Final Structural Evaluation of Phoenix Rio Salado Bridges - Phase I

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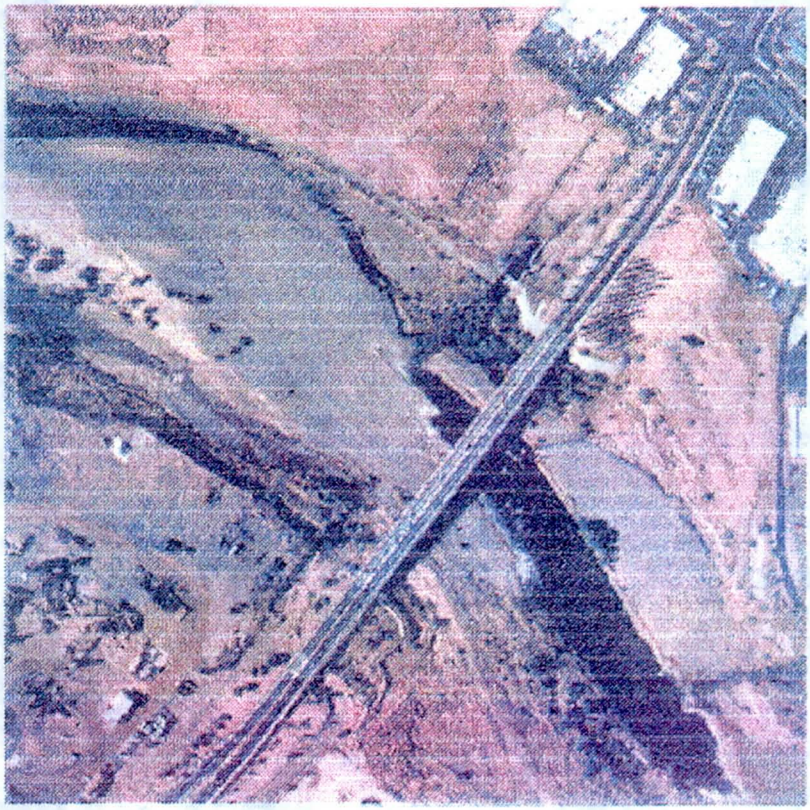

City of Phoenix

U.S. Army Corps Of Engineers
Los Angeles District

WEST CONSULTANTS, INC.

Submitted by: T·Y·LIN INTERNATIONAL

January 18, 2000

Final Structural Evaluation of Phoenix Rio Salado Bridges - Phase I

Seventh Ave. & South Central Ave.

Prepared for
U.S. Army Corps of Engineers
Los Angeles District

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Contract:
DACW09-97-D-0022

January 18, 2000

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T·Y·LIN INTERNATIONAL

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1.0 EXECUTIVE SUMMARY

This structural evaluation of Phoenix Rio Salado Bridges is a summary of the final engineering evaluation performed to determine if either the Seventh Avenue Bridge or the South Central Avenue Bridge are compromised by the proposed low flow channel condition on a 100-year event.

By examination, the elevation of maximum scour for ***South Central Avenue*** Bridge is more than three feet below the bottom of footing elevation. Consequently, this structure is recommended for retrofit.

The foundations for the ***Seventh Avenue Bridge*** were deemed to be adequate to resist the stream forces associated with the 100-year peak event; therefore no retrofit measurements are required for this bridge structure.

2.0 INTRODUCTION

West Consultants, Inc recently conducted a bridge scour analysis for seven bridge structures over the Salt River. These structures are the 24th Street Bridge, the Upstream Conveyor Bridge, the 16th Street Bridge, the 7th Street Bridge, the South Central Avenue Bridge, and the Downstream Conveyor Bridge. The bridge scour analysis was performed as a result of a hydraulic and sediment transport analysis for three low flow channel design alternatives for the Phoenix Reach of the Rio Salado Project. A brief description of the three alternatives investigated by West Consultants, Inc are listed below:

- Alternative 1 is the Corps of Engineers feasibility design concept. This is a trapezoidal channel with a 2H:1V soil cement bank protected side slopes, earth bottom and soil cement grade control structures located within the low flow channel. This concept included a 200-foot bottom width throughout the project with five grade control structures. West Consultants, Inc made some modifications to this concept after their hydraulic and channel stability analysis showed that the bottom width of the low flow channel was less than the proposed in the feasibility study. Also, three grade control structures were recommended instead of five.

- Alternative 2 is the Value Engineering (VE) M-26 concept. This VE concept was modified to have a 3H:1V vegetated side slopes and soil cement at locations requiring additional protection. For this concept the grade control structures are extended across the full width of the flood control channel and included a notch for the low flood channel.

- Alternative 3 is the same as alternative 2 except that the overbank guide dikes are added to maintain the alignment of the low channel flow.

West Consultants, Inc modeled the low flow channel alignment by locating the channel thalweg from 1-foot contour mapping. In the model, the alignment of the low flow channel was adjusted to avoid major features that were identified by the Corps of

Engineers, the City of Phoenix and the County Flood Control District. The low flow channel location and alignment considered the number of bridge piers within the low flow channel and their orientation with respect to the channel flow. The same low flow channel geometry was used for the three alternatives with a 3H:1V side slopes.

Consequently, West Consultants, Inc performed a bridge scour analysis in the project reach based on the 100-year discharge of 166,000 cfs. Contraction scour and abutment scour were estimated to be negligible at the seven bridge structures based on the low flow channel results. There is no flow contraction between the bridges approach section and the bridges opening since the flow is confined within the channel banks, and the abutments do not project abruptly into the flow area. West Consultants, Inc estimated the bridge scour for the seven structures over the Salt River by using the Corps of Engineering, HEC-RAS computer program (Version 2.2, September 1998) per Federal Highway Administration (FHWA) guidelines. The scour computations are based on the data in the HEC-RAS model.

To determine the local pier scour, West Consultants, Inc used the Colorado State University (CSU) equation. In order to comply with the Arizona Department of Transportation guidelines, West Consultants, Inc added two feet increase in pier width per side for the top 12 feet to account for debris loading. An angle of attack of 0 degrees was assumed in the computations of the pier scour since the low flow channel alignment was line up parallel to the piers of all bridges.

All HEC-RAS output and scour computations including flows, scour elevations and water surface elevations included in this report are referenced from a memo provided by West Consultants, Inc dated on September 16th, 1999. Their values are based on the results of the analysis between 90% to 100% of the Final Report "Low-Flow Channel Design Analysis for Rio Salado (Salt River), Arizona dated on January 11th, 2000. The anticipated scour elevation for the Salt River through downtown Phoenix based on the scour analysis will be lowered as much as twelve feet for a 100-year event. The seven bridge structures over the Salt River are impacted by the lowered scour elevation.

Therefore, there is a need for a detailed and thorough scour investigation of these seven bridge structures over the Salt River in order to avoid catastrophic effects due to excessive scour.

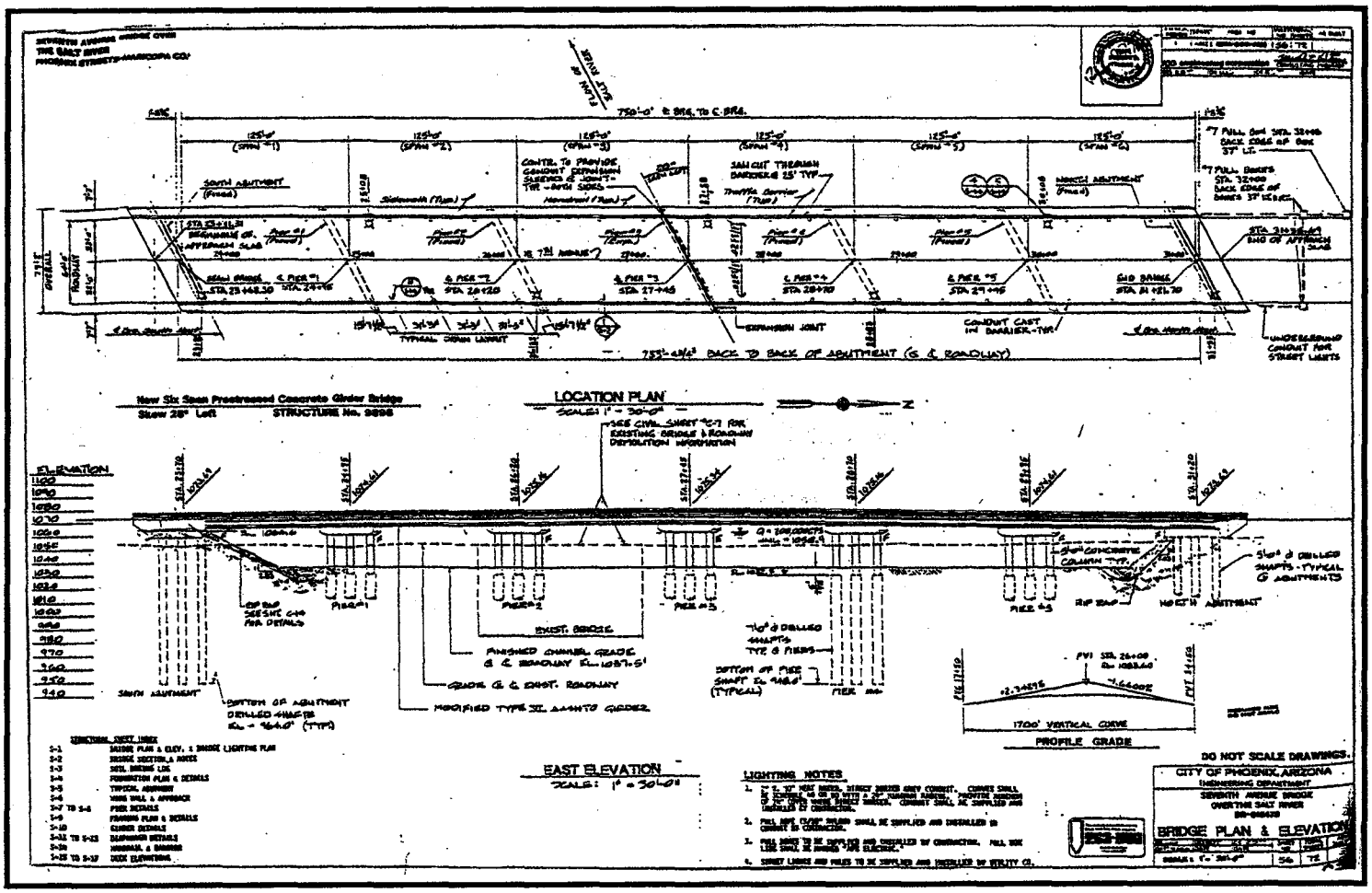
The following report summarizes the impact of the lowered scour elevation on two of the seven structures due to low-flow channel conditions – ***Seventh Avenue and South Central Avenue***. This report does not examine the existing conditions. Results of the bridge scour analysis with the low-flow channel geometry conducted by West Consultants, Inc anticipates that the elevation of maximum pier scour for the ***Seventh Avenue*** and ***South Central Avenue Bridges*** is estimated to be 1002.84 feet and 1006.74 feet, respectively. Preliminary recommendations will be proposed for retrofit measurements where the increase in scour depth reduces the bridge capacity below Arizona Department of Transportation (ADOT) standards.

3.0 BRIDGE DESCRIPTION

As-built plans for both bridges were obtained and computer models generated based upon the information contained in these documents. Below is a brief description of both structures.

3.1 Seventh Avenue

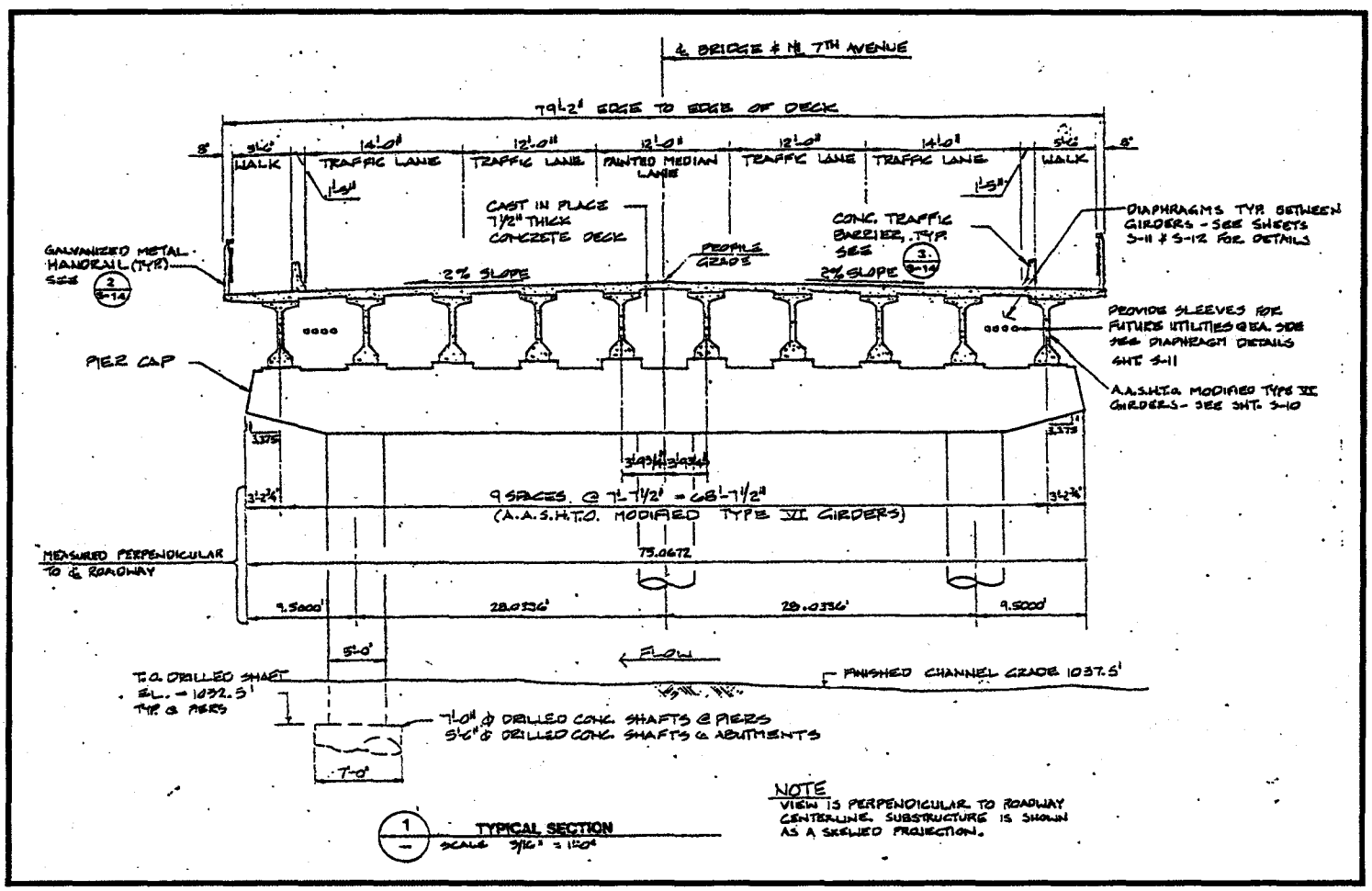
The Seventh Avenue Bridge is a six-span structure 750-feet long and 79-feet wide.



Plan and Elevation – Seventh Avenue Bridge

The AASHTO girder bridge – built in 1987 – is supported on three-column bents and spill-through type abutments. The five-foot diameter shafts at the abutments are founded 73-feet beneath the channel bottom (Elevation 964), while the seven-foot diameter shafts

at the piers are extended nearly 90-feet into the riverbed (Elevation 948). At both abutments, riprap was placed along the slopes and is extended five to ten feet into the riverbed.



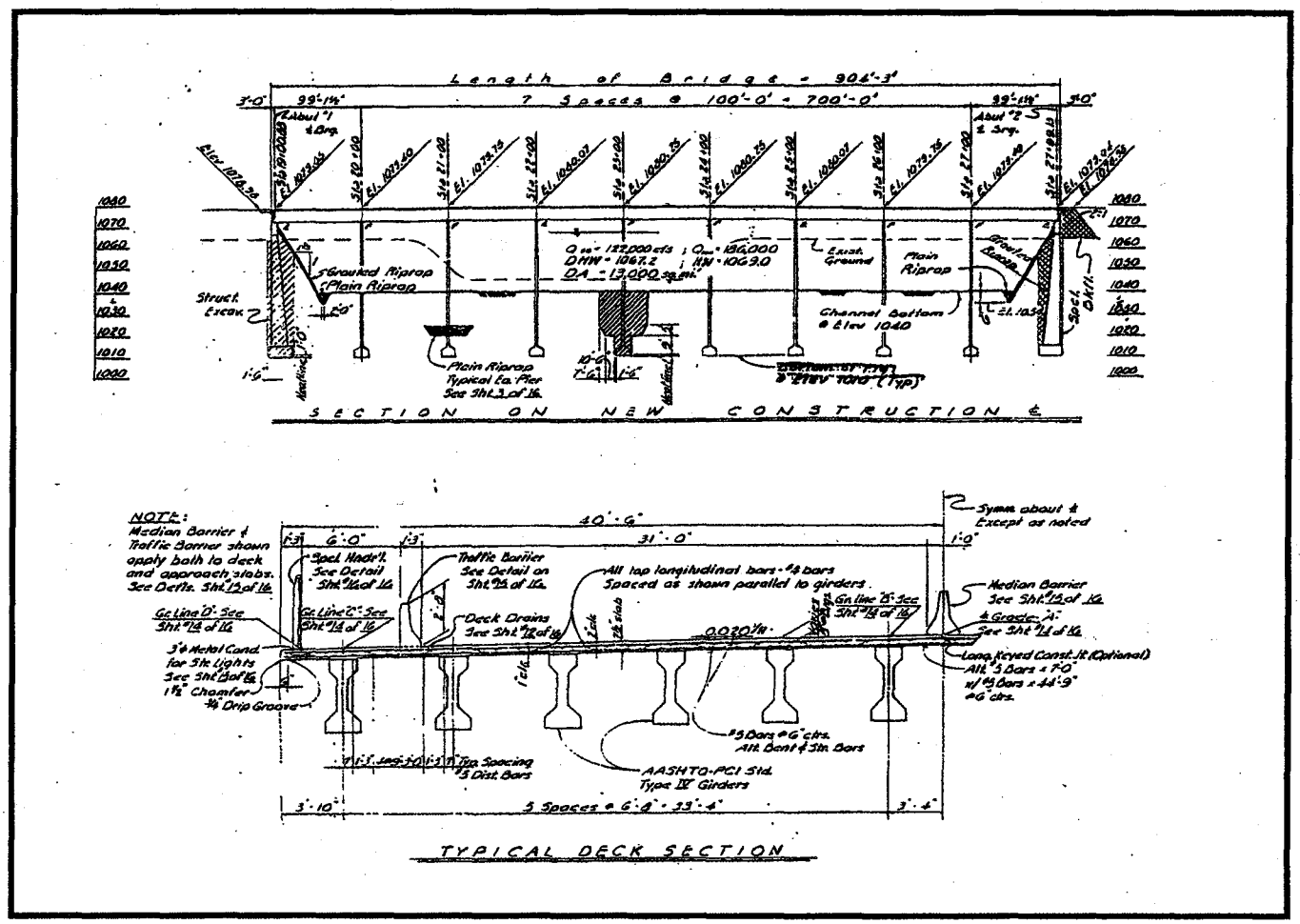
Typical Section – Seventh Avenue Bridge

For the purposes of comparison, the following table summarizes the hydraulic data shown on the as-built plans in 1987 and the proposed data supplied by West Consultants, Inc from the bridge scour results.

