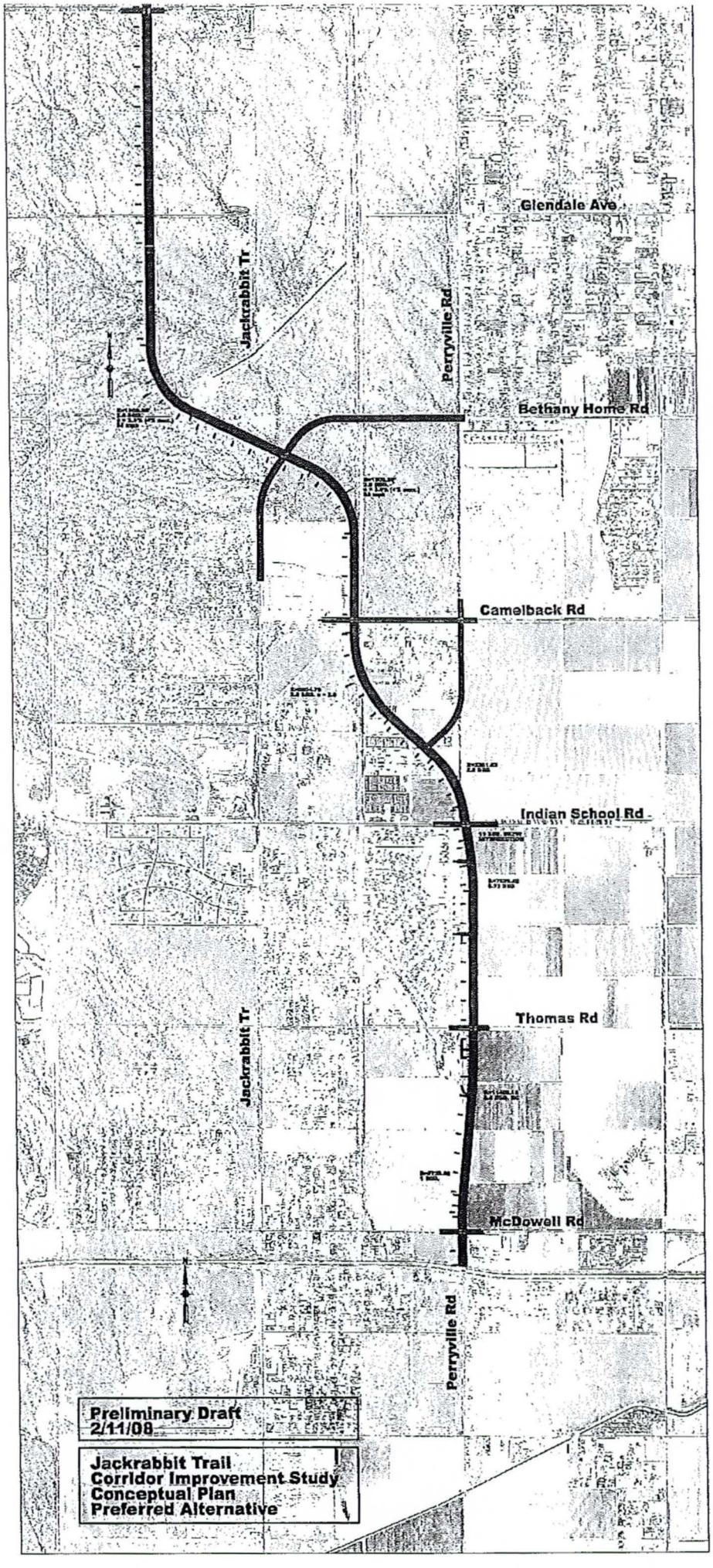
| Allan Zimmerman | azimmerm@azcorrections.gov | 602/509-0104 |
| BRIAN ROSE | brose@buckeyeaz.gov | 623-349-6208 |
| Mike Greenslade | mdg@mail.maricopa.gov | 602-506-5426 |

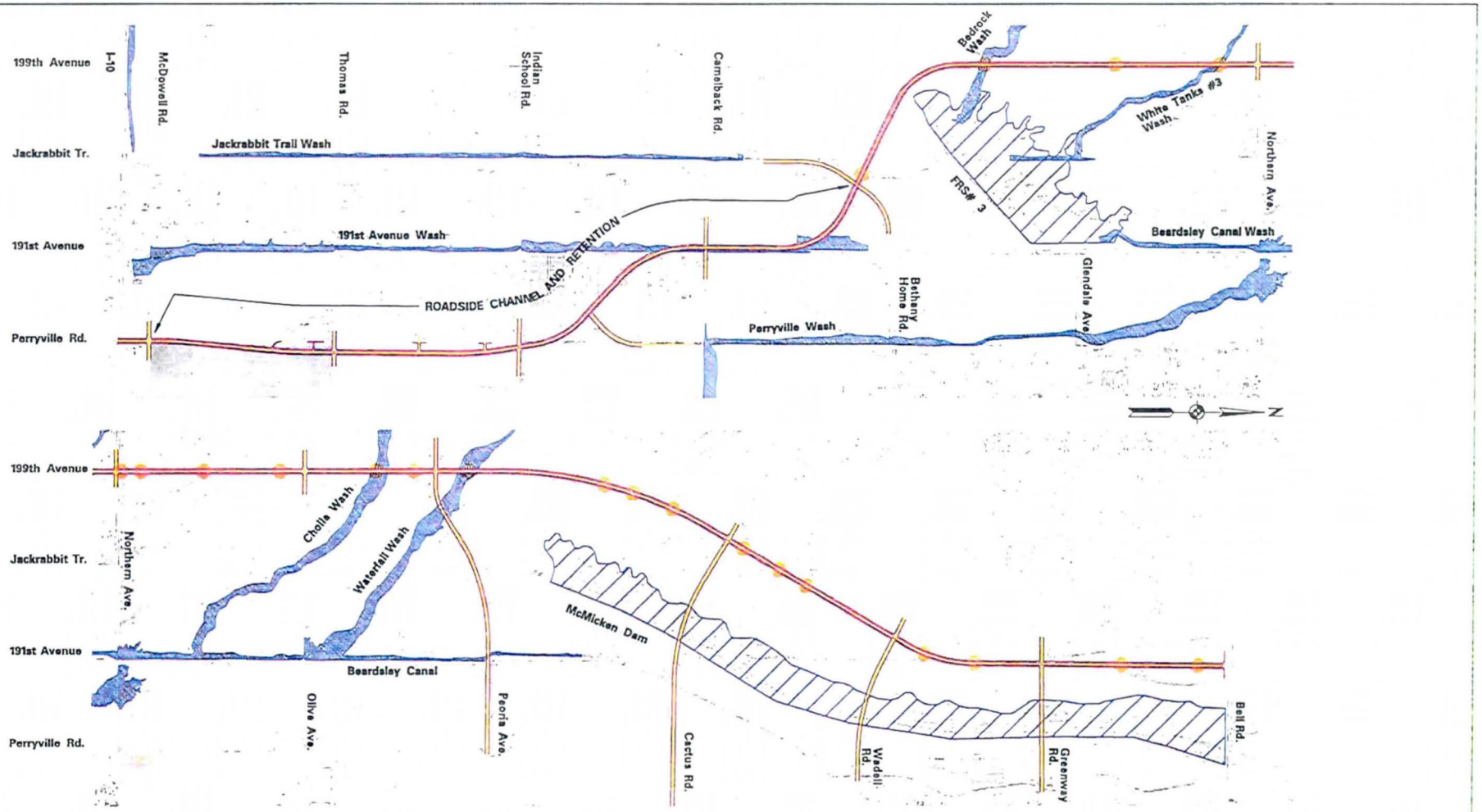
Bob DARR rdarr@glendale.lea2.com 623-930-2942

LUKE ALBERT LUKE.ALBERT@GOODYEARAZ.GOV 623-882-7519

Bob DARR rdarr@glendale.lcaz.com 623-930-2942

LUKE ALBERT LUKE.ALBERT@GOODYEARAZ.GOV 623-882-7519


Glendale Ave
Jackrabbit Tr
Perryville Rd
Bethany Home Rd
Camelback Rd
Indian School Rd
Thomas Rd
McDowell Rd
Preliminary Draft
2/11/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative

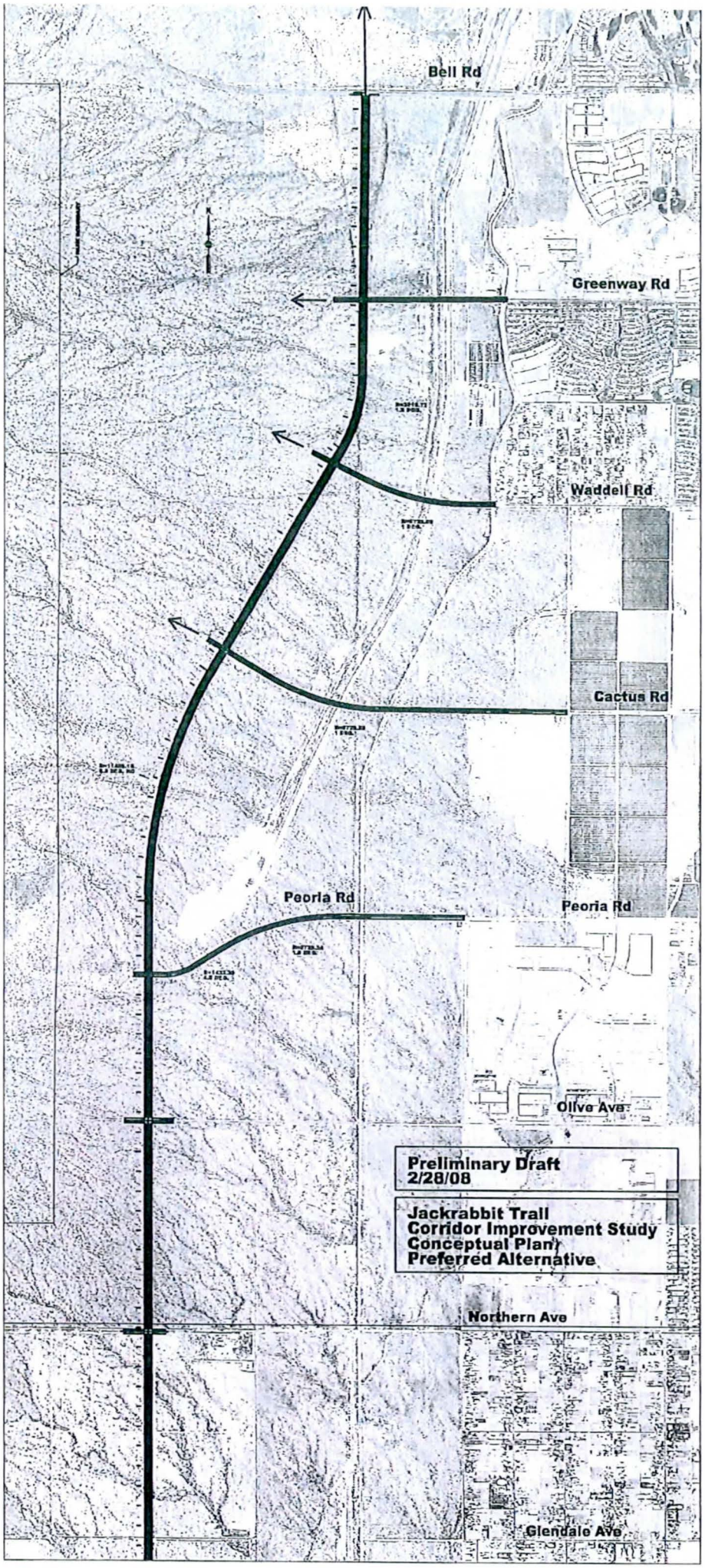



# DRAINAGE FEATURES
## Along Preferred Alternative

Jackrabbit Trail, I-10 to Bell Road
Access Control and Corridor Improvement Study

Andes Engineering

2/25/2008 3:21:53 PM
J:\ANDES\ACAD\PROJECTS\0605 Jackrabbit Trail\Figures\Preferred Alternative Mapdgn


Bell Rd
Greenway Rd
Waddell Rd
Cactus Rd
Peoria Rd
Peoria Rd
Olive Ave
Northern Ave
Glendale Ave
Preliminary Draft
2/28/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## Stakeholder Advisory Committee Meeting #4-Agenda

*March 5, 2008: 2 PM to 3:30 PM*
*MCDOT Apache Conference Room*
*2901 W. Durango*
*Phoenix, Arizona 85009*

- Introductions
- Study Process
- Alternative Screening Process
- Summary of Tier 1 and Tier 2 Evaluation
- Summary of Public Meeting in November 2007
- Summary of Meetings with Key Stakeholders
- Preferred Alignment Concept
- Drainage Features
- Traffic Volumes Analysis
- Next Steps
    - Public Meeting- March 12, 2008
    - Technical Memorandum #6- March 2008
    - Draft Report in May 2008 including-
        - Design Features of Preferred Alignment
        - Access Management
        - Phasing & Implementation
        - Final Report- June 2008
- Questions

DMJM HARRIS | AECOM

JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

Evaluation of Tier 2 Corridors

DRAFT

| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | | Segment 2: Indian School Rd. to Northern Ave. | | | | Segment 3: Northern Ave. to Peoria Ave. | | | | Segment 4: Peoria Ave. to Bell Rd. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) | ◑ | ◑ | | | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) | ○ | ● (Sonoran Ridge Estates) | | | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side ) | ● (Existing development & future development) | ● (Existing development on both sides of corridor) | ● (FRS #3) | ◑ | ◑ (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● | ◑ | ○ | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) | ○ | ○ | | | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed intersections) | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) | ○ | ● (McMicken Dam crossing) | | | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Dell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | ○ | ○ | ○ | |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact; proximity to State lands) | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ◑ (Game crossing) | |
| | Recommendations | Place corridor as east as possible of the existing developments | | | | Place corridor as east as possible of the existing developments | | | | Place corridor as far west as possible with connection to preferred corridor to south | | | | Place corridor west of McMicken Dam and west of flood pool (Alt. C) | | | |

○ Least Significant Impact (Most Desirable)  ◑ Moderate Impact  ● Most Significant Impact (Least Desirable)

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: October 16, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: Stakeholder Workshop on Tier 2 Alternatives Evaluation

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Purpose of Meeting

The purpose of the meeting was to get updates from the various stakeholders, namely, City of Surprise, Town of Buckeye and the Flood Control District of Maricopa County (FCDMC) on their various projects and status of planned developments. In addition, consensus on Tier 2 evaluation of alternatives was also sought.

### III. Stakeholder Updates

The stakeholders were requested to provide updates on the various planned developments and projects within their jurisdiction.

*Buckeye*

Woody Scoutten provided the following information on the planned developments within the Town of Buckeye-

- Canyon Views at the intersection of Bethany Home and Jackrabbit Trail is in rezoning stage. On the northeast corner of the site, a small retail center is zoned with frontage on Jackrabbit Trail.
- Arroyo Seco and Arroyo Verde are in the pre-application process
- Along the
- Mixed use residential is proposed at the northeast corner of Indian School Road and Jackrabbit Trail. A retail shopping center is proposed at the southeast corner of the intersection.
- Verrado is in the final platting stage along the high school. Only some areas have their final plats ready.
- Pre-application was furnished for a 20-acre shopping center at the south east corner of I-10 and jackrabbit almost a year ago

## IV. Traffic Volumes

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Based on the above-mentioned criteria, four main considerations were kept in mind while selecting the geographical zones through which potential alternatives could be drawn. These considerations were-

i. Topographical concerns
ii. Proximity to environmental resources
iii. Public acceptance during the scoping process
iv. High-level planning-where to locate corridor in order to serve the community in the best possible manner and avoid circuitous routing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained.

These zones span from the Tuthill Road alignment till half mile east of 191st Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Overview of Tier 2 Screening Process

Based on the zone analysis from Tier 1 Screening Process, three potential alternative corridors were identified for the next level of evaluation. However, these were broad conceptual corridors that did not represent the actual footprint in any manner. (See attached figure)

Draft Tier 2 Evaluation criteria is as follows-

- Right-of-way required
- General impact to community
- General impact to future planned developments & developable land
- Public acceptance
- Cost
- Engineering complexity & constructability
- Drainage/Flood control
- Public transportation planning policy
- Corridor footprint/ Design consistency
- Potential environmental impacts

Please see attachment for a detailed description of each of these criteria.

The next steps in the process are as follows-

i. Incorporate stakeholder input on evaluation criteria and alternatives
ii. Conduct Tier 2 evaluation
iii. Travel demand modeling

## VI. Tier 2 Screening Criteria

The study need has to be demonstrated using the modeling before the next public meeting. The PAC also needs to decide the next PAC meeting date and the tentative schedule for the next public meeting.

## VII. Corridor Analysis By Segment

## VIII. Next Steps

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

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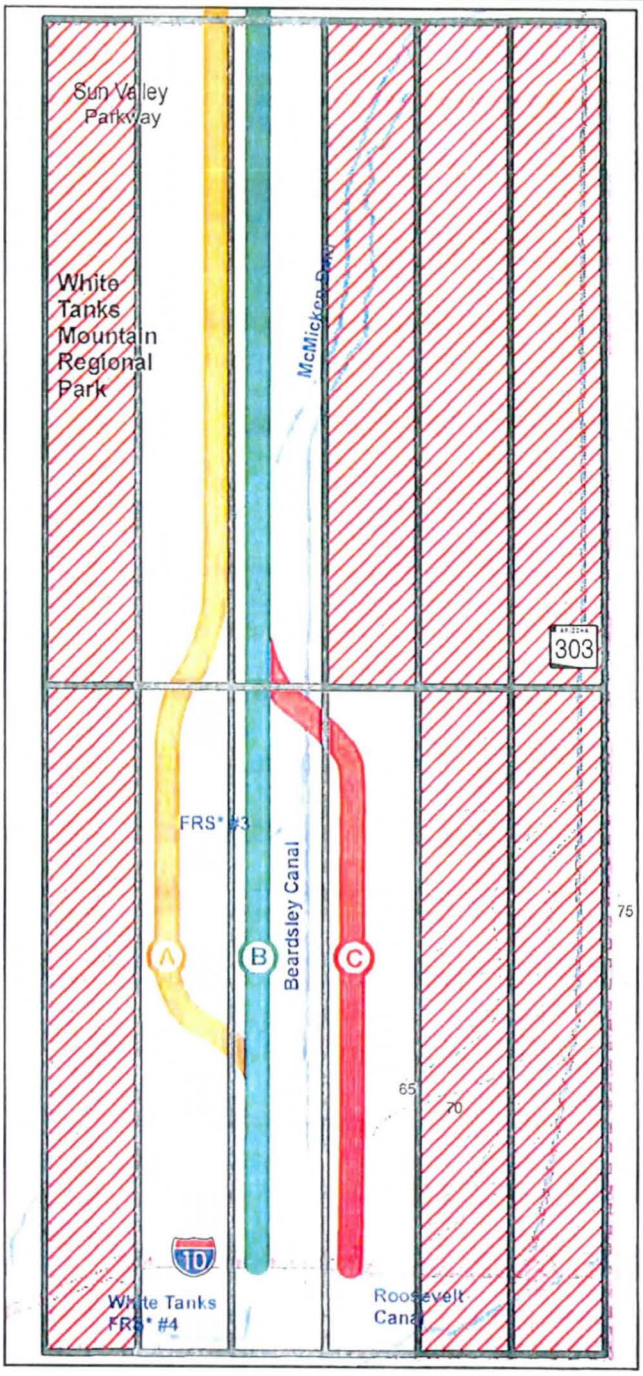
| Rodney Bragg | rodney.bragg@dmjmharris.com | (602) 337-2617 |
| Randy Overmyer | Randall.Overmyer@surpriseaz.com | 480.225.2309 |
| DAN MARUM | Wilson & Company dan.marum@wilsonco.com | 602 283-2702 |
| JOHN MCNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

## Tier 2: Potential Alternative Corridors in Selected Zones




### Legend

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

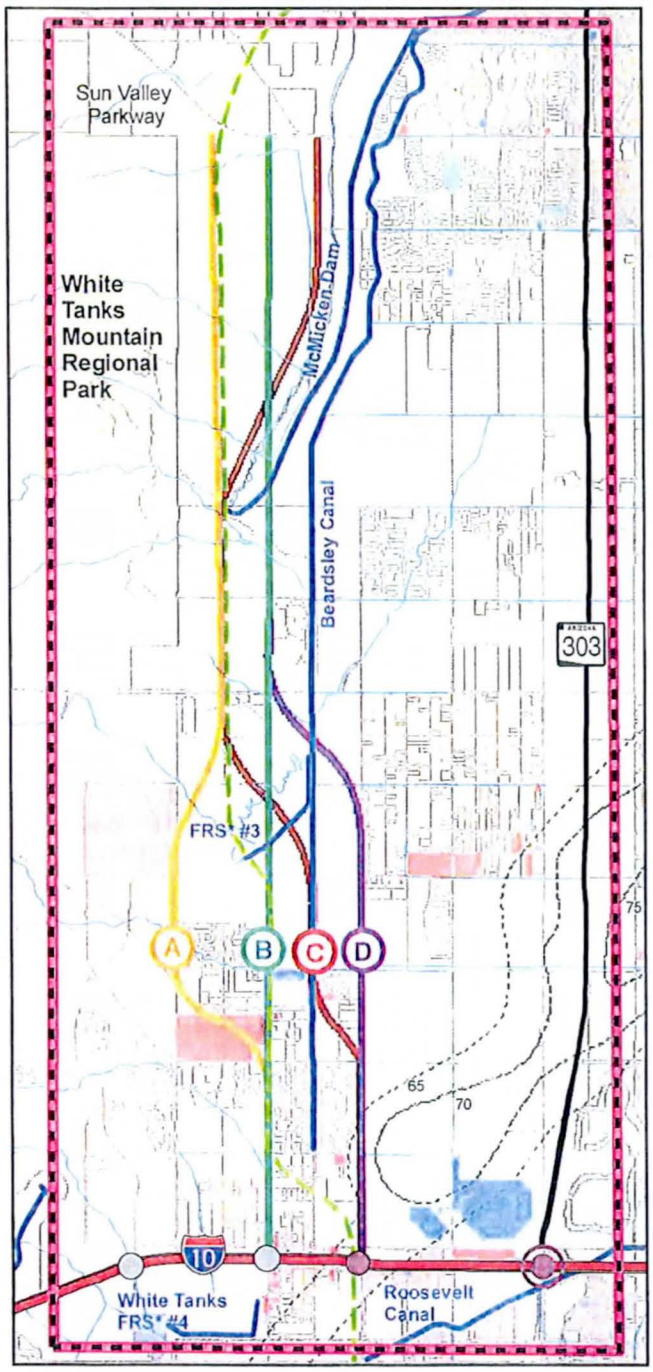
DRAFT

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*June 2007*

# Tier 2: Potential Alternative Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Existing Land Use*

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Developing Residential
- Commercial
- Developing Commercial
- Industrial
- Institutional
- Public Facilities
- Office/Employment
- Open Space
- Agriculture
- Water
- Vacant

