BRIDGE SELECTION REPORT

FOR WIDENING

ALMA SCHOOL ROAD SOUTH BRIDGE

AT SALT RIVER

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

WORK ORDER NO. 68931

CONTRACT NO. CY 1997-09

DRAFT

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TABLE OF CONTENTS

SECTION		PAGE
I.	GENERAL	1
II.	MAJOR BRIDGE WIDENING ISSUES	4
III.	BRIDGE WIDENING ALTERNATES	9
	Alternate 1 - Widen Existing Bridge on Both Sides	9
	Alternate 2 - Widen Existing Bridge on East Side Only	11
IV.	COST COMPARISON	14
V.	SUMMARY	15

Appendix "A" - Relative Cost Comparisons

Appendix "B" - General Plan and Details

I. GENERAL

Purpose

The purpose of this report is to discuss the structural options for widening the existing Alma School Road South Bridge over the Salt River and make a recommendation for the structural type, location and details most appropriate for this project. The approved results of this report will be used to develop the final bridge widening design and construction plans.

Background

Alma School Road from McLellan Road to McKellips Road is an existing urban principal arterial road which crosses the Salt River in two locations. The north crossing is a precast, prestressed concrete box beam bridge over the main river channel whereas the south crossing is a similar structure over a smaller secondary channel. The south channel also serves as a haul road from sand and gravel pits located on the west side of Alma School Road to Sunward Materials plant operations located on the east side of Alma School Road with primary access currently located between the two bridges. The existing roadway and bridges have a clear roadway width of 20.7m (68')from McLellan to just north of the north bridge and are striped for 2 traffic lanes in each direction separated by a continuous left turn lane.

Extension of the Red Mountain (Loop 202) Freeway from Price Road to McKellips Road is currently under construction. As part of the freeway project, a full diamond interchange is being constructed at Alma School Road between McLellan Road and the Salt River. Alma School Road will be improved through the interchange limits as part of the freeway project.

Plans for the Red Mountain interchange indicate that as part of the freeway project, Alma School Road will be improved by ADOT from a point just north of the McLellan Road intersection to a point immediately south of the south bridged crossing of the Salt River secondary channel. The roadway traffic section through the interchange area will include 3 southbound through lanes with 1 southbound left turn lane to accommodate eastbound freeway access and 2 northbound through lanes with 2 north bound left turn lanes to accommodate westbound freeway access. Once through the interchange, ADOT plans to taper the traffic lanes to match the existing 5 traffic lane section approximately 183m (600') north of the freeway westbound on and off ramps which is within 15.2m (50') of the south abutment of the south bridge.

To help eliminate a possible bottleneck situation and increase the level of service on Alma School Road during peak hour traffic, Maricopa County Department of Transportation (MCDOT) intends to improve the portion of Alma School Road, including widening the south bridge over the Salt River, from the northern ADOT right-of-way limits for the Red Mountain Freeway interchange to the southern limits of the existing north bridge over the Salt River. All of the proposed project limits fall within MCDOT or SRPMIC rights-of-way.

A Candidate Assessment Report (CAR) C96-0044-09 for this project was prepared for MCDOT by Inca Engineers, Inc., dated December 15, 1995. The results of the preliminary studies and the CAR indicate that improvement of the roadway section north of the interchange to a point just south of the north bridge structure should be reasonable from a cost standpoint and will help minimize the adverse effects of the potential traffic problem in this area. Widening the existing roadway section between the interchange and the south end of the north bridge structure would require widening the south bridge structure approximately 6 meters plus additional width to accommodate current County standard sidewalk sections.

Their are several constraints and major issues of concern associated with this proposed project including, but not limited to, the close proximity of the freeway interchange with the south bridge, alignment of the roadway and subsequent ultimate traffic lanes through the bridge corridor, roadway and bridge drainage, site drainage, access to local properties (especially Sunward Materials plant site), river hydraulics and scour potential, bridge superstructure and substructure widening concepts and methods, overhead high voltage power lines, right-of-way considerations, construction traffic movement and control, and constructibility including possible staging.

All design procedures will be in accordance with MCDOT Roadway Design Manual and MCDOT Traffic Engineering Manuals and Procedures. Standard project specifications and details will be in accordance with the Maricopa Association of Governments (MAG) Standard Plans and Specifications, 1996 Metric Edition. All bridge design will be in accordance with AASHTO Standard Specifications for Road and Bridge Construction, 1996, Sixteenth Edition. All bridge plans will be developed and prepared in the SI (metric system) of units. All bridge special provisions to the project standard specifications will be prepared in the SI (metric system) of units.

Existing Bridge Description

The existing bridge is a 7-span right angled structure approximately 124.8m (409.5′) long. The structure was designed for AASHTO HS-20-44 loading and in accordance with AASHTO Standard Specifications for Highway Bridges, 1977 edition including 1978 Interim Specifications and revisions through 1980.