	Invert Elevation (ft)	Design Flow (cfs)	Water Surface Elevation (ft)
As-Builts	1037.50	200,000	1058.90
Proposed	1024.61	166,000	1060.77

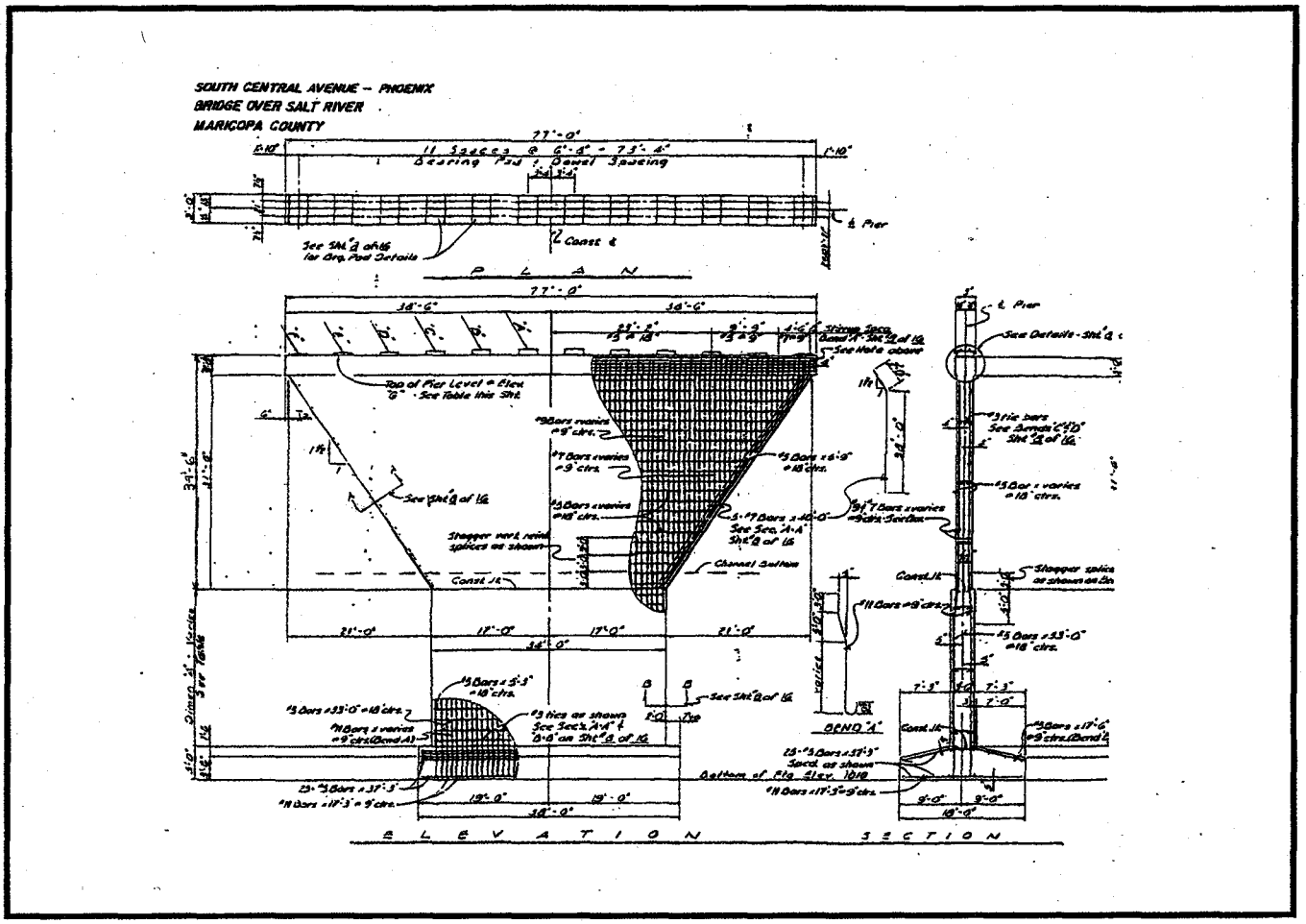
3.2 South Central Avenue

Built in 1975, the South Central Avenue Bridge is a nine-span structure approximately 903-feet long and 81-feet wide.



Elevation and Typical Section – South Central Avenue Bridge

The precast, prestressed concrete girders with cast-in-place concrete deck are supported on tapered, 2'-6" round-nose piers and spill-through, seat-type abutments. Both the abutments and the piers are founded on spread footings approximately thirty feet below the channel bottom (Elevation 1010). The elliptical-shaped dikes around the abutments are paved with 18 inch of grouted riprap to a depth of six feet below the channel bed. A buried, five-foot layer of plain riprap lies just above each pier footing.



Pier Elevation and Section – South Central Avenue Bridge

For the purposes of comparison, the following table summarizes the hydraulic data shown on the as-built plans in 1977 and the proposed data supplied by West Consultants, Inc from the bridge scour results.

	Invert Elevation (ft)	Design Flow (cfs)	Water Surface Elevation (ft)
As-Builts	1040.00	186,000	1069.00
Proposed	1025.84	166,000	1063.08

4.0 SUMMARY OF ANALYSIS

The basis for the analysis of the bridge foundations is set by the "Standard Specifications for Highway Bridges," American Association of State Highway and Transportation Officials (AASHTO), 1996 Edition, and approved revisions through 1998. AASHTO has developed a standard loading conditions which the bridge components or elements must withstand in order to be consider safe. In general, the bridge structure is analyzed to carry the following loads and forces:

- Dead Load (DL) – AASHTO Art. 3.3

  The dead load on a bridge structure is the aggregate weight of all the elements in the structure. This will include but not limited to the deck, wearing surface, stay-in-place-forms, sidewalks and railings, parapets, signing and utilities. The first step in any design or analysis of a bridge structure is to compile a list of all the elements, which contribute to dead load. Dead loads are the principal permanent loading condition. AASHTO provides a list of some dead load unit weights that are used in computing the overall value of the structure (ASSHTO 3.3.6).

- Live Load (LL) – AASHTO Art. 3.7

  The term live load means a load that moves along the length of a bridge span. In most cases, live load represents the major temporary loading condition. The live load force consists of the applied moving load of vehicles, cars and pedestrians. A person walking along the bridge is considered live load. Obviously, a highway bridge needs to be designed to resist more than pedestrian loading.

  AASHTO has developed a hypothetical design vehicle based on a truck loading to give the designers the ability to accurately model the live load on a bridge. AASHTO has issued a loading scheme based on two loading systems, the H loadings and the HS

loadings. To meet the demands of heavier trucks, five truck classes were introduced in 1944.

These classes have the following designations and gross weights:

1. H10-44 (20,000 pounds)
2. H15-44 (30,000 pounds)
3. H20-44 (40,000 pounds)
4. HS15-44 (54,000 pounds)
5. HS20-44 (72,000 pounds)

Today, all but the H10-44 vehicle are still incorporated in the AASHTO Specifications.

AASHTO Figures 3.7.6A & 3.7.7A illustrate these design trucks and their associated geometries. The H loading and HS loading trucks were developed with two and three axles, respectively. These design trucks represent the core standard in use today in the United States. Replacing the train of trucks in the 1935 circa design code are lane loading configurations which consists of a uniform distributed load combined with a concentrated load (AASHTO Figure 3.7.6B). The AASHTO design trucks and lane loading are meant to cover 10 feet width (AASHTO 3.6.1). These loads are then placed in 12 feet lane, which are spaced across the bridge from curb to curb (AASHTO 3.6.2).

Another form of live loading is known as alternative military loading which was developed by the Federal Highway Administration in 1956. This live loading consists of two axles separated by 4 feet and each weights 24,000 lbs. This loading is used to represent heavy military vehicles (AASHTO 3.7.4).

A reduction in the live load intensity is permitted for bridges with three or more lanes that have maximum force caused by fully loading each lane. A 90 percent reduction

of three lane structures and 75 percent reduction for bridges with four or more lanes are permitted given the rarity of the situation where simultaneously loading in multiple lanes occurs (AASHTO 3.12).

- Impact (I) – AASHTO Art. 3.8

An impact factor is used as multiplier for certain structural components in order to account for the dynamic effects of the sudden loading of a vehicle onto a structure. A load that moves across a member introduces larger stresses than one statically placed on it. AASHTO defines the impact factor in a conservative idealization as follows:

$$I = \frac{50}{L + 125}$$

where:

I = Impact Factor (not to exceed 30 percent)

L = Length of Span Loaded to Create Maximum Stress, ft

The live load intensity is then multiplied by this factor which increases the live load values. The impact factor is designed to take into account the effects of a vehicle vibrating and striking imperfections in the deck as well as the dynamic effects of impact.

- Longitudinal Forces (LF) – AASHTO Art. 3.9

Longitudinal forces are developed from vehicles braking or accelerating while on a bridge. AASHTO specifies that 5 percent of the appropriate lane load, without impact, along with the concentrated force from moment for all travel lanes going in the same direction be used as the resulting longitudinal force. This longitudinal force is applied 6 feet above the top of deck surface. The longitudinal force affects the substructure elements more significantly than the superstructure elements.

- Wind Loads (W) – AASHTO Art. 3.15

Wind loading offers a complicated set of loading conditions, which must be idealized in order to provide a workable design. AASHTO specifies an assumed wind velocity of 100 miles per hour for the loading on a bridge. Wind forces are applied in the transverse and longitudinal direction at the center of gravity of the exposed region of the superstructure. AASHTO offers a set of wind loading values for different type of superstructure configurations based on the angle of attack (skew angle) of wind forces. Conventional slab-on-girder bridges with span less than or equal to 125 feet can used the following basic loading (AASHTO 3.15.2.1.3):

1. Wind Load on Superstructure:
   Transverse Loading = 50 lbs/ft^2
   Longitudinal Loading = 12 lbs/ft^2

2. Wind Load on Live Load:
   Transverse Loading = 100 lbs/ft^2
   Longitudinal Loading = 40 lbs/ft^2

3. Wind Load on Substructure - (AASHTO 3.15.2.2):
   Transverse Loading = 40 lbs/ft^2
   Longitudinal Loading = 40 lbs/ft^2

The transverse and longitudinal loads are to be placed simultaneously for all wind loads (AASHTO 3.15.2.1.3).

Another loading consideration is the effect of overturning. AASHTO specifies an upward force of 20 pounds per square foot of slab and sidewalk plan, applied at the quarter point of the transverse superstructure width to account for the effect of overturning (AASHTO 3.15.3).

- Thermal Forces (T) – AASHTO Art. 3.16)

The effects of thermal forces on a structure are caused by fluctuations in temperature. This change in temperature is greatly dependent on the location of the bridge site. As a reference point, the estimated temperature at the time of construction is determined using temperature rise and fall values which are computed from extreme hot and cold temperatures. AASHTO provides recommended temperature ranges for the design of different bridge structures (AASHTO 3.16).

- Channel Forces – (AASHTO Art. 3.18)

Channel forces are those loads imposed on the bridge structure due to water course-related features. These forces include, but are not limited to stream flow, floating ice, and buoyancy. Channel forces principally affect substructure elements.

1. Stream Flow (SF) – AASHTO 3.18.1:

Structures with supports in watercourses are at risk for having those supports slide or overturn due to stream flow forces. An excessive stream flow velocity can lead to adverse scour conditions, which can undermine footings and threaten the integrity of the bridge structure. AASHTO defines the average pressure acting on a bridge pier due to flowing water as:

$$P_{avg} = K * (V_{avg})^2$$

where:

P_{avg} = Average Stream Pressure (lb/ft)

K = Constant based on Shape of Pier

V_{avg} = Average Velocity of Water (ft/s)

The equation for the pressure due to stream flows uses a constant to describe the geometry of the pier in a water channel. K has three possible values, 1.4 for piers

subjected to drift build-up and square ended piers, 0.7 for circular piers and 0.5 for angled ends. The average velocity is computed by dividing the flow rate by the flow area. The flow values are obtained from a hydrologic or hydraulic study for conditions producing maximum velocities. The maximum stream flow pressure P_{max} is equal to twice the average stream pressure P_{avg}. A triangular distribution is assumed with P_{max} located at the top of the water surface and a pressure of zero at the flow line.

2. Buoyancy (B) – AASHTO 3.19:

Bridge structures with elements, which are submerged underwater such as pier footings and piles can sometimes be impacted from the effects of buoyancy.

$$B = \gamma_{water} * \text{Area}$$

where:

γ_{water} = Density of water (62.40 lb/ft^3)

Area = Area of the cross section subjected to the Stream Flow

The "Bridge Design and Detailing Manual (BD&D)," Arizona Department of Transportation (ADOT), 1994 Edition provides guidelines for the analysis of bridges over waterways for four different streambed ground lines in part 1 – Section 1.2.1.

Case 1 is the as-constructed stream cross section. For this case, the bridge is analyzed to withstand the forces from AASHTO Group I to VII load combinations Table 3.22.1A.

Case 2 corresponds to the long-term dry streambed cross section i.e. the as constructed stream cross section minus the depth of the general scour. The bridge is analyzed to resist the same forces as Case 1 but the analysis for Seismic Forces is based solely on general scour.

Case 3 corresponds to the streambed cross section condition for the most critical design flow. Abutment protection is provided to withstand this event and abutments are protected from scour for this condition. On the other hand, the piers are subjected to the full general and critical flow local scour. For this condition, the bridge is analyzed to withstand the forces from the AASHTO Group I to VI load combinations.

Case 4 corresponds to the streambed cross section conditions for the superflood condition. All bank protection and approach embankments are assumed to have failed for this case. The abutments and piers are analyzed for the superflood scour, which means that all the substructure elements have experienced the maximum scour simultaneously.

The bridge is analyzed to make sure that it can withstand the following force:

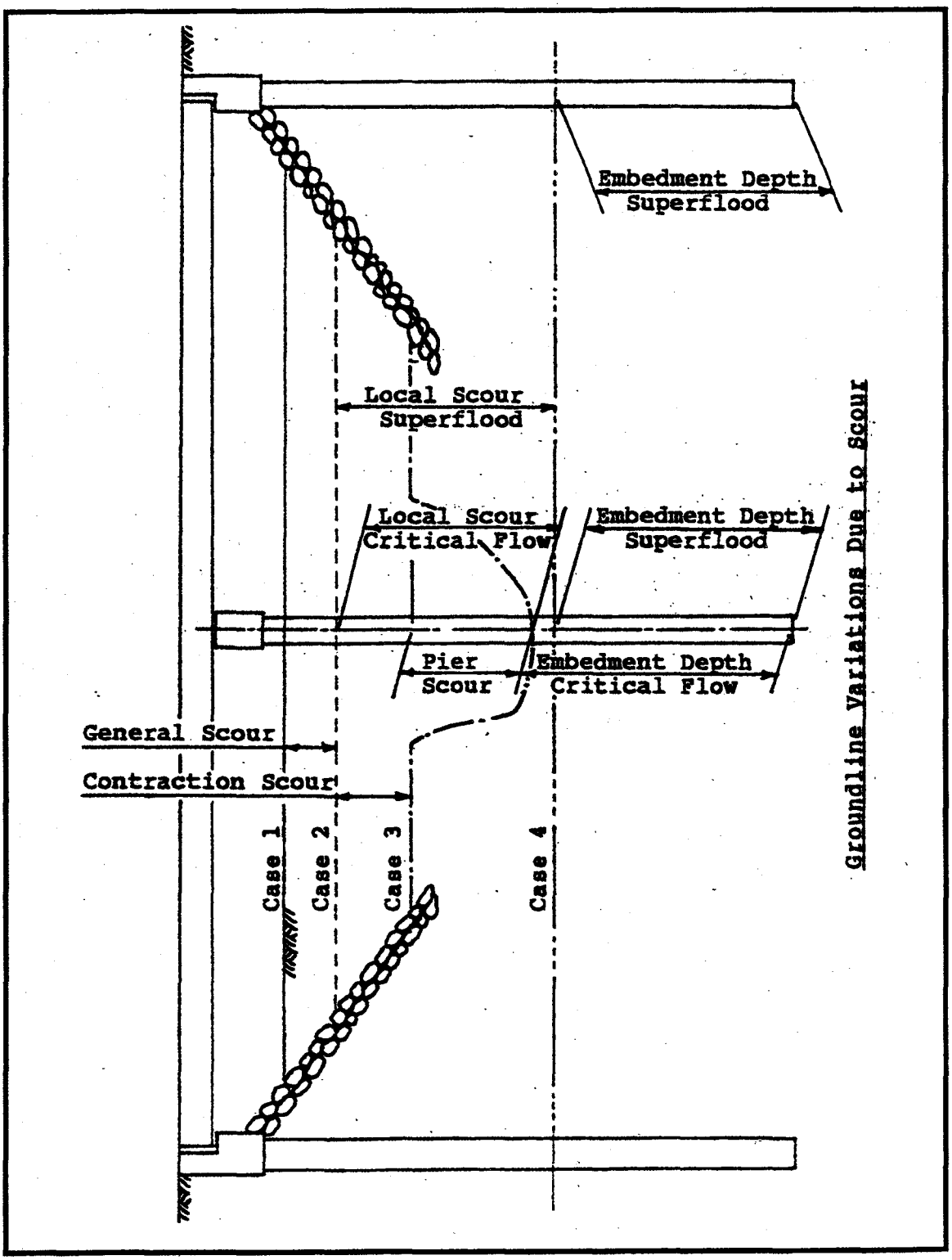
$$DL + SF + B + 0.5\,W$$

where:

DL = Dead Load
SF = Stream Force
B = Buoyancy
W = Wind on Structure

As previously stated, the bridge scour analysis for the low-flow channel performed by West Consultants, Inc is based on the 100-year discharge of 166,000 cfs. This discharge is considered the most critical flow; as a result, the piers are subjected to the critical flow local scour. Based on the results of the low-flow channel, the abutment scour was estimated to be insignificant at the bridge structures. For these conditions, the structural analysis only needs to be executed for Case 3 of the "Bridge Design and Detailing Manual (BD&D)". The bridge structures are verified to withstand the forces from the AASHTO load group combinations I to VI. The following figure provides a detail

illustration of the four different streambed ground lines for bridges over natural waterways.



A three-dimensional, finite-element analysis of the existing bridges was performed using the structural program SAP90. The program has acquired the status of being the most reputable and widely used computer program in the field of structural analysis. Idealized models are used in structural analysis that represent pinned and fixed supports as well as pin-connected and fixed-connected joints. In reality, however, all connections exhibit some stiffness toward joint rotations, owing to friction and material behavior. When selecting a particular model for each support or joint, it is vital to be aware of how the assumptions will affect the actual performance of the member and whether the assumptions are reasonable for the structural design.

The assumptions made on the structural model for the analysis of the ***Seventh Avenue Bridge*** are as follows:

- The support at the abutment is represented as roller even though the existing abutment is a monolithic diaphragm abutment. The monolithic diaphragm abutment is connected directly to the drilled shafts. Some of the major benefits of using a monolithic diaphragm abutment are its effectiveness in absorbing higher loads and its ability to accommodate structurally relative large thermal movements. However, a more conservative assumption for this pier scour analysis is to model the support at the abutment as a roller, consequently, conveying most of the loads to the pier elements.

- Given that long embedded drilled shafts support the piers, a point of fixity of four times the diameter of the drilled shaft was assumed to ideally model the support conditions at the piers. In addition, soil springs were generated to model the stiffness and support provided at the bridge foundations. The soil springs where included in the structural model in order to approximate the existing conditions in the piers.

  The soil parameters used to model the soil springs at the piers are based on a preliminary geothechnical report performed by **AGRA** Earth & Environmental, Inc on October 14, 1999. A copy of their findings is included in Appendix A. The

geothechnical review was based on existing soil borings at ***Seventh Avenue Bridge***. **AGRA** Earth & Environmental, Inc has provided us with an Effective Unit Weight (γ_{soil}) of 140 pcf and a Submerged Unit Weight (γ_{sub}) of 77.6 pcf.