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- MAG I-10/ Hassayampa Valley Roadway Framework Study

**DRAFT**

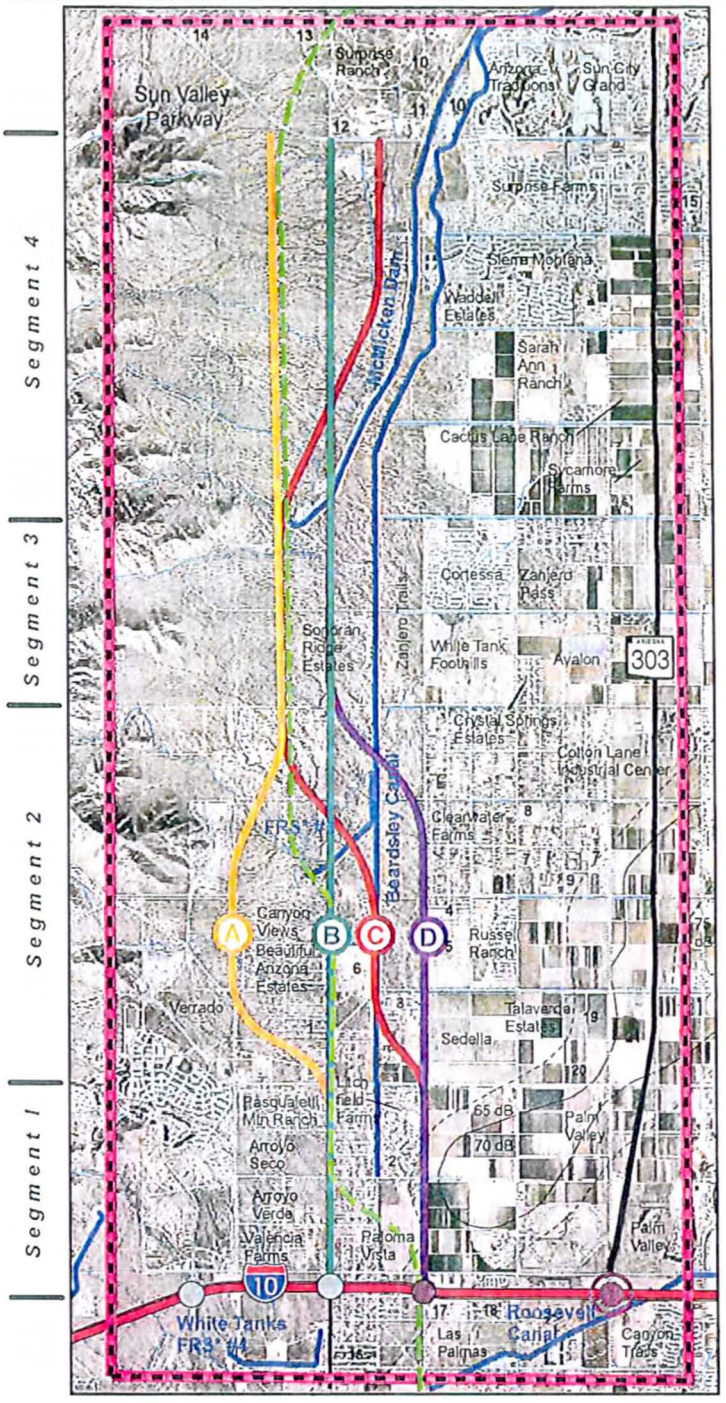
*FRS stands for Flood Retardant Structure

1 0.5 0 1 Miles

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

*October 2007*

# Tier 2: Potential Alternative Corridor Analysis




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

**DRAFT**

1 0.5 0 1 Miles

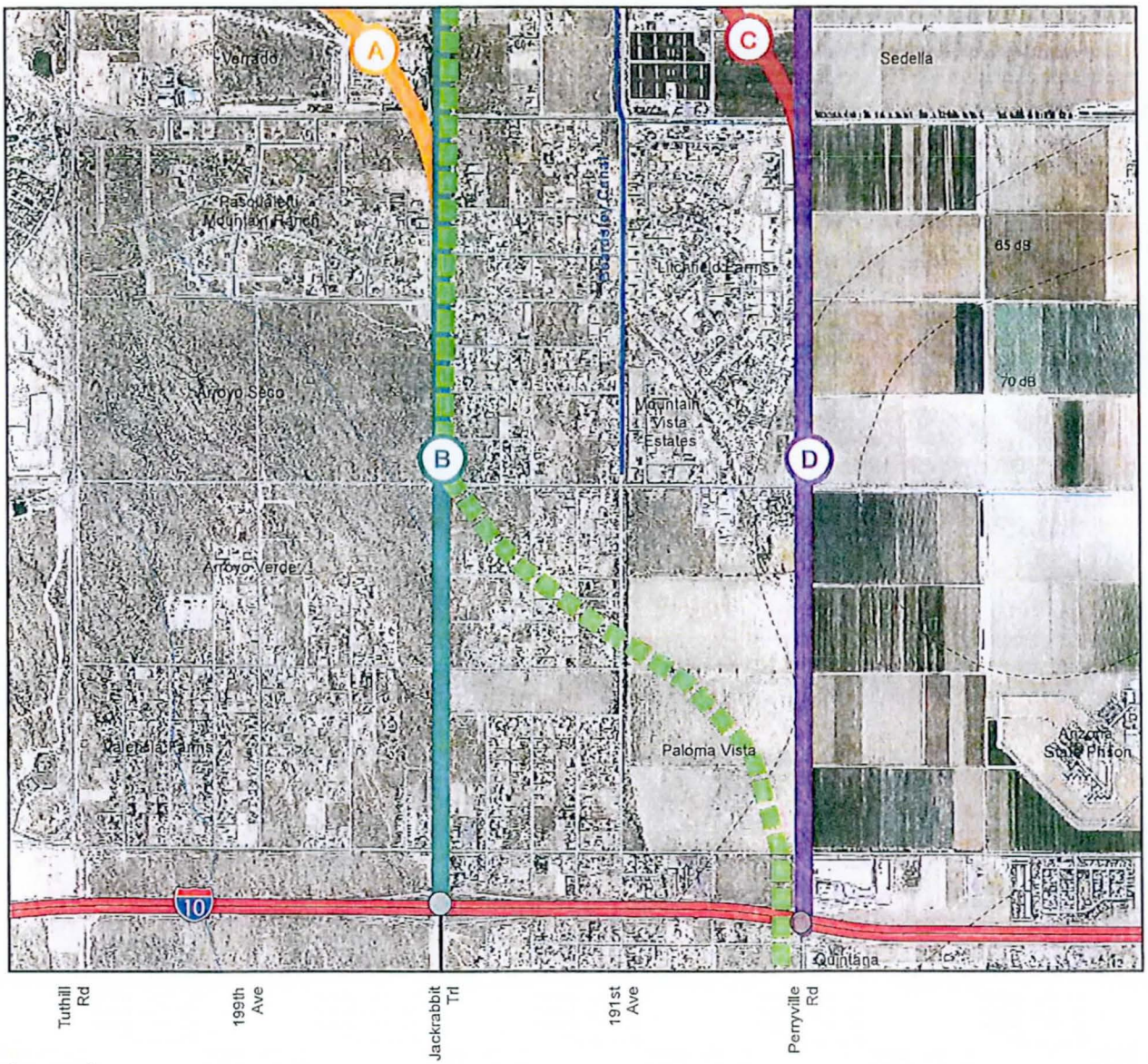
**FRS stands for Flood Retardant Structure*

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 1




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

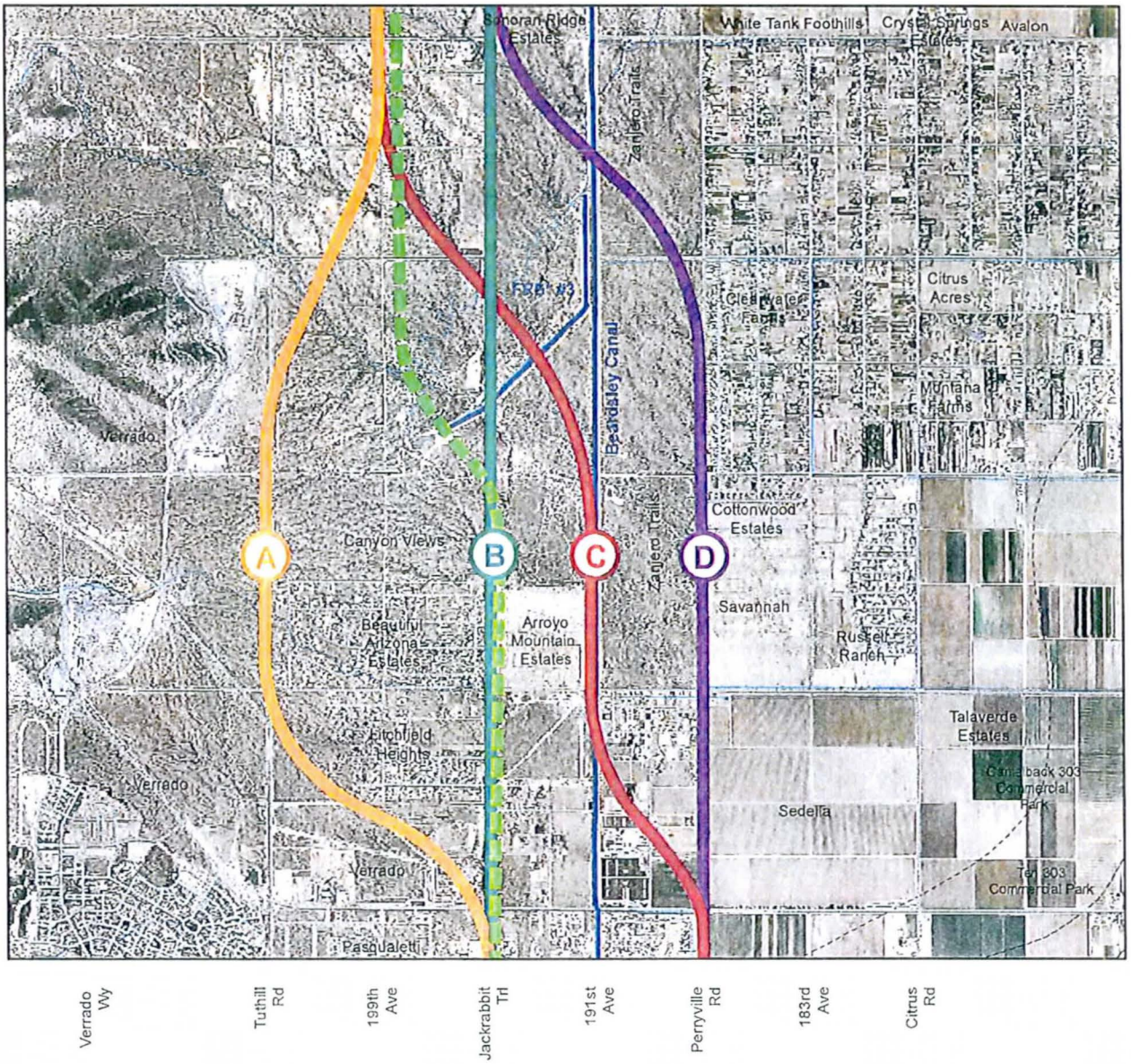
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 2




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

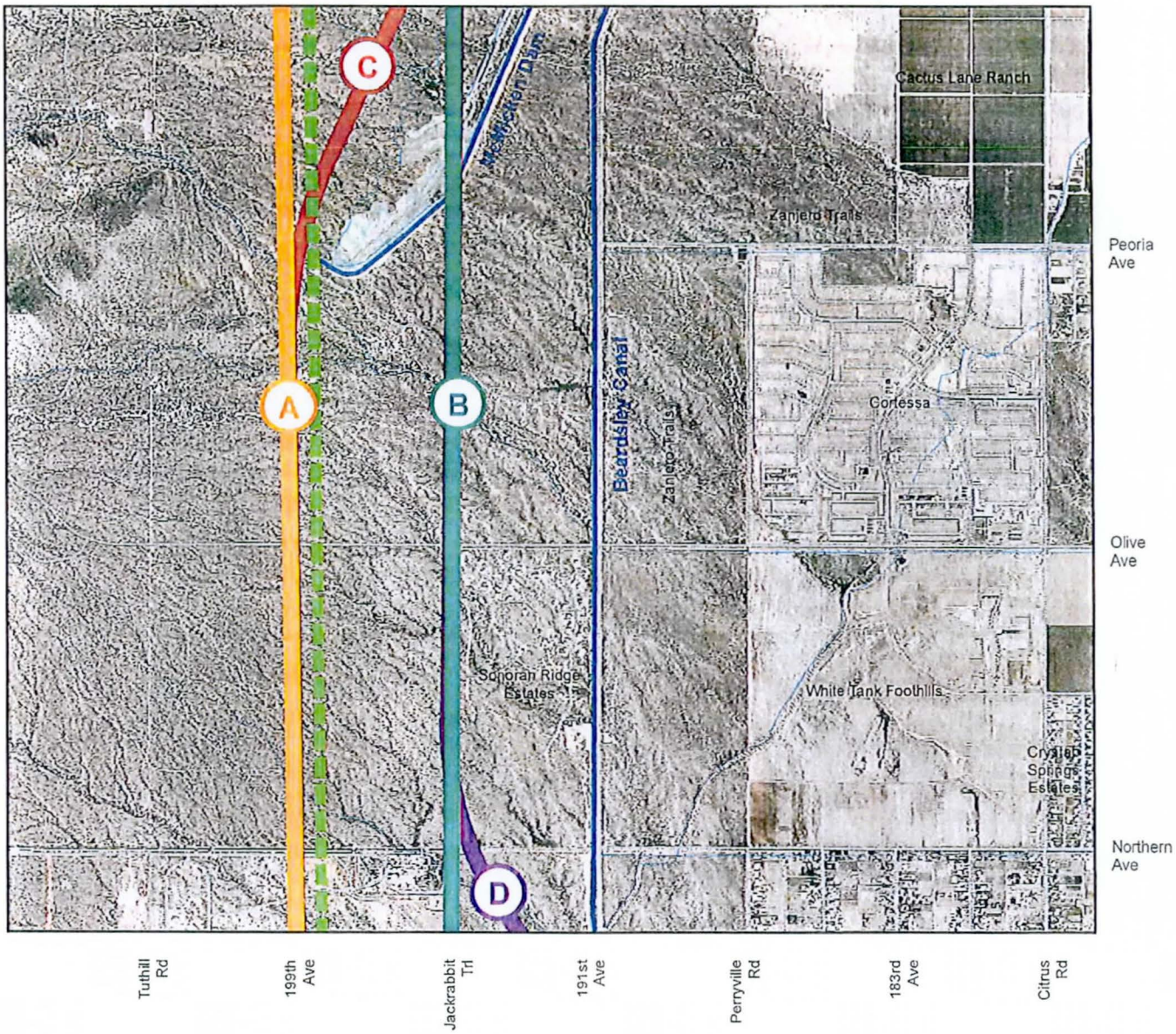
0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 3




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

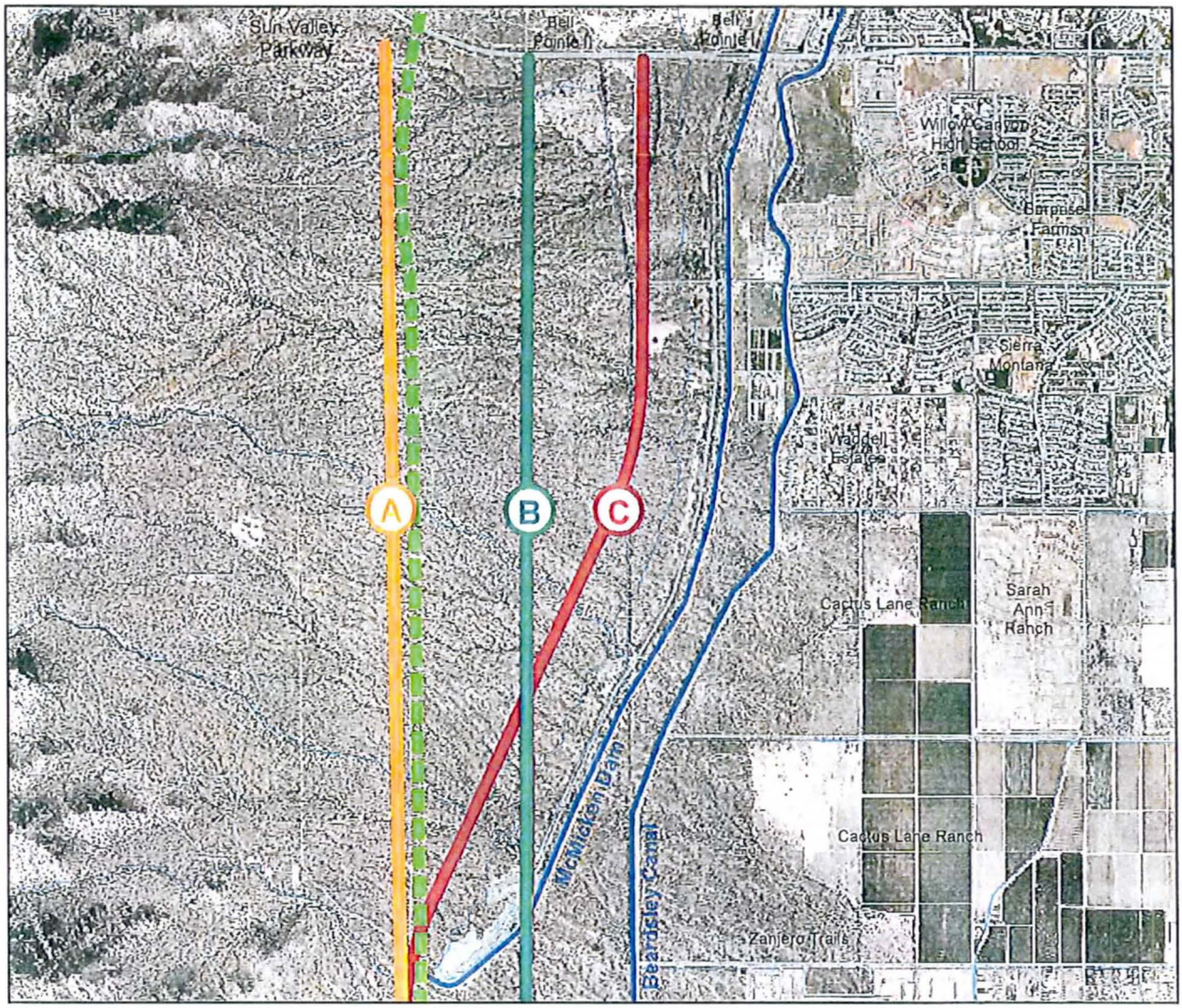
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 4




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 15, 2008

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 14, 2008, Alternatives Evaluation Stakeholder Meeting with Maricopa Water District (MWD) and Flood Control District of Maricopa County (FCDMC)

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meeting that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept and described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Rodney Bragg stated that the preferred alignment crosses the Beardsley Canal at one location- just south of Camelback Road. Glen Vortherms, MWD stated that the project team should contact Dave Maguire from Land Solutions Inc. to incorporate the plans for Zanjero Trails. Mike Greenslade, FCDMC apprised the project team about the status of the FRS #3 Rehabilitation Project and stated that the Phase 1 of the project was under construction and Phase two was in 60% design stage anticipated to be completed by October 2008. He also informed that the Alternatives C and D as shown on the map would be crossing potential earth fissure risk zones, and Alternatives B & C would cut off the reservoir from the emergency spillway. He emphasized that the team's drainage analysis would have to mitigate these issues. The FCDMC modeling indicates that these areas have the potential to develop earth fissure zones, though they are not there at present. Mike Greenslade also informed the attendees subsidence has also occurred at both FRS #3 and McMicken Dam.