The superstructure in each span is comprised of 21 - 1219mm (4′) wide precast, prestressed concrete box beams with asphalt concrete overlay for a wearing surface. The beams were designed as simple spans for all loads. The overall out-to-out deck width is 25.6m (84′) with 20.7m (68′) clear roadway between concrete traffic barriers. There is a 1168mm (3′-10″) wide pedestrian walkway with a concrete parapet and chain link fence on the west side and a 2083mm (6′-10″) pedestrian walkway/bicycle path with a concrete parapet and chain link fence on the east side.

To minimize differential vertical deflection between adjacent concrete beams, grout keys were provided on both sides of all interior girders and on the interior sides of the two exterior beams. In addition, to help minimize differential deflections and provide for lateral continuity, 1¼" diameter tensioning rods were placed transversely through the box beams and secured with a steel plate and nut assembly at the outside face of each exterior beam.

The substructure consists of 2 abutments and 6 piers. The abutments are high wall type with skewed wingwalls on each side. Both abutments are protected by a rip rap covered sloped bank. Both abutments and wingwalls are supported on steel H-pile foundations. The piers are 4 column bents supported on steel H-pile foundations.

Widened Bridge Criteria

The new widened bridge cross section will be designed to accommodate seven traffic lanes (three northbound lanes, three southbound lanes and one median lane) with sidewalk sections on each side of the bridge separated from the traffic lanes by concrete traffic barriers. The new widened roadway section will accommodate the standard Maricopa County roadway width of 28.6m (94′) minimum between barriers.

II. MAJOR BRIDGE WIDENING ISSUES

The following major issues effecting selection of the appropriate bridge widening location, methods and details have been identified:

- Geometric Interface with Approach Roadway Alignment

The existing roadway alignment from McClellan to McKellips is composed of several horizontal curves and tangents. ADOT's Red Mountain Interchange plans revised the existing centerline alignment and designed their north connection to the existing County roadway section utilizing a 64km/h (40mph) design speed with no superelevation. This configuration assumed the County roadway and bridge project would widen on each side of Alma School Road.

Preliminary investigations indicated that some major benefits might be realized by widening the bridge to one side only. A roadway alignment study was then prepared to determine the feasibility of this approach. It was determined that widening only to the east side of the bridge could effectively accommodate the new traffic lane requirements with minor adjustments. See the Alignment Analysis Technical Memorandum prepared for this project for more details.

- Bridge Deck Drainage

The existing bridge deck drainage system consists of scupper blockouts through the concrete traffic barriers and prefabricated drain tubes through the pedestrian fencing curbs at approximately 32ft centers. The drains were designed to disperse accumulated rainfall on the deck surface directly into the riverbed below. In accordance with NPDES requirements of the Federal Clean Water Act, this is no longer an acceptable method for dispensing with bridge deck rainfall accumulations.

Preliminary results of the Drainage Report being prepared for this project indicate that design rainfall accumulations can be carried in the gutter lanes and drained longitudinally off the bridge into the new roadway storm drain system in compliance with current County roadway drainage design standards, therefore, there will be no deck drains required in the widened portion of the bridge. See the Drainage Report Technical Memorandum prepared for this project for more drainage details.

- Utilities

There are currently no known utilities carried in the existing bridge. There is an existing 12Kv powerline located east of the bridge and a 69Kv powerline to the west. A minimum of 2-69Kv powerline towers may be impacted by the new construction depending on whether or not the bridge is widened to the west.

At this time it is anticipated that several utility conduits will need to be accommodated on the new widened portion of the bridge. Conduit for cable television as well as future street light and possible signalization at the Sunward Materials main access have been identified. Conduit will be provided in the new traffic barrier, pedestrian curb or through the new precast girders as appropriate.

- Hydraulic and Scour Analysis

In 1993 a river grade control structure was designed and constructed across the Salt River immediately downstream from both bridge structures in an attempt to control stream bed degradation and head cutting which was negatively impacting the existing bridge substructures. The grade control structures were designed by MCDOT as part of the FEMA program.

A preliminary scour analysis prepared by Dibble & Associates for this project indicates that while the degradation and head cutting problems may have been solved, there still remains potential local scour problems that could possibly adversely affect the existing bridge foundations. The design of any additional scour protection that may be required, if any, for the existing bridge substructure is beyond the scope of this project. See the Drainage Report Technical Memorandum prepared for this project for further hydraulic detail.

The new widened bridge foundation final designs for the pier and abutment extensions will consider the calculated local scour depth, as reflected in the approved Project Drainage Report, in the selection of the appropriate foundation type and size.

- Substructure Design and Connections

In order to maintain structural consistency and aesthetic compatibility, the substructure configuration of reinforced concrete column bents with reinforced concrete cap beams at the piers and high wall abutments will be maintained throughout the widened section of the structure.

Foundations for the existing pier and abutment substructures as well as the abutment wingwalls consist of reinforced concrete footings supported by driven steel H-piles. Driving steel piles in the Salt River for the existing bridge and grade control structure proved somewhat difficult at this location, therefore, it is anticipated the new bridge widening will be supported on drilled, cast-in-place concrete shafts designed for full support beneath the river scour depth. This method has proven to be more cost effective on similar structures in the recent past.