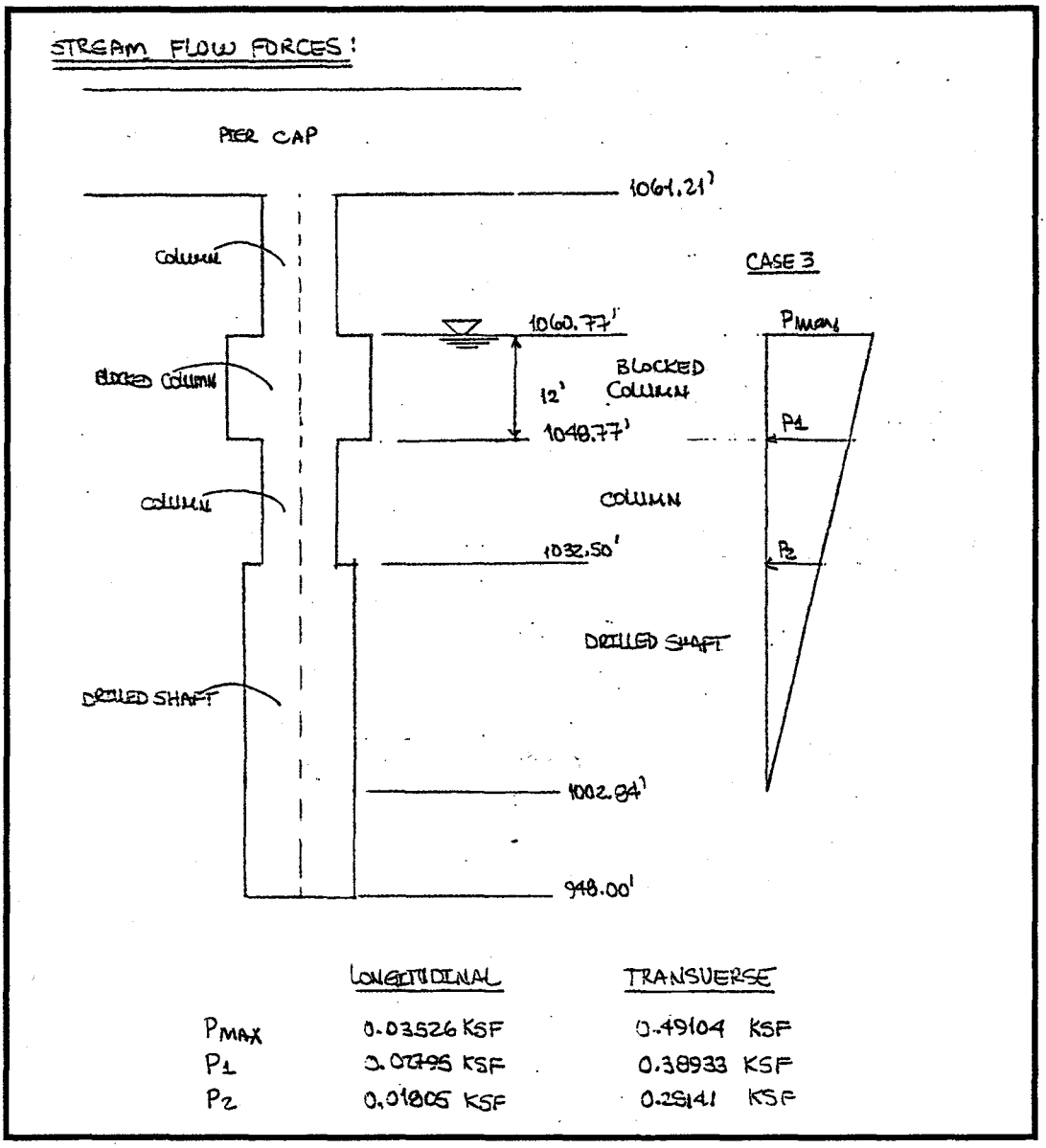
- The stream forces for the 100-year peak event were applied to the piers/shafts along with other loads for the appropriate load groups as per AASHTO specifications.

Finally, the demand forces generated by SAP90 were compared to the pier/shaft capacities; where the demand exceeds the capacity, retrofit measures must be taken. Where the demand placed upon the pier/shaft is equal to or less than its capacity, retrofit measures need not be taken.

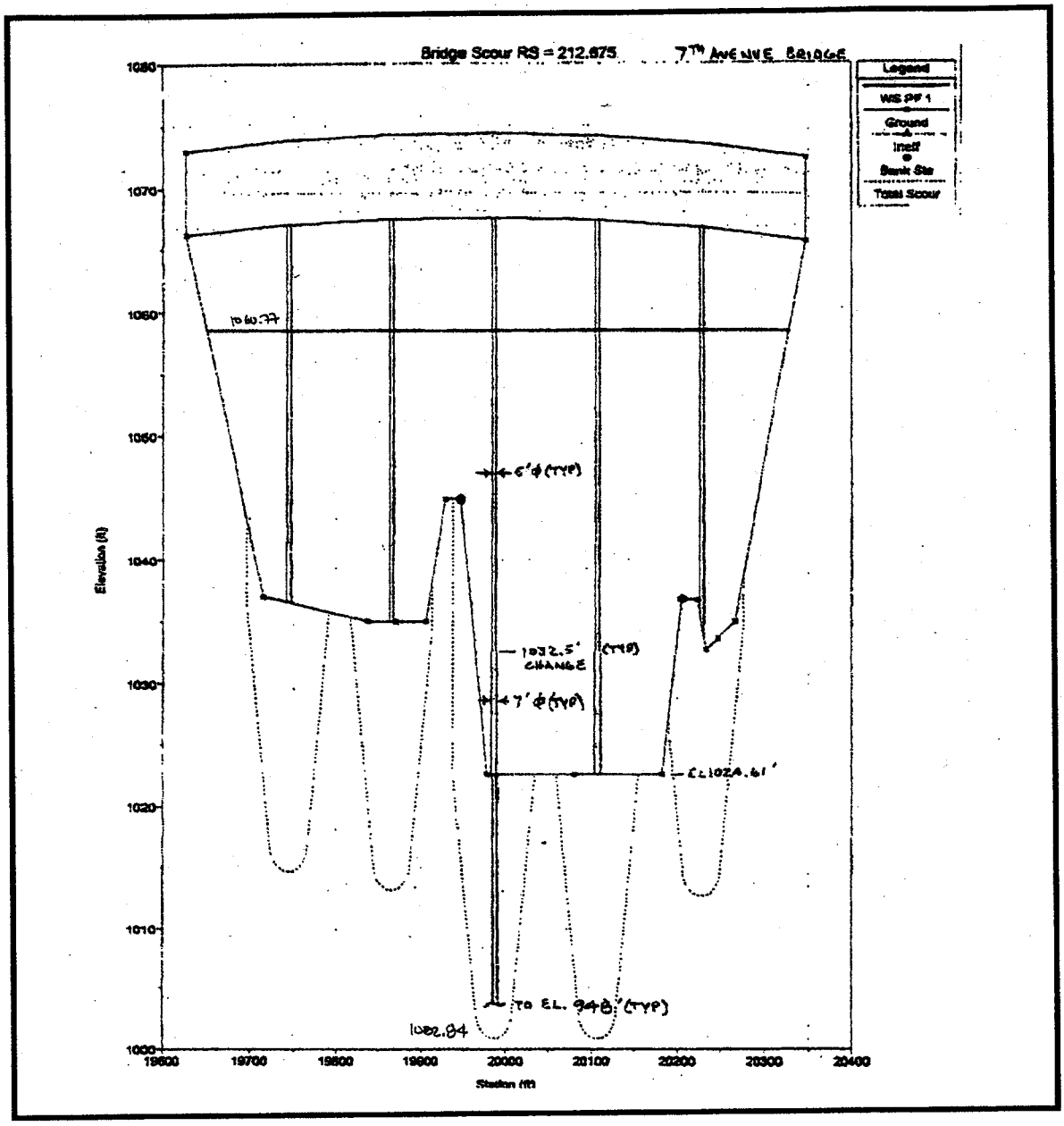
4.1 Seventh Avenue

AGRA Earth & Environmental, Inc estimated the downward and upward capacities of the existing foundations for the ***Seventh Avenue Bridge*** using the BETA method recommended by AASHTO. The estimate was for two conditions of flood flow and resulting scour around the foundations. The ***Seventh Avenue Bridge*** foundation consists of column/drilled shafts. The columns have a diameter of 5.0 feet from the bottom of the pier cap (about elevation 1061 feet) to elevation 1032.50 feet. Below this elevation to the tip of the shafts (elevation 948) the drilled shaft diameter is 7.0 feet. **AGRA** Earth & Environmental, Inc evaluated two conditions of maximum scour elevations for the 7-foot diameter drilled shaft – elevations 1002.8 ft and 1012.0 ft. These conditions are representative of the maximum scour at piers 3 and 4 of the bridge structure. The embedded depths of the 7-foot diameter shafts for these conditions are about 55 and 64 feet, respectively. The calculated ultimate downward capacities are 3914 kip and 4446 kip for the scour elevations 1002.8 ft and 1012.0 ft, respectively. The actual load capacity of the 7- foot drilled shaft based on the structural analysis is 1782 kip. As a result, the 7-foot diameter drilled shaft holds a safety factor of 2.2 for the scour elevation of 1002.8 ft and 2.5 for the scour elevation of 1012.0 ft.

The structural analysis revealed that the 5-foot diameter and the 7-foot diameter drilled shafts are adequate to resist the stream flow and scour associated with the 100-year peak event. The flexural demand forces from SAP90 were compared to the drilled shaft flexural capacities. The structural program PCYIELD was used to determine the flexural capacity of the column/shaft based upon the area of concrete, tie spacing and amount of longitudinal reinforcing. The flexural capacity/demand ratio for the Seventh Avenue Bridge is approximately 1.00.



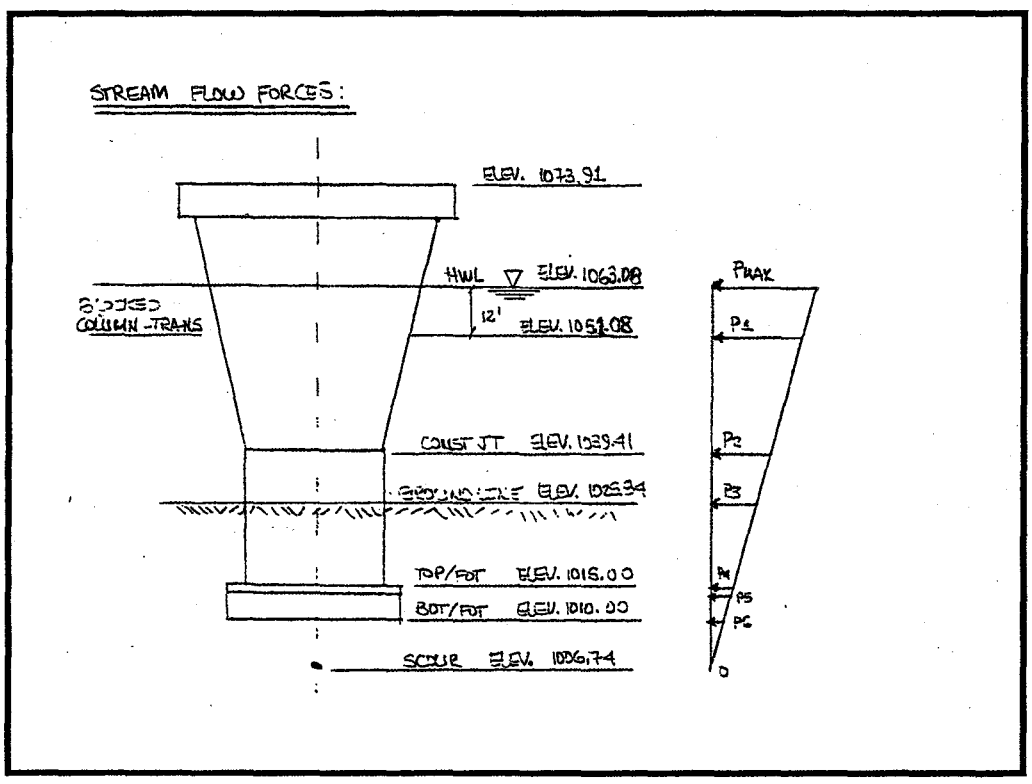
Stream Flow Diagram – Seventh Avenue Bridge



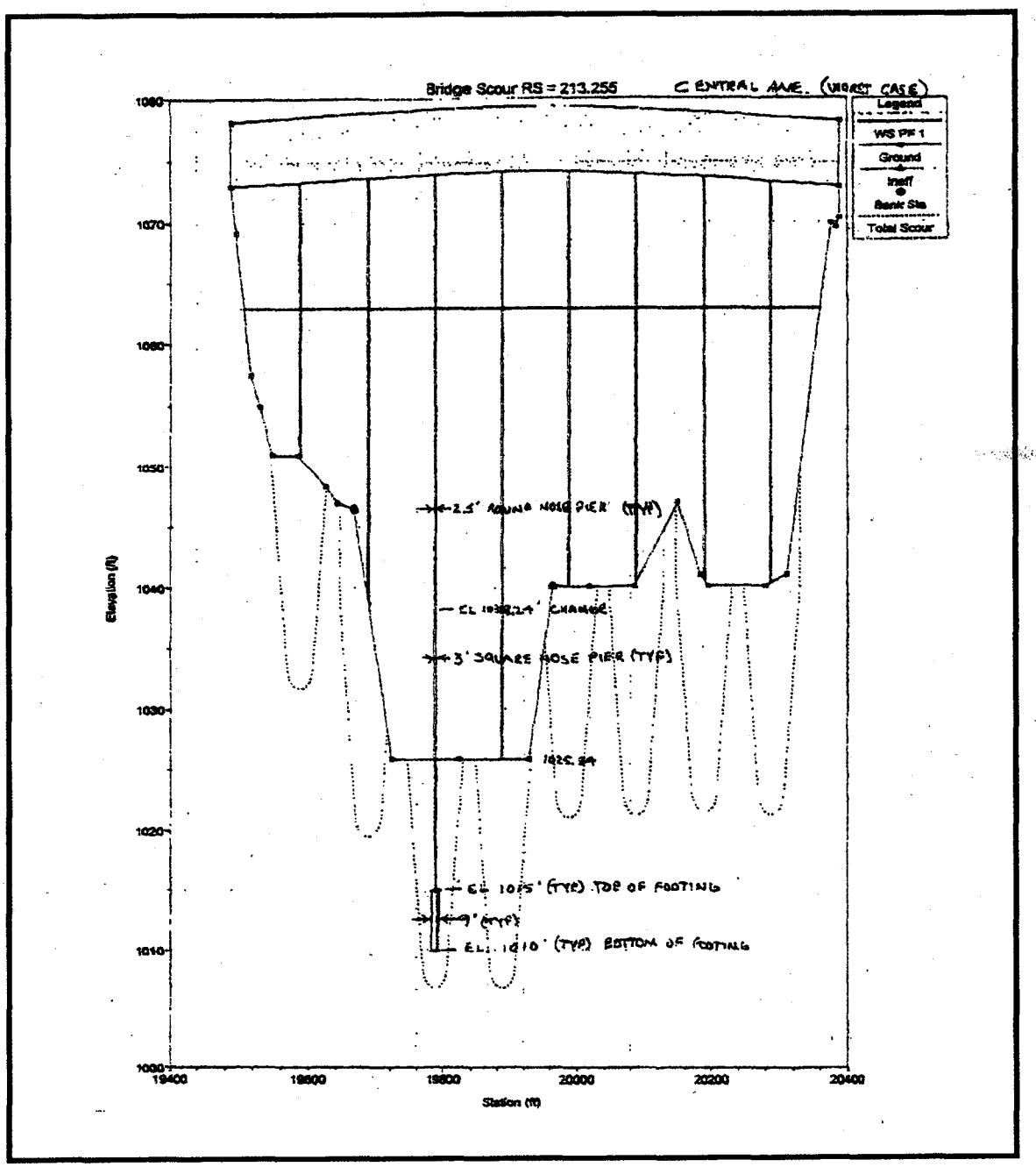
Proposed Scour – Seventh Avenue Bridge

4.2 South Central Avenue

The capacity/demand ratio for South Central Avenue – by examination – is less than one, because the estimated scour elevation is 1006.74 while the bottom of footing elevation for all piers and both abutments is only 1010.00. Regardless of the ability of the pier to resist the stream forces associated with the peak-event, the related scour will undermine the spread footings and compromise the integrity of the bridge. Retrofit measures are discussed in the next section.



Stream Flow Force Diagram – South Central Avenue Bridge



Proposed Scour – South Central Avenue

5.0 RETROFIT MEASURES

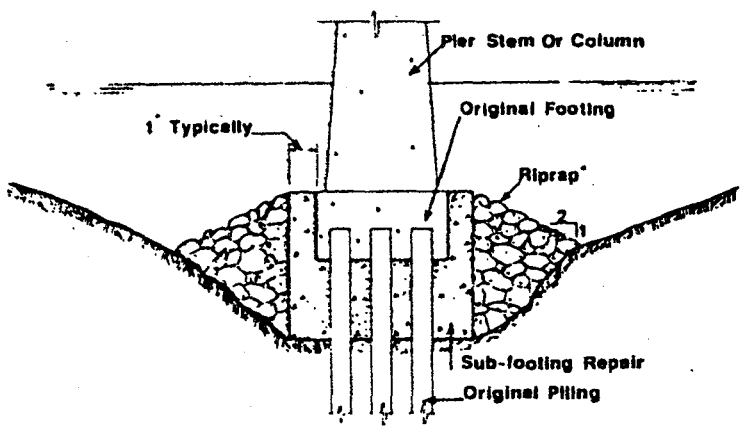
The South Central Avenue Bridge is recommended for retrofit. The retrofit measures can be classified into two categories: 1) scour countermeasures; and 2) structural retrofit of deficient element(s).

Scour countermeasure include:

- grade control structures,
- soil cement/concrete aprons with cutoff walls.

A recommended scour countermeasure is a grade control structure located immediately downstream of Central Avenue with a soil-cement apron within the low flow channel and extending through the bridge.

Structural retrofits for the spread footings on the South Central Avenue Bridge include concrete jacketing and riprap and additional drilled shafts located outside the existing footing but tied into the footing similar to concrete jacketing (see sketch below).



Section showing repair to scour-damaged pile footing using concrete jacketing and riprap.

Further analysis and cost estimates illustrated that the scour countermeasure has the most cost-effective method for retrofit. Final plans and details will be included in the Phase I - Plan, Specifications & Estimate Package for the Corp of Engineers.

AGRA
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October 14, 1999
AEE Job No. 9-117-001113

U.S. Army Corps of Engineers
Los Angeles District, Installation Support Section
911 Wilshire Boulevard
Los Angeles, CA 90017-3401

Attention: Jatin T. Desai
Civil Design B
Engineering Division

Gentlemen:

RE: STRUCTURAL RETROFIT
7TH AVENUE BRIDGE
PHOENIX, ARIZONA

In response to your request, AGRA Earth & Environmental, Inc. (AEE) presents herein an evaluation of the downward and upward capacities of the existing foundations for the 7th Avenue bridge over the Salt River in Phoenix, Arizona. The evaluation was for two conditions of flood flow and resulting scour around the foundations, as provided by Daniel N. Heller, P.E., Principal with T. Y. Lin International. Ultimate downward and upward capacities are provided in this letter report, along with a brief discussion of the appropriate safety factor to use for the flood conditions assumed.

Based on the as-built plans for the 7th Avenue bridge, the foundation system consists of drilled, cast-in-place concrete shafts connected to pier caps. The shafts have a diameter of 5.0 feet from the bottom of the pier cap (about elevation 1061feet) to elevation 1032.5 feet. Below this elevation to the base of the shafts (elevation 948 feet) the shaft diameter is 7.0 feet.

Two conditions of maximum scour were evaluated, one extending to elevation 1002.8 feet and the other to elevation 1012.0 feet. These conditions are representative of the maximum scour at Piers 3 and 4. The embedded depths of the 7-foot diameter shafts for these conditions are about 55 and 64 feet, respectively.

Based on the boring logs included with the project plans, the embedded sections of the shafts at maximum scour are in very dense, well-graded gravels or sand, gravel and cobble (SGC) mixtures. The number of blows per foot required to penetrate the soil strata of interest using a Becker hammer drill advancing 6 5/8-inch outside diameter steel drive pipe was evaluated. At the location of Pier 3, the blow count values varied from 55 to 233 with a mean of 126. And at the location of Pier 4, the blow count values varied from 43 to 175 with a mean of 105. These blow counts are indicative the soil descriptions shown on the boring logs. Further, no significant

soft sand or sand and gravel layers were indicated.

Shaft capacities for compressive loads were computed using the Beta method recommended by AASHTO (1996).[1] The governing equations and the parameters assumed for the analyses are shown on the attached calculation sheets. A single SGC stratum having a saturated unit weight of 140 pounds per cubic foot (pcf) was assumed. The reinforced concrete shafts were assumed to have a total unit weight of 145 pcf. The bouyant unit weights for these materials were assumed to be 77.6 and 81.6 pcf, respectively. The unit end bearing of the shafts was assumed to be 90 kips per square foot, based on the recorded blow count values. However, for the 7 foot diameter shafts the procedure requires this value be reduced by about 40 percent.

The calculated ultimate downward, or compression, capacities are 3,914 and 4,446 kips for maximum scour elevations of 1002.8 and 1012.0 feet, respectively. The calculated ultimate upward, or tension, capacities are 2,199 and 2,790 kips, respectively. These values are for the soil and do not consider the compressive or tensile capacities of the reinforced concrete shafts.

AASHTO (1996) recommends a safety factor of 2.5 be applied to the ultimate capacities, unless a load test is conducted. However, this safety factor is intended to apply to normal loading conditions. For the extreme loading conditions associated with maximum scour events, AEE typically recommends a factor of safety of 1.5 be applied.

Should you have any questions concerning the analyses presented in this letter report, please do not hesitate in contacting either of the undersigned.

Respectfully submitted,

AGRA Earth & Environmental, Inc.

Lawrence A. Hansen, Ph.D., P.E.
Senior Vice President

Reviewed by:

Norman H. Wetz, P.E.
Senior Geotechnical Engineer

c: Addressee (1)
T. Y. Lin International
Attn: Daniel N. Heller, P.E., Principal (1)

[1]American Association of State Highway and Transportation Officials (AASHTO), 1996, Standard Specifications for Highway Bridges, Sixteenth Edition, Washington, D.C.