Rodney Bragg inquired if there was any work being done on the FRS #3 outlet channel. Valerie Swick informed the attendees that the appraisers were currently looking at the prospects of acquiring the first row of lots along the west side of Jackrabbit Trail to settle the right-of-way issues, the report for which is expected by the end of February to mid-march 2008 timeframe. Mike Greenslade also informed the team the Maricopa County Parks and Recreation Department was planning a trailhead staging area at the south end of the McMicken Dam and reiterated the importance of avoiding conflict between pedestrian, equestrian and vehicular movements. He also indicated that the alternative for the dam would be available by March-April 2008 and could present MCDOT with a partnering opportunity. He also indicated that the district was aware of the City of Surprise Transportation Plan and realized that sometime in the future the east-west arterial streets would have to cross over the dam. Mike Greenslade also mentioned that the area has significant archaeological sites.

Mike Greenslade expressed his concerns about the parkway facility crossing the FRS #3 and stated that the south option would have less potential impact to the structure and that would be to FCDMC. Rodney Bragg also stated that the current horizontal curves drawn for the preferred alternative just barely meet the parkway design speed. He also inquired if the MWD had any concerns regarding canal crossings. MWD expressed that a bridge crossing should be used whenever the canal has to be crossed. Javier Guana inquired if the bridge crossing had to be at-grade. Glen Vortherms stated that that was entirely dependent on the

design but the freeboard operation and maintenance would need to be met. Javier Guana also inquired if there would be any objections if the alignment of the Beardsley Canal was modified or encased. Glen Vortherms stated that the alignment modification could be considered but not desirable and encasing would bring in maintenance issues. Bob Darr inquired how the western extension of Northern Avenue would tie in with this network. Rodney Bragg stated that all section lines would connect and tie into the Jackrabbit Trail facility. He also mentioned that based on this discussion, the south option of Alternative C seemed to be the path of least resistance. Mike Greenslade concurred and also reiterated the chances for a partnering opportunity since this study would tie in very well with the channel design and also with the McMicken Dam. Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 14, 2008: 1 PM to 3 PM***
***Maricopa Water District***
***14825 W. Grand Avenue***
***Surprise, AZ 85374***

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
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Bob DARR rdarr@glendalea.com 623-930-2942

LUKE ALBERT LUKE.ALBERT@GOODYEARAZ.GOV 623-882-7519

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 15, 2008

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 10, 2008, Alternatives Evaluation Stakeholder Meeting with Arizona State Land Department (ASLD) and Arizona Department of Corrections

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

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Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meetings that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept. Ruben Ojeda mentioned that the state land property east of the proposed parkway would need access as well, and maybe another frontage road on the east would be feasible. He also informed that there were a few irrigation wells on the state land property sub-leased to Sunfresh Farms by the Department of Corrections, which will have to be taken into account. Warren Davis informed the attendees that the State Prison at Perryville had no expansion plans on the west side of their property.

Rodney Bragg described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Gordon Taylor and Ruben Ojeda said that the ASLD would prefer to sweep around the FRS #3 and thus, the southern option was preferred. Woody Scoutten and Brian Rose mentioned that Canyon Views, a planned development at the intersection of Bethany Home Road and Jackrabbit Trail will be impacted by this option and thus Buckeye would support the northern option. Woody Scoutten also mentioned that Canyon Views was still in the rezoning stage.

While discussing the northern part of the corridor, both Ruben Ojeda and Gordon Taylor felt that the current corridor minimized impacts to the ASLD property. Since the proposed alternative is about 600 feet to 1800 feet west of the floodpool of the McMicken Dam, Randy Overmyer mentioned that if we push the facility further west, then other east-west arterials would have to be extended that extra distance. The project team was trying to minimize the infrastructure footprint on the ASLD property. Randy Overmyer said that the City of Surprise was supportive of the current preferred alignment for the parkway corridor. He also mentioned that the City of Surprise wants to protect enough right-of-way for the connection of Jackrabbit Trail with Bell Road based on the traffic volumes. Gordon Taylor expressed that the ASLD engineering department would also like to take a look at the intersection of Jackrabbit Trail and Bell Road/Sun Valley Parkway.

Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and stated that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders such as Flood Control District, Maricopa Water District, Litchfield Park Elementary School District, etc. the project team will finalize the layout of the

proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 10, 2008: 2 PM to 4 PM***
***MCDOT Navajo Conference Room***
***2901 W. Durango, Phoenix, Arizona 85009***

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sadekar | mansi.sadekar@dmjmharris.com | 602-337-2652 |
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| RUBEN OJEDA | ROJEDA@LAND.AZ.GOV | (602) 542-2648 |
| GORDON TAYLOR | gtaylor@land.az.gov | 602 542 2647 |
| Randall Overmyer | Randall.Overmyer@Surprise-az.com | 623-222-3290 |

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## MEETING MINUTES

Date: January 29, 2008

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 10, 2008, Alternatives Evaluation Stakeholder Meeting with Litchfield Park Elementary School District #79

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. Rodney Bragg mentioned that the purpose of this study was to establish a footprint and accordingly protect right-of-way. Ernest Rubi informed the attendees about the connection of this study with the larger MAG I-10/Hassayampa Valley Roadway Framework Study and emphasized that this corridor study was looking to establish a connection between Bell Road and I-10 east of the White Tank Mountains. Rodney Bragg provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meetings that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg mentioned that there were a couple of key form-givers in this study- Zanjero Trails, a master planned community that goes all the way from Camelback Road till Bell Road; and the property owned by the Arizona State Land Department (ASLD), which the department intends to auction at some point in the future. Rodney Bragg then walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept. Ken Axford stated the attendees that the Scott Libby Elementary School currently uses Thomas Road as an entry access and Perryville Road as an exit for the parents, and buses use Perryville Road alone. The current bus turnaround is a problem and the school district is working on improving the circulation system. He also stated that the district owns the land north of Encanto Boulevard and plans additional facilities possibly over the next ten years. Ken Axford inquired about the future traffic interchange on Perryville Road with I-10 as it had been shown on the map (See attached). Rodney Bragg informed the attendees that this interchange is funded under Prop 400.

Ken Axford inquired about the access control on Perryville Road and its connection with the future parkway facility. Rodney Bragg stated that the parkway facility typically has more access control than an arterial and less than a freeway. Thus, there would be limited direct driveways on to the facility. Dave Gourlay inquired if stop signs, traffic lights or ramps would be used to achieve this access control. Rodney Bragg told the attendees that in order to have more capacity on the roadway, there would be very few median openings and a combination of traffic lights and stop signs could achieve that desired level of access control. Ken Axford reiterated that the school district would have no objections to the improvements as long as connection and access to Thomas Road was ensured in the plans. Dave Gourlay also mentioned that the school district would be supportive of the proposed alternative as long as there was enough buffer between this high-level facility and the school premises. Ken Axford informed the attendees that the school district was planning to shift the main entrance to the school from Perryville Road to Thomas Road.

Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 29, 2008: 1 PM to 2:30 PM***
***Litchfield Elementary School District #79***
***553 Plaza Circle Litchfield Park, AZ 85340***

**SIGN-IN SHEET**

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|---|---|---|
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| DAVID GOURLAY | GOURLAY@LESD.K12.AZ.US | 623-535-6075 |
| K. AXFORD | AXFORD@LESD.K12.AZ.US | 623.535.6016 |
| Rodney Bragg | rodney.bragg@dmjmharris.com | 602.337.2617 |
| Ernest Russi | | 602-506-1015 |

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

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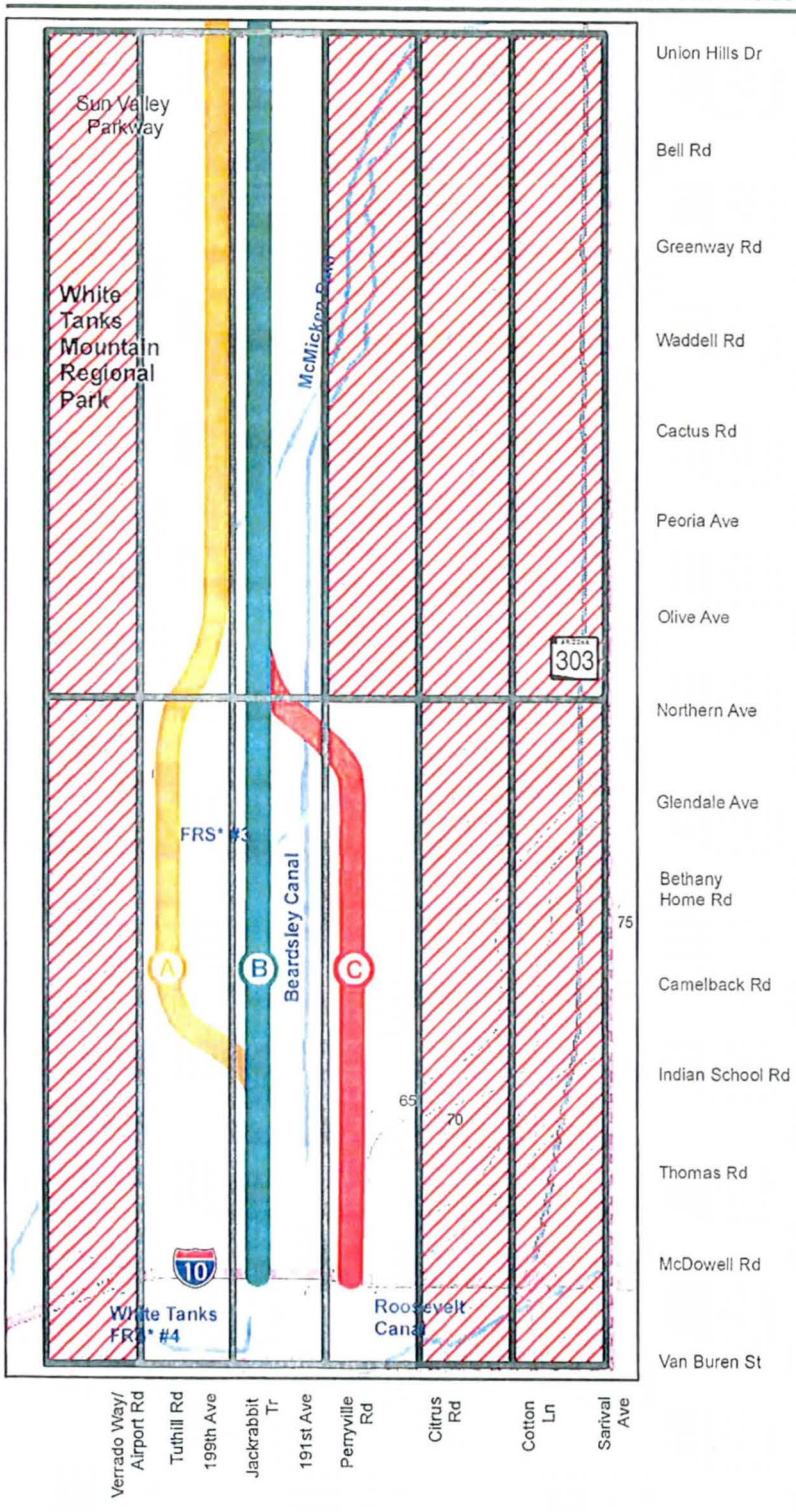
| Jennifer Toth | jennifer.livingston@dmjmharris.com | 602-337-2516 |
| ERNEST RUBI | ERNESTRUBI @ MAIL.MARICOPA.GOV | 602-506-1049 |
| WOODY SCOUTTEN | WOODY@SCOUTTEN.COM | 623-547-4661 |
| JAVIER GUANA | jguana@azdes.us | 602-374-7119 |
| Valerie Swick | vas@mail.maricopa.gov | (602) 506-2929 |
| Rodney Bragg | rodney.bragg@dmjmharris.com | (602) 337-2617 |
| Randy Overmyer | Randall.overmyer@surpriseaz.com | 480.225.2309 |
| DAN MARUM | Wilson & Company dan.marum@wilsonco.com | 602 283-2702 |
| JOHN MCNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

# Tier 2: Potential Alternative Corridors in Selected Zones




## Legend

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

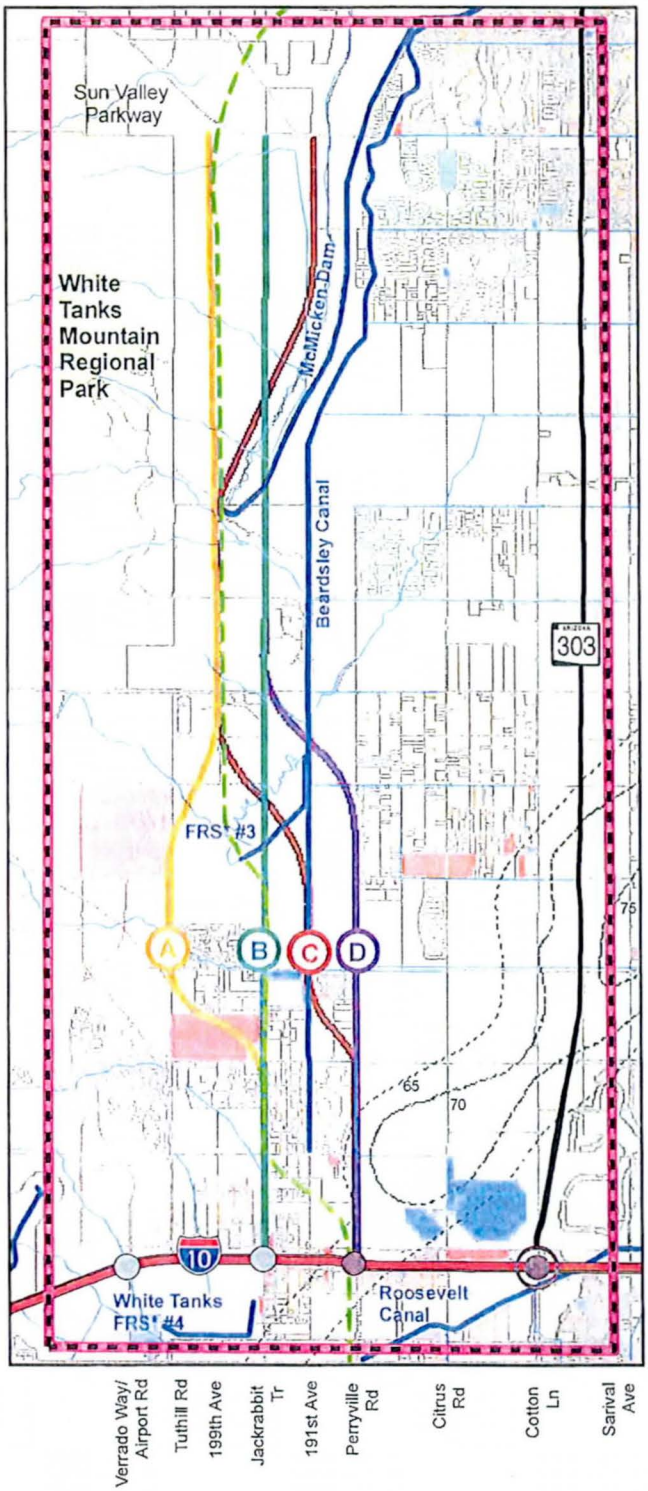
DRAFT

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

June 2007

# Tier 2: Potential Alternative Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Existing Land Use*

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Developing Residential
- Commercial
- Developing Commercial
- Industrial
- Institutional
- Public Facilities
- Office/Employment
- Open Space
- Agriculture
- Water
- Vacant

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- MAG I-10/ Hassayampa Valley Roadway Framework Study

DRAFT

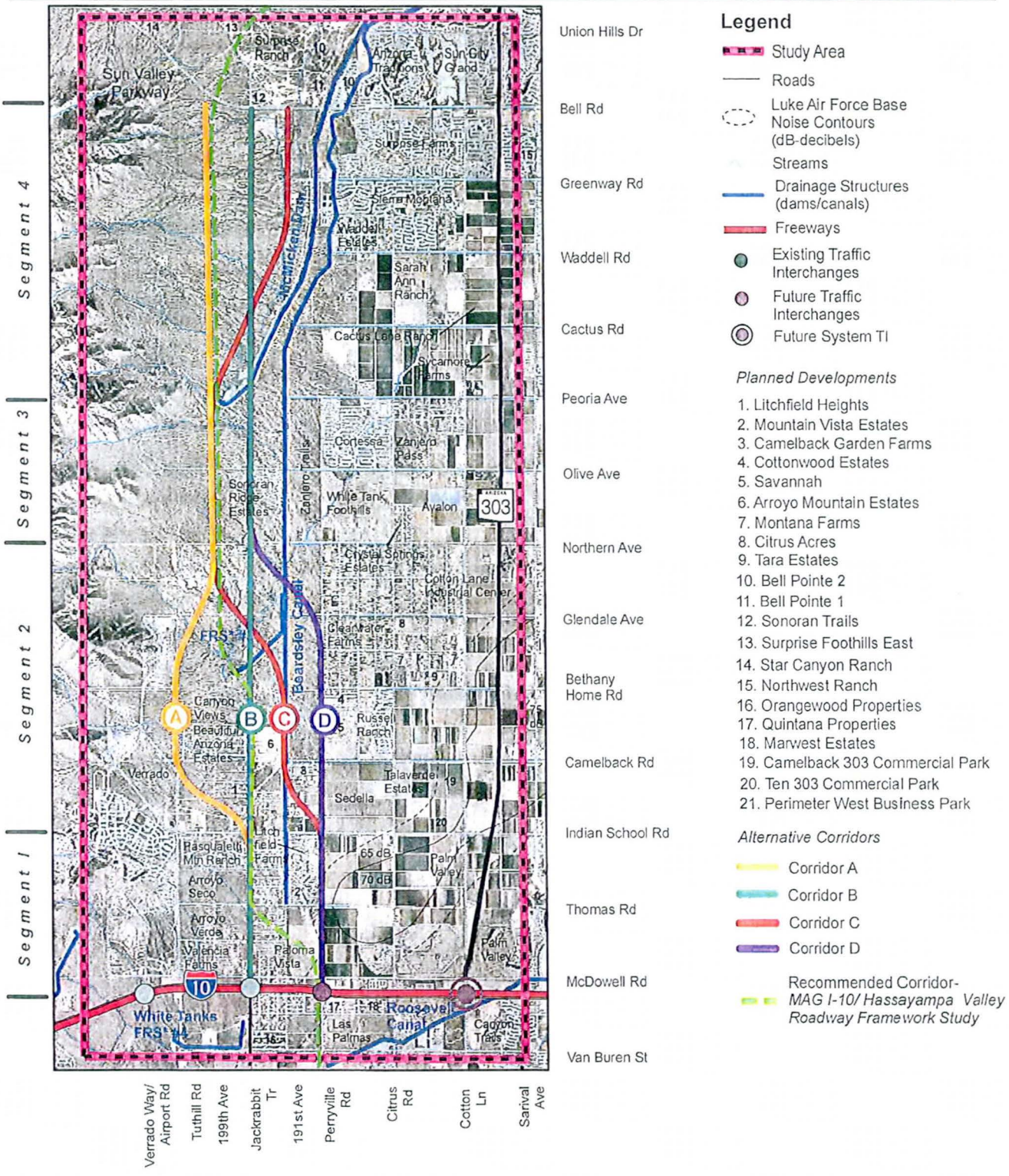
*FRS stands for Flood Retardant Structure

1 0.5 0 1 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*October 2007*

# Tier 2: Potential Alternative Corridor Analysis




*FRS stands for Flood Retardant Structure

DRAFT

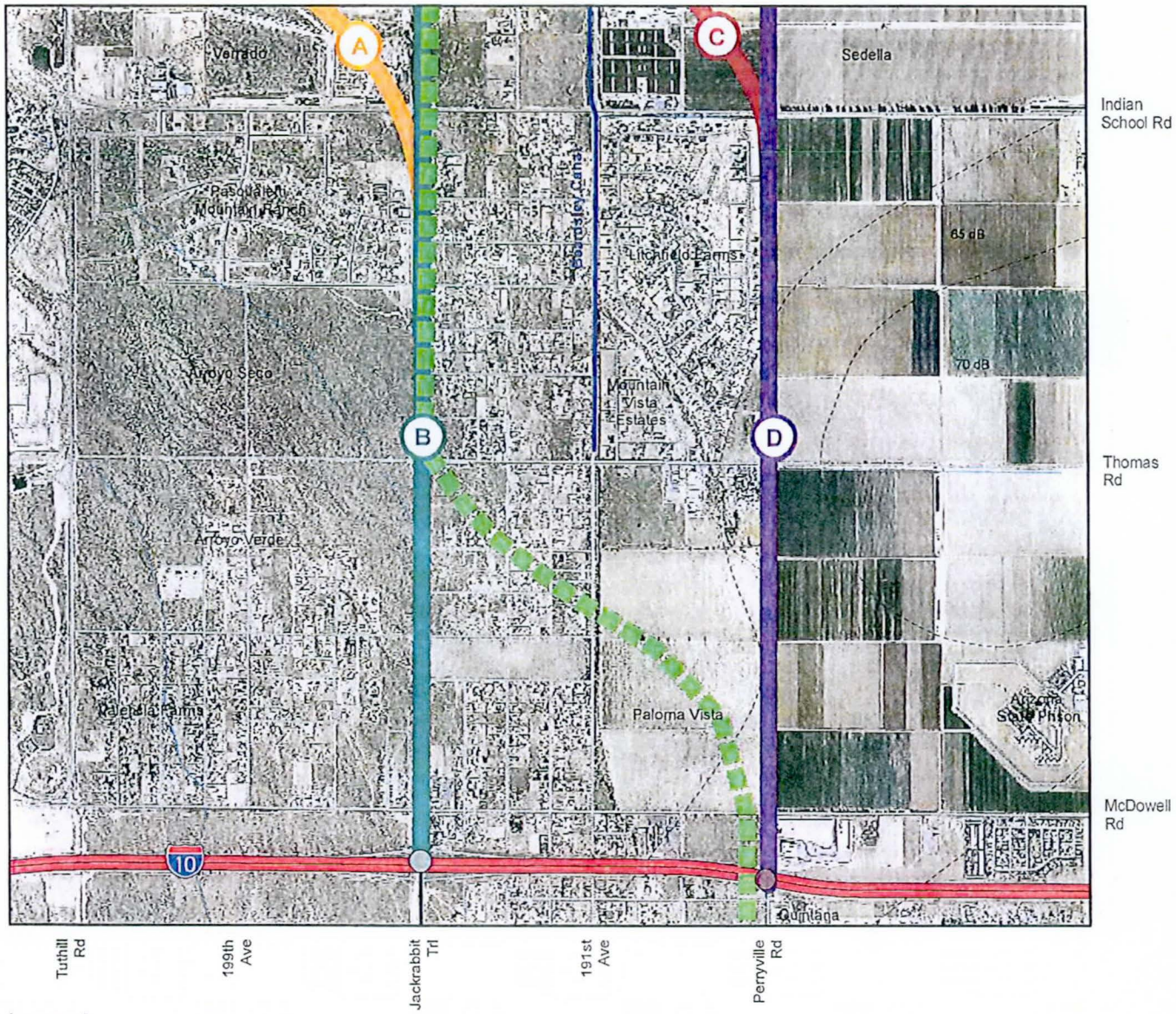
1 0.5 0 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