The existing abutment wingwalls and footings are separated from the existing abutment walls and footings by an expansion type joint. Both the walls and footings are joined with shear dowels in expansion sleeves cast in the wing sections. The existing wingwalls and wingwall footings will be removed with the existing steel H-piles cut off at a sufficient depth to avoid conflict with the widened sections. The new abutment wall and footing extensions and new wingwalls will be designed similar to the existing sections, however, the new extensions will be supported on foundation types recommended in the approved Geotechnical Report. Drilled cast-in-place concrete shaft type foundations are anticipated.

The existing concrete pier caps are flush with the outside edge of the deck and cantilevered 1600mm (5'-3") from the center of the exterior pier columns. The new pier extensions will be self supporting and will only be tied to the existing piers through nominal drilled and grouted dowel bars in the ends of the cap beams in an effort to minimize potential lateral separation.

- Superstructure Design and Connections

The existing superstructure consists of seven spans of side-by-side 762mm (30") deep precast prestressed concrete box beams connected laterally by 31.8mm (1¼") diameter tensioning rods. Differential vertical movement between the beams is controlled by grouted shear keys running longitudinally along the top of all interior beams. The deck is covered with an asphalt concrete wearing surface.

The existing beams were designed as simple span units for all loads including HS20-44 live load in accordance with AASHTO Standard Specifications for Highway Bridges, 1977 edition, revised through 1980.

There are three different bearing conditions associated with the existing structure. Pier 4 has a sliding or expansion bearing to the south with a fixed bearing condition to the north. All other piers have fixed bearing conditions. The beams simply rest on elastomeric bearing pads at each abutment. The fixed bearing assemblies at the piers consist of vertical dowels extending from the pier caps into vertical pockets blocked out in the ends of the beams. In addition, horizontal hairpin bars cast in the beams, extend into the pockets and around the vertical dowels. These pockets are grouted solid. The expansion bearings at pier 4 consist of Flourogold slide bearing assemblies and vertical notched steel bar shear connectors.

Based on the As-Built drawings for the existing structure, the bearing assemblies at all piers make it extremely difficult to remove any of the existing beams. In addition, to remove an existing beam would require release and at least partial removal of the lateral tensioning rods. Since Alma School Road is to remain open to traffic during construction, removal of the lateral rods could loosen the grout in the longitudinal shear keys making it difficult to re-tension. Due to these and other considerations, it is recommended that the existing beams remain intact.

The new beams will require development of special bearing and shear details. This will be accomplished during final design. The new bearing and shear details will be compatible with the design intent of the existing structure.

To provide lateral continuity and minimize differential vertical deflection, several methods were investigated. Removal of the existing asphalt concrete wearing surface and replacement with reinforced concrete topping extending over the new beams was considered, however, the necessary construction techniques and excessive cost made this option unacceptable. Extending the existing lateral tie rods through the new beams requires difficult coupling procedures and could create problems if traffic remains on structure during construction as previously discussed. Steel angles cast in the top edges of the new beams with field welded tie plates was considered and appears to be the most cost effective and constructible option considered. A special tie plate detail will be developed to laterally connect the new beams to the existing beams. See proposed details on Drawing 2 of 2 in Appendix B of this report.

- Remove and Replace Barriers and Fence Curbs

Obtaining the desired roadway width will require removal and relocation of the existing concrete traffic barriers and fence curbs. Since removal of the beams with these elements attached is impractical, it will be necessary to carefully remove these elements without damaging their respective beams. Sawcutting may be required.

- Constructibility

Since the dry river bed beneath the bridge is used as a haul road from Sunward Material's mining operation to the west of the bridge to their plant operations located east of the bridge, special consideration will be given to erection methods and timing. Coordination of the beam erection schedule with Sunward's plant operations will be required.

Traffic will be maintained on Alma School Road during the bridge widening operations. Construction sequencing and beam erection schedules will be developed to minimize disruption of traffic and at the same time optimize the construction methods.

Construction of the pier and abutment foundations will be complicated by the existence of the concrete and rock mattress grade control structure. Drilling through this structure will be difficult and expensive. Clearance of the drill rig boom with the high tension powerlines will require de-energizing the lines during drilling operations. This may limit the drilling operation to low energy usage times of the year.

- Right-of-Way and Easements

Additional rights-of-way and/or easements for the bridge widening are not anticipated at this time.

- Construction Costs

Comparative construction costs for the bridge widening alternatives will be evaluated and considered in the selection of the preferred alternative. A comparative cost analysis of the major common items for both alternates has been prepared and included in Section IV of this report.

III. BRIDGE WIDENING ALTERNATES

ALTERNATE 1 - WIDEN EXISTING BRIDGE on BOTH SIDES:

The Candidate Assessment Report prepared for this project suggests widening the existing bridge on each side to provide for the City of Mesa standard roadway width of 26.8m (88′) and MCDOT standard pedestrian walkways as the preferred alternative alignment. Subsequent discussions with key MCDOT staff indicate a County standard 28.6m (94′) roadway section with pedestrian walkways on each side would be preferred. This alternative reflects the latter concept.