7TH AVE BRIDGE

ULTIMATE CAPACITY BY BETA METHOD

SCOUR ELEVATION = 1002.8'

Sheet 1 of 2
Date: 10/12/99
By: LAH
Ch. By: NHW
Job/Prop. No. 9-117-001113

$Q_{ULT} = Q_S + Q_T - W$ COMPRESSION

$= Q_S + W$ TENSION

$Q_S = \pi B \sum_{i=1}^{n} \gamma_i z_i \beta_i \Delta z_i$

$\gamma_i \cong 140 - 62.4 = 77.6$ PCF (SUBMERGED)
$\Delta z_i = 1002.8 - 948 = 54.8'$
$z_i = \frac{1}{2}(54.8) = 27.4'$
$B = 7'$
$n = 1$

$\beta_i = 1.5 - 0.135 (z_i)^{1/2}$
$= 1.5 - 0.135 (27.4)^{1/2} = 0.79$

$Q_S = \pi (7)(77.6)(27.4)(0.79)(54.8)/1000$

$= 2{,}024$ KIPS

$Q_T = q_T A_T$

$q_T = 90 (50/12B) = 90 (50/84) = 53.6$ KSF
$A_T = \pi B^2/4 = \pi (7)^2/4 = 38.5$ FT^2

$Q_T = 53.6 (38.5) = 2{,}064$ KIPS

$W = \gamma_c A \Delta z$ ($\gamma_c \cong 145 - 62.4 = 82.6$ PCF)

$= 82.6 (38.5)(54.8)/1000$

$= 174$ KIPS

$Q_{ULT} = 2{,}024 + 2{,}064 - 174 = 3{,}914$ KIPS COMPRESSION

$Q_{ULT} = 2{,}024 + 174 = 2{,}199$ KIPS TENSION

AGRA
ENGINEERING GLOBAL SOLUTIONS

7TH AVE BRIDGE

ULTIMATE CAPACITY BY BETA METHOD

SCOUR ELEVATION = 1012.0

Sheet 2 of 2
Date: 10/12/99
By: LAH
Ch. By: NHW
Job/Prop. No. 9-117-001113

SEE PREVIOUS PAGE FOR EQUATIONS

$\gamma_i = 77.6$ PCF (SUBMERGED)
$\Delta z_i = 1012.0 - 948 = 64.0'$
$z_i = \frac{1}{2}(64.0) = 32.0'$
$B = 7'$
$n = 1$

$\beta_i = 1.5 - 0.135(32.0)^{1/2}$
$= 0.74$

$Q_S = \pi(7)(77.6)(32.0)(0.74)(64.0)/1000$

$= 2{,}586$ KIPS

$Q_T = 2{,}064$ KIPS

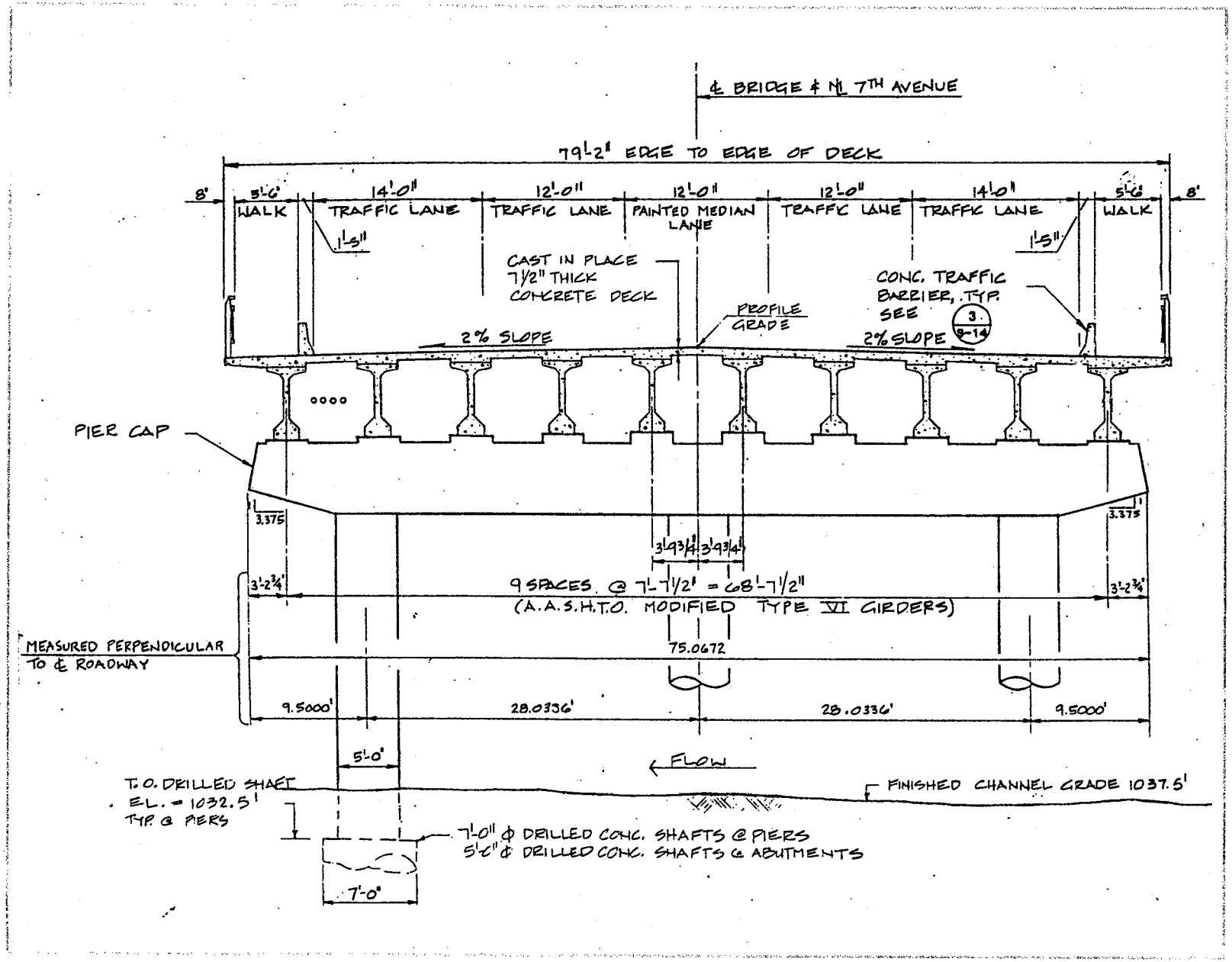
$W = 82.6(38.5)(64.0)/1000$

$= 204$ KIPS

$Q_{ULT} = 2{,}586 + 2{,}064 - 204 = 4{,}446$ KIPS COMPRESSION

$Q_{ULT} = 2{,}586 + 204 = 2{,}790$ KIPS TENSION

AGRA
ENGINEERING GLOBAL SOLUTIONS



PBI INTERNATIONAL

Project: Salt River Bridge - Scour

Item: Seventh Avenue Bridge

Job No. 1317.00

Designer: VPD

Date: 9/9/99

Sheet: of

Checker:

Date:

Grid: 1/8"

TYLIN INTERNATIONAL

Project: Salt River Bridges Scour	Job No. 1317.00	Sheet: of
Item: Seventh Avenue Bridge	Designer: VPD	Date: 9/8/99
	Checker:	Date:
		Grid: 1/8"

- DESIGN CONDITIONS

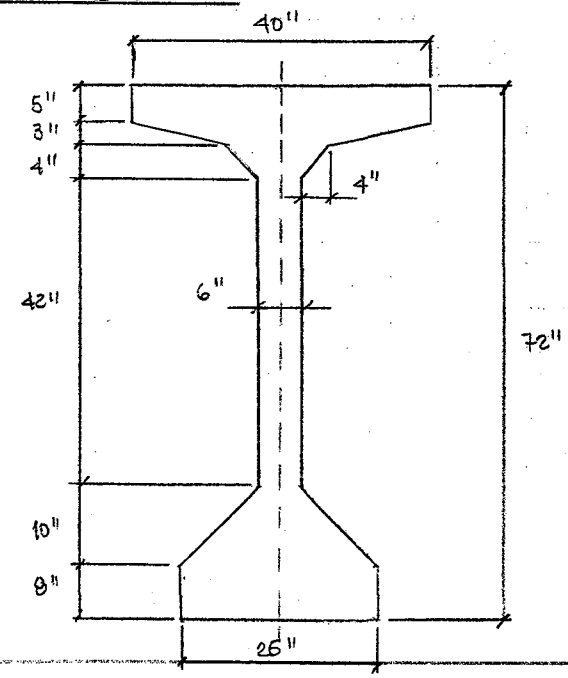
- 2- THREE SPAN UNITS OF 125 Ft x 79'-2" WIDTH
- HS20 LIVELOAD - 4 LANES
- 10 AASHTO MODIFIED TYPE VI GIRDERS. COMPOSITE CONSTRUCTION WITH 7-½ IN. DECK SLAB.
- ALLOW FOR 25 PSF FUTURE WEARING SURFACE

- MATERIALS

- CONCRETE: NORMAL WEIGHT
  CLASS S, f'c = 3000 PSI - BARRIERS AND APPROACH SLABS.
  CLASS S, f'c = 4500 PSI - DECK SLAB & DIAPHRAGMS,
  fc = 1900 PSI
  CLASS S, f'c = 4000 PSI - DRILLED SHAFTS, COLUMNS, PIERCAPS, AND WINGWALLS.

- REINFORCEMENT
  ALL REINFORCING BARS ARE AGIS DEFORMED BILLET STEEL GRADE 60
  Fy MIN = 60,000 PSF
  fs = 24,000 PSI
  fs = 20,000 PSI - DECK AND DIAPHRAGMS ONLY.

- GIRDER SELECTION



SECTION PROPERTIES

$A_c = 941 \text{ in}^2$
$I = 671088 \text{ in}^4$
$y_b = 36.44 \text{ in}$
$S_b = 18416 \text{ in}^3$
$S_t = 18872 \text{ in}^3$
$w_D = 0.980 \text{ K/Ft}$

TY·LIN INTERNATIONAL

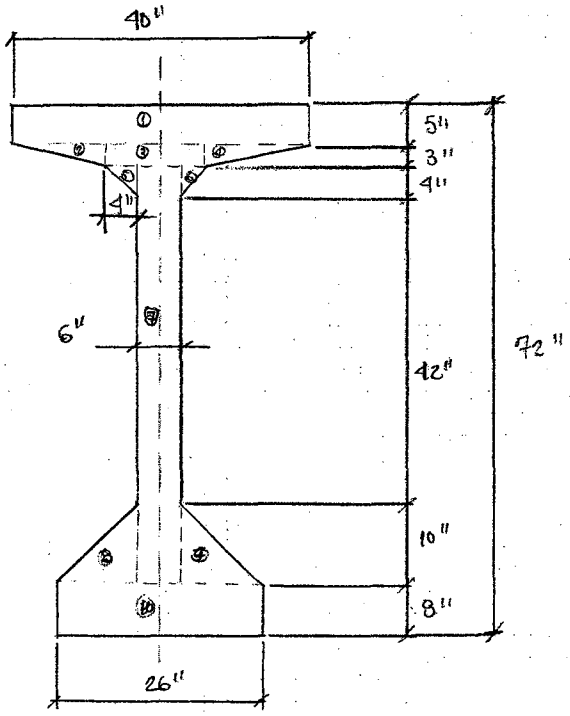
Projects: Salt River Bridge Scour | Job No. 1317.00 | Sheet: of

Item: Seventh Avenue Bridge | Designer: VPD | Date: 9/8/99

Checker: | Date:

Grid: 1/8"

Iyy



SECTION	AREA (Ft^2)	X bot (Ft)	Area * X bot (Ft^3)	Area $(\bar{X} - X_{bot})^2$ (Ft^4)	Io (Ft^4)
1	1.38889	1.667	2.31481	0.000	1.28601
2	0.13542	0.7222	0.0978	0.12081	0.00883
3	0.29167	1.667	0.48611	0.000	0.03308
4	0.13542	2.6111	0.3536	0.12081	0.00883
5	0.05556	1.30556	0.07254	0.00725	0.00034
6	0.05556	2.02778	0.11266	0.00725	0.00034
7	2.3333	1.667	3.88889	0.000	0.04861
8	0.34722	1.13889	0.39545	0.09673	0.0134
9	0.34722	2.19444	0.76196	0.09673	0.0134
10	1.4444	1.667	2.40738	0.000	0.56507

$\Sigma\ 6.535\ Ft^2$ $\Sigma\ 10.8912\ Ft^3$ $\Sigma\ 0.23242\ Ft^4 + \Sigma\ 1.9779\ Ft^4$

$$\bar{X} = \frac{\Sigma\ Area * Y\ bot}{\Sigma\ Area} = \frac{10.8912}{6.535} = 1.667\ Ft$$

$$I_{yy} = 2.21003\ Ft^4$$

TYLIN INTERNATIONAL

Project:	Salt River Bridges Scour	Job No.	1317.00	Sheet:	
Item:	7th Avenue Bridge	Designer:	VPD	Date:	9/16/99
A:\[GEOM.XLS]COOR		Checker:		Date:	

Concrete Properties

F'c (slab):	4500 PSI
F'c (girder):	6000 PSI
No.Girders:	10

Left Outside distance:	5.271 ft
Girder Spacing:	7.625 ft
Right outside distance:	5.271 ft

Girder Properties:

Area:	6.535 ft^2
Yb:	3.037 ft^2
Yt:	2.963 ft^2
H:	6.000 ft^2
Ix:	32.363 ft^4
St:	10.921 ft^3
Sb:	10.658 ft^3

Section Properties for Superstructure:

Area:	120.382 ft^2
Ycb:	4.592 ft^2
Yct:	2.199 ft^2
Hc:	6.792 ft^2
Izz:	646 ft^4
Iyy:	56054 ft^4
Ixx:	31.462 ft^4

Izz

	Location	X ft	Width ft	Thickness ft	E ksf	Area ft^2	y ft	Area*y ft^3	A(y-ycb)^2 ft^4	I ft^4	E(I+Ay^2) ksf-ft^4
0.0 L	SLAB	0.000	79.167	0.625	550609	49.48	6.48	320.58	176.18	1.61	97892055
	HAUNCH		3.333	0.167	550609	5.56	6.08	33.80	12.35	0.01	6808584
	G1				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G2				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G3				635789	6.53	3.04	19.84	15.81	32.36	30629361
Girders	G4				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G5				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G6				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G7				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G8				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G9				635789	6.53	3.04	19.84	15.81	32.36	30629361
	G10				635789	6.53	3.04	19.84	15.81	32.36	30629361
					Sum:	120.38		552.82			410994251
							ycb=	4.59 ft			

Iyy

	Location	X ft	Width ft	Thickness ft	E ksf	Area ft^2	y ft	Area*y ft^3	A(y-ycb)^2 ft^4	I ft^4	E(I+Ay^2) ksf-ft^4
0.0 L	SLAB	0.000	0.625	79.167	550609	49.48	39.58	1958.55	0.00	25841.98	14228838618
	HAUNCH		0.167	3.333	550609	5.56	0.00	219.91	2664.78	0.01	1467259196
	G1	34.313			635789	6.53	5.27	34.44	7693.64	2.21	4892936312
	G2	26.688			635789	6.53	12.90	84.27	4654.18	2.21	2960479542
	G3	19.063			635789	6.53	20.52	134.10	2374.58	2.21	1511136964
Girders	G4	11.438			635789	6.53	28.15	183.93	854.85	2.21	544908579
	G5	3.813			635789	6.53	35.77	233.75	94.98	2.21	61794387
	G6	3.813			635789	6.53	43.40	283.58	94.98	2.21	61794387
	G7	11.438			635789	6.53	51.02	333.41	854.85	2.21	544908579
	G8	19.063			635789	6.53	58.65	383.23	2374.58	2.21	1511136964
	G9	26.688			635789	6.53	66.27	433.06	4654.18	2.21	2960479542
	G10	34.313			635789	6.53	73.90	482.89	7693.64	2.21	4892936312
					Sum:	120.38		4765.12			35638609381
							ycb=	39.58 ft			

Ixx

	Location	Width ft	Thickness ft	E ksf	E*W*T^3 ksf-ft^4
0.0 L	SLAB	79.167	0.625	550609	10642068
	HAUNCH	3.333	0.167	550609	84971
Girders	G1 to G10	6.000	1.089	635789	49282402
				Sum:	60009440

SLAB HAUNCH GIRDERS

$$EI=\frac{(E*W1*T1^3+E*No.\ Girders*W2*T2^3+E*No.\ Girders*W3*T3^3)}{3}$$

EI= 20003147

Ixx= 31.462 ft^4

TYLIN INTERNATIONAL

Project:	Salt River Bridges Scour	Job No.	1317.00	Sheet:	
Item:	7th Avenue Bridge	Designer:	VPD	Date:	10/21/99
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SECTION PROPERTIES

HAUNCH PROPERTIES

Location	X ft	Width ft	Thickness ft	E ksf	Area ft^2	y ft	Area*y ft^3	A(y-ycb)^2 ft^4	I ft^4	E(I+Ay^2) ft^4
G1	34.313	3.333	0.167	550609	0.556	5.27	2.93	654	0.001	360144409
G2	26.688	3.333	0.167	550609	0.556	12.90	7.16	396	0.001	217865416
G3	19.063	3.333	0.167	550609	0.556	20.52	11.40	202	0.001	111156171
G4	11.438	3.333	0.167	550609	0.556	28.15	15.64	73	0.001	40016675
G5	3.813	3.333	0.167	550609	0.556	35.77	19.87	8	0.001	4446927
G6	3.813	3.333	0.167	550609	0.556	43.40	24.11	8	0.001	4446927
G7	11.438	3.333	0.167	550609	0.556	51.02	28.34	73	0.001	40016675
G8	19.063	3.333	0.167	550609	0.556	58.65	32.58	202	0.001	111156171
G9	26.688	3.333	0.167	550609	0.556	66.27	36.82	396	0.001	217865416
G10	34.313	3.333	0.167	550609	0.556	73.90	41.05	654	0.001	360144409
					5.556		219.91	2665	0.013	1467259196
						ycb=	39.583	ft		

ADDITIONAL DEAD LOAD ADDED

DIAPHRAGMS

Location	Total Load kips
ABUT 1	232.31
PIER 1	339.05
PIER 2	339.05
PIER 3	409.98
PIER 4	339.05
PIER 5	339.05
ABUT 2	232.31

PIER NOMENCLATURE

Location	Dist - x ft	Dist - y ft
C1	-37.534	-19.957
G1	-34.313	-18.244
C2	-30.534	-16.235
C3	-28.034	-14.906
G2	-26.688	-14.190
G3	-19.063	-10.136
C4	-14.017	-7.453
G4	-11.438	-6.081
G5	-3.813	-2.027
C5	0.000	0.000
G6	3.813	2.027
G7	11.438	6.081
C6	14.017	7.453
G8	19.063	10.136
G9	26.688	14.190
C7	28.034	14.906
C8	30.534	16.235
G10	34.313	18.244
C9	37.534	19.957