## Jackrabbit Trail Access Control and Corridor Improvement Study
### *Interstate-10 to Bell Road*

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 1




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

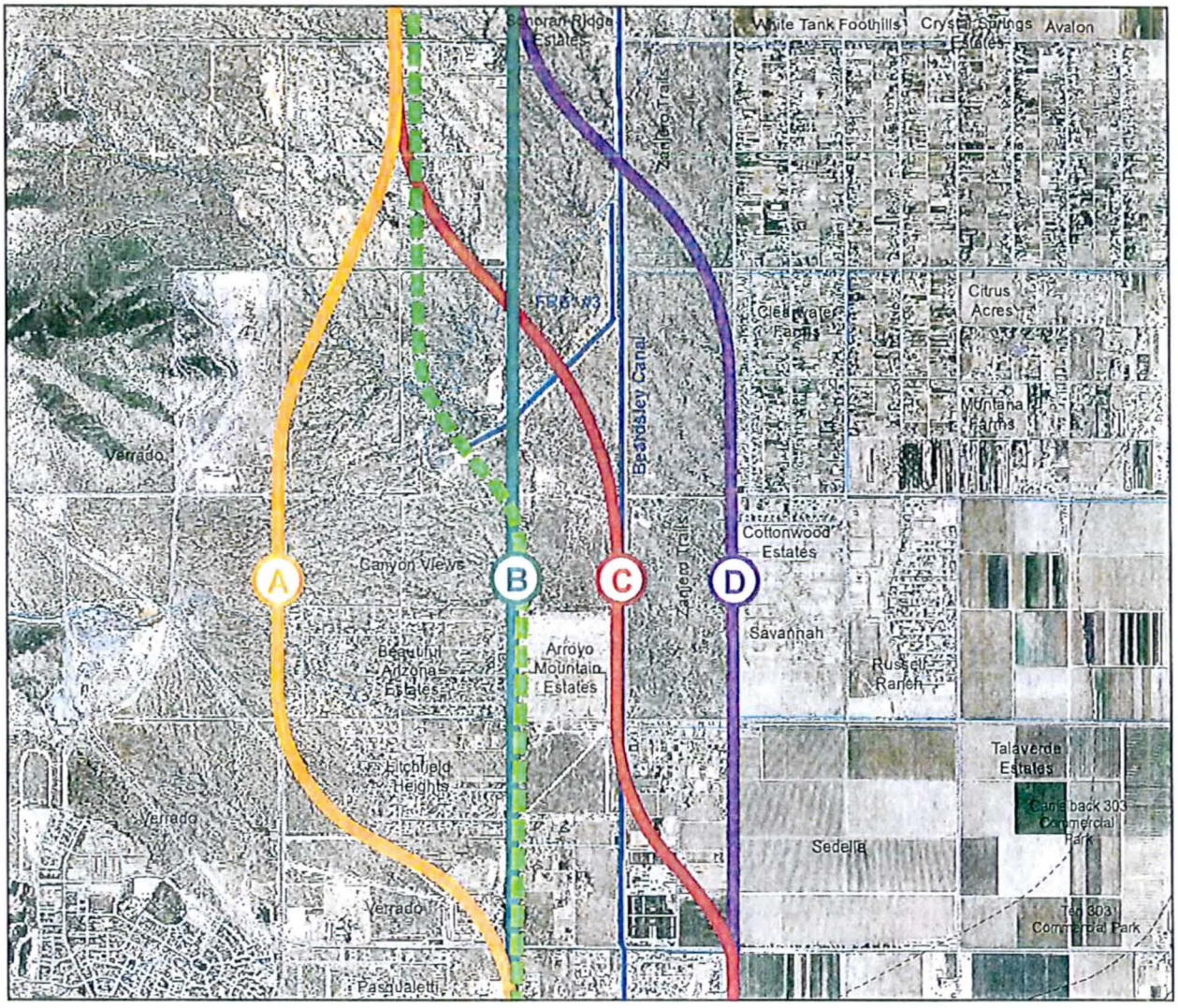
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 2




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

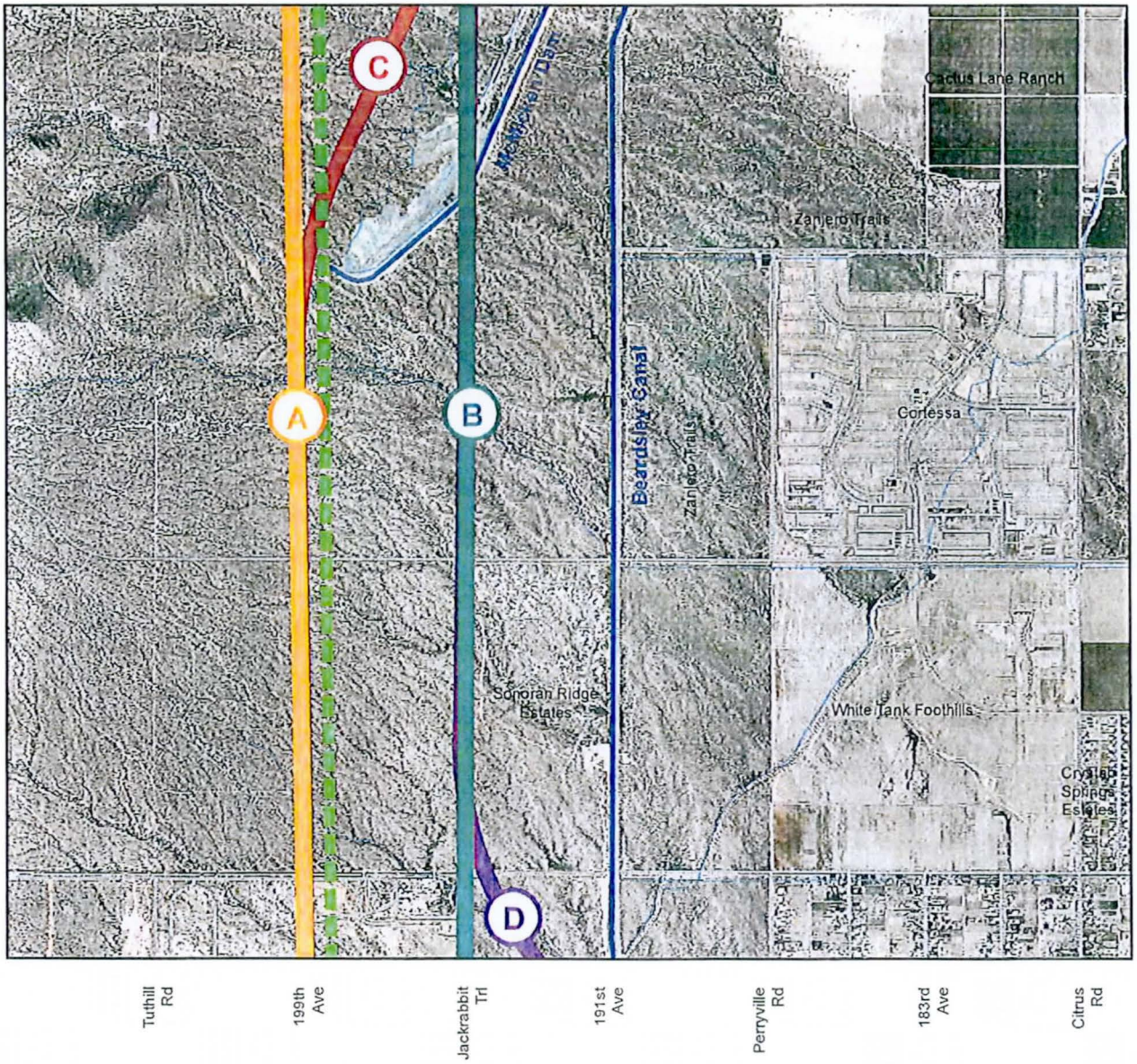
0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

## Tier 2: Potential Alternative Corridor Analysis-Segment 3




**Legend**

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

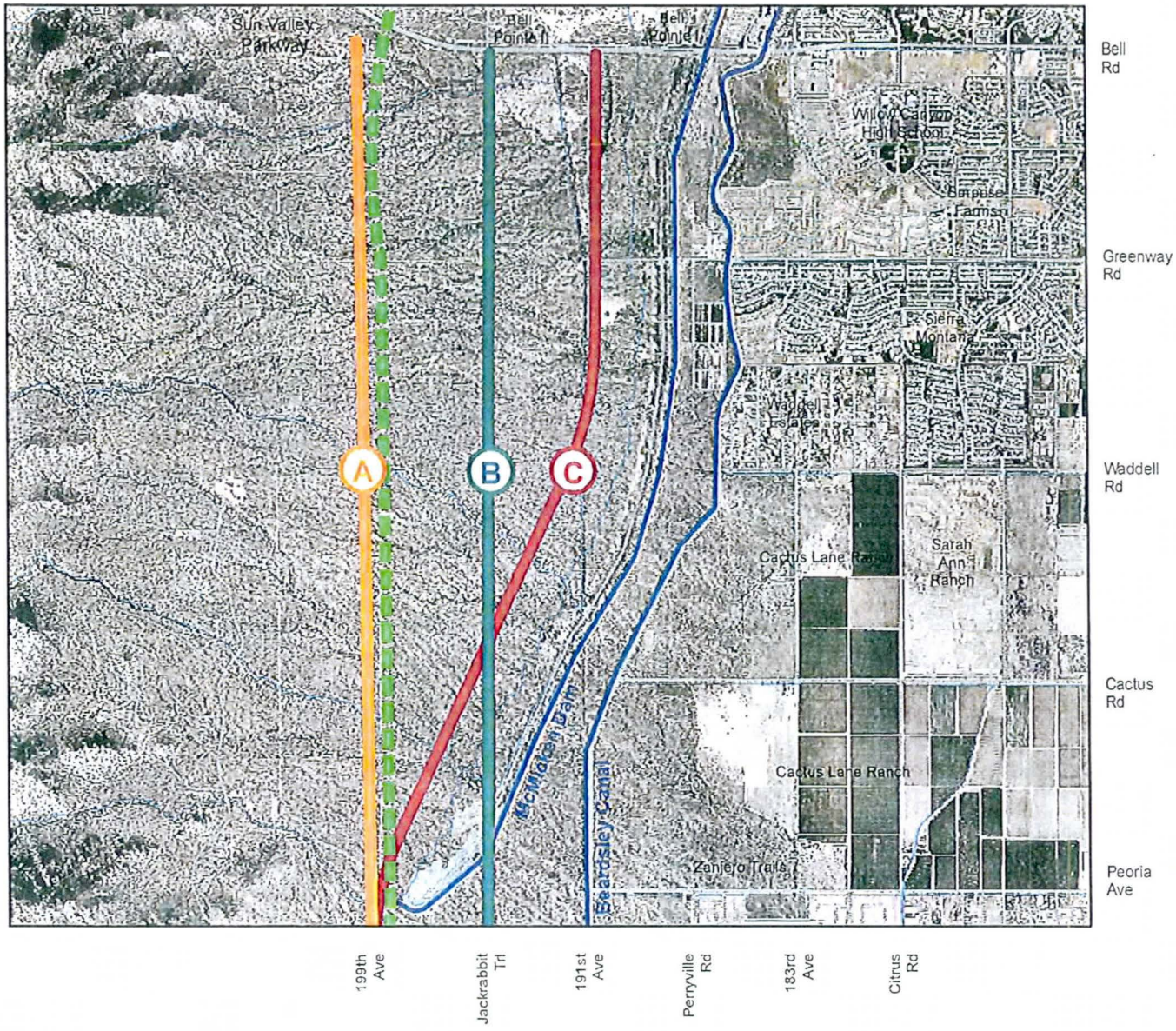
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 4




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

| | |
|---|---|
| Date: | January 15, 2008 |
| To: | Ernest Rubi, Project Manager, MCDOT |
| From: | Jennifer Livingston, Project Manager, DMJM Harris |
| Re: | Jackrabbit Trail Access Control and CIS |
| Subject: | January 14, 2008, Alternatives Evaluation Stakeholder Meeting with Maricopa Water District (MWD) and Flood Control District of Maricopa County (FCDMC) |
| Attendees: | See attached sign-in sheet |

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meeting that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept and described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Rodney Bragg stated that the preferred alignment crosses the Beardsley Canal at one location- just south of Camelback Road. Glen Vortherms, MWD stated that the project team should contact Dave Maguire from Land Solutions Inc. to incorporate the plans for Zanjero Trails. Mike Greenslade, FCDMC apprised the project team about the status of the FRS #3 Rehabilitation Project and stated that the Phase 1 of the project was under construction and Phase two was in 60% design stage anticipated to be completed by October 2008. He also informed that the Alternatives C and D as shown on the map would be crossing potential earth fissure risk zones, and Alternatives B & C would cut off the reservoir from the emergency spillway. He emphasized that the team's drainage analysis would have to mitigate these issues. The FCDMC modeling indicates that these areas have the potential to develop earth fissure zones, though they are not there at present. Mike Greenslade also informed the attendees subsidence has also occurred at both FRS #3 and McMicken Dam.

Rodney Bragg inquired if there was any work being done on the FRS #3 outlet channel. Valerie Swick informed the attendees that the appraisers were currently looking at the prospects of acquiring the first row of lots along the west side of Jackrabbit Trail to settle the right-of-way issues, the report for which is expected by the end of February to mid-march 2008 timeframe. Mike Greenslade also informed the team the Maricopa County Parks and Recreation Department was planning a trailhead staging area at the south end of the McMicken Dam and reiterated the importance of avoiding conflict between pedestrian, equestrian and vehicular movements. He also indicated that the alternative for the dam would be available by March-April 2008 and could present MCDOT with a partnering opportunity. He also indicated that the district was aware of the City of Surprise Transportation Plan and realized that sometime in the future the east-west arterial streets would have to cross over the dam. Mike Greenslade also mentioned that the area has significant archaeological sites.

Mike Greenslade expressed his concerns about the parkway facility crossing the FRS #3 and stated that the south option would have less potential impact to the structure and that would be to FCDMC. Rodney Bragg also stated that the current horizontal curves drawn for the preferred alternative just barely meet the parkway design speed. He also inquired if the MWD had any concerns regarding canal crossings. MWD expressed that a bridge crossing should be used whenever the canal has to be crossed. Javier Guana inquired if the bridge crossing had to be at-grade. Glen Vortherms stated that that was entirely dependent on the

design but the freeboard operation and maintenance would need to be met. Javier Guana also inquired if there would be any objections if the alignment of the Beardsley Canal was modified or encased. Glen Vortherms stated that the alignment modification could be considered but not desirable and encasing would bring in maintenance issues. Bob Darr inquired how the western extension of Northern Avenue would tie in with this network. Rodney Bragg stated that all section lines would connect and tie into the Jackrabbit Trail facility. He also mentioned that based on this discussion, the south option of Alternative C seemed to be the path of least resistance. Mike Greenslade concurred and also reiterated the chances for a partnering opportunity since this study would tie in very well with the channel design and also with the McMicken Dam. Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 14, 2008: 1 PM to 3 PM***
***Maricopa Water District***
***14825 W. Grand Avenue***
***Surprise, AZ 85374***

**SIGN-IN SHEET**

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| ERNEST RUBI | ERNESTRUBI@MAIL.MARICOPA.GOV | 602-506-1049 |
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| Javier Guana | jguana@ardes.us | 602-374-7119 |
| Don Breeding | donb@mwdaz.com | 623-546-8266 |
| Veronica Valenzuela | veronicav@mwdaz.com | 623-546-8266 |
| Chris Cain | Chrisc@mwdaz.com | 623/546-8266 |
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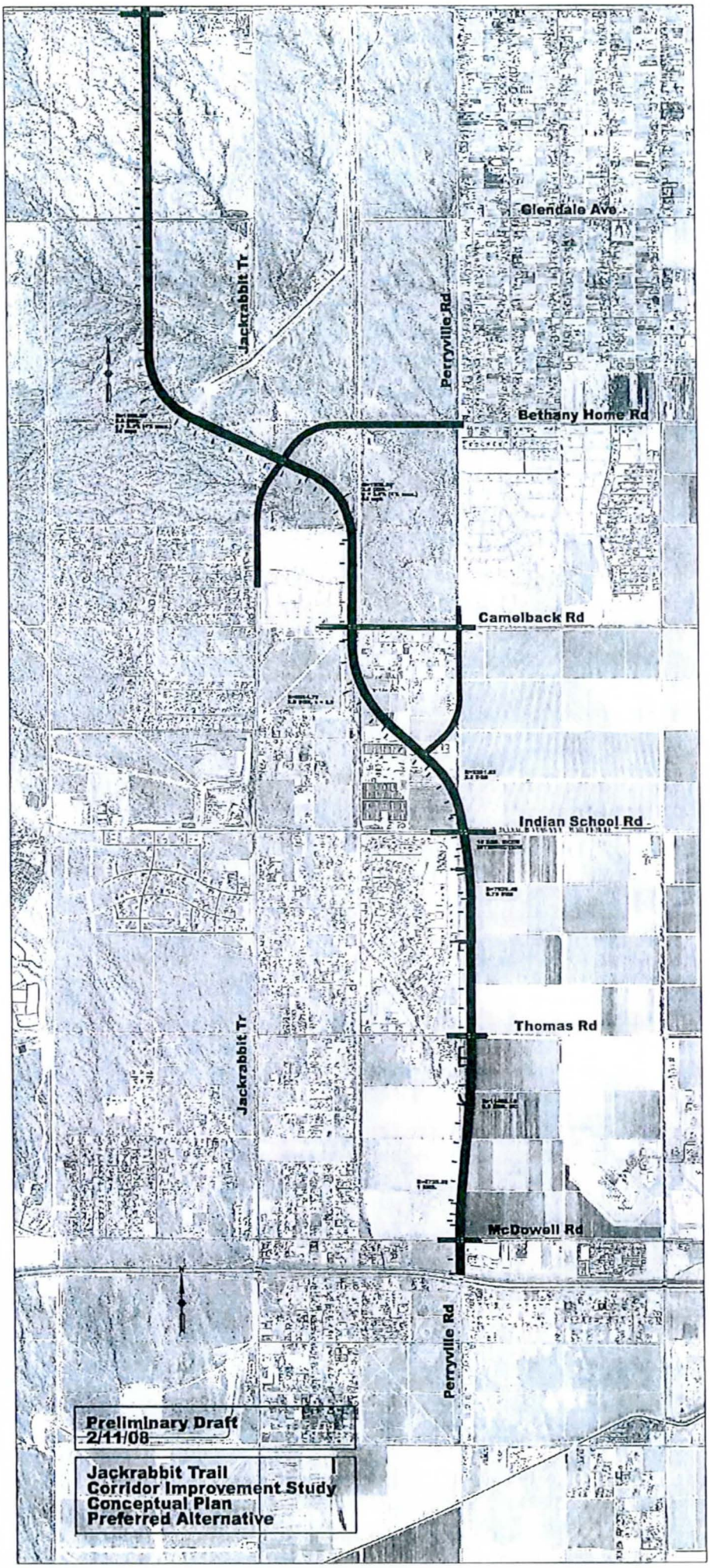
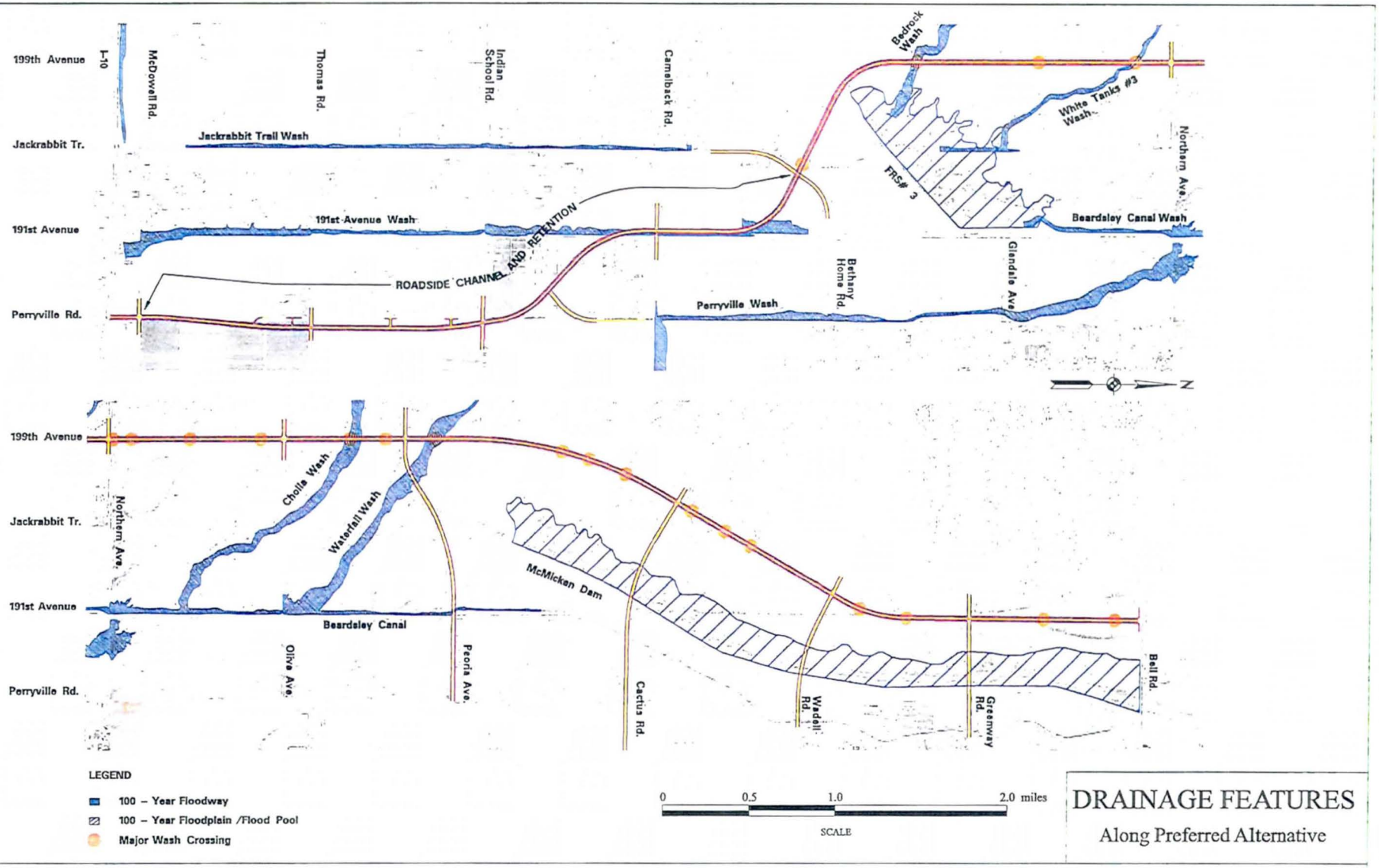
| Allan Zimmerman | azimmermg@azcorrections.gov | 602/509-0104 |
| BRIAN ROSE | brose@buckeyeaz.gov | 623-349-6208 |
| Mike Greenslade | mdg@mail.maricopa.gov | 602-506-5426 |