- Geometric Interface

Widening the existing bridge on each side will accommodate the proposed approach roadway geometrics and permit widening both sidewalk sections to current MCDOT standards.

Maintaining the existing roadway centerline and providing a 432mm (1′-5″) wide traffic barrier, a 1830mm (6′) sidewalk section and a 305mm (12″) wide fence curb section on each side of the bridge will require adding 3 - 1219mm (4′) wide beam lines to the east and 4 - 1219mm (4′) wide beam lines to the west for a total of 49 new beams.

- Deck Drainage Considerations

Existing tubular steel deck drains will need to be removed from each side of the bridge. According to the drainage report for this project, the deck drainage can be accomplished by the longitudinal vertical curve in the deck which will allow water to travel in the curb lane and enter the roadway drainage system at each end of the bridge.

- Utilities Considerations

Conduit can be provided for any new utilities through the barriers, curbs or new deck units as required. Expansion sleeves will be required at all joints. Major utility conflicts with the existing high tension powerline located on the west side of Alma School Road will result if the bridge is widened to the west. A minimum of 2 poles will be affected.

- Hydraulics and Scour Considerations

Preliminary scour analysis, indicates local scour will be produced at each of the upstream pier columns. Local scour will be minimized at the downstream columns due to protection from the grade control structure. New pier foundations will be designed for stability beneath the anticipated scour depth. See the Drainage Report for this project.

- Substructure Considerations

Extending the piers on each side will require a minimum of 2 columns on each side for stability. This will result in the addition of 24 new columns and pier foundations. It is anticipated the pier foundations will be drilled shaft types as an extension of the columns. This will require penetrating the existing grade control structure with a minimum of 12 shafts. As discussed previously, this is a difficult operation and will cost an estimated 2 times the cost per foot of drilling the shafts on the east side of the existing bridge.

It is anticipated that extending the abutments on all 4 corners will require approximately 4 drilled shafts per abutment extension and an additional 4 per wingwall for a total of 32 drilled shafts. As discussed for the piers, the new west side abutment and wingwall foundations will be extremely difficult to construct due to interference with the existing grade control structure and the overhead high tension powerlines.

- Superstructure Considerations

Connections for securing the new widened beams to the existing beams will be accomplished with steel angles and weld plates. Since this alternate requires widening on each side, angles will need to be secured to the external side of each existing exterior unit, 14 beams total, by drilling and installing inserts at appropriate spacing.

- Remove and Replace Barriers and Fence Curbs

Widening for this alternative will require removal and replacement of the existing concrete barriers, curbs and fencing on each side of the bridge. This will allow for installation of County standard sidewalk sections on each side. The current sidewalk section on the west side is substandard at only 1,168mm wide.

- Constructibility Considerations

Widening on both sides will require considerable moving of major construction equipment such as beam erection cranes and foundation drilling rigs from one side to the other. This will negatively impact haul road traffic due to extending the overall construction schedule. Alma School Road traffic will also be negatively impacted by construction time increases and the need to switch traffic from one side of the bridge to the other depending on construction sequence.

- Right-of-Way Considerations

No additional right-of-way will be required for widening the existing structure on both sides.

ALTERNATE 2 - WIDEN EXISTING BRIDGE on EAST SIDE ONLY:

In the early stages of reviewing existing data, it became apparent that significant cost savings could probably by achieved by widening the existing bridge to one side only. This alternate was then investigated to determine if all final design criteria could be met utilizing this approach.

- Geometric Interface

The preliminary alignment study prepared for this project confirms that with minor modifications to the roadway striping alignment across the new bridge, widening to the east side only will accommodate the proposed approach roadway geometrics. This option, however, does not allow for modification of the existing substandard west side sidewalk area.

To accommodate the new 28.6m (94′) roadway section, 7 - 1219mm (4′) wide beam lines for a total of 49 new beams will need to be added.

- Deck Drainage Considerations

Existing tubular steel deck drains will need to be removed only from the east side of the bridge. The existing west side drains can be plugged to be in compliance with the federal Clean Water Act NPDES requirements. According to the drainage report for this project, the deck drainage can be accomplished by the longitudinal vertical curve in the deck which will allow water to travel in the curb lane and enter the roadway drainage system at each end of the bridge.

- Utility Considerations

Conduit can be provided for any new utilities through the barriers, curbs or new deck units as required. Expansion sleeves will be required at all joints. Major utility conflicts with the existing high tension powerline located on the west side of Alma School Road will be avoided in this option. This will result in considerable savings. See Section IV of this report.

- Hydraulics and Scour Considerations

Preliminary scour analysis, indicates local scour will be produced at each of the upstream pier columns, therefore, the new pier foundations will be designed for stability beneath the anticipated scour depth. See the Drainage Report for this project.

- Substructure Considerations

Extending the piers to the east side only will require a minimum of 2 columns per pier for stability. Geotechnical and scour considerations may require a third column at each new pier extension. This will result in the addition of 12 to 18 new columns and pier foundations. It is anticipated the pier foundations will be drilled shaft types as an extension of the columns. Widening only to the east will eliminate conflicts with the existing grade control structure. This will greatly reduce the foundation costs for this project.