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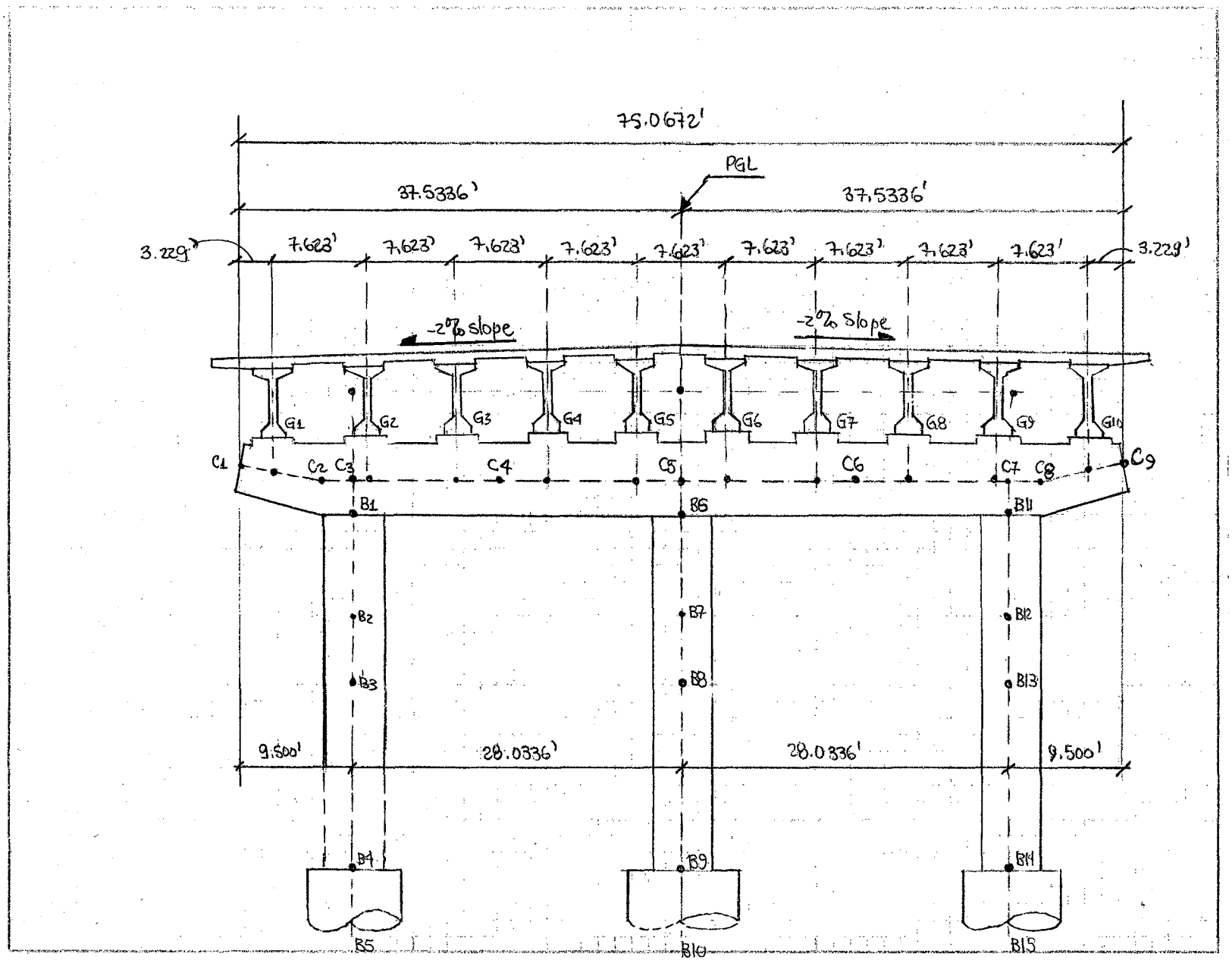
Item:	7th Avenue Bridge	Designer:	VPD	Date:	9/16/99
A:\[GEOM.XLS]COOR		Checker:		Date:	

COORDINATES & SECTION PROPERTIES

	Location	Joint No.	X ft	Y ft	Z ft	Area ft^2	Iz ft^4	Iy ft^4	Ix ft^4
ABUT 1	0.00 L	101	0.00	0.00	1073.14	120.382	646.432	56054	31.462
	0.25 L	102	31.25	0.00	1073.14	120.382	646.432	56054	31.462
	0.50 L	103	62.50	0.00	1073.14	120.382	646.432	56054	31.462
	0.75 L	104	93.75	0.00	1073.14	120.382	646.432	56054	31.462
PIER 1	1.00 L	105	125.00	0.00	1073.14	120.382	646.432	56054	31.462
	1.25 L	106	156.25	0.00	1073.14	120.382	646.432	56054	31.462
	1.50 L	107	187.50	0.00	1073.14	120.382	646.432	56054	31.462
	1.75 L	108	218.75	0.00	1073.14	120.382	646.432	56054	31.462
PIER 2	2.00 L	109	250.00	0.00	1073.14	120.382	646.432	56054	31.462
	2.25 L	110	281.25	0.00	1073.14	120.382	646.432	56054	31.462
	2.50 L	111	312.50	0.00	1073.14	120.382	646.432	56054	31.462
	2.75 L	112	343.75	0.00	1073.14	120.382	646.432	56054	31.462
PIER 3	3.00 L	113	375.00	0.00	1073.14	120.382	646.432	56054	31.462
	3.25 L	114	406.25	0.00	1073.14	120.382	646.432	56054	31.462
	3.50 L	115	437.50	0.00	1073.14	120.382	646.432	56054	31.462
	3.75 L	116	468.75	0.00	1073.14	120.382	646.432	56054	31.462
PIER 4	4.00 L	117	500.00	0.00	1073.14	120.382	646.432	56054	31.462
	4.25 L	118	531.25	0.00	1073.14	120.382	646.432	56054	31.462
	4.50 L	119	562.50	0.00	1073.14	120.382	646.432	56054	31.462
	4.75 L	120	593.75	0.00	1073.14	120.382	646.432	56054	31.462
PIER 5	5.00 L	121	625.00	0.00	1073.14	120.382	646.432	56054	31.462
	5.25 L	122	656.25	0.00	1073.14	120.382	646.432	56054	31.462
	5.50 L	123	687.50	0.00	1073.14	120.382	646.432	56054	31.462
	5.75 L	124	718.75	0.00	1073.14	120.382	646.432	56054	31.462
ABUT 2	6.00 L	125	750.00	0.00	1073.14	120.382	646.432	56054	31.462



TYLIN INTERNATIONAL

Project: Salt River Bridges - Scour

Item: Seventh Avenue Bridge

Job No. 1317.00

Sheet: of

Designer: VPD

Date: 9/8/99

Checker:

Date:

Grid: 1/8"

TYLIN INTERNATIONAL

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COORDINATES & SECTION PROPERTIES

	Item	Location	Joint No.	X ft	Y ft	Z ft	Area ft^2	Iz ft^4	Iy ft^4	Ix ft^4
PIER 1	PIER CAP	C1	201	105.04	37.53	1065.21	21.333	28.444	50.568	61.201
		G1		106.76	34.31	1064.75	26.242	59.531	62.202	98.580
		C2	202	108.76	30.53	1064.21	32.000	96.000	75.852	142.432
		C3 - COL1	203	110.09	28.03	1064.21	32.000	96.000	75.852	142.432
		G2		110.81	26.69	1064.21	32.000	96.000	75.852	142.432
		G3		114.86	19.06	1064.21	32.000	96.000	75.852	142.432
		C4	204	117.55	14.02	1064.21	32.000	96.000	75.852	142.432
		G4		118.92	11.44	1064.21	32.000	96.000	75.852	142.432
		G5		122.97	3.81	1064.21	32.000	96.000	75.852	142.432
		C5 - COL 2	205	125.00	0.00	1064.21	32.000	96.000	75.852	142.432
		G6		127.03	-3.81	1064.21	32.000	96.000	75.852	142.432
		G7		131.08	-11.44	1064.21	32.000	96.000	75.852	142.432
		C6	206	132.45	-14.02	1064.21	32.000	96.000	75.852	142.432
		G8		135.14	-19.06	1064.21	32.000	96.000	75.852	142.432
		G9		139.19	-26.69	1064.21	32.000	96.000	75.852	142.432
		C7 - COL 3	207	139.91	-28.03	1064.21	32.000	96.000	75.852	142.432
		C8	208	141.24	-30.53	1064.21	32.000	96.000	75.852	142.432
		G10		143.24	-34.31	1064.75	26.242	59.531	62.202	98.580
		C9	209	144.96	-37.53	1065.21	21.333	28.444	50.568	61.201
	COL1	Top	601	110.09	28.03	1061.21	19.635	30.680	30.680	61.359
		HWL	602	110.09	28.03	1060.77	19.635	30.680	30.680	61.359
		12 ft below	603	110.09	28.03	1048.77	19.635	30.680	30.680	61.359
		Top of DS	604	110.09	28.03	1032.50	19.635	30.680	30.680	61.359
		Groundline	605	110.09	28.03	1002.84	38.485	117.859	117.859	235.718
		1 "Dia."	606	110.09	28.03	995.84	38.485	117.859	117.859	235.718
		2 "Dia."	607	110.09	28.03	988.84	38.485	117.859	117.859	235.718
		3 "Dia."	608	110.09	28.03	981.84	38.485	117.859	117.859	235.718
		4 "Dia."	609	110.09	28.03	974.84	38.485	117.859	117.859	235.718
	COL2	Top	610	125.00	0.00	1061.21	19.635	30.680	30.680	61.359
		HWL	611	125.00	0.00	1060.77	19.635	30.680	30.680	61.359
		12 ft below	612	125.00	0.00	1048.77	19.635	30.680	30.680	61.359
		Top of DS	613	125.00	0.00	1032.50	19.635	30.680	30.680	61.359
		Groundline	614	125.00	0.00	1002.84	38.485	117.859	117.859	235.718
		1 "Dia."	615	125.00	0.00	995.84	38.485	117.859	117.859	235.718
		2 "Dia."	616	125.00	0.00	988.84	38.485	117.859	117.859	235.718
		3 "Dia."	617	125.00	0.00	981.84	38.485	117.859	117.859	235.718
		4 "Dia."	618	125.00	0.00	974.84	38.485	117.859	117.859	235.718
	COL3	Top	619	139.91	-28.03	1061.21	19.635	30.680	30.680	61.359
		HWL	620	139.91	-28.03	1060.77	19.635	30.680	30.680	61.359
		12 ft below	621	139.91	-28.03	1048.77	19.635	30.680	30.680	61.359
		Top of DS	622	139.91	-28.03	1032.50	19.635	30.680	30.680	61.359
		Groundline	623	139.91	-28.03	1002.84	38.485	117.859	117.859	235.718
		1 "Dia."	624	139.91	-28.03	995.84	38.485	117.859	117.859	235.718
		2 "Dia."	625	139.91	-28.03	988.84	38.485	117.859	117.859	235.718
		3 "Dia."	626	139.91	-28.03	981.84	38.485	117.859	117.859	235.718
		4 "Dia."	627	139.91	-28.03	974.84	38.485	117.859	117.859	235.718

TYLIN INTERNATIONAL

Project:	Salt River Bridges Scour	Job No.	1317.00	Sheet:	
Item:	7th Avenue Bridge	Designer:	VPD	Date:	10/21/99
D:\My Documents\Projects\Salt River Bridges - Scour\7th Ave\excel\[geom.xls]COOR		Checker:		Date:	

COORDINATES & SECTION PROPERTIES

	Item	Location	Joint No.	X ft	Y ft	Z ft	Area ft^2	Iz ft^4	Iy ft^4	Ix ft^4
PIER 2	PIER CAP	C1	301	230.04	37.53	1065.21	21.333	28.444	50.568	61.201
		G1		231.76	34.31	1064.75	26.242	59.531	62.202	98.580
		C2	302	233.76	30.53	1064.21	32.000	96.000	75.852	142.432
		C3 - COL1	303	235.09	28.03	1064.21	32.000	96.000	75.852	142.432
		G2		235.81	26.69	1064.21	32.000	96.000	75.852	142.432
		G3		239.86	19.06	1064.21	32.000	96.000	75.852	142.432
		G4		242.55	14.02	1064.21	32.000	96.000	75.852	142.432
		C4	304	243.92	11.44	1064.21	32.000	96.000	75.852	142.432
		G5		247.97	3.81	1064.21	32.000	96.000	75.852	142.432
		C5 - COL 2	305	250.00	0.00	1064.21	32.000	96.000	75.852	142.432
		G6		252.03	-3.81	1064.21	32.000	96.000	75.852	142.432
		G7		256.08	-11.44	1064.21	32.000	96.000	75.852	142.432
		C6	306	257.45	-14.02	1064.21	32.000	96.000	75.852	142.432
		G8		260.14	-19.06	1064.21	32.000	96.000	75.852	142.432
		G9		264.19	-26.69	1064.21	32.000	96.000	75.852	142.432
		C5 - COL 3	307	264.91	-28.03	1064.21	32.000	96.000	75.852	142.432
		C7	308	266.24	-30.53	1064.21	32.000	96.000	75.852	142.432
		G10		268.24	-34.31	1064.75	26.242	59.531	62.202	98.580
		C8	309	269.96	-37.53	1065.21	21.333	28.444	50.568	61.201
	COL1	Top	701	235.09	28.03	1061.21	19.635	30.680	30.680	61.359
		HWL	702	235.09	28.03	1060.77	19.635	30.680	30.680	61.359
		12 ft below	703	235.09	28.03	1048.77	19.635	30.680	30.680	61.359
		Top of DS	704	235.09	28.03	1032.50	19.635	30.680	30.680	61.359
		Groundline	705	235.09	28.03	1002.84	38.485	117.859	117.859	235.718
		1 "Dia."	706	235.09	28.03	995.84	38.485	117.859	117.859	235.718
		2 "Dia."	707	235.09	28.03	988.84	38.485	117.859	117.859	235.718
		3 "Dia."	708	235.09	28.03	981.84	38.485	117.859	117.859	235.718
		4 "Dia."	709	235.09	28.03	974.84	38.485	117.859	117.859	235.718
	COL2	Top	710	250.00	0.00	1061.21	19.635	30.680	30.680	61.359
		HWL	711	250.00	0.00	1060.77	19.635	30.680	30.680	61.359
		12 ft below	712	250.00	0.00	1048.77	19.635	30.680	30.680	61.359
		Top of DS	713	250.00	0.00	1032.50	19.635	30.680	30.680	61.359
		Groundline	714	250.00	0.00	1002.84	38.485	117.859	117.859	235.718
		1 "Dia."	715	250.00	0.00	995.84	38.485	117.859	117.859	235.718
		2 "Dia."	716	250.00	0.00	988.84	38.485	117.859	117.859	235.718
		3 "Dia."	717	250.00	0.00	981.84	38.485	117.859	117.859	235.718
		4 "Dia."	718	250.00	0.00	974.84	38.485	117.859	117.859	235.718
	COL3	Top	719	264.91	-28.03	1061.21	19.635	30.680	30.680	61.359
		HWL	720	264.91	-28.03	1060.77	19.635	30.680	30.680	61.359
		12 ft below	721	264.91	-28.03	1048.77	19.635	30.680	30.680	61.359
		Top of DS	722	264.91	-28.03	1032.50	19.635	30.680	30.680	61.359
		Groundline	723	264.91	-28.03	1002.84	38.485	117.859	117.859	235.718
		1 "Dia."	724	264.91	-28.03	995.84	38.485	117.859	117.859	235.718
		2 "Dia."	725	264.91	-28.03	988.84	38.485	117.859	117.859	235.718
		3 "Dia."	726	264.91	-28.03	981.84	38.485	117.859	117.859	235.718
		4 "Dia."	727	264.91	-28.03	974.84	38.485	117.859	117.859	235.718

TYLIN INTERNATIONAL

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- DESIGN LOADS - PER GIRDER

- GALVANIZED METAL HANDRAIL = 50 lbs/Ft * 2 ÷ 1000 ÷ 10 girders = 0.010 Klf
- CONCRETE BARRIER = 0.372 K/Ft * 2 ÷ 10 girders = 0.0744 Klf
- SLAB = 79.1667 Ft * $\frac{7.50}{12}$ in * 0.150 Kcf ÷ 10 girders = 0.742 Klf
- FWS = 25 psf * 64.0 Ft ÷ 1000 ÷ 10 girders = 0.160 Klf
- GIRDER = 0.980 Klf
- BUILD UP = $\frac{40}{12}$ * $\frac{2}{12}$ * 0.150 Kcf = 0.08333 Klf

≦ 2.04973 Klf per girder

- ADDITIONAL DEADLOADS

- PIER DIAPHRAGM:

FIXED PIER = [(5.333 Ft * (9 * 8.635 Ft * 6.00 Ft)) + (6.53 Ft² * 5.333 Ft) − (10 * 2 * 6.53 Ft² * 2.00 Ft)] * 0.150 Kcf = 339.052 Kips

EXPANSION PIER = [(6.333 Ft * (9 * 8.635 Ft * 6.00 Ft)) + (6.53 Ft² * 6.333 Ft) − (10 * 2 * 6.53 Ft² * 2.00 Ft)] * 0.150 Kcf = 409.975 Kips

- ABUTMENT DIAPHRAGM:

FIXED ABUTMENT = [3.00 Ft * 89.667 Ft * 6.00 Ft] − [10 * 6.53 Ft * 0.50 Ft] = 1581.356 Ft³ * 0.150 Kcf = 237.203 Kips

- INT. DIAPHRAGM: [0.75 Ft * (8.635 Ft * 6.00 Ft) − [6.53 Ft² * 0.75]] * 10 = 339.60 Ft³ * 0.150 Kcf = 50.94 Kips

TOTAL DEAD LOAD = 3212.44 Kips ÷ 10 girders = 321.440 Kips/girder

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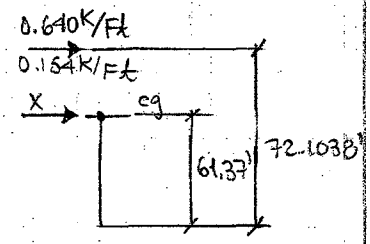
- WIND LOADS

-ON SUPERSTRUCTURE



WIND LOAD = WIND $_{\substack{TRANS \\ LONG}}$ * h_{WIND}

$h_{WIND} = 6.00 Ft + \frac{2''}{12} + \frac{7.5''}{12} + \sim 6.00 Ft = 12.79167 Ft$

METAL HANDRAIL

POINT OF APPLICATION = $\frac{h_{WIND}}{2} = 6.39583 Ft$

$\left.\begin{array}{l} WIND_{TRANS} = 50 \ Lbs/Ft^2 \\ WIND_{LONG} = 12 \ Lbs/Ft^2 \end{array}\right\}$ BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

$WIND\ LOAD_{TRANS} = 0.050 \ KSF * 12.79167 Ft = 0.6396 \ K/Ft * 1.1749 = 0.75147 K/Ft$

$WIND\ LOAD_{LONG} = 0.012 KSF * 12.79167 Ft = 0.1535 \ K/Ft * 1.1749 = 0.18035 \ K/Ft$

-OVERTURNING FORCES

$F_{WIND} = W_{OVER} * WIDTH_SUPERSTRUCTURE * LENGTH$

$W_{OVER} = 20 \ Lbs/Ft^2$

POINT OF APPLICATION = 1/4 WIDTH_SUPERSTRUCTURE

$F_{WIND} = 0.020 \ KSF * 79.1667 Ft = 1.5833 \ K/Ft$

$M_{WIND} = 0.020 \ KSF * 79.1667 Ft * (\frac{1}{4} * 79.1667 Ft) = 31.337 \ \frac{K\text{-}Ft}{Ft} * TRIB. LENGTH$

$M_{WIND}(P1) = 31.337 \ \frac{K\text{-}Ft}{Ft} * 125.0 Ft = 3917.104 \ K\text{-}Ft$

$M_{WIND}(P2) = M_{WIND}(P3) = M_{WIND}(P4) = M_{WIND}(P5) = 3917.104 \ K\text{-}Ft$

-ON SUBSTRUCTURE

WIND LOAD = WIND $_{\substack{TRANS \\ LONG}}$ * WIDTH $_{\substack{TRANS \\ LONG}}$

$\left.\begin{array}{l} WIND_{TRANS} = 40 \ Lbs/Ft^2 \\ WIND_{LONG} = 40 \ Lbs/Ft^2 \end{array}\right\}$ BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

-FIXED PIER CAP:

$WIND_{TRANS} = 0.040 \ KSF * 6.0 Ft * 5.333 Ft \div 85.04167' = 0.01505 \ K/Ft$

$WIND_{LONG} = 0.040 \ KSF * 6.0 Ft = 0.240 \ K/Ft$

-EXPANSION PIER CAP:

$WIND_{TRANS} = 0.040 \ KSF * 6.0 Ft * 6.333 Ft \div 85.04167' = 0.01787 \ K/Ft$

$WIND_{LONG} = 0.040 \ KSF * 6.0 Ft = 0.240 \ K/Ft$

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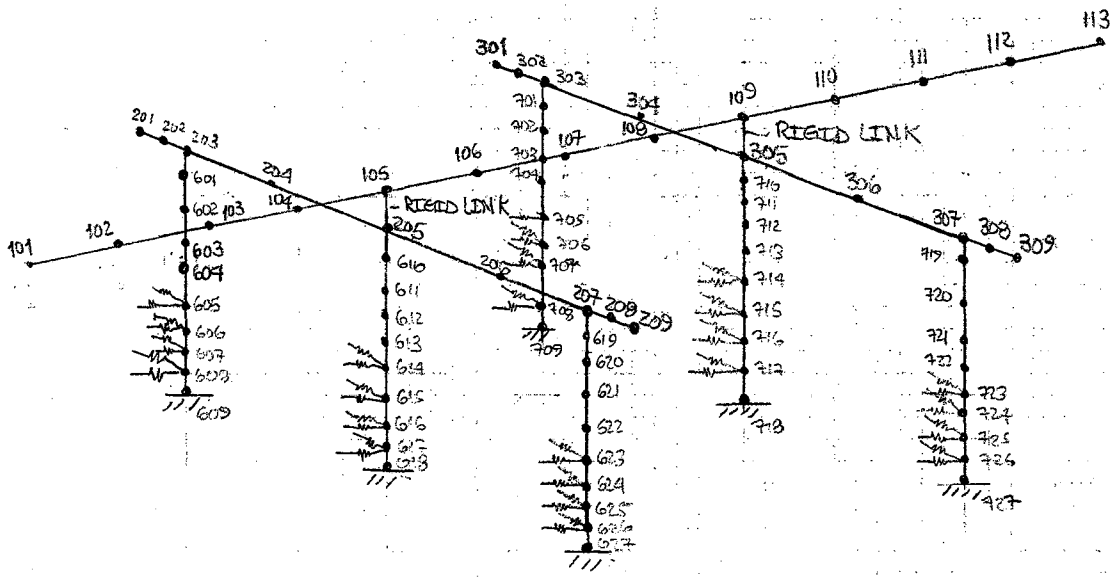
CASE 3 - 100 YR FLOOD (LONGITUDINAL)



NODAL NOMENCLATURE FOR SAP 90

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		Grid: 1/8"

- WIND LOADS - (Cont.)