Bob DARR rdarr@glendale.az.com 623-930-2942

LUKE ALBERT LUKE.ALBERT@GOODYEARAZ.GOV 623-882-7519

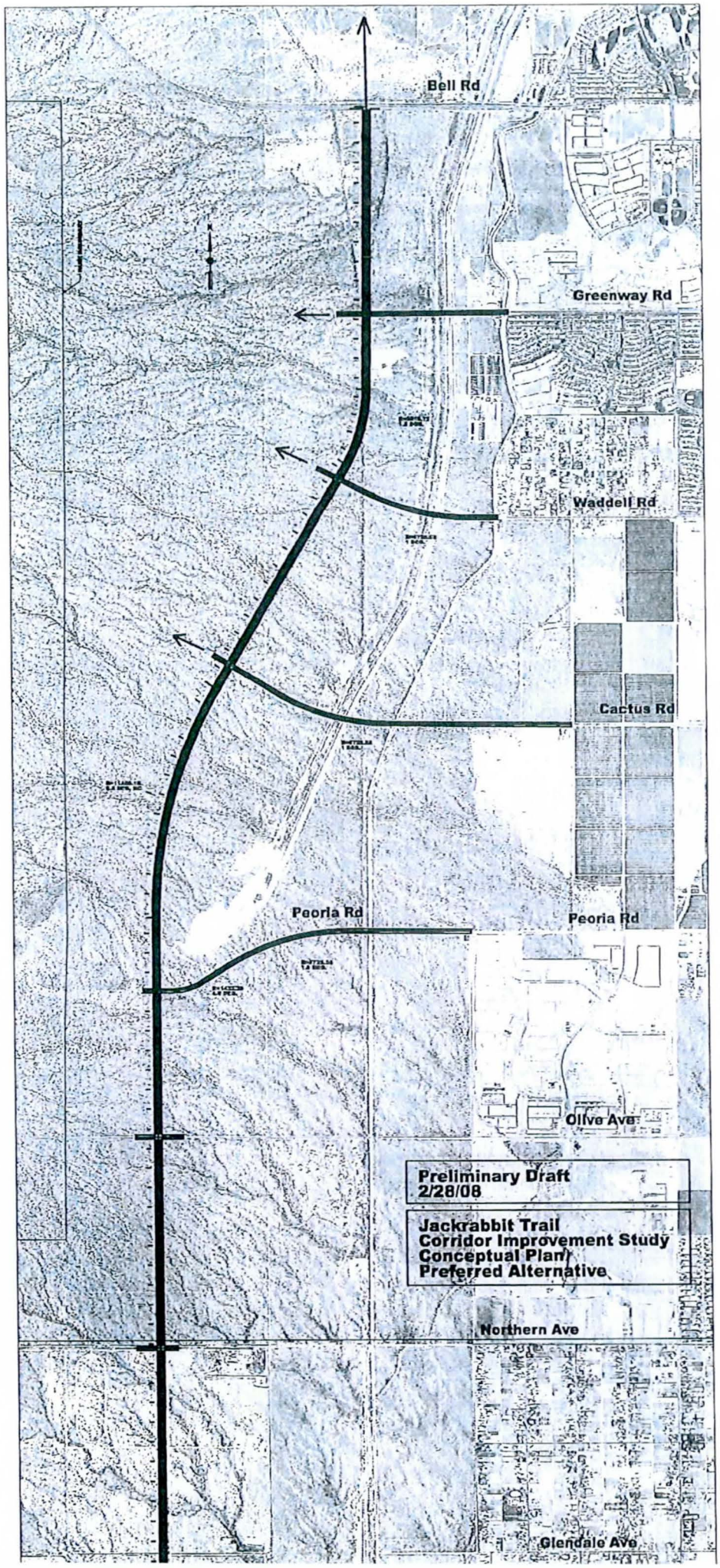

Glendale Ave
Jackrabbit Tr
Perryville Rd
Bethany Home Rd
Camelback Rd
Indian School Rd
Jackrabbit Tr
Thomas Rd
McDowell Rd
Perryville Rd
Preliminary Draft
2/11/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative




# DRAINAGE FEATURES
Along Preferred Alternative

Jackrabbit Trail, I-10 to Bell Road
Access Control and Corridor Improvement Study

Andes Engineering


Bell Rd
Greenway Rd
Waddell Rd
Cactus Rd
Peoria Rd
Peoria Rd
Olive Ave
Preliminary Draft
2/28/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative
Northern Ave
Glendale Ave

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## Stakeholder Advisory Committee Meeting #4-Agenda

*March 5, 2008: 2 PM to 3:30 PM*
*MCDOT Apache Conference Room*
*2901 W. Durango*
*Phoenix, Arizona 85009*

- Introductions
- Study Process
- Alternative Screening Process
- Summary of Tier 1 and Tier 2 Evaluation
- Summary of Public Meeting in November 2007
- Summary of Meetings with Key Stakeholders
- Preferred Alignment Concept
- Drainage Features
- Traffic Volumes Analysis
- Next Steps
    - Public Meeting- March 12, 2008
    - Technical Memorandum #6- March 2008
    - Draft Report in May 2008 including-
        - Design Features of Preferred Alignment
        - Access Management
        - Phasing & Implementation
        - Final Report- June 2008
- Questions

Evaluation of Tier 2 Corridors

DRAFT

| No. | Criteria | Segment 1: I-10 to Indian School Rd | | | | Segment 2: Indian School Rd. to Northern Ave. | | | | Segment 3: Northern Ave. to Peoria Ave. | | | | Segment 4: Peoria Ave. to Bell Rd. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D | Corridor A | Corridor B | Corridor C | Corridor D |
| 1 | ROW needed to be acquired in relation other alternatives within the segment | | ● | | ● | ● (Potential Building Displacement) | ◑ (Potential Building Displacement) | ● (Potential Building Displacement) | ◑ (Potential/future development) | ◑ | ◑ | | | ◑ | ◑ | ◑ | |
| 2 | Compatibility with Existing Developments | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side) | ◑ (Two developments impacted) | ● (Existing development on both sides of corridor) | ○ (Minimum impact to existing development) | ◑ (Existing development on east side) | ○ | ● (Sonoran Ridge Estates) | | | ● (Proximity to White Tanks) | ◑ | ○ | |
| 3 | Compatibility with Planned Future Developments | | ◑ (Planned developments on both sides of corridor) | | ○ (State lands on east side of corridor) | ● (Verrado and Canyon Views) | ◑ (Canyon Views and Zanjero Trails) | ◑ (Canyon Views and Zanjero Trails) | ● (Zanjero Trails) | ○ | ◑ (Sonoran Ridge Estates- Phase II) | | | ● (Bisects ASLD land) | ◑ | ○ (Leaves most developable area for State Lands) | |
| 4 | Public Acceptability | | ● (Existing development on both sides of corridor) | | ◑ (Existing development on one side ) | ● (Existing development & future development) | ● (Existing development on both sides of corridor) | ● (FRS #3) | ◑ | ◑ (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● | ◑ | ○ | |
| 5 | Cost | | ○ (Minimum length) | | ○ (Minimum length) | ◑ (Long corridor) | ● (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Canal crossing, FRS #3 Inlet Channel) | ○ | ○ | | | ○ | ● (McMicken Dam crossing) | ◑ (Longer corridor) | |
| 6 | Engineering Complexity & Constructability | | ◑ (Flood Control Channel) | | ◑ (Proposed West Valley South Power Line) | ◑ (Curvature and skewed intersection) | ◑ (FRS #3) | ● (FRS #3, Curvature & skewed intersections) | ◑ (Skewed intersections) | ◑ (Potential Fissure Zone) | ● (Fissure zone) | | | ◑ (Potential Fissure zone) | ● (McMicken Dam crossing) | ◑ (Potential Fissure zone) | |
| 7 | Drainage/ Flood Control | | ◑ (Flood Control Channel) | | ○ | ◑ (Tuthill Dyke) | ● (FRS #3) | ● (FRS #3) | ◑ (FRS #3 Inlet Channel) | ○ | ● (McMicken Dam crossing) | | | ○ | ● (McMicken Dam crossing) | ○ | |
| 8 | Long-Term Regional and Local Transportation Policy | | ○ (Shown in all City and County General Plans) | | ◑ (Proximity to SR 303) | ◑ (Not in General Plan but on section line not compatible with approved Verrado) | ○ (Shown in all City and County General Plans) | ◑ (Not in General Plan but on mid section line) | ● (Not in General Plan and not compatible with approved Zanjero Trails) | ◑ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans) | | | ○ (Consistent with MAG Hassayampa Study) | ○ (Consistent with local plans, City of Surprise) | ◑ (Connects to route north of Bell Road in MCDOT Classification map) | |
| 9 | Accommodation of Forecast Regional Travel Demand | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | ○ | ○ | ○ | |
| 10 | Environmental Considerations | | ◑ (Flood Control Channel) | | ○ (Less impact; proximity to State lands) | ○ (Minor drainage crossings) | ◑ (FRS #3) | ● (Beardsley Canal & FRS #3) | ◑ (Beardsley Canal) | ● (Proximity to White Tanks) | ● (McMicken Dam crossing) | | | ● (Proximity to White Tanks) | ◑ (Flood pool & game crossing) | ◑ (Game crossing) | |
| | Recommendations | Place corridor as east as possible of the existing developments | | | | Place corridor as east as possible of the existing developments | | | | Place corridor as far west as possible with connection to preferred corridor to south | | | | Place corridor west of McMicken Dam and west of flood pool (Alt. C) | | | |

○ Least Significant Impact (Most Desirable)  ◑ Moderate Impact  ● Most Significant Impact (Least Desirable)

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

MCDOT Contract No. 2006-025,
Work Order No. TT005

## MEETING MINUTES

Date: October 16, 2007

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: Stakeholder Workshop on Tier 2 Alternatives Evaluation

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Purpose of Meeting

The purpose of the meeting was to get updates from the various stakeholders, namely, City of Surprise, Town of Buckeye and the Flood Control District of Maricopa County (FCDMC) on their various projects and status of planned developments. In addition, consensus on Tier 2 evaluation of alternatives was also sought.

### III. Stakeholder Updates

The stakeholders were requested to provide updates on the various planned developments and projects within their jurisdiction.

***Buckeye***

Woody Scoutten provided the following information on the planned developments within the Town of Buckeye-

- Canyon Views at the intersection of Bethany Home and Jackrabbit Trail is in rezoning stage. On the northeast corner of the site, a small retail center is zoned with frontage on Jackrabbit Trail.
- Arroyo Seco and Arroyo Verde are in the pre-application process
- Along the
- Mixed use residential is proposed at the northeast corner of Indian School Road and Jackrabbit Trail. A retail shopping center is proposed at the southeast corner of the intersection.
- Verrado is in the final platting stage along the high school. Only some areas have their final plats ready.
- Pre-application was furnished for a 20-acre shopping center at the south east corner of I-10 and jackrabbit almost a year ago

## IV. Traffic Volumes

Tier 1 Screening process employed a "critical flaw" procedure that efficiently reduced the universe of alternatives to a manageable number of feasible options. These would be subject to detailed evaluation in the subsequent screening levels. Based on the constraints identified at the end of the stakeholder and community input process, the following criteria were used for excluding infeasible and undesirable alternatives:

i. Land Use: compatibility with existing and future land use
ii. Drainage/flood control: Compatibility with existing & planned facilities
iii. Environment: impacts to environmental resources like the White Tanks Mountain Regional Park
iv. Public Transportation Planning Policy: Compatibility with adopted agency/jurisdictional transportation plans including considerations for TI spacing

Based on the above-mentioned criteria, four main considerations were kept in mind while selecting the geographical zones through which potential alternatives could be drawn. These considerations were-

i. Topographical concerns
ii. Proximity to environmental resources
iii. Public acceptance during the scoping process
iv. High-level planning-where to locate corridor in order to serve the community in the best possible manner and avoid circuitous routing

Twelve zones were identified, six north and six south of Northern Avenue and each zone was approximately one-mile wide. (See attached figure) These north and south zones were then subject to the "critical flaw" criteria and checked for compatibility. Compatibility was rated as "yes", "no" or "maybe" and based on this analysis, zones were either eliminated or retained for further consideration. (See attached matrix)

At the end of this analysis, five zones were retained to move into the next level of the screening process. Zones 2 and 3 North, and Zones 2, 3 and 4 South were retained.

These zones span from the Tuthill Road alignment till half mile east of 191st Avenue alignment in the north and all the way up to a quarter-mile east of Citrus Road in the south. The critical issues that surfaced from this analysis were as follows-

- Facility to connect to I-10 either at Perryville Road or at the Jackrabbit Trail section line alignment
- Avoid White Tanks Mountain Regional Park
- Network discontinuity
- Coordination with FCDMC to mitigate potential impacts
- Adherence to jurisdictional transportation planning policy
- Public acceptance

## V. Overview of Tier 2 Screening Process

Based on the zone analysis from Tier 1 Screening Process, three potential alternative corridors were identified for the next level of evaluation. However, these were broad conceptual corridors that did not represent the actual footprint in any manner. (See attached figure)

Draft Tier 2 Evaluation criteria is as follows-

- Right-of-way required
- General impact to community
- General impact to future planned developments & developable land
- Public acceptance
- Cost
- Engineering complexity & constructability
- Drainage/Flood control
- Public transportation planning policy
- Corridor footprint/ Design consistency
- Potential environmental impacts

Please see attachment for a detailed description of each of these criteria.

The next steps in the process are as follows-

i. Incorporate stakeholder input on evaluation criteria and alternatives
ii. Conduct Tier 2 evaluation
iii. Travel demand modeling

## VI. Tier 2 Screening Criteria

The study need has to be demonstrated using the modeling before the next public meeting. The PAC also needs to decide the next PAC meeting date and the tentative schedule for the next public meeting.

## VII. Corridor Analysis By Segment

## VIII. Next Steps

a. PAC Meeting
b. Public Meeting

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Stakeholder Workshop-Tier 2 Evaluation of Alternatives**

**Tuesday, October 16, 2007**
**11:00 a.m. to 2:00 p.m.**
**DMJM Harris Conference Room #1**

**SIGN-IN SHEET**

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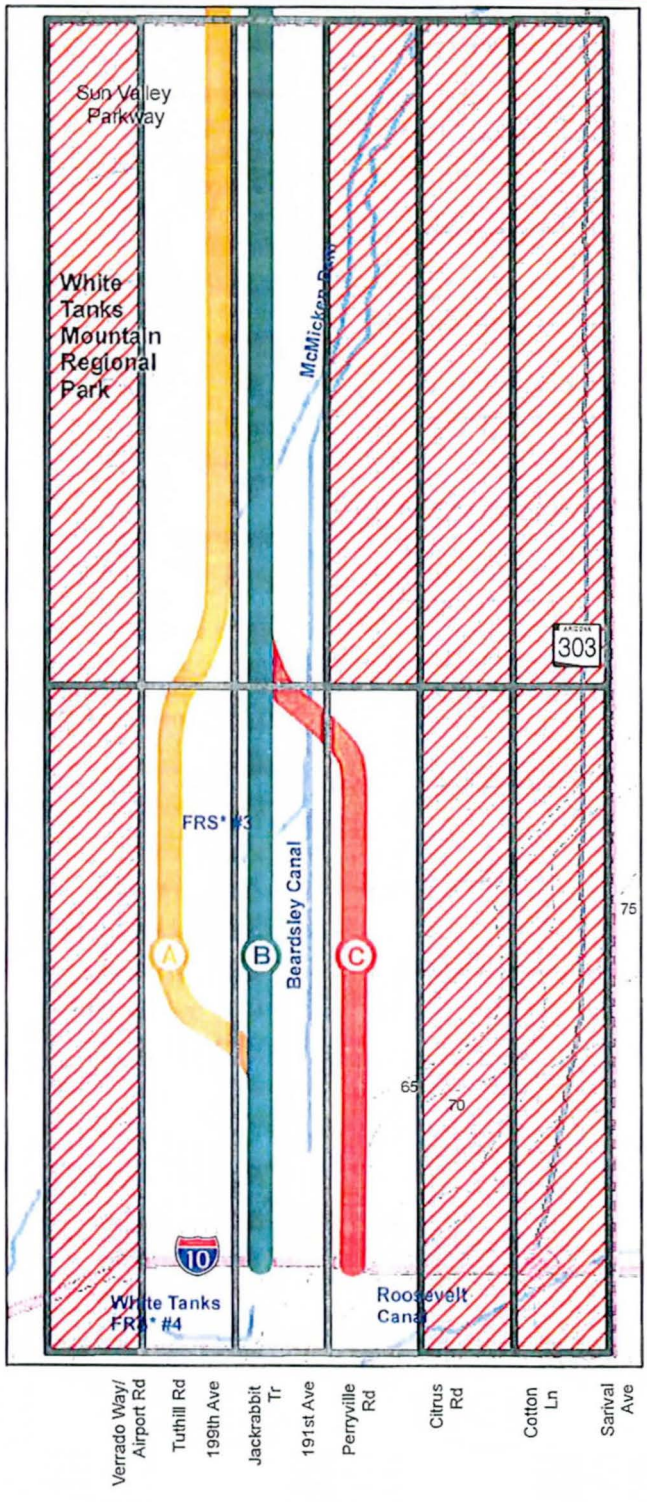
| Randy Overmyer | Randall.overmyer@surpriseaz.com | 480.225.2309 |
| DAN MARUM | Wilson & Company dan.marum@wilsonco.com | 602 283-2702 |
| JOHN MCNAMARA | DMJM HARRIS john.mcnamara@dmjmharris.com | (602) 337-2587 |