It is anticipated that extending the abutments to the east will require approximately 4 drilled shafts per abutment extension and an additional 4 per wingwall for a total of 16 new drilled shafts. Widening only to the east will require the removal and replacement of only 2 wingwalls. Again, no interference with the existing grade control structure will be a major cost benefit.

- Superstructure Considerations

Connections for securing the new widened beams to the existing beams will be accomplished with steel angles and weld plates. Since this alternative requires widening on only one side, angles will need to be secured to the external side of each existing exterior unit, 7 beams total, by drilling and installing inserts at appropriate spacing.

- Remove and Replace Barriers and Fence Curbs

Since the west side of the existing structure will remain unchanged, it will only be necessary to remove and replace the east side existing concrete traffic barrier and fence curb section.

The current substandard sidewalk section on the west side will remain. The impact of this situation is diminished when considering the existing bridge immediately to the north of this bridge has the same substandard section and is not scheduled for improvement in the foreseeable future.

- Constructibility Considerations

From a constructibility standpoint, widening to one side only will quite beneficial. It will require only one mobilization and move-in of major construction equipment such as beam erection cranes and foundation drilling rig. Current Alma School Road traffic patterns can be maintained throughout most of the bridge construction operation. The existing east side traffic barrier can remain in place until the new widened section is constructed and ready for paving. Milling the existing A.C. deck surface and replacing with new A.C. or Rubberized Asphalt wearing surface will require special traffic control measures. Reduction in overall construction time will also benefit the Sunward Material's haul road traffic.

- Right-of-Way Considerations

No additional right-of-way will be required for widening the existing structure all to the east.

IV. COST COMPARISONS

The following section presents a relative cost comparison of major bridge construction items for Alternate 1 - Widen Existing Bridge on Both Sides and Alternate 2 - Widen Existing Bridge on East Side Only. This comparison is not a complete estimate of bridge construction costs for each alternate and only represents comparable costs for selected major items in an effort to distinguish differential costs in support of the recommended alternate. See Appendix "A" for cost analysis comparisons of each alternate.

Cost Comparison Summary:

Alternate 1

Drilled Shaft Foundations		
Piers (24)	$199,680	
Abutments & Wings (32)	$199,680	
Piers		
Columns (24)	$ 25,920	
Abutments		
4 Wingwalls	$ 34,320	
Remove & Replace Barriers, Curbs & Fences		
Traffic Barriers	$ 36,250	
Concrete Curbs and Fences	$ 20,000	
Powerline Relocations	$150,000	
TOTAL ALTERNATE 1 SELECTED COSTS		**$665,850**

Alternate 2

Drilled Shaft Foundations		
Piers (18 conservative)	$115,200	
Abutments & Wings (16)	$ 76,800	
Piers		
Columns (18)	$ 19,440	
Abutments		
2 Wingwalls	$ 17,160	
Remove & Replace Barriers, Curbs & Fences		
Traffic Barriers	$ 18,125	
Concrete Curbs and Fences	$ 10,000	
TOTAL ALTERNATE 2 SELECTED COSTS		**$256,725**

APPROXIMATE COST DIFFERENTIAL **$409,125**

V. SUMMARY

In order to obtain acceptable aesthetic appearance and structural compatibility, it is recommended the existing south bridge over the Salt River be widened in kind, i.e., precast, prestressed concrete box beam superstructure with concrete column and cap beam type piers, high wall concrete abutments and skewed concrete wingwalls.

Two alternative widening options were considered. Alternate 1 would widen the existing bridge appropriately on each side. This alternative would accommodate the full 28.6m (94') roadway width and MCDOT standard sidewalks on each side, however, major conflicts with foundation construction, powerline relocations, construction scheduling and construction traffic maintenance exist. This alternate is also the most expensive to construct.

Alternate 2 would widen the existing bridge all to the east or upstream side. This option also accommodates approach roadway requirements, however, the west side sidewalk section would remain substandard and will continue to match the corresponding sidewalk section on the existing bridge immediately to the north of this project. Substructure construction time and costs would be reduced due to fewer pier and abutment foundation shafts, fewer pier columns, removal and replacement of only 2 wingwalls and the reduction in move-in and mobilization time for foundation drilling. Superstructure construction time and costs would be reduced due to minimum beam erection time for one side erection, removal and replacement of only one set of traffic barrier and fence curb, and the installation of only one set of connection assemblies from existing to new beams. Construction traffic disruption would be minimized.

As noted in previous sections of this report, the ultimate traffic operation and roadway configuration will not be compromised by widening the bridge all to the east side. In addition, the hydraulic report for this project indicates that if the bridge were widened all to the east side, sufficient bridge opening will still be available to adequately handle the design flow.

Based on the previous discussions of each alternative and the significant cost differential between the two, it is recommended that Alternate 2 - Widen Bridge on East Side Only be the preferred alternate and that the final design reflect this option.