- ON SUBSTRUCTURE - (Cont.)

- COLUMN:

$WIND_{TRANS} = 0.040\ KSF * 5.00\ Ft = 0.200\ K/Ft$

$WIND_{LONG} = 0.040\ KSF * 5.00\ Ft = 0.200\ K/Ft$

- THERMAL FORCES

T = -40 °F (FALL)

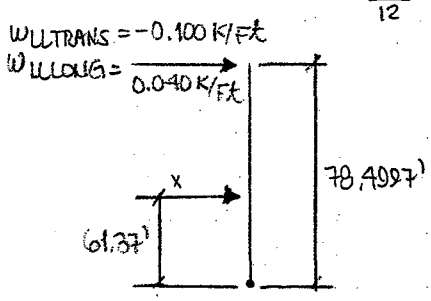
- WIND ON LIVE LOAD

WIND ON LIVE LOAD = W LIVELOAD TRANS / LONG

POINT OF APPLICATION = 6.00' FROM FLOOR SLAB

$W_{LL\ TRANS} = 100\ Lbs/Ft$
$W_{LL\ LONG} = 40\ Lbs/Ft$ } BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

DISTANCE TO LOAD = $6.00\ Ft + \frac{2''}{12} + \frac{7.5''}{12} + 6.00\ Ft = 12.79167\ Ft$



EQUIVALENT FORCES:

$W_{LL\ TRANS} = -0.100 * 1.27912 = -0.12791\ K/Ft$

$W_{LL\ LONG} = 0.040 * 1.27912 = 0.05116\ K/Ft$

- LONGITUDINAL FORCES FROM LIVE LOAD

$L.F._{LIVE\ LOAD} = 5\%$ NO. LANES $[R.F. * (0.640 * LENGTH + 18^K)]$

POINT OF APPLICATION = 6.00 Ft ABOVE THE FLOOR SLAB

NO. LANES = (79.1667' - 15.1667') ÷ 12 = 5.33 lanes USE 3 LANES SAME DIR.

$L.F. = 0.05 * 3\ lanes * 0.90 * 0.640\ K/Ft = 0.0864\ K/Ft * 1.27912 = 0.1105\ K/Ft$

$L.F. = 0.05 * 3\ lanes * 0.90 * 18^K * 0.20 = 0.486^K * 1.27912 = 0.62165\ K/Ft$

↑ DISTRIBUTED @ THE 5 PIERS.

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Item: Seventh Avenue Scour	Designer: VPD	Date: 10/20/99	
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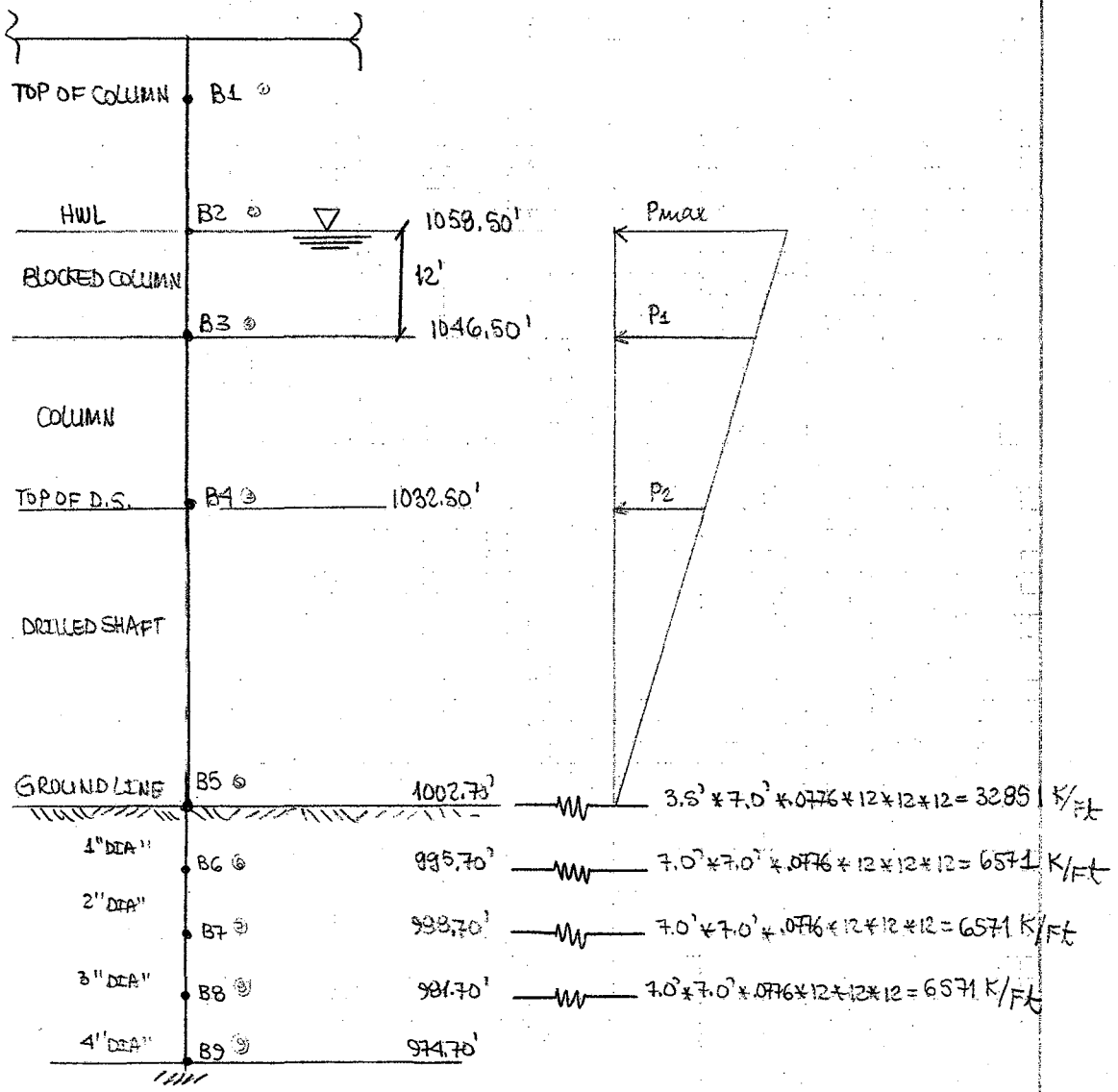
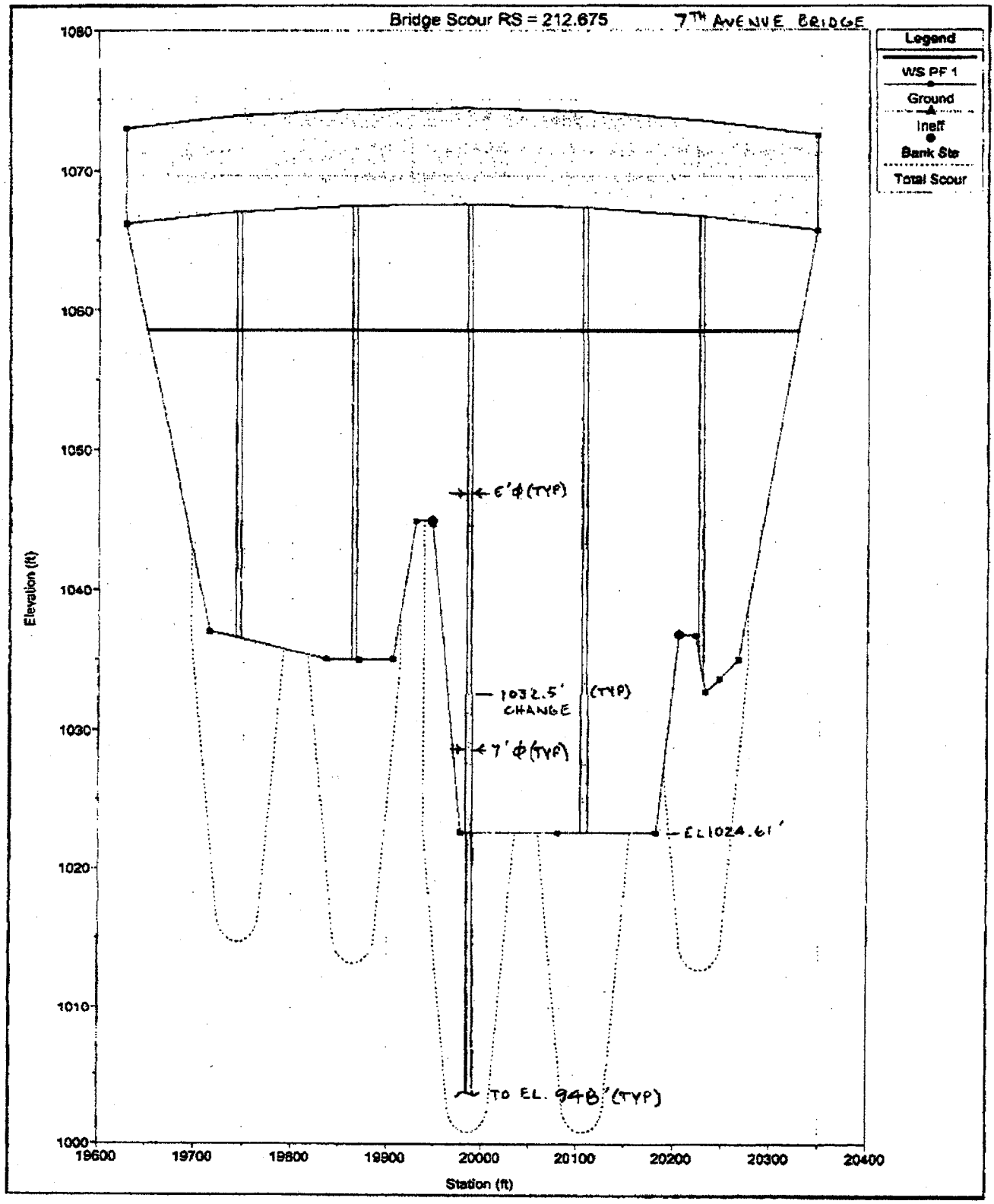
SOIL SPRINGS

CASE 3- PIER SCOUR




Bridge Scour RS = 212.675
7TH AVENUE BRIDGE
Legend
WS PF 1
Ground
Ineff
Bank Sta
Total Scour
Elevation (ft)
Station (ft)
1080
1070
1060
1050
1040
1030
1020
1010
1000
19600
19700
19800
19900
20000
20100
20200
20300
20400
6'Φ (TYP)
1032.5' CHANGE
(TYP)
7'Φ (TYP)
EL 1024.61'
TO EL. 948' (TYP)

Alternative 1 Bridge Scour With Long Term Degradation, River Station 212.675, 7th Avenue Bridge

Results Computed Using HEC-RAS Version 2.2 and HEC-18 Guidelines

Hydraulic Design Data

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Group of Cylinders
Pier Width (ft):	9
Grain Size D50 (ft):	0.0197
Depth Upstream (ft):	36.16
Velocity Upstream (ft/s):	13.71
K1 Nose Shape:	1
Pier Angle:	0
Pier Length (ft):	153.01
K2 Angle Coef:	1
K3 Bed Cond Coef:	1.1
Grain Size D90 (ft):	0.2461
K4 Armouring Coef:	1

Results

Scour Depth Ys (ft):	21.77
Froude #:	0.4
Equation:	CSU equation

Alternative case analysis:

Yf	Y1	Yf/Y >>	Vf/V1	V1	Vf
7.89	36.16	0.2182	0.74	13.71	10.1454

Notes: Two feet of bulking is added to each side of piers less than 6' wide.
Exposed pile cap is 7' wide, which should not be bulked. The near bottom velocity on the unbulked pier will clearly produce less scour, so it is not computed herein.

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Project:	Salt River Bridges - Scour	Job No.	1317.00	Sheet:	
Item:	Seventh Avenue Bridge	Designer:	VPD	Date:	9/16/99
	Case 3 - Contraction Scour - (Pier Scour)	Checker:		Date:	

FORCE OF STREAM CURRENT ON PIERS: (AASHTO Art. 3.18.1 & ADOT BD&D Sec. 1.2.1)

MEAN VELOCITY, V =	13.71	FT/SEC
ANGLE OF ATTACK =	15	DEGREES
COLUMN DIAMETER =	5.00	FT
DRI'D SHFT DIAM =	7.00	FT

STREAM PRESSURE: (AASHTO Art. 3.18.1.1)

The effect of flowing water on piers and drift build-up, assuming a second-degree parabolic velocity distribution and thus a triangular pressure distribution, shall be calculated by the formula:

$$P_{avg} = K\,(V_{avg})^2 \qquad \text{(AASHTO Eqn. 3-4)}$$

where: P_{avg} = Average Stream Pressure, in pounds per square foot
V_{avg} = Average Velocity of water in feet per second
K = A Constant, 1.4 for all piers subjected to drift build-up

V_{avg} long = **3.55** ft/sec $\qquad$ V_{avg} trans = **13.24** ft/sec

The maximum Stream Flow Pressure, P_{max}, shall be equal to twice the Average Stream Flow Pressure, P_{avg}, computed by Equation 3-4. Stream Flow Pressure shall be a triangular distribution with P_{max} located at the top of water elevation and a zero pressure located at the flow line.

$$P_{max} = 2 * K\,(V_{avg})^2 \qquad \text{where:} \qquad K = 1.4$$

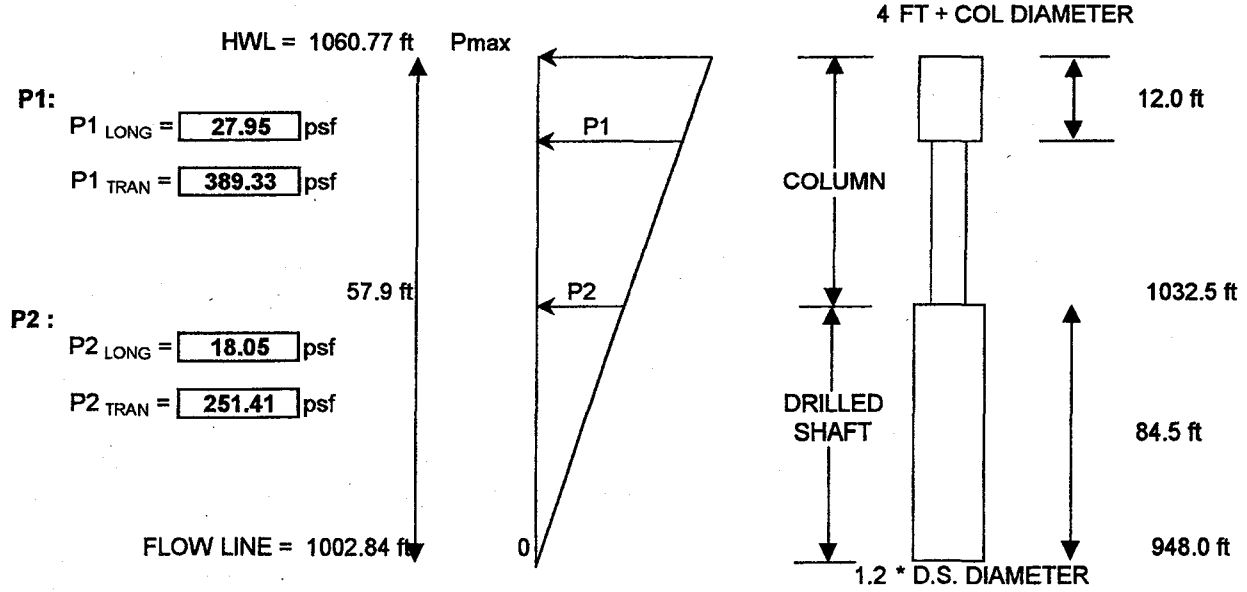
P_{max} long = **35.26** psf $\qquad$ P_{max} trans = **491.04** psf

BUOYANCY:

COLUMN =	62.40 kcf	* PI /4 *	(5.00 ft) ^{2}	=	1.23	k/ft	↑ upward force
DRI'D SHAFT =	62.40 kcf	* PI /4 *	(7.00 ft) ^{2}	=	2.40	k/ft	↑ upward force

P1:
P1 LONG = **27.95** psf
P1 TRAN = **389.33** psf

P2 :
P2 LONG = **18.05** psf
P2 TRAN = **251.41** psf



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Projects: Salt River Bridges - Scour | Job No. 1317.00 | Sheet: of
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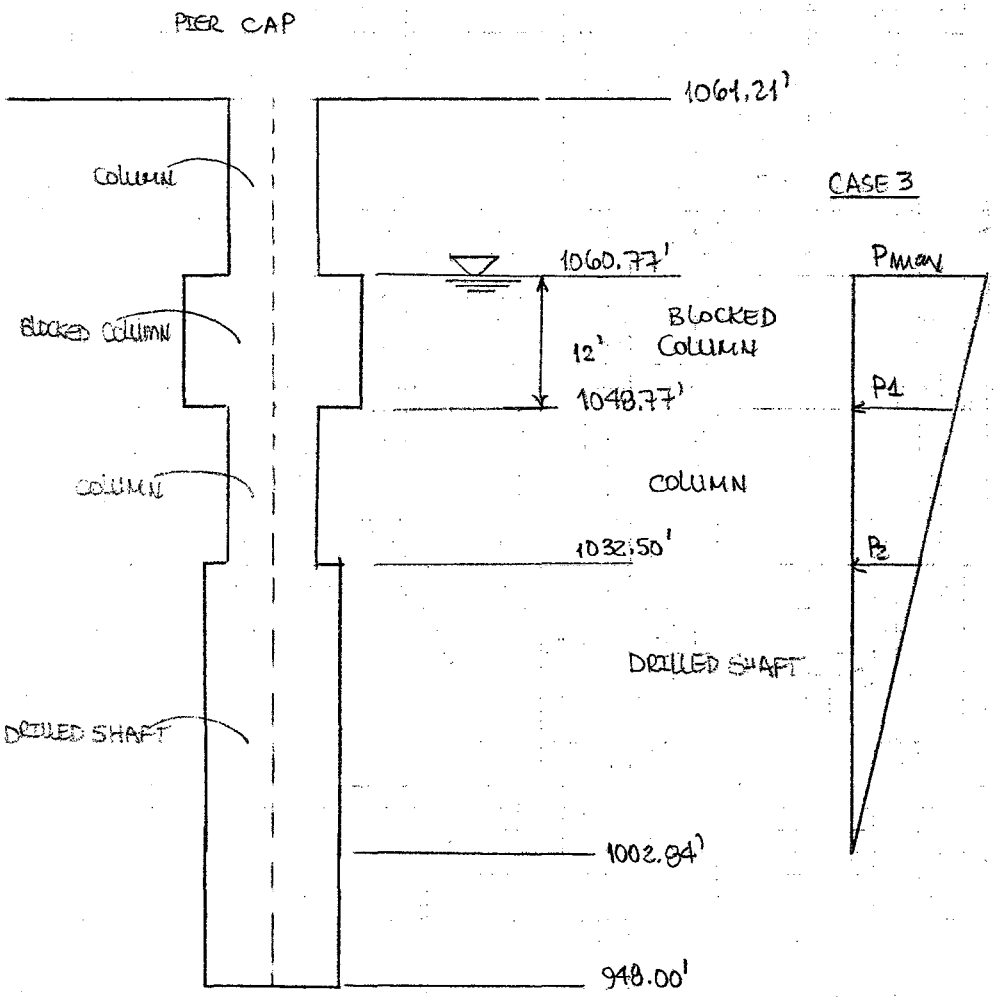
Checker: | Date:
Grid: 1/8"

STREAM FLOW FORCES!