# Tier 2: Potential Alternative Corridors in Selected Zones




## Legend

Zones eliminated from further consideration

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C

1 0.5 0 1 Miles

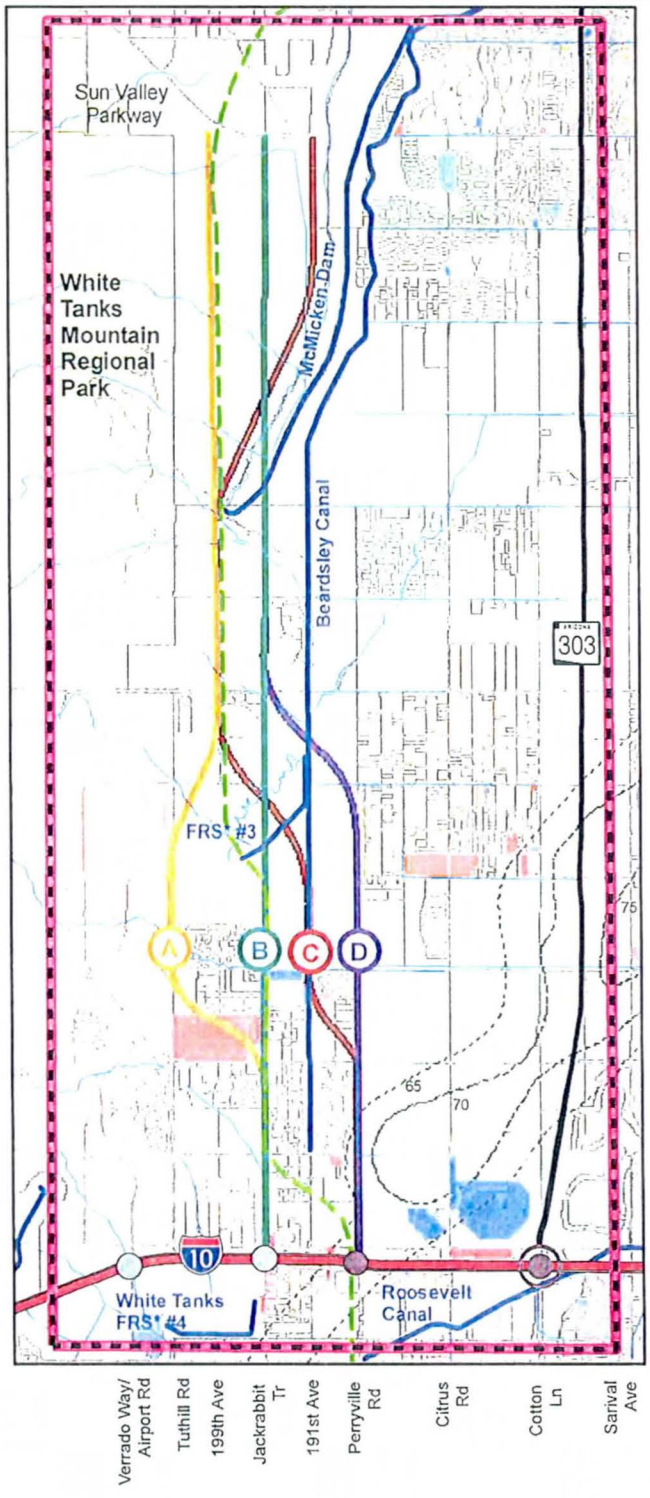
*DRAFT*

*FRS stands for Flood Retardant Structure

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*June 2007*

# Tier 2: Potential Alternative Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Existing Land Use*

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Developing Residential
- Commercial
- Developing Commercial
- Industrial
- Institutional
- Public Facilities
- Office/Employment
- Open Space
- Agriculture
- Water
- Vacant

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- MAG I-10/ Hassayampa Valley Roadway Framework Study

**DRAFT**

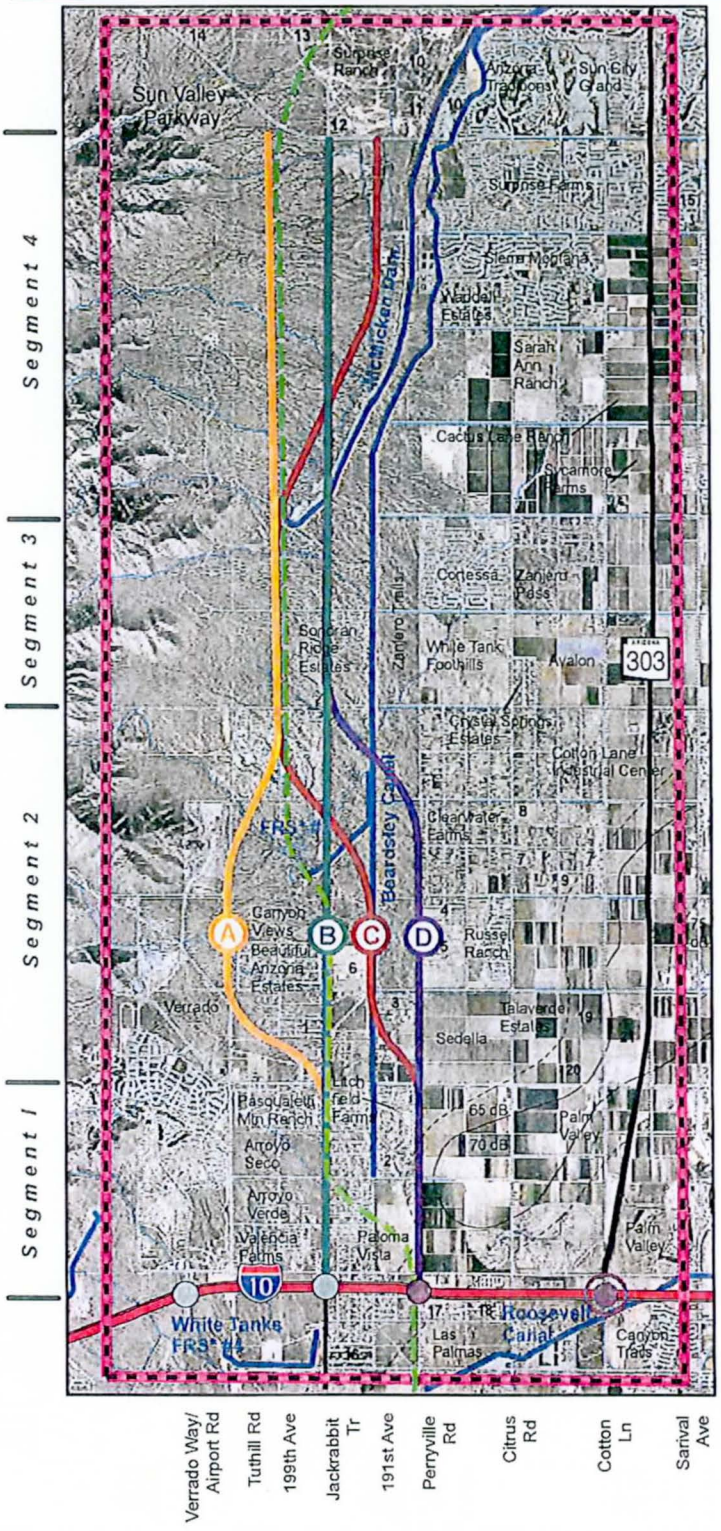
*FRS stands for Flood Retardant Structure

1 0.5 0 1 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

*October 2007*

# Tier 2: Potential Alternative Corridor Analysis




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI

*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D

Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

*FRS stands for Flood Retardant Structure

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

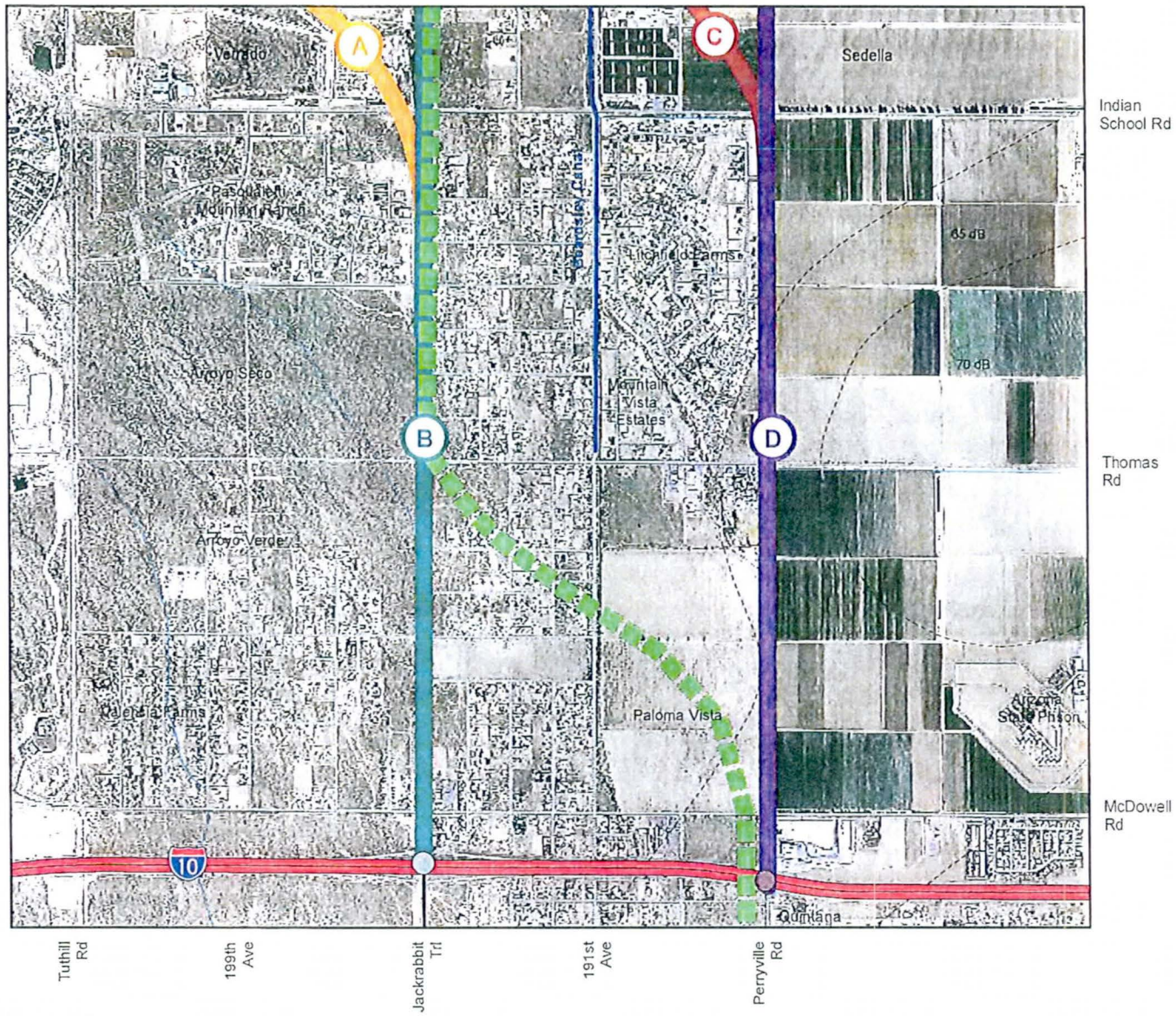
DRAFT

1 0.5 0 1 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 1




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

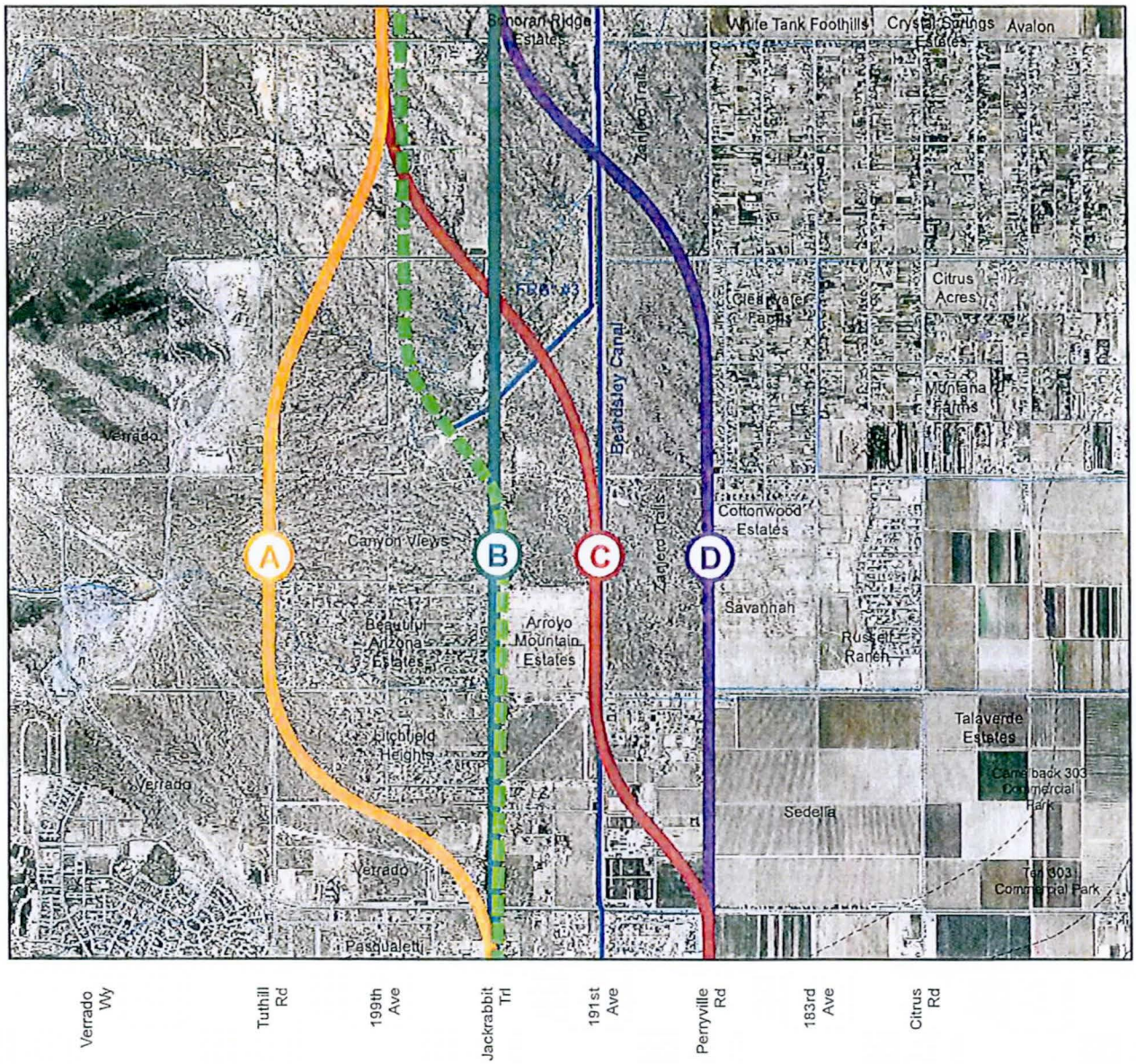
*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

0 0.125 0.25 0.5 Miles

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 2




## Legend

- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

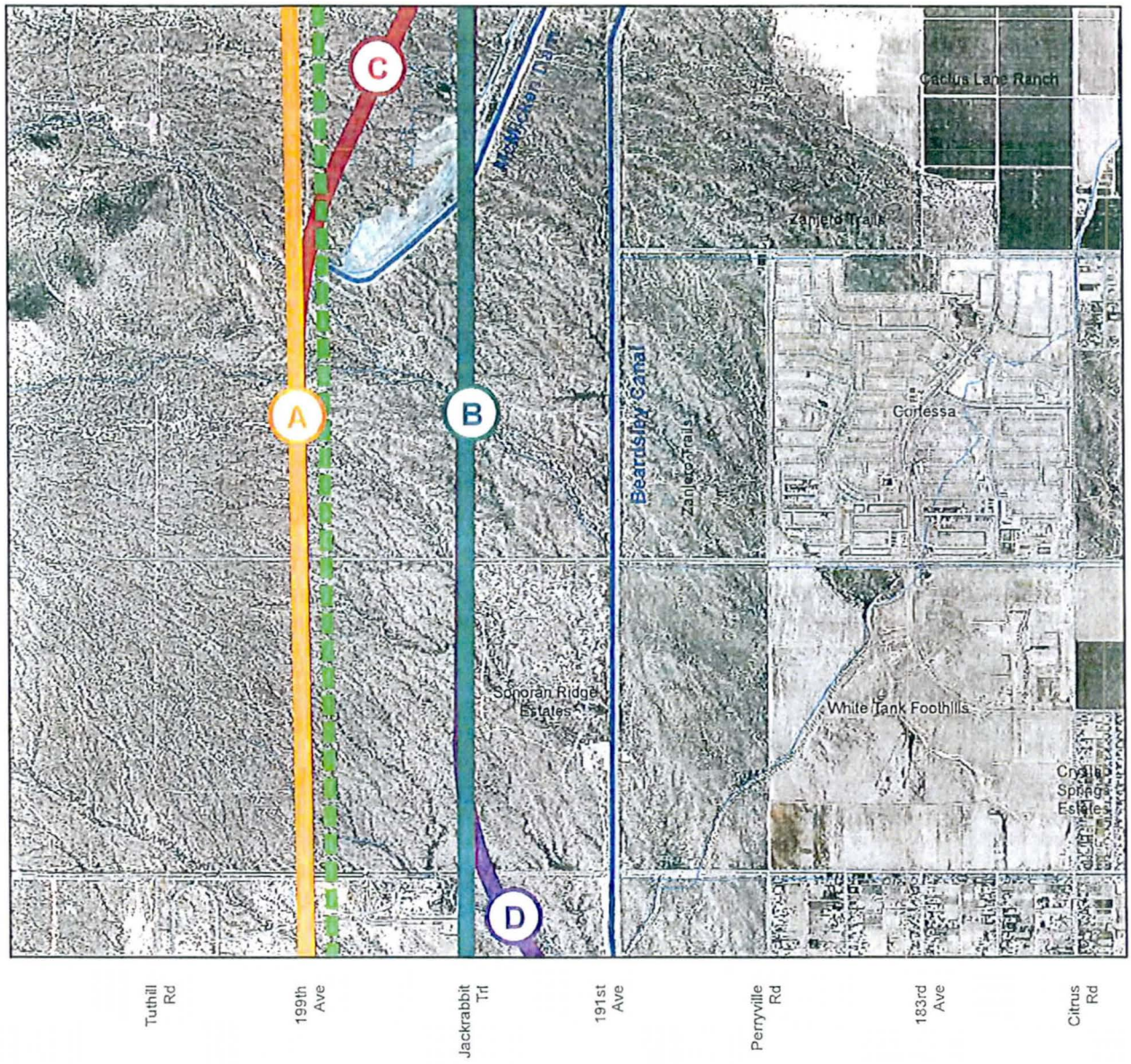
0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 3




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

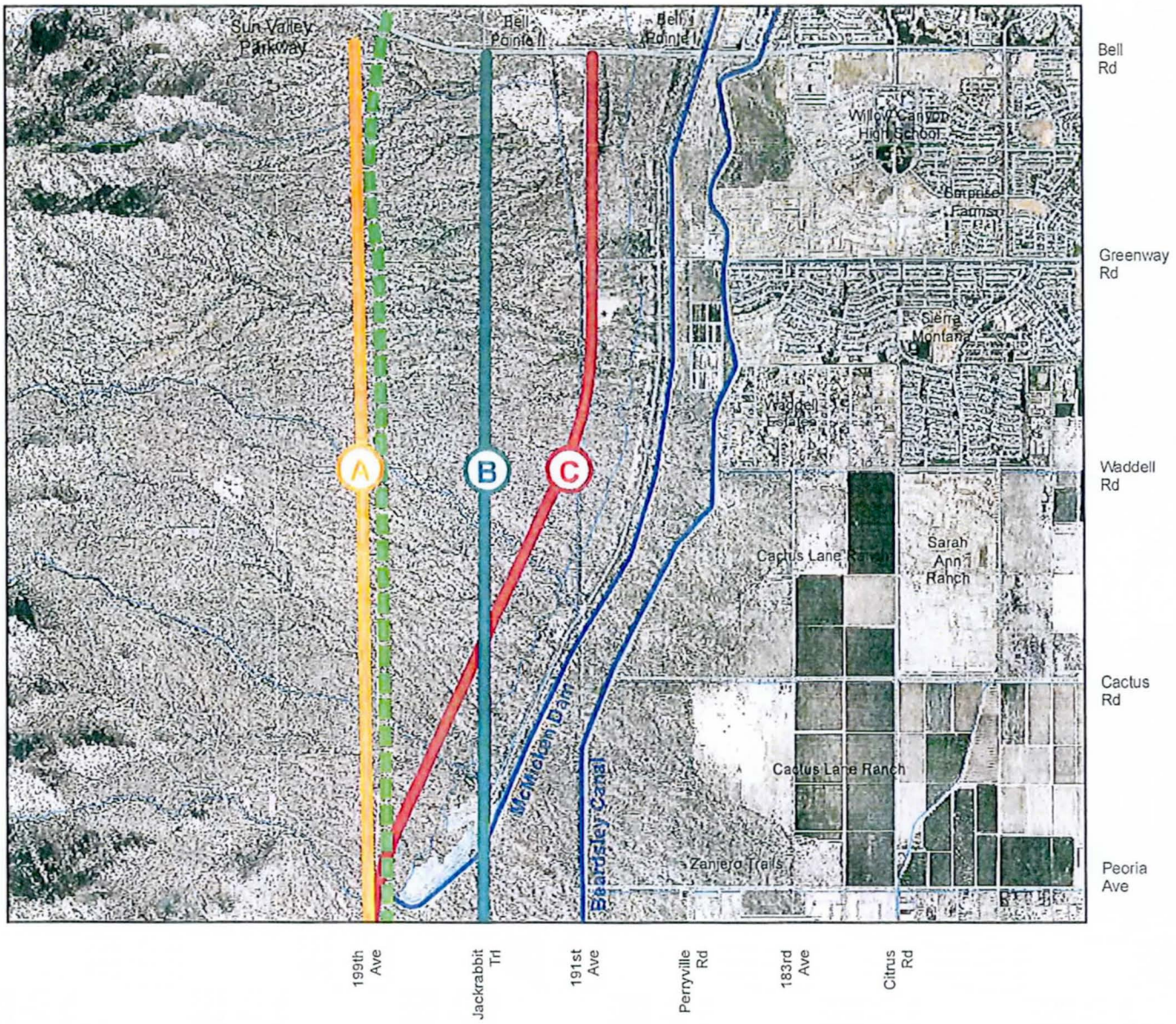
0 0.125 0.25 0.5 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

# Tier 2: Potential Alternative Corridor Analysis-Segment 4




## Legend

- Roads
- Streams
- Drainage Structures (dams/canals)

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Recommended Corridor- *MAG I-10/Hassayampa Valley Roadway Framework Study*

DRAFT

0 0.25 0.5 1 Miles

*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*

**Jackrabbit Trail Access Control and Corridor Improvement Study**
***Interstate-10 to Bell Road***

October 2007

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

Date: January 15, 2008

To: Ernest Rubi, Project Manager, MCDOT

From: Jennifer Livingston, Project Manager, DMJM Harris

Re: Jackrabbit Trail Access Control and CIS

Subject: January 14, 2008, Alternatives Evaluation Stakeholder Meeting with Maricopa Water District (MWD) and Flood Control District of Maricopa County (FCDMC)

Attendees: See attached sign-in sheet

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meeting that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept and described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Rodney Bragg stated that the preferred alignment crosses the Beardsley Canal at one location- just south of Camelback Road. Glen Vortherms, MWD stated that the project team should contact Dave Maguire from Land Solutions Inc. to incorporate the plans for Zanjero Trails. Mike Greenslade, FCDMC apprised the project team about the status of the FRS #3 Rehabilitation Project and stated that the Phase 1 of the project was under construction and Phase two was in 60% design stage anticipated to be completed by October 2008. He also informed that the Alternatives C and D as shown on the map would be crossing potential earth fissure risk zones, and Alternatives B & C would cut off the reservoir from the emergency spillway. He emphasized that the team's drainage analysis would have to mitigate these issues. The FCDMC modeling indicates that these areas have the potential to develop earth fissure zones, though they are not there at present. Mike Greenslade also informed the attendees subsidence has also occurred at both FRS #3 and McMicken Dam.