APPENDIX "A"

RELATIVE COST COMPARISONS

ALTERNATE 1 - WIDEN BOTH SIDES

1. Drilled Shaft Foundations

Abutments (32 total shafts required)

East Side:	16 shafts	x	12 m/shaft	x	$400 /m	=	$76,800
West Side:	16 shafts	x	12 m/shaft	x	$640 /m	=	$122,880

Piers (24 total shafts required)

East Side:	12 shafts	x	16 m/shaft	x	$400 /m	=	$76,800
West Side:	12 shafts	x	16 m/shaft	x	$640 /m	=	$122,880

SUBTOTAL DRILLED SHAFT FOUNDATIONS = $399,360

2. Columns (24 required) - Includes Concrete & Reinforcing Steel

Piers:	3 cu m/col	x	24 cols.	x	$360 /cu m	=	$25,920

SUBTOTAL COLUMNS = $25,920

3. Wingwalls (4 required) - Includes Concrete & Reinforcing Steel

East Side:	2 wings	x	22 cu m/wing	x	$390 /cu m	=	$17,160
West Side:	2 wings	x	22 cu m/wing	x	$390 /cu m	=	$17,160

SUBTOTAL WINGWALLS = $34,320

4. Remove and Replace Barriers and Curbs (2 each required)

Barrier:	2 barriers	x	125 m/barrier	x	$145 /m	=	$36,250
Curb:	2 curbs	x	125 m/curb	x	$80 /m	=	$20,000

SUBTOTAL BARRIERS AND CURBS = $56,250

5. Remove and Replace Powerline Towers (2 minimum required)

Towers:	2 towers	x	$75,000 ea.	=	$150,000

SUBTOTAL POWERLINE TOWERS = $150,000

TOTAL COMPARATIVE COSTS - ALTERNATE 1 $665,850

RELATIVE COST COMPARISONS

ALTERNATE 2 - WIDEN EAST SIDE ONLY

1. Drilled Shaft Foundations

Abutments (16 total shafts required)

East Side:	16 shafts	x	12 m/shaft	x	$400 /m	=	$76,800
West Side:	0 shafts	x	12 m/shaft	x	$640 /m	=	$0

Piers (18 total shafts required)

East Side:	18 shafts	x	16 m/shaft	x	$400 /m	=	$115,200
West Side:	0 shafts	x	16 m/shaft	x	$640 /m	=	$0

SUBTOTAL DRILLED SHAFT FOUNDATIONS = $192,000

2. Columns (18 required) - Includes Concrete & Reinforcing Steel

Piers:	3 cu m/col	x	18 cols.	x	$360 /cu m	=	$19,440

SUBTOTAL COLUMNS = $19,440

3. Wingwalls (2 required) - Includes Concrete & Reinforcing Steel

East Side:	2 wings	x	22 cu m/wing	x	$390 /cu m	=	$17,160
West Side:	0 wings	x	22 cu m/wing	x	$390 /cu m	=	$0

SUBTOTAL WINGWALLS = $17,160

4. Remove and Replace Barriers and Curbs (1 each required)

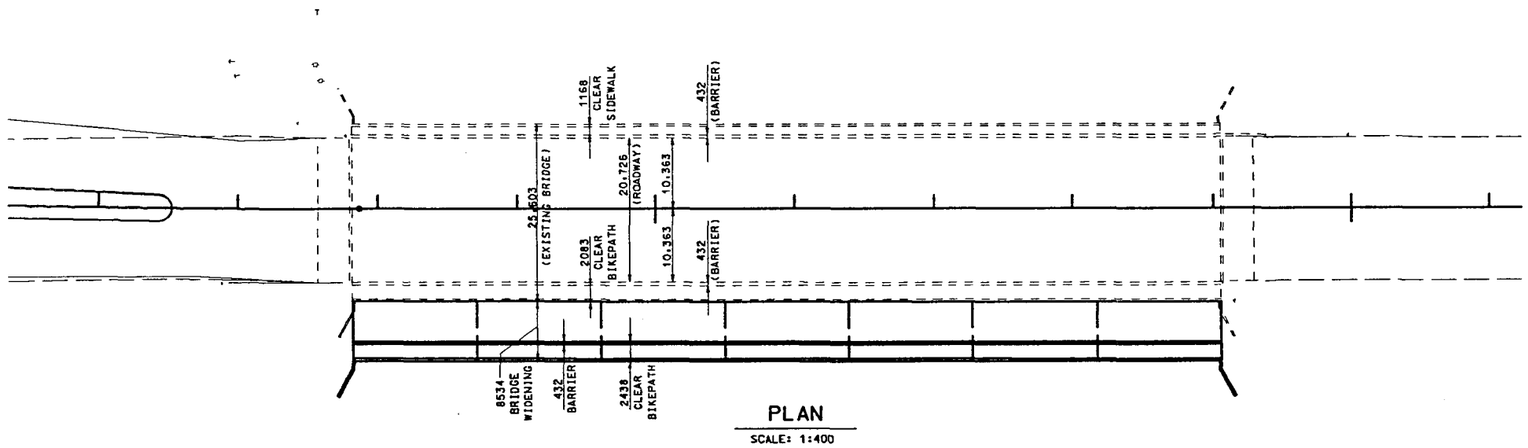
Barrier:	1 barriers	x	125 m/barrier	x	$145 /m	=	$18,125
Curb:	1 curbs	x	125 m/curb	x	$80 /m	=	$10,000