	LONGITUDINAL	TRANSVERSE
P_{MAX}	0.03526 KSF	0.49104 KSF
P_1	0.02795 KSF	0.38933 KSF
P_2	0.01805 KSF	0.25141 KSF

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CASE 3:

LONGITUDINAL

BLOCKED COLUMN:	@ 0.0'	0.03526	KSF *(5.00+2*2) = 0.3173 K/Ft
	@ 12.0'	0.02795	KSF *(5.00+2*2) = 0.2516 K/Ft
COLUMN:	@ 12.0'	0.02795	KSF * 5.00' = 0.1398 K/Ft
	@ 26.0'	0.01805	KSF * 5.00' = 0.0903 K/Ft
DRILLED SHAFT:	@ 26.0'	0.01805	KSF *7.00' = 0.126 K/Ft
	@ 55.8'	0.000	KSF *7.00' = 0.00 K/Ft

TRANSVERSE

BLOCKED COLUMN:	@ 0.0'	0.49104	KSF *(5.00+4.00) = 4.419 K/Ft
	@ 12.0'	0.38933	KSF *(5.00+4.00) = 3.504 K/Ft
COLUMN:	@ 12.0'	0.38933	KSF *5.00' = 1.947 K/Ft
	@ 26.0'	0.25141	KSF *5.00' = 1.257 K/Ft
DRILLED SHAFT	@ 26.0'	0.25141	KSF *7.00' = 1.7599 K/Ft
	@ 55.8'	0.000	KSF *7.00' = 0.000 K/Ft

TYLIN INTERNATIONAL

Projects: Salt River Bridges - Scour	Job No. 1317.00	Sheet:	of
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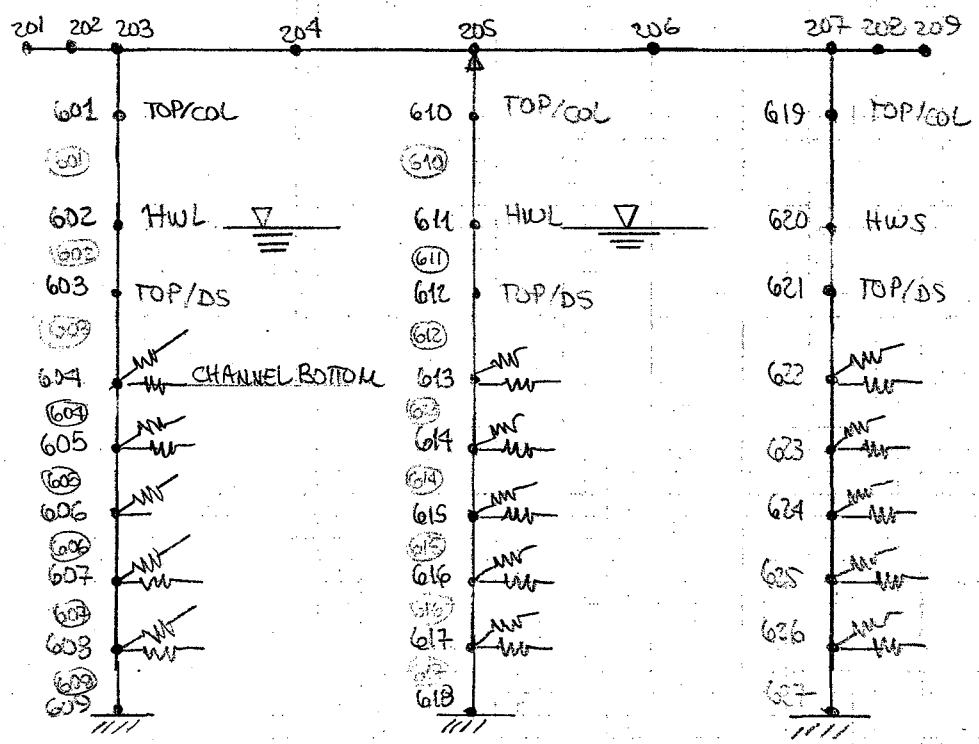
	Checker:	Date:	
		Grid: 1/8"	

CASE 3 - 100 YR FLOOD (TRANSVERSE)



NODAL NOMENCLATURE FOR SAP 90

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Projects: Salt River Bridges - Scour	Job No. 1317.00	Sheet:	of
Item: 7th Avenue Bridge	Designer: VPD	Date: 9/16/99	
	Checker:	Date:	
		Grid: 1/8"	

Reaction due to live load

- Live load distribution Factors for front and Rear axles.

"As per AASHTO 3.23.1, lateral distribution of wheel loads at the end of the beam shall be that produced by assuming the floor to act as a simple span between beam. For wheels or axles in other positions in the span, the lateral distribution shall be as per Table 3.23.1"

Span length $l_{span} = 125.00\ ft$

Impact factor $I = \frac{50}{l_{span}+125} = 0.20$

Beam Spacing $S_{beam} = 7.623\ ft$

Spacing of axle $S_{axle} = 14.00\ ft$

Spacing of wheel $S_{wheel} = 6.00\ ft$

Reaction of Front Axle $R_{FRONT} = 8$ Kips

Reaction of Rear axle $R_{rear} = 32$ kips

Distribution Factor

For Front and Rear axle $DF_F = \frac{S_{beam}}{11} = 0.693$

For middle axle $DF_M = \frac{S_{beam} - S_{wheel}}{S_{beam}} + 1.00 = 1.213$

MAXIMUM LIVE LOAD REACTION

$$R_{MAX} = \frac{R_{REAR}}{2} * DF_M + (R_{REAR} + R_{FRONT}) * \frac{(l_{span} - S_{axle})}{l_{span}} * DF_F$$

$$R_{MAX} = \frac{32.0}{2} * 1.213 + (32+8) * \frac{(125-14)}{125} * 0.693 = 44.022 \text{ kips}$$

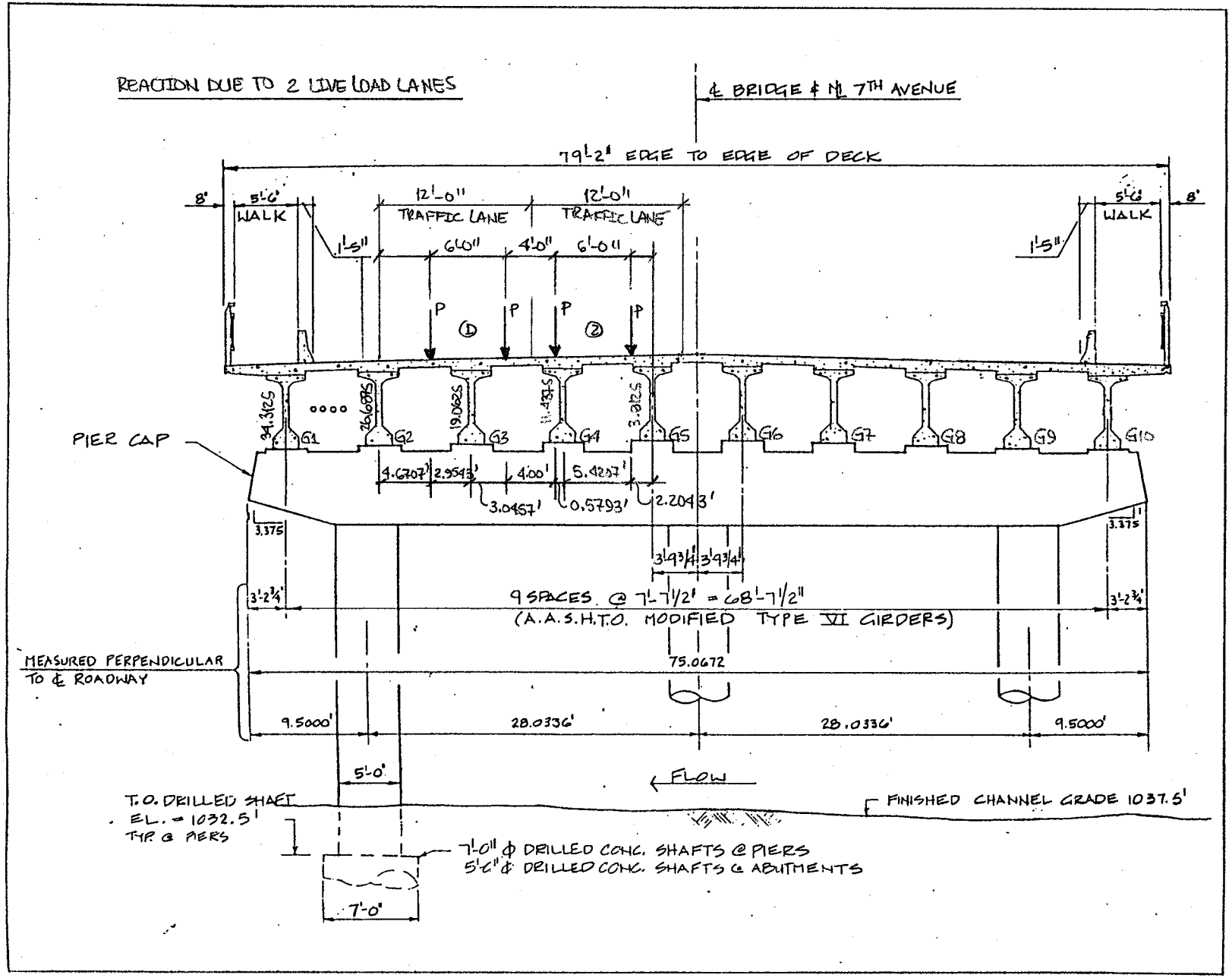
Reaction to the adjacent Beams

(the reaction to the adjacent beam will be conservatively placed as to maximize the effects being investigated)

$$R_{adj} = \frac{R_{rear}}{2} * \left(\frac{S_{wheel}}{S_{beam}}\right) + (R_{rear} + R_{front}) * \left(\frac{l_{span} - S_{axle}}{l_{span}}\right)(1 - DF_F)$$

$$R_{adj} = \frac{32.0}{2} * \left(\frac{6.00}{7.623}\right) + (32+8) * \left(\frac{125-14}{125}\right)(1 - 0.693) = 23.498 \text{ Kips}$$

$$R_{live\ load} = 44.022^K + 23.498^K = 67.52^K \div 2 = 33.76^K * 1.20 = 40.512\ K/wheel$$



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REACTION DUE TO 2 LIVE LOAD LANES

GIRDER 2

$$R_{G2} = \frac{R_{live}}{S_{beam}} (S_{beam} - 4.6707)$$

$$R_{G2} = \frac{40.512^K}{7.625} (7.625 - 4.6707) = 15.696 \text{ Kips}$$

GIRDER 3

$$R_{G3} = \frac{R_{live}}{S_{beam}} (S_{beam} - 2.9543) + \frac{R_{live}}{S_{beam}} * (S_{beam} - 3.0457 + 0.5793)$$

$$R_{G3} = \frac{40.512^K}{7.625} (7.625 - 2.9543) + \frac{40.512}{7.625} * (7.625 - 3.0457 + 0.5793)$$

$$R_{G3} = 52.224 \text{ Kips}$$

GIRDER 4

$$R_{G4} = \frac{R_{live}}{S_{beam}} (S_{beam} - 0.5793 + 3.0457) + \frac{R_{live}}{S_{beam}} * (S_{beam} - 5.4207)$$

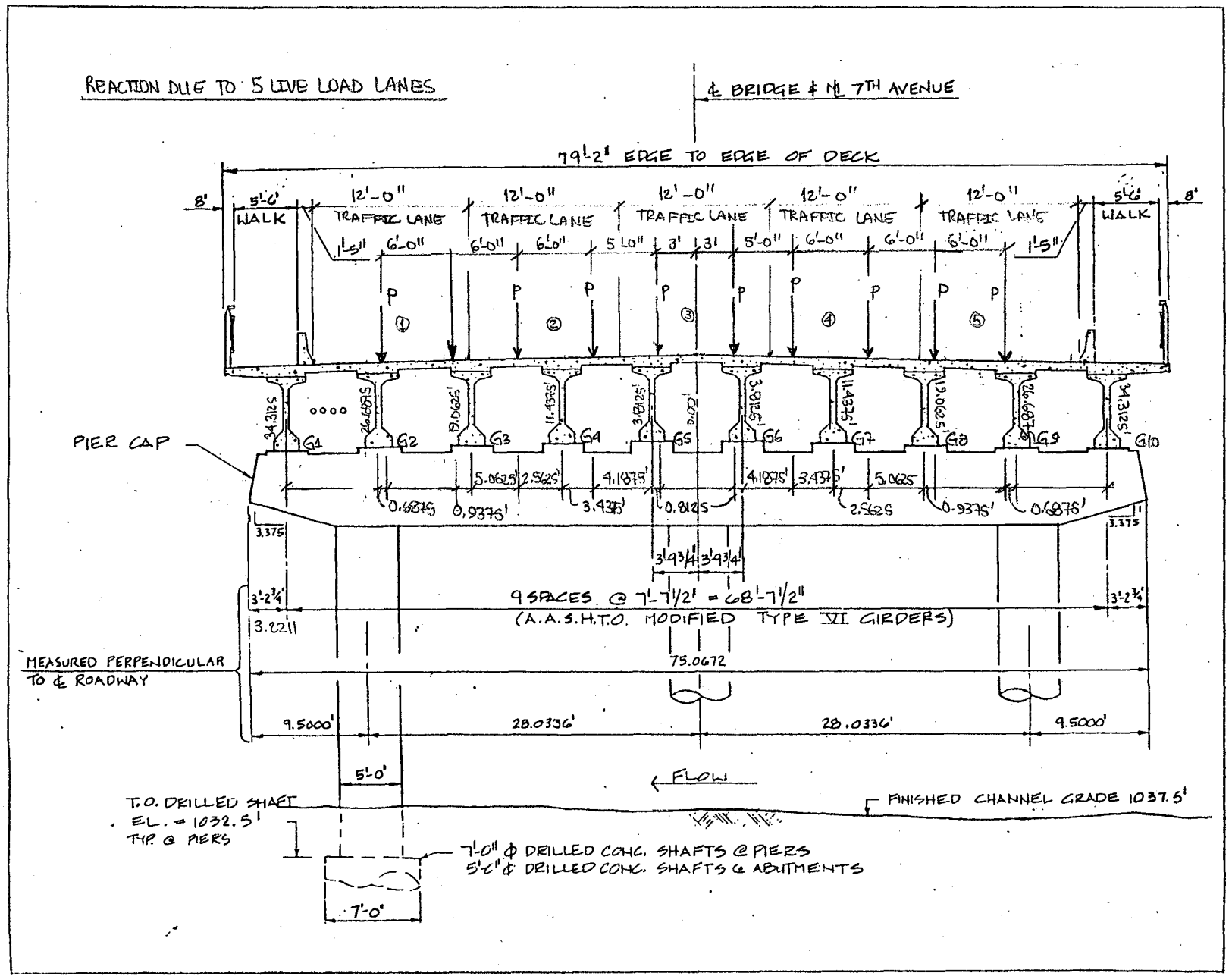
$$R_{G4} = \frac{40.512^K}{7.625} (7.625 - 0.5793 + 3.0457) + \frac{40.512}{7.625} * (7.625 - 5.4207)$$

$$R_{G4} = 65.328 \text{ Kips}$$

GIRDER 5

$$R_{G5} = \frac{R_{live}}{S_{beam}} * (S_{beam} - 2.2043)$$

$$R_{G5} = \frac{40.512^K}{7.625} (7.625 - 2.2043) = 28.800 \text{ Kips}$$



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REACTION DUE TO 5 LIVE LOAD LANES

GIRDER 2

$$R_{G2} = \frac{R_{live}}{S_{beam}}\left(S_{beam} - 0.6875 + 0.9375\right)$$

$$R_{G2} = \frac{40.512 * \overset{\text{R.F.}}{0.75}}{7.625}\left(7.625 - 0.6875 + 0.9375\right) = 31.3802 \text{ Kips.}$$

GIRDER 3

$$R_{G3} = \frac{R_{live}}{S_{beam}}\left(S_{beam} - 0.9375 + 0.6875\right) + \frac{R_{live}}{S_{beam}}\left(S_{beam} - 5.0625\right)$$

$$R_{G3} = \frac{40.512 * 0.75}{7.625}\left(7.625 - 0.9375 + 0.6875\right) + \frac{40.512 * 0.75}{7.625}\left(7.625 - 5.0625\right)$$

$$R_{G3} = 39.599 \text{ Kips}$$

GIRDER 4

$$R_{G4} = \frac{R_{live}}{S_{beam}}\left(S_{beam} - 2.5625\right) + \frac{R_{live}}{S_{beam}}\left(S_{beam} - 3.4375\right)$$

$$R_{G4} = \frac{40.512 * 0.75}{7.625}\left(7.625 - 2.5625\right) + \frac{40.512 * 0.75}{7.625}\left(7.625 - 3.4375\right)$$

$$R_{G4} = 36.859 \text{ Kips}$$

GIRDER 5

$$R_{G5} = \frac{R_{live}}{S_{beam}}\left(S_{beam} - 4.1875\right) + R_{live}$$

$$R_{G5} = \frac{40.512 * 0.75}{7.625}\left(7.625 - 4.1875\right) + 40.512 * 0.75 = 44.0817 \text{ Kips}$$

GIRDER 6 $R_{G6} = R_{G5} = 44.0817$ Kips

GIRDER 7 $R_{G7} = R_{G4} = 36.859$ Kips

GIRDER 8 $R_{G8} = R_{G3} = 39.599$ Kips

GIRDER 9 $R_{G9} = R_{G2} = 31.3802$ Kips.

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- WIND LOADS

- ON SUPERSTRUCTURE

WIND LOAD = WIND $_{\text{TRANS}}^{\text{LONG}}$ * h_{WIND}

h_{WIND} = 6.00 Ft + 2"/12 + 7.5"/12 + ~6.00 Ft = 12.792 Ft
METAL HANDRAIL

POINT OF APPLICATION = h_{WIND} / 2 = 6.396 Ft

WIND TRANS = 50 lbs/Ft²
WIND LONG = 12 lbs/Ft²
} BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

WIND LOAD TRANS = 50 lbs/Ft² * 12.792 Ft * 125 Ft = 79.95 Kips * 1.1749
WIND LOAD LONG = 12 lbs/Ft² * 12.792 Ft * 125 Ft = 19.188 Kips * 1.1749

WIND LOAD TRANS ∥ = 79.95 Kips * cos 28° = 70.592 Kips * 1.1749
WIND LOAD TRANS ⊥ = 79.95 Kips * sin 28° = 37.534 Kips * 1.1749

WIND LOAD LONG ∥ = 19.188 Kips * sin 28° = 9.0082 Kips * 1.1749
WIND LOAD LONG ⊥ = 19.188 Kips * cos 28° = 16.942 Kips * 1.1749

WIND LOAD ∥ = 70.592 + 9.008 = 79.600 Kips * 1.1749 ÷ 85.02 Ft = 1.100 K/Ft
WIND LOAD ⊥ = 37.534 + 16.942 = 54.476 Kips * 1.1749 ÷ 85.02 Ft = 0.753 K/Ft

- ON SUBSTRUCTURE

WIND LOAD = WIND $_{\text{TRANS}}^{\text{LONG}}$ * WIDTH $_{\text{TRANS}}^{\text{LONG}}$

WIND TRANS = 40 lbs/Ft²
WIND LONG = 40 lbs/Ft²
} BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

- CAP:

W TRANS = 0.040 * 5.333 * 6.00 = 1.280 Kips ÷ 85.02 Ft = 0.01505 K/Ft
W LONG = 0.040 * 6.00 = 0.240 Kips/Ft

- COLUMN

W TRANS = 0.040 * 5.00 = 0.200 K/Ft
W LONG = 0.040 * 5.00 = 0.200 K/Ft.