Rodney Bragg inquired if there was any work being done on the FRS #3 outlet channel. Valerie Swick informed the attendees that the appraisers were currently looking at the prospects of acquiring the first row of lots along the west side of Jackrabbit Trail to settle the right-of-way issues, the report for which is expected by the end of February to mid-march 2008 timeframe. Mike Greenslade also informed the team the Maricopa County Parks and Recreation Department was planning a trailhead staging area at the south end of the McMicken Dam and reiterated the importance of avoiding conflict between pedestrian, equestrian and vehicular movements. He also indicated that the alternative for the dam would be available by March-April 2008 and could present MCDOT with a partnering opportunity. He also indicated that the district was aware of the City of Surprise Transportation Plan and realized that sometime in the future the east-west arterial streets would have to cross over the dam. Mike Greenslade also mentioned that the area has significant archaeological sites.

Mike Greenslade expressed his concerns about the parkway facility crossing the FRS #3 and stated that the south option would have less potential impact to the structure and that would be to FCDMC. Rodney Bragg also stated that the current horizontal curves drawn for the preferred alternative just barely meet the parkway design speed. He also inquired if the MWD had any concerns regarding canal crossings. MWD expressed that a bridge crossing should be used whenever the canal has to be crossed. Javier Guana inquired if the bridge crossing had to be at-grade. Glen Vortherms stated that that was entirely dependent on the

design but the freeboard operation and maintenance would need to be met. Javier Guana also inquired if there would be any objections if the alignment of the Beardsley Canal was modified or encased. Glen Vortherms stated that the alignment modification could be considered but not desirable and encasing would bring in maintenance issues. Bob Darr inquired how the western extension of Northern Avenue would tie in with this network. Rodney Bragg stated that all section lines would connect and tie into the Jackrabbit Trail facility. He also mentioned that based on this discussion, the south option of Alternative C seemed to be the path of least resistance. Mike Greenslade concurred and also reiterated the chances for a partnering opportunity since this study would tie in very well with the channel design and also with the McMicken Dam. Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 14, 2008: 1 PM to 3 PM***
***Maricopa Water District***
***14825 W. Grand Avenue***
***Surprise, AZ 85374***

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
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| Mike Greenslade | mdg@mail.maricopa.gov | 602-506-5426 |

Bob DARR rdarr@glendaleaz.com 623-930-2942

LUKE ALBERT LUKE.ALBERT@GOODYEARAZ.GOV 623-882-7519

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

| | |
|---|---|
| Date: | January 15, 2008 |
| To: | Ernest Rubi, Project Manager, MCDOT |
| From: | Jennifer Livingston, Project Manager, DMJM Harris |
| Re: | Jackrabbit Trail Access Control and CIS |
| Subject: | January 10, 2008, Alternatives Evaluation Stakeholder Meeting with Arizona State Land Department (ASLD) and Arizona Department of Corrections |
| Attendees: | See attached sign-in sheet |

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. He provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meetings that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till

Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept. Ruben Ojeda mentioned that the state land property east of the proposed parkway would need access as well, and maybe another frontage road on the east would be feasible. He also informed that there were a few irrigation wells on the state land property sub-leased to Sunfresh Farms by the Department of Corrections, which will have to be taken into account. Warren Davis informed the attendees that the State Prison at Perryville had no expansion plans on the west side of their property.

Rodney Bragg described three options developed by the team to cross or go around the FRS #3. One option was to directly cross the structure at Maryland Avenue. The second option was to bypass the structure completely by continuing north along the Beardsley Canal till Orangewood Avenue and swing west to meet the 199th Avenue alignment and follow the route described above till Bell Road. The third option (or the south option) was to start swinging west, half-mile south of Bethany Home Road, curve around the southern edge of the FRS #3 and then turn north along 199th Avenue alignment and follow a similar route till Bell Road.

Gordon Taylor and Ruben Ojeda said that the ASLD would prefer to sweep around the FRS #3 and thus, the southern option was preferred. Woody Scoutten and Brian Rose mentioned that Canyon Views, a planned development at the intersection of Bethany Home Road and Jackrabbit Trail will be impacted by this option and thus Buckeye would support the northern option. Woody Scoutten also mentioned that Canyon Views was still in the rezoning stage.

While discussing the northern part of the corridor, both Ruben Ojeda and Gordon Taylor felt that the current corridor minimized impacts to the ASLD property. Since the proposed alternative is about 600 feet to 1800 feet west of the floodpool of the McMicken Dam, Randy Overmyer mentioned that if we push the facility further west, then other east-west arterials would have to be extended that extra distance. The project team was trying to minimize the infrastructure footprint on the ASLD property. Randy Overmyer said that the City of Surprise was supportive of the current preferred alignment for the parkway corridor. He also mentioned that the City of Surprise wants to protect enough right-of-way for the connection of Jackrabbit Trail with Bell Road based on the traffic volumes. Gordon Taylor expressed that the ASLD engineering department would also like to take a look at the intersection of Jackrabbit Trail and Bell Road/Sun Valley Parkway.

Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and stated that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders such as Flood Control District, Maricopa Water District, Litchfield Park Elementary School District, etc. the project team will finalize the layout of the

proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

# JACKRABBIT TRAIL ACCESS CONTROL AND CORRIDOR IMPROVEMENT STUDY: I-10 TO BELL ROAD

**MCDOT Contract No. 2006-025,**
**Work Order No. TT005**

## MEETING MINUTES

| | |
|---|---|
| Date: | January 29, 2008 |
| To: | Ernest Rubi, Project Manager, MCDOT |
| From: | Jennifer Livingston, Project Manager, DMJM Harris |
| Re: | Jackrabbit Trail Access Control and CIS |
| Subject: | January 10, 2008, Alternatives Evaluation Stakeholder Meeting with Litchfield Park Elementary School District #79 |
| Attendees: | See attached sign-in sheet |

The following meeting notes set forth our understanding of the discussions and decisions made at this meeting. If you have any questions, additions or comments, please contact the author immediately. If we do not hear from you within 10 days, we will assume that our understandings are the same. We are proceeding based upon the contents of these meeting notes.

### I. Introductions

See attached sign-in sheet

### II. Project Background and Update

Rodney Bragg gave an overview and background of the project. Rodney Bragg mentioned that the purpose of this study was to establish a footprint and accordingly protect right-of-way. Ernest Rubi informed the attendees about the connection of this study with the larger MAG I-10/Hassayampa Valley Roadway Framework Study and emphasized that this corridor study was looking to establish a connection between Bell Road and I-10 east of the White Tank Mountains. Rodney Bragg provided a synopsis of the Stakeholder Advisory Committee (SAC) meeting and public meetings that were held in November 2007 to evaluate the alternatives developed by the project team.

### III. Discussion on Preferred Alternative

Rodney Bragg mentioned that there were a couple of key form-givers in this study- Zanjero Trails, a master planned community that goes all the way from Camelback Road till Bell Road; and the property owned by the Arizona State Land Department (ASLD), which the department intends to auction at some point in the future. Rodney Bragg then walked the attendees through the results of the evaluation matrix, which leaned towards a hybrid alternative. This hybrid alternative connects the corridor along Perryville Road near the southern end of the project (please see attached Potential Corridors map), swings half-mile west just north of Indian School Road, travels north till Bethany Home Road along the Beardsley Canal. It then swerves west again till the 199th Avenue alignment by crossing over the FRS #3 and continues north from a half-mile south of Northern Avenue till Peoria Avenue and travels along the McMicken Dam and joins up with 191st Avenue Alignment at its intersection with Bell Road. From Indian School Road to south of Thomas Road, the facility shifts 200-300 feet east and the existing Perryville Road could act as a frontage road.

Rodney Bragg explained that the project team wished to get feedback from the stakeholders on the preferred alignment concept. Ken Axford stated the attendees that the Scott Libby Elementary School currently uses Thomas Road as an entry access and Perryville Road as an exit for the parents, and buses use Perryville Road alone. The current bus turnaround is a problem and the school district is working on improving the circulation system. He also stated that the district owns the land north of Encanto Boulevard and plans additional facilities possibly over the next ten years. Ken Axford inquired about the future traffic interchange on Perryville Road with I-10 as it had been shown on the map (See attached). Rodney Bragg informed the attendees that this interchange is funded under Prop 400.

Ken Axford inquired about the access control on Perryville Road and its connection with the future parkway facility. Rodney Bragg stated that the parkway facility typically has more access control than an arterial and less than a freeway. Thus, there would be limited direct driveways on to the facility. Dave Gourlay inquired if stop signs, traffic lights or ramps would be used to achieve this access control. Rodney Bragg told the attendees that in order to have more capacity on the roadway, there would be very few median openings and a combination of traffic lights and stop signs could achieve that desired level of access control. Ken Axford reiterated that the school district would have no objections to the improvements as long as connection and access to Thomas Road was ensured in the plans. Dave Gourlay also mentioned that the school district would be supportive of the proposed alternative as long as there was enough buffer between this high-level facility and the school premises. Ken Axford informed the attendees that the school district was planning to shift the main entrance to the school from Perryville Road to Thomas Road.

Ernest Rubi thanked all present for their contribution and input.

## IV. Next Steps

Rodney Bragg apprised the attendees about the schedule of the study and told that the project team was looking to complete the study by June 2008. Following this round of meetings with the key stakeholders, the project team will finalize the layout of the proposed facility. Another round of Stakeholder Advisory Committee meeting and public meeting will be held in March 2008.

DMJM HARRIS | AECOM

**Jackrabbit Trail Access Control and Corridor Improvement Study**
**Interstate-10 to Bell Road**

**Preferred Alternative Discussion Meeting**

***January 29, 2008: 1 PM to 2:30 PM***
***Litchfield Elementary School District #79***
***553 Plaza Circle Litchfield Park, AZ 85340***

**SIGN-IN SHEET**

| Name | E-Mail | Phone No. |
|---|---|---|
| Mansi Sachdev | mansi.sachdev@dmjmharris.com | 602-337-2652 |
| DAVID GOURLAY | GOURLAY@LESD.K12.AZ.US | 623-535-6075 |
| K. AXFORD | AXFORD@LESD.K12.AZ.US | 623.535.6016 |
| Rodney Briggs | rodney.briggs@dmjmharris.com | 602.337.2617 |
| Ernest Russi | | 602-506-1049 |
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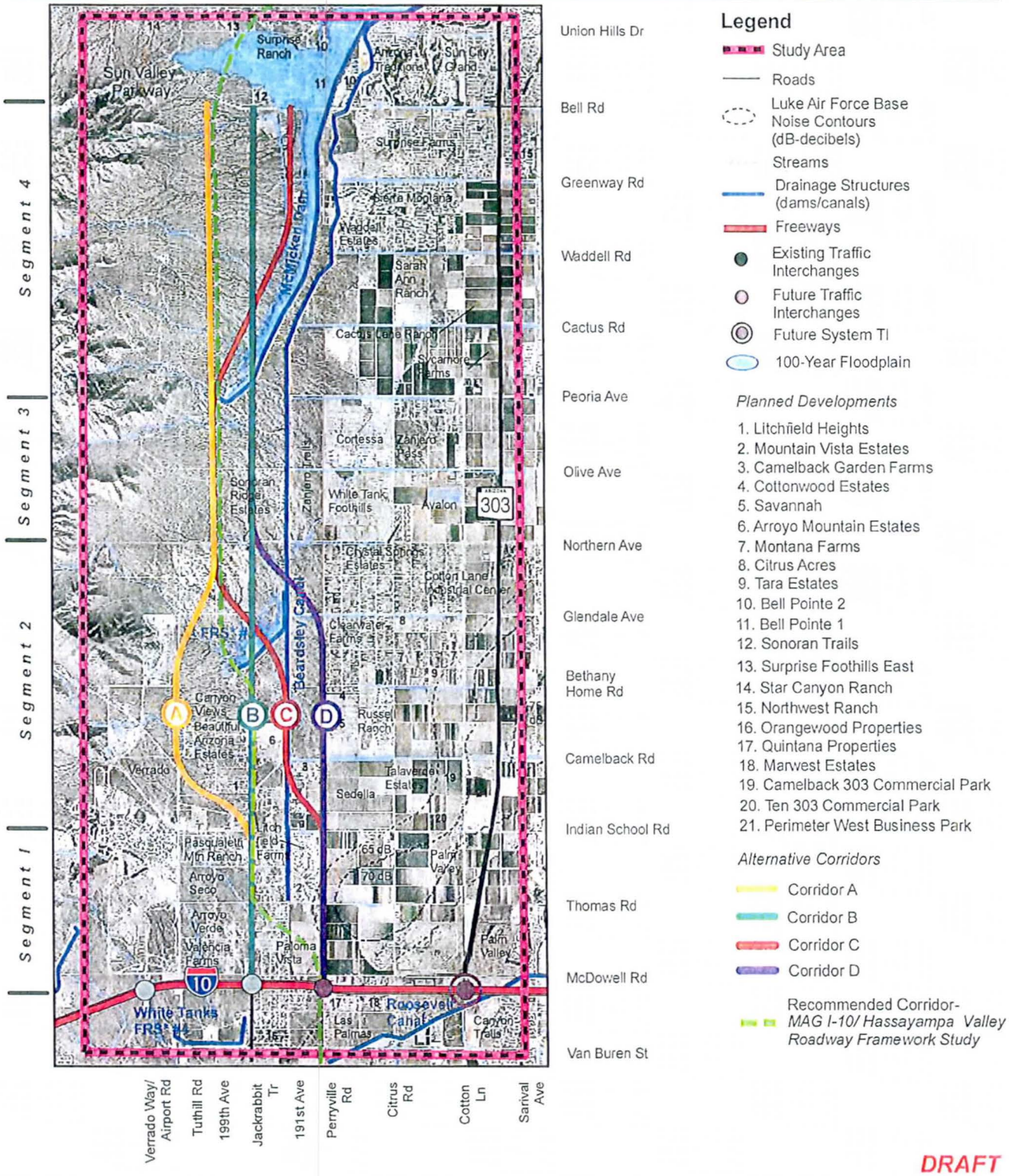
# Tier 2: Potential Corridors




## Legend

- Study Area
- Roads
- Luke Air Force Base Noise Contours (dB-decibels)
- Streams
- Drainage Structures (dams/canals)
- Freeways
- Existing Traffic Interchanges
- Future Traffic Interchanges
- Future System TI
- 100-Year Floodplain

*Planned Developments*

1. Litchfield Heights
2. Mountain Vista Estates
3. Camelback Garden Farms
4. Cottonwood Estates
5. Savannah
6. Arroyo Mountain Estates
7. Montana Farms
8. Citrus Acres
9. Tara Estates
10. Bell Pointe 2
11. Bell Pointe 1
12. Sonoran Trails
13. Surprise Foothills East
14. Star Canyon Ranch
15. Northwest Ranch
16. Orangewood Properties
17. Quintana Properties
18. Marwest Estates
19. Camelback 303 Commercial Park
20. Ten 303 Commercial Park
21. Perimeter West Business Park

*Alternative Corridors*

- Corridor A
- Corridor B
- Corridor C
- Corridor D

Recommended Corridor- *MAG I-10/ Hassayampa Valley Roadway Framework Study*

**DRAFT**

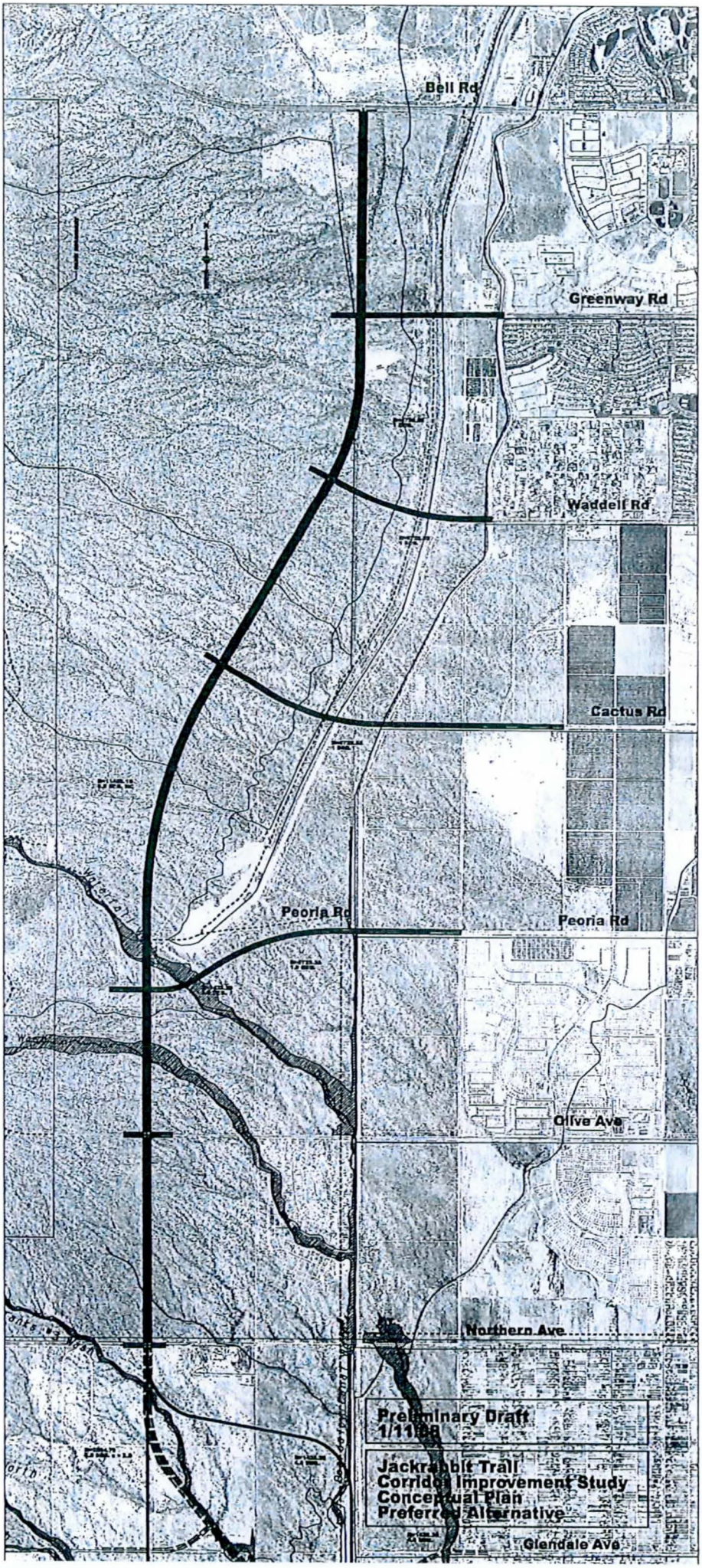
*FRS stands for Flood Retardant Structure