SUBTOTAL BARRIERS AND CURBS = $28,125

TOTAL COMPARATIVE COSTS - ALTERNATE 2 **$256,725**

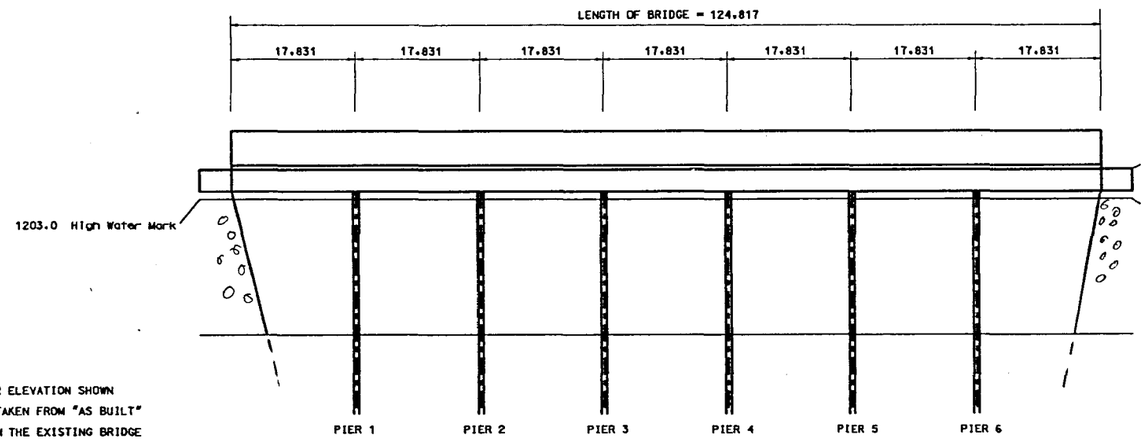
APPENDIX "B"

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931			



PLAN

SCALE: 1:400



ELEVATION

SCALE: HOR. 1:400
VERT. 1:100

NOTE A:
HIGH WATER ELEVATION SHOWN HAS BEEN TAKEN FROM "AS BUILT" PLANS FROM THE EXISTING BRIDGE DATED 11-10-80.

NOTE B:
ELEVATIONS SHOWN ARE MEASURED THE TOP OF ROADWAY (TOP OF WEARING SURFACE) AT THE ℄ OF THE EXISTING ROADWAY. (TYP.)

GENERAL NOTES:

CONSTRUCTION:
Maricopa Association of Governments Uniform Standard Specification for Public Works Construction, 1996 Edition including all supplements and amendments by MCDOT and the Project Special Provisions

DESIGN:
AASHTO Standard Specifications for Highway Bridges, 1996 Edition, revised to date, metric units.

LOADING CLASS: AASHTO MS18-44

STRESSES:

CONCRETE:

Abutments	f'c = 30 MPa - Class AA
Piers	f'c = 30 MPA - Class AA
Box Beams	f'c = 35 MPa - Class Special
Barrier, Curb & Approach Slabs	f'c = 20 MPa - Class B

REINFORCING STEEL: ASTM A615M
Grade 400 f's = 165 MPa

PRESTRESSING STEEL:
12.70 mm dia. 7-wire low-relaxation strand f's = 1860 MPA
Prestressing Steel shall conform to ASTM A416.

STRUCTURAL STEEL: ASTM A709 Grade 36

All placement dimensions for reinforcing steel shall be to the center of the bar unless otherwise noted.

All bend dimensions for reinforcing steel shall be measured out to out unless otherwise noted.

All reinforcing steel shall have a minimum 50 mm clear cover unless otherwise noted.

All welding shall conform to the requirements of the American Welding Society Structural Welding Code D1.1-92, revised to date.

Dimensions shall not be scaled for drawings.

All dimensions are in millimeters (mm) and all elevations are in meters (m) unless otherwise noted.

For additional information relating to the existing bridge not shown, see the "As Built" plans dated 11-10-80.