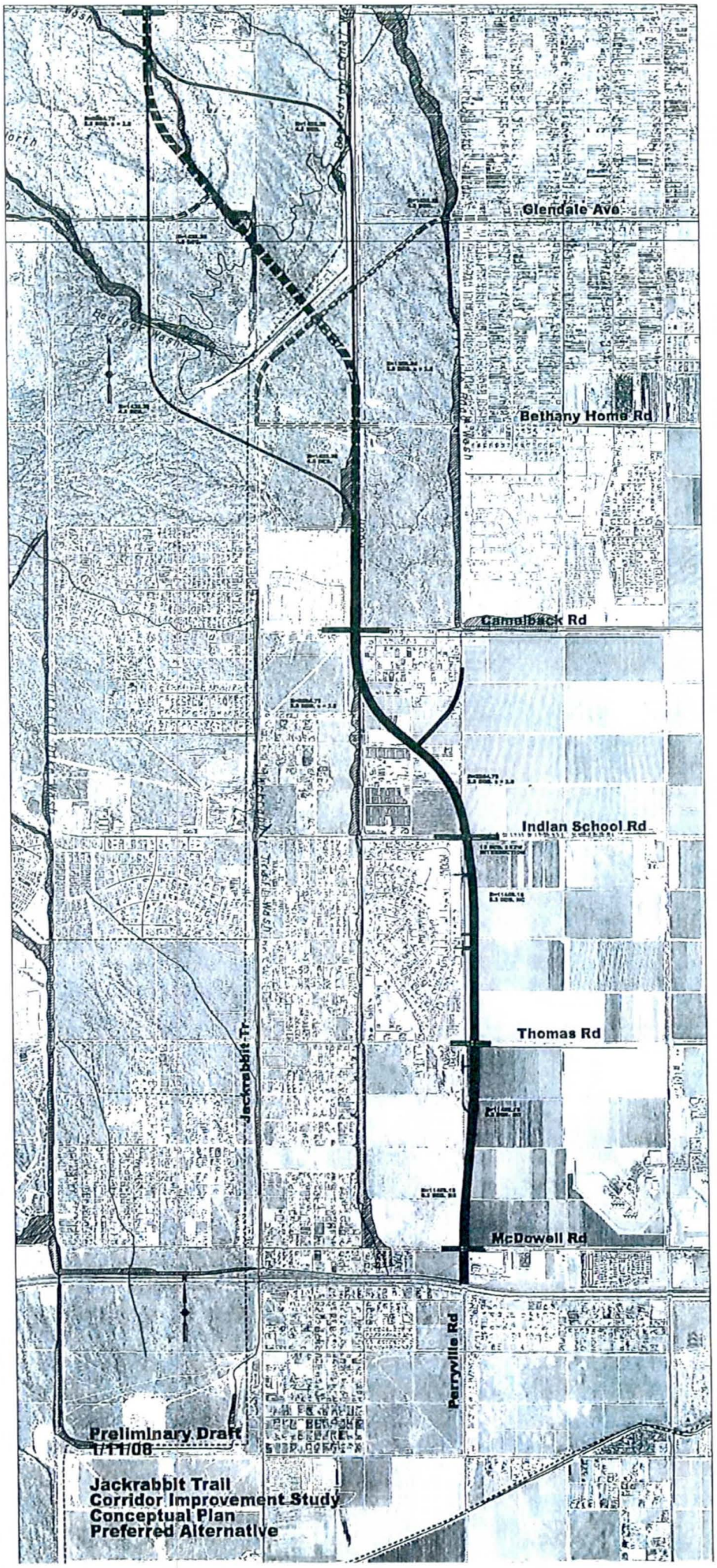
*Source: - Maricopa County Department of Transportation*
*- City of Surprise*
*- City of Goodyear*
*- City of Glendale*
*- Maricopa Association of Governments*

1 0.5 0 1 Miles

# Jackrabbit Trail Access Control and Corridor Improvement Study
## *Interstate-10 to Bell Road*

October 2007


Bell Rd
Greenway Rd
Waddell Rd
Cactus Rd
Peoria Rd
Peoria Rd
Olive Ave
Northern Ave
Glendale Ave
Preliminary Draft
1/11/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative


Glendale Ave
Bethany Home Rd
Camelback Rd
Indian School Rd
Thomas Rd
McDowell Rd
Jackrabbit Tr
Perryville Rd
Preliminary Draft
1/11/08
Jackrabbit Trail
Corridor Improvement Study
Conceptual Plan
Preferred Alternative

# Appendix XVIII
# Access Management

## Definition

Access management consists of the planning, design and implementation of land use and transportation strategies that maintain a safe flow of traffic while accommodating the access needs of adjacent properties. Access is managed through the regulation of vehicular access to public roadways from adjoining properties, and vice versa. Management of access is provided through legal, administrative and technical strategies available to political jurisdictions under their police powers to maintain public health, safety and welfare.

Access management can be categorized as either full or partial access control. Full access control means that properties abutting a roadway do not have direct access thereto, and that access is provided only at grade-separated interchanges. Partial access control allows some at-grade crossing and some private driveway connections, but only at designated points and often for designated movements (e.g., right-in and right-out only). Uncontrolled access means that all abutting properties are allowed direct access to the roadway.

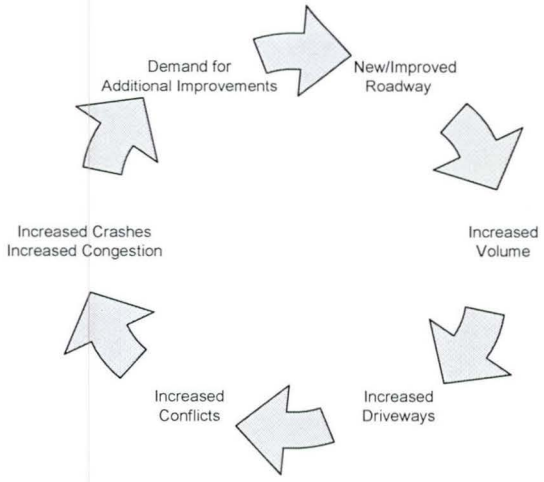
## Purpose and Need for Access Management

The purpose of access management is to preserve the capacity of public highways and maintain safety on these highways, while retaining access to private land. Access management is intended to balance a roadway's two main functions: mobility and access. The proper balance between these two functions depends on the classification of the roadway. In general, the higher the functional classification, the more importance is given to through traffic mobility as opposed to access to adjoining properties. Higher functional class roadways, such as principal arterials, are designed to satisfy the public need for high mobility over substantial distances. Fast, efficient travel in a safe, uniform manner is the primary objective of these roads.

Major transportation corridors allow activities to take place through the safe and efficient movement of people and goods with minimal delay or interference from conflicting vehicle movements. However, over time, the addition of more traffic signals and/or curb cuts with resulting turning movements degrades the intended function of the transportation corridor. The use of land along a major transportation corridor is heavily dependent upon vehicular access to the corridor. Often no direct (lateral) access exists between adjacent properties along a corridor, necessitating indirect access via the through roadway. Uncoordinated internal circulation systems therefore force more trips onto major highways. As traffic congestion increases, the level of service provided by the major transportation corridor suffers. Crashes along such a corridor generally increase due to the large number of turning vehicles and other conflicts along the route.

As the motoring public experiences increasing travel delays, requests for solutions are made to transportation officials. Typical solutions include adding more travel lanes and constructing raised medians. However, these retrofitting techniques are expensive to implement and disrupt the motoring public as well as adjacent land uses. If demand for the roadway continues to exceed the supplied roadway capacity, then businesses begin to feel the effects due to a deterioration of access. Potential customers are deterred by delays in leaving and re-entering the main road, or if they perceive a safety risk in making difficult turning movements. In response, some businesses may relocate to areas that offer better accessibility. Frequently, as economic activity declines in the area with congested traffic, so does the property value and tax base. Ultimately, the highway is transformed into a low-speed road with a confusing mixture of signs and curb cuts that is no longer useful as a major transportation corridor. The vicious circle of conflict between land use and access is demonstrated in Figure 1. In extreme cases, the roadway becomes virtually useless for its original function.

## Figure 1 "Vicious Circle" Due to Poor Access Management




Source: *Access Management Manual*, Transportation Research Board

Some of the consequences of *not* managing access on a transportation corridor are:

- The efficiency of the transportation system deteriorates, and traffic and land use conflicts increase.
- Neighborhood streets not designed for through traffic are used to bypass congested intersections.
- Crashes increase as vehicles cross and turn along the road in an uncoordinated manner.
- Roadway users demand additional improvements to restore capacity squandered by inefficient traffic operations.
- Bypass routes built to relieve congestion become as congested as the roads they were built to relieve.
- Adjacent businesses suffer when customers have trouble turning to and from their sites.
- Freight and delivery trucks lose time and money stuck in traffic.
- Pedestrians can't find a safe spot to cross the road.

### Benefits

The need for access management and the benefits thereof are two sides of the same coin. Numerous studies have documented how good access management can significantly reduce the number of crashes. Access points, such as driveways and unsignalized intersections, introduce conflicts and friction into the traffic stream. Many studies have shown that crash rates increase along with the frequency of driveways and intersections. The crash rate indices (per million vehicle miles traveled (MVMT)) shown in Table 1 were derived using ten access points per mile as a base. The table shows crash rates increasing with the number of access points per mile. For example, a roadway segment with sixty access points per mile would be expected to have a rate three times higher than one with ten access points per mile.

**Table 1 Crash Rate Indices**

| Total Access Points per Mile (Both Directions) | Crash Rate index (per MVMT) |
|---|---|
| 10 | 1.0 |
| 20 | 1.4 |
| 30 | 1.8 |
| 40 | 2.1 |
| 50 | 2.5 |
| 60 | 3.0 |
| 70 | 3.5 |

Source: NCHRP Report 420, *Impacts of Access Management Techniques*, 1999

Tables 2 and 3 illustrate how crash rates rise as the total access points per mile (both signalized and unsignalized) increase in both urban/suburban and rural areas as a function of median type. On urban and suburban highways, the crash rate rises in direct proportion to the number of access points and in inverse proportion to the degree of separation of opposing traffic. The pattern is the same in rural areas, although crash rates for all roadway categories tend to be lower than in cities because of lower traffic volumes.

**Table 2 Representative Crash Rates (Crashes Per Million VMT) By Type of Median – Urban and Suburban Areas**

| Total Access Points per Mile | Median Type | | |
|---|---|---|---|
| | Undivided | Two-Way Left Turn Lane | Non-Traversable Median |
| ≤ 20 | 3.8 | 3.4 | 2.9 |
| 20.01 – 40 | 7.3 | 5.9 | 5.1 |
| 40.01 – 60 | 9.4 | 7.9 | 6.8 |
| ≥ 60 | 10.6 | 9.2 | 8.2 |
| *All* | *9.0* | *6.9* | *5.6* |

Source: NCHRP Report 420, *Impacts of Access Management Techniques*, 1999

**Table 3 Representative Crash Rates (Crashes Per Million VMT) By Type of Median – Rural Areas**

| Total Access Points per Mile | Median Type | | |
|---|---|---|---|
| | Undivided | Two-Way Left Turn Lane | Non-Traversable Median |
| ≤ 15 | 2.5 | 1.0 | 0.9 |
| 15.01 – 30 | 3.6 | 1.3 | 1.2 |
| ≥ 30 | 4.6 | 1.7 | 1.5 |
| *All* | *3.0* | *1.4* | *1.2* |

Source: NCHRP Report 420, *Impacts of Access Management Techniques*, 1999

The findings from National Cooperative Highway Research Program (NCHRP) Report 420 indicate that reducing the number of access points along a roadway segment tends to reduce both travel time and crash rates. The physical separation of travel directions particularly reduces the potential for head-on crashes, which often cause death or serious injury.

Traffic congestion frustrates motorists and prevents roads from functioning according to design. Uncontrolled points of conflict caused by too many opportunities to turn onto or off the road are a major contributor to congestion. Good access management preserves capacity and travel time and extends the useful life of the road. In addition, when traffic moves smoothly, vehicles burn fuel more efficiently and generate less air pollution.

The travel time on a roadway is directly related to the number of access points. Vehicles tend to travel closer to posted speeds on roads where access is managed. The *Highway Capacity Manual*, 2000 Edition, provides an adjustment factor for reducing free-flow speed that is equivalent of 0.25 mph for every access point up to 40 per mile.

Table 4 demonstrates that the spacing of signalized intersections affects the performance of the roadway segment in terms of vehicle travel time. Travel time increases as the density of signalized intersections along a roadway segment increases.

**Table 4 Travel Time Compared to Traffic Signal Density**

| Signals per Mile | Percent Increase in Travel times (Compared with Two Signals per Mile) |
|---|---|
| 2 | 0 |
| 3 | 9% |
| 4 | 16% |
| 5 | 23% |
| 6 | 29% |
| 7 | 34% |
| 8 | 39% |

Source: NCHRP Report 420, *Impacts of Access Management Techniques*, 1999

Effective access management establishes the location and design requirements of all access points along a major roadway. The quality of site access and the protection of private property investments are more than a function of the number of driveways. They also depend on the design and spacing of driveways, the ease and safety of pulling off or onto a road, distance from intersections and traffic signal sequencing. Proper planning and coordination of these elements result in a safe and reasonably convenient means of access to each property. Businesses with safe and easy access are more inviting and generate economic gains for the community.

In summary, effective access management will:

- Reduce traffic crashes and crash potential
- Preserve roadway capacity and postpone the need for roadway widening
- Improve travel times for the delivery of goods and services
- Ease movement between destinations
- Support local economic development
- Improve air quality and fuel efficiency, thus benefiting motorists, land owners and the public at large.

### Techniques

Access rights are property rights protected by the U.S. and Arizona constitutions. An owner of a property abutting a public highway has a private right or easement for the purpose of ingress to and egress from the property. This easement may not be taken or substantially impaired without compensation. Property right of access is not an absolute right, however, and is subject to the public's right of passage. Thus, the right of access is a right of reasonable access and not a private right of direct access. An owner is deemed to have a right to access the public road system in a reasonably convenient manner, but not to any specific street or any specific point of access. The following access management techniques are not an all-inclusive list, but have been found to be among the most effective techniques to enhance traffic safety and mobility along a major arterial, while preserving the basic access to the public roadway system to which every adjacent property is entitled.

### Limiting the Number of Conflict Points

The crash potential of a roadway is largely due to conflict points. Good access management strategies are designed to reduce the number and density of such points. A conflict point is any point where the

paths of two through or turning vehicles diverge, merge or cross. Drivers make more mistakes and collisions increase when drivers are presented with complex situations. Simplifying the driving task by limiting the number and type of conflicts between vehicles can reduce the crash rate.

*Raised Medians at Intersections*

Raised medians at intersections (signalized or unsignalized, including driveway intersections) provide a center barrier to prevent some turning movements from occurring. For example, medians can be constructed to allow for left turn in only/no left turn out, which facilitates access to the adjacent property and leaves right turns unrestricted. Right-in/right-out driveways are also commonly used, often in conjunction with raised medians.

Raised medians may be particularly effective in retrofit situations where high volumes of turning vehicles have degraded operations and safety, and where more comprehensive approaches to access management would be too expensive because of limited right-of-way and the constraints of the built environment. Raised medians at signalized intersections are especially desirable because they can prevent left turns to and from driveways located near the intersection. Such turning movements create special hazards because of the complexity of traffic operations at many signals, including queuing of vehicles. One disadvantage of this treatment is that motorists entering from driveways may need to make U-turns elsewhere along the highway. This is often safer than permitting turns across opposing traffic near major intersections, however. If a median barrier is provided between as well as at intersections, U-turns can be directed to the safest locations.

*Full Raised or Non-Traversable Medians*

Continuous raised or wide non-traversable medians provide a barrier on the main roadway that separates opposing travel lanes and prevents both left turns and cross traffic. Full raised medians reduce conflict points by restricting turn movements to right-in/right-out only, except at full median breaks. Continuous raised medians are an especially effective access management measure on roadways with high traffic volumes and high driveway densities. The main advantage of a raised median is that it limits highway crossings and left turns to specific locations where adequate sight distance and vehicle storage can be provided. If the median is wide enough, it can also provide a refuge for pedestrians crossing the highway. By removing left-turning vehicles from through traffic, continuous raised medians with left-turn lanes at designated breaks help maintain roadway operating speed. Raised medians also provide space for landscaping and other aesthetic treatments. A disadvantage of providing medians is that by limiting the number of locations where one can cross the highway, the number of U-turns will most likely increase. Further, this design treatment does not eliminate conflicts between left turning vehicles to and from the main roadway. At some unsignalized intersections, especially where traffic volumes are substantial and speeds relatively high, the problem may be exacerbated by concentrating such turns at just a few points. Good roadway design practices can help minimize the hazards.

Because raised medians are a restrictive access management technique, building such a median along an arterial often generates controversy among business and property owners. Two-way left turn lanes are much less restrictive—but also a much less effective access management technique, because they fail to physically restrict turning and crossing movements. Businesses and property owners may perceive that installation of raised medians will have a large, negative impact on their customers, sales, and property values. A business vitality study of nine access management corridors in Iowa communities examined impacts on businesses and business customers along these routes (Center for Transportation Research and Education at Iowa State University, *Iowa Access Management Awareness Project*). In general, the study demonstrated that access-managed corridors had lower rates of business turnover than other parts of their communities and higher retail sales growth rates once the access management projects were completed. Educational campaigns should emphasize that consumers want to patronize businesses whose access is safe, predictable and low-stress.

**Separating Conflict Areas**

This set of access management techniques provide time for drivers to address one potential conflict before facing another. Separating the conflict areas helps to simplify the driving task while improving the operation of the roadway.

*Driveway Spacing and Consolidation*

A critical aspect of access management is maintaining adequate spacing between driveways. The speed differences caused by traffic turning into and out of driveways can produce conflicts that may lead to broadside and rear-end collisions between vehicles. Spacing requirements may be based on posted speed limits, the classification of the roadway, and the amount of traffic generated by a development along with other design considerations. The MCDOT RDM outlines driveway spacing based on driveway type (residential, commercial, industrial), land use, and posted speed. The minimum distance from one driveway centerline to the next ranges from 65 to 330 feet for multi-family residential uses, and from 165 to 330 feet for commercial and industrial uses.

Driveways are consolidated to limit the number of access points per mile along a road and provide adequate spacing between driveways in order to reduce the number of conflicts. Driveway consolidation can be achieved by closing driveways, creating alternative access ways, creating shared driveways, relocating entrances to side streets, and promoting cross access (i.e., lateral access between adjacent commercial properties to remove very short trips from the main roadway). These techniques can be applied individually or through projects such as installation of medians, two-way left turn lanes, and frontage or reverse access roads. This access management technique requires property owners to agree to reduce/combine their access points or share access with adjacent property owners. Reducing the number of driveways can benefit owners of commercial property both directly (by freeing up space for parking or other use) and indirectly (by making access safer and less confusing to drivers on the main road; this is especially important to merchants who rely on drive-by traffic). In some cases, consolidation of driveways serving a major retail center can justify installation of a right-turn deceleration lane to serve customers.

*Joint Driveways/Cross Access*

Joint access requirements provide for a unified on-site circulation plan serving several properties on a commercial corridor. This serves as an alternative method of achieving adequate driveway spacing where lot frontage is otherwise inadequate. This method could also be employed to provide a definition of a driveway in an area where driveway/access locations are not well defined. Cross access requirements allow for circulation between sites and may be applied in accordance with a joint access plan, or as a means of connecting major developments to allow such circulation. This method requires establishment of joint-use driveways and cross access easements between properties to provide a logical circulation system. Cross-circulation between adjacent properties and provision for service roads allows movement across adjacent parcels without re-entry to the major roadway. This strategy typically requires adoption of a local jurisdictional ordinance requiring property owners to meet cross access standards to develop their property.

*Corner Clearance*

Adequate corner clearance (i.e., the distance from the edge of the intersection to the nearest curb cut) is important in maintaining safe and efficient operations at the intersection. Driveway and access points should be located outside the functional intersection area, as drivers on the main roadway are making decisions regarding the intersection and do not expect turning movements from adjacent driveways. The functional intersection area is defined by AASHTO's *Policy on Geometric Design of Highway and Streets* (2001), which states that "the functional area extends both upstream and downstream from the physical intersection area and includes the longitudinal limits of auxiliary lanes." The functional area includes the turn lanes approaching the intersection as well as the perception-reaction distance of the driver approaching the intersection. This functional area is longer on the upstream (approach) side of the intersection than the downstream (departure) side. The MCDOT RDM provides minimum corner clearances based on the type of roadway and location of access point. These clearances range from 85 to 230 feet for signalized intersections, and from 75 to 115 feet for unsignalized intersections. MCDOT enforces these standards for new driveways along county roads.

## Removing Turning Vehicles from Through Lanes

*Dedicated Left and Right Turn Lanes*

One way to accomplish a smooth flow of traffic is to provide dedicated turn lanes, removing turning vehicles from the through traffic flow at roadway intersections and near busy driveways. Turning traffic reduces the capacity of lanes to carry through traffic, causing congestion and delay to increase. This is most obvious in the case of left turning vehicles, which must await a safe gap in opposing traffic. However, right turning vehicles also delay through traffic in their lane because of the need to slow down to a safe turning speed. Turning movements from through lanes result in speed differentials that contribute to crashes, especially rear-end collisions, which are often the most common crash type in urban environments. Dedicated turn lanes allow through traffic to keep moving at a steady speed. A combination of medians and turn lanes provides the fullest protection for turning movements, thus reducing the crash potential. MCDOT has specific standards for requiring acceleration and deceleration lanes, based on volume warrants outlined in the RDM.

## Reduce the Number of Turning Movements

*Alternative Access Ways*

Alternative access ways can be provided to sites adjoining the main road by either frontage or reverse access roads that run parallel to the mainline route. Alternative access may be achieved by using frontage, collector or arterial roads off the major roadway right-of-way. Property access is provided along the frontage or reverse access road, which accesses the arterial via a cross road. This reduces the number and density of conflict points along the arterial. Frontage roads are typically constructed adjacent to the major roadway providing access to properties fronting the highway, thereby funneling local traffic to a common point to gain access. Frontage roads can be one-way or two-way, depending on the situation. Reverse access or "backage" roads also parallel the main roadway, but are offset from the right-of-way to provide site access along the "back side" of the property rather than the highway side. Both kinds of alternative access ways are beneficial in providing convenient access to local properties, while preserving the safety and capacity of the highway. Operational problems involving queues on the cross road blocking closely spaced intersections can occur if adequate separation is not provided between the frontage road and the highway, however. An effective frontage road system therefore requires a substantial investment in right-of-way.