NO.	REVISION	BY	DATE
1			
2			
3			
4			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE
AT THE SALT RIVER
PROJECT NO. 68931

	BY	DATE
DESIGNED		
DRAWN		
CHECKED		

DE LEUW, CATHER CO.
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

GENERAL PLAN

SHEET __ OF _

TRACS NO.

mb.dgn 12/02/94

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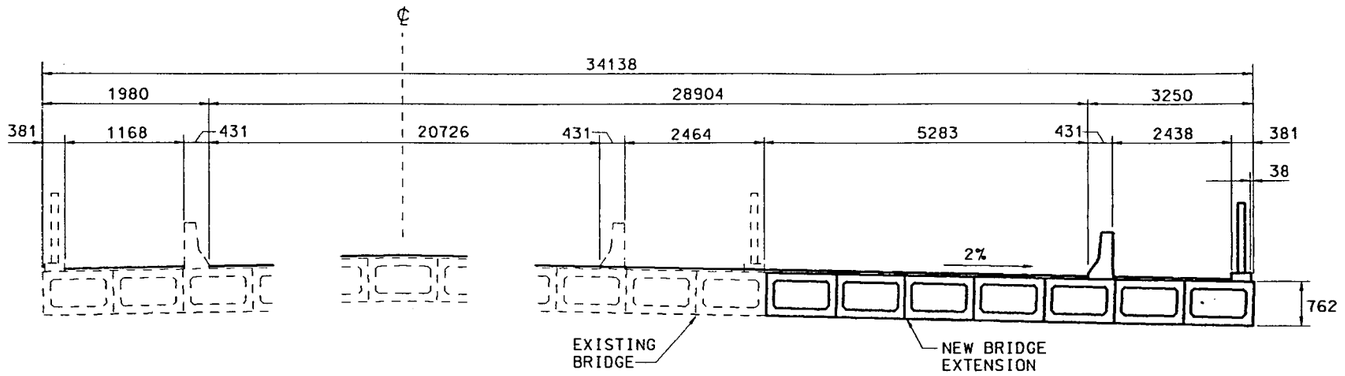
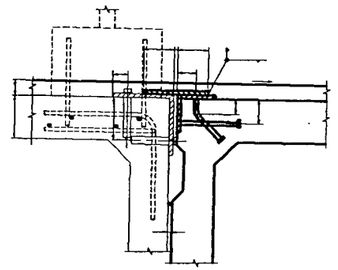
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68931			



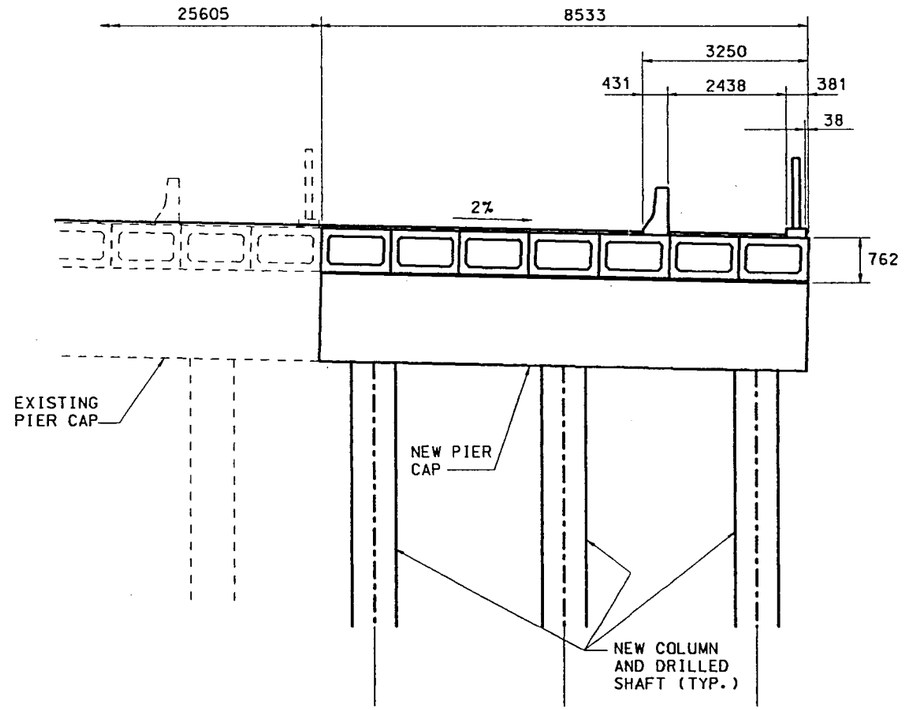
TYPICAL DECK SECTION

(LOOKING NORTH)
Scale 1:50



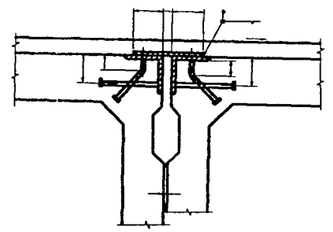
BOX BEAM CONNECTION DETAIL

(BETWEEN EXISTING & PROPOSED BOX BEAMS)
Scale 1:50



TYPICAL SECTION AT PIER

(LOOKING NORTH)
Scale 1:50



BOX BEAM CONNECTION DETAIL

(BETWEEN PROPOSED BOX BEAMS)
Scale 1:50

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ALMA SCHOOL ROAD SOUTH BRIDGE AT THE SALT RIVER PROJECT NO. 68931

	BY	DATE
DESIGNED	W ZAPFEL	5/97
DRAWN	M FEE	5/97
CHECKED		

DE LEUW, CATHER CO.
3875 N. 44th Street, Suite 250
Phoenix, Arizona 85018

BRIDGE DETAILS

SHEET __ OF __

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