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- WIND ON LIVE LOAD

$W_{LIVELOAD} = W_L * L_{Span}$

POINT OF APPLICATION = 6.00 Ft FROM FLOOR SLAB

$W_{L\,TRANS} = 100$ lbs/Ft
$W_{L\,LONG} = 40$ lbs/Ft } BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

$W_{LIVELOAD_TRANS} = 0.100 * 125$ Ft $= 12.50$ Kips

$W_{LIVELOAD_TRANS\,\parallel} = 12.50$ Kips $* 1.27912 * \cos 28° \div 85.02$ Ft $= 0.16605$ Kip/Ft

$W_{LIVELOAD_TRANS\,\perp} = 12.50$ Kips $* 1.27912 * \sin 28° \div 85.02$ Ft $= 0.0883$ Kip/Ft

$W_{LIVELOAD_LONG} = 0.040 * 125$ Ft $= 5.00$ Kips

$W_{LIVELOAD_LONG\,\parallel} = 5.00$ Kips $* 1.27912 * \sin 28° \div 85.02$ Ft $= 0.0353$ Kip/Ft

$W_{LIVELOAD_LONG\,\perp} = 5.00$ Kips $* 1.27912 * \cos 28° \div 85.02$ Ft $= 0.0664$ Kip/Ft

$W_{LIVELOAD_\parallel} = 0.16605 + 0.0353 = 0.2014$ Kip/Ft

$W_{LIVELOAD_\perp} = 0.0883 + 0.0664 = 0.1547$ Kip/Ft

- LONGITUDINAL FORCES

L.F. = 5% * NO. LANES * [RED. FACTOR FOR MULT. LANES * UNIF. LOAD * LENGTH + CONC LOAD]

POINT OF APPLICATION = 6.00 Ft FROM FLOOR SLAB

3 LIVE LOAD LANES

$L.F. = 0.05 * 3 * [0.90 * (0.640 * 125 + 18)] = 13.23$ Kips

$L.F._{\parallel} = 13.23$ Kips $* 1.27912 * \sin 28° \div 85.02$ Ft $= 0.0934$ Kip/Ft

$L.F._{\perp} = 13.23$ Kips $* 1.27912 * \cos 28° \div 85.02$ Ft $= 0.1758$ Kip/Ft.

- OVERTURNING FORCES

$F_{WIND} = W_{OVER} * WIDTH_{SUPER} * L_{TRIB}$

$W_{OVER} = 20$ psf

POINT OF APPLICATION = 1/4 WIDTH_SUPER

$F_{WIND} = 0.020 * 79.1667 * 125 = 197.92$ Kips @ 22.415' FROM ℄ CONST

- THERMAL FORCES

$\Delta TEMP = 40°F$

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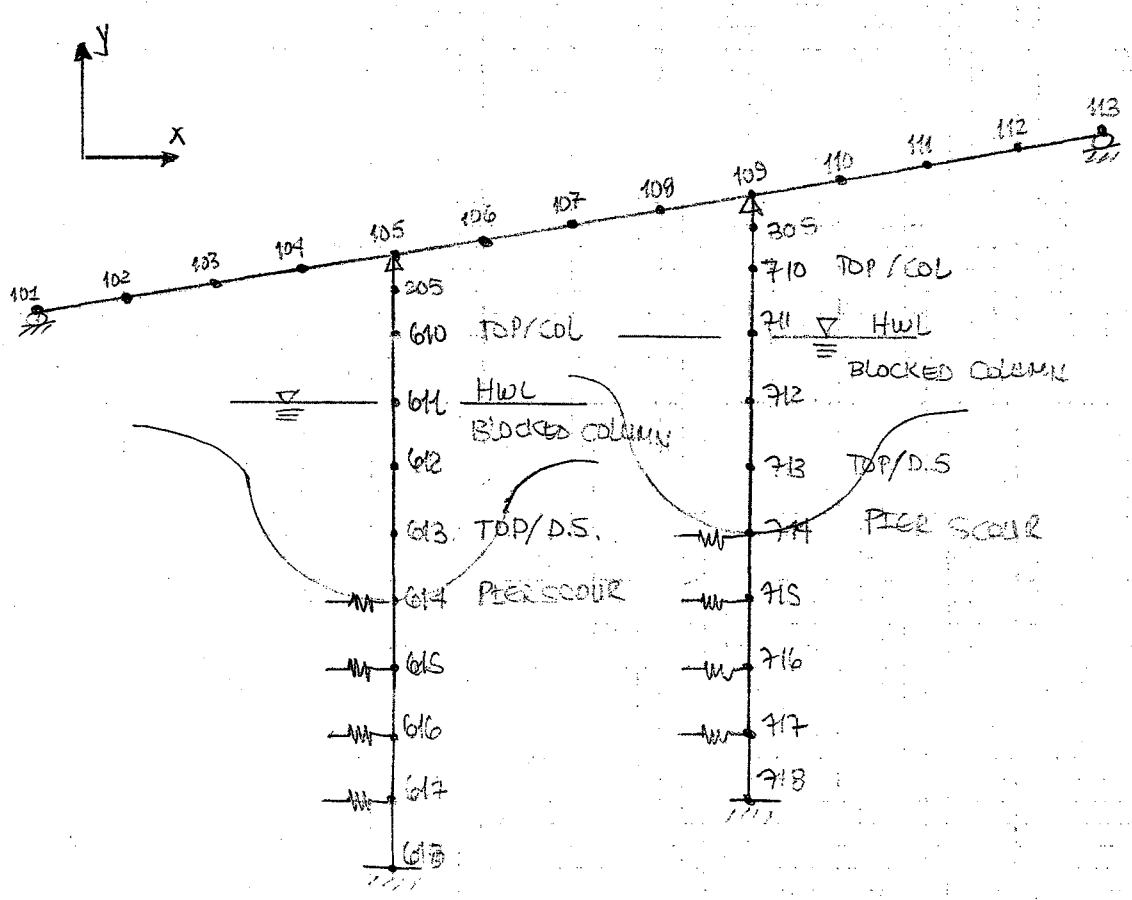
CASE 3 - 100 YR FLOOD (LONGITUDINAL)



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SALT RIVER BRIDGES - SCOUR  (7TH AVENUE BRIDGE)   "7THAVELO"
C
C UNITS: KIPS, FEET, SECONDS
C
SYSTEM
C LOAD CONDITION 1, DEAD LOAD
C LOAD CONDITION 2, WIND ON STRUCTURE (TRANSVERSE, LONGITUDINAL & OVERTURNING)
C LOAD CONDITION 3, WIND ON LIVE LOAD
C LOAD CONDITION 4, LONGITUDINAL FORCE DUE TO LIVE LOAD
C LOAD CONDITION 5, STREAM FORCE ON COLUMN
C LOAD CONDITION 6, TEMPERATURE
C
L=6
C
JOINTS
C   CL OF SUPERSTRUCTURE
101  X=  0.00  Y=1073.14  Z=0.00
102  X= 31.25  Y=1073.14  Z=0.00
103  X= 62.50  Y=1073.14  Z=0.00
104  X= 93.75  Y=1073.14  Z=0.00
105  X=125.00  Y=1073.14  Z=0.00
106  X=156.25  Y=1073.14  Z=0.00
107  X=187.50  Y=1073.14  Z=0.00
108  X=218.75  Y=1073.14  Z=0.00
109  X=250.00  Y=1073.14  Z=0.00
110  X=281.25  Y=1073.14  Z=0.00
111  X=312.50  Y=1073.14  Z=0.00
112  X=343.75  Y=1073.14  Z=0.00
113  X=375.00  Y=1073.14  Z=0.00
C   PIER 1 - CAP
205  X=125.00  Y=1064.21  Z=0.00
C   PIER 2 - CAP
305  X=250.00  Y=1064.21  Z=0.00
C   PIER 1 - COLUMNS
610  X=125.00  Y=1061.21  Z=0.00
611  X=125.00  Y=1058.90  Z=0.00
612  X=125.00  Y=1046.90  Z=0.00
613  X=125.00  Y=1032.50  Z=0.00
614  X=125.00  Y=1002.84  Z=0.00
615  X=125.00  Y=995.84   Z=0.00
616  X=125.00  Y=988.84   Z=0.00
617  X=125.00  Y=981.84   Z=0.00
618  X=125.00  Y=974.84   Z=0.00
C   PIER 2 - COLUMNS
710  X=250.00  Y=1061.21  Z=0.00
711  X=250.00  Y=1058.90  Z=0.00
712  X=250.00  Y=1046.90  Z=0.00
713  X=250.00  Y=1032.50  Z=0.00
714  X=250.00  Y=1002.84  Z=0.00
715  X=250.00  Y=995.84   Z=0.00
716  X=250.00  Y=988.84   Z=0.00
717  X=250.00  Y=981.84   Z=0.00
718  X=250.00  Y=974.84   Z=0.00

RESTRAINTS
C   ABUT 1
101  R=0 1 1 1 1 0          :ROLLER
C   PIER 1
105  R=0 0 1 1 1 0
C 610  617 1 R=0 0 1 1 1 0
618  R=1 1 1 1 1 1
C   PIER 2
109  R=0 0 1 1 1 0
C 710  717 1 R=0 0 1 1 1 0
718  R=1 1 1 1 1 1
C   PIER 3
```



```
113  R=0 1 1 1 1 0          :ROLLER

SPRINGS
C
614 K=3285,0,0,0,0,0
615 K=6571,0,0,0,0,0
616 K=6571,0,0,0,0,0
617 K=6571,0,0,0,0,0
714 K=3285,0,0,0,0,0
715 K=6571,0,0,0,0,0
716 K=6571,0,0,0,0,0
717 K=6571,0,0,0,0,0

FRAMES
C
NM=6   NL=13  Y=-1 0 0 0 0 0
C
C  ALL MATERIALS CONCRETE:
C  ROADWAY, 6'-0" DEEP BY 79'-2" WIDE MODIFIED TYPE VI AASHTO GIRDER,
C  ADDITIONAL WEIGHT/MASSS EQUIVALENT TO 2.5" BY 79'-2" CONCRETE INCLUDED TO
C  ACCOUNT FOR FUTURE WEARING SURFACE AND BARRIERS.
C SUPERSTRUCTURE, 79'-2" BY 6'-0"
1  A=120.382 I=646.432,56036. J=31.462 AS=120.382,120.382 E=635789 TC=6E-6 W=20.5
01
C FIXED PIER DIAPHRAGM, 85'-1/2" BY 5'-4"
2  A=294.778 I=698.646,75050. J=2791.8 AS=294.778,294.778 E=519120 TC=6E-6 W=44.2
17
C COLUMN, 5' DIAMETER
3  A= 58.905 I= 92.040, 92.04 J=184.08 AS= 58.905, 58.905 E=519120 TC=6E-6 W= 8.8
36
C SHAFT, 7' DIAMETER
4  A=115.455 I=353.577,353.58 J=707.16 AS=115.455,115.455 E=519120 TC=6E-6 W=17.3
18
C SHAFT, 7' DIAMETER
5  A= 38.485 I=117.859,117.86 J=235.72 AS= 38.485, 38.485 E=519120 TC=0E-6 W= 0.0
00
C RIGID MEMBER LINK, 39'2" BY 3'-6"
6  A=  6.535 I= 28.444, 50.59 J= 61.36 AS=  6.535,  6.535 E=519120 TC=6E-6 W= 0.0
00
C
C Load Case I SDL (Abut, Int & Pier Diaph Load)
1  PLD= 0.000  -232.306  0
2  PLD= 0.000  -339.052  0
3  PLD=31.250  -204.988  0
4  PLD= 0.000   -50.940  0
C
C Load Case II WIND LOAD ON STRUCTURE
C
C wind on superstructure is load #5
C tran: 50 psf on 12.792' height (GLOBAL Y DIR)
C long: 12 psf on 12.792' height (GLOBAL X DIR)
C
5  WL=0.1804  0.000   0.000
C
C wind on substructure is load #6 & #7
C Fixed Pier Cap
C tran: 40 psf on  5.33' width (axis 3 - Y DIR)
C long: 40 psf on 85.04' width (axis 2 - X DIR)
C
6  WG=0.240   0.000   0.000
C
C Column
C tran: 40 psf on  5.00' width (axis 3 - Y DIR)
C long: 40 psf on  5.00' width (axis 2 - X DIR)
C
7  WG=0.200  0.000  0.000
```

```
C
C Load Case V WIND LOAD ON LIVE LOAD
C
C wind on live load is load #6
C tran: 100 plf at 6' above deck plus half girder depth (axis 3 - Y DIR)
C long:  40 plf at 6' above deck plus half girder depth (axis 1 - X DIR)
C
8  WL= 0.051  0.000  0.000
C
C Load Case VI LONGITUDINAL FORCE ON LIVE LOAD
C
C longitudinal force on live load is load #9
C long: 0.05*no.lanes*(Red.Factor*0.640k/ft) at 6' above deck
C       plus half girder depth (X-DIR)
C       0.05*no.lanes*(Red.Factor*18.0kip)*0.5(distributed at the piers only)
C       at 6' above deck plus half girder depth (X-DIR)
C
9  WL= 0.111  0.000   0.000
C
C Load Case VII STREAM FORCE
C
C Blocked Column - 9' Diameter
C
10 TRAP=0.0 0.317 4.419 -1.00 0.252 3.504
C
C Column - 5' Diameter
C
11 TRAP=0.0 0.140 1.947 -1.00 0.090 1.257
C
C Drilled Shaft - 7' Diameter
C
12 TRAP=0.0 0.126 1.760 -1.00 0.000 0.000
C
C Load Case VIII TEMPERATURE
C
13 T=-40,0,0
C
C SPAN 1
101,101,102  LP=1,0          M=1  NSL=1  5  8  9   0  13
102,102,103                  M=1  NSL=0  5  8  9   0  13
103,103,104                  M=1  NSL=4  5  8  9   0  13
104,104,105                  M=1  NSL=0  5  8  9   0  13
C SPAN 2
105,105,106                  M=1  NSL=2  5  8  9   0  13
106,106,107                  M=1  NSL=0  5  8  9   0  13
107,107,108                  M=1  NSL=4  5  8  9   0  13
108,108,109                  M=1  NSL=0  5  8  9   0  13
C SPAN 3
109,109,110                  M=1  NSL=2  5  8  9   0  13
110,110,111                  M=1  NSL=0  5  8  9   0  13
111,111,112                  M=1  NSL=4  5  8  9   0  13
112,112,113                  M=1  NSL=3  5  8  9   0  13
C PIER 1 - CAP
200,105,205  LR=1 0 0 0 0 0  M=2  NSL=0  6  8  0   0  13
C PIER 1 - CAP TO COLUMN
201,205,610                  M=6
C PIER 2 - CAP
300,109,305  LR=1 0 0 0 0 0  M=2  NSL=0  6  8  0   0  13
C PIER 2 - CAP TO COLUMN
301,305,710                  M=6
C PIER 1 - COLUMN
610,610,611                  M=3  NSL=0  7  0  0   0  13
611,611,612                  M=3  NSL=0  0  0  0  10  13
612,612,613                  M=3  NSL=0  0  0  0  11  13
613,613,614                  M=4  NSL=0  0  0  0  12  13
614,614,615                  M=5  NSL=0  0  0  0   0  13  G=3,1,1,1
```



```
C PIER 2 - COLUMN
710,710,711                  M=3  NSL=0  7  0  0   0  13
711,711,712                  M=3  NSL=0  0  0  0  10  13
712,712,713                  M=3  NSL=0  0  0  0  11  13
713,713,714                  M=4  NSL=0  0  0  0  12  13
714,714,715                  M=5  NSL=0  0  0  0   0  13  G=3,1,1,1
C
LOADS
C Load Case IV LONGITUDINAL FORCE ON LIVE LOAD
105  L=4  F=0.622, 0.000, 0.000, 0.000, 0.000, 0.000
109  L=4  F=0.622, 0.000, 0.000, 0.000, 0.000, 0.000
```

```
     $$$$$$$$     $$$$$$$$$$    $$$$$$$        $$$$$$$$        $$$$$$$
   $$$$$$$$$$    $$$$$$$$$$    $$$$$$$$$$    $$$$$$$$$$$    $$$$$$$$$$
  $$            $$      $$    $$       $$   $$       $$    $$        $$
 $$            $$        $$   $$        $$  $$        $$   $$        $$
 $$$$$$$$     $$$$$$$$$$    $$$$$$$$$$     $$$$$$$$$$    $$        $$
        $$    $$        $$   $$                      $$    $$        $$
       $$    $$        $$   $$                      $$    $$        $$
$$$$$$$$$$   $$        $$   $$            $$$$$$$$$$    $$$$$$$$$$
$$$$$$$$    $$        $$   $$             $$$$$$$$       $$$$$$$
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STRUCTURAL ANALYSIS PROGRAMS

VERSION P5.31

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C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 1
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
101								
	1	0.00			0.00			
		0.00	1046.96	0.00				
		31.25	406.31	22707.29				
		31.25			0.00			
	2	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			-5.64			
	3	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.01				
		31.25			-1.59			
	4	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			-3.47			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	4.07	0.00				
		31.25	4.07	127.20				
		31.25			0.00			
102								
	1	0.00			0.00			
		0.00	406.31	22707.29				
		19.82	0.00	26733.53				
		31.25	-234.35	25394.07				
		31.25			0.00			
	2	0.00			-5.64			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			-11.27			
	3	0.00			-1.59			
		0.00	0.00	0.01				
		31.25	0.00	0.03				
		31.25			-3.19			
	4	0.00			-3.47			
		0.00	0.00	0.00				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 2
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		31.25	0.00	0.00				
		31.25			-6.94			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	4.07	127.20				
		31.25	4.07	254.40				
		31.25			0.00			
103								
	1	0.00			0.00			
		0.00	-285.29	25394.07				
		31.25	-925.95	6468.47				
		31.25			0.00			
	2	0.00			-11.27			
		0.00	0.00	0.00				
		31.25	0.00	-0.01				
		31.25			-16.91			
	3	0.00			-3.19			
		0.00	0.00	0.03				
		31.25	0.00	0.04				
		31.25			-4.78			
	4	0.00			-6.94			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			-10.41			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	4.07	254.40				
		31.25	4.07	381.60				
		31.25			0.00			
104								
	1	0.00			0.00			
		0.00	-925.95	6468.47				
		31.25	-1566.60	-32477.64				
		31.25			0.00			
	2	0.00			-16.91			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 3
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.00	-0.01				
		31.25	0.00	-0.01				
		31.25			-22.55			
	3	0.00			-4.78			
		0.00	0.00	0.04				
		31.25	0.00	0.05				
		31.25			-6.38			
	4	0.00			-10.41			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			-13.88			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	4.07	381.60				
		31.25	4.07	508.80				
		31.25			0.00			
105								
	1	0.00			0.00			
		0.00	1306.78	-32477.63				
		31.25	666.13	-1650.93				
		31.25			0.00			
	2	0.00			11.27			
		0.00	0.00	0.01				
		31.25	0.00	0.01				
		31.25			5.64			
	3	0.00			3.19			
		0.00	0.00	0.06				
		31.25	0.00	0.06				
		31.25			1.59			
	4	0.00			6.94			
		0.00	0.00	0.01				
		31.25	0.00	0.00				
		31.25			3.47			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			4.68			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 4
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.00	508.80				
		31.25	0.00	508.80				
		31.25			4.68			
106								
	1	0.00			0.00			
		0.00	666.13	-1650.93				
		31.25	25.47	9155.26				
		31.25			0.00			
	2	0.00			5.64			
		0.00	0.00	0.01				
		31.25	0.00	0.00				
		31.25			0.00			
	3	0.00			1.59			
		0.00	0.00	0.06				
		31.25	0.00	0.05				
		31.25			0.00			
	4	0.00			3.47			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			4.68			
		0.00	0.00	508.80				
		31.25	0.00	508.80				
		31.25			4.68			
107								
	1	0.00			0.00			
		0.00	-25.47	9155.26				
		31.25	-666.13	-1650.93				
		31.25			0.00			
	2	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	-0.01				
		31.25			-5.64			
	3	0.00			0.00			
		0.00	0.00	0.05				
		31.25	0.00	0.05				
		31.25			-1.59			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 5
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	4	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			-3.47			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			4.68			
		0.00	0.00	508.80				
		31.25	0.00	508.80				
		31.25			4.68			
108								
	1	0.00			0.00			
		0.00	-666.13	-1650.93				
		31.25	-1306.78	-32477.63				
		31.25			0.00			
	2	0.00			-5.64			
		0.00	0.00	-0.01				
		31.25	0.00	-0.01				
		31.25			-11.27			
	3	0.00			-1.59			
		0.00	0.00	0.05				
		31.25	0.00	0.05				
		31.25			-3.19			
	4	0.00			-3.47			
		0.00	0.00	0.00				
		31.25	0.00	-0.01				
		31.25			-6.94			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			4.68			
		0.00	0.00	508.80				
		31.25	0.00	508.80				
		31.25			4.68			
109								
	1	0.00			0.00			
		0.00	1566.60	-32477.64				
		31.25	925.95	6468.47				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 6
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		31.25			0.00			
	2	0.00			22.55			
		0.00	0.00	0.01				
		31.25	0.00	0.01				
		31.25			16.91			
	3	0.00			6.38			
		0.00	0.00	0.06				
		31.25	0.00	0.04				
		31.25			4.78			
	4	0.00			13.88			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			10.41			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	-4.07	508.80				
		31.25	-4.07	381.60				
		31.25			0.00			
110								
	1	0.00			0.00			
		0.00	925.95	6468.47				
		31.25	285.29	25394.07				
		31.25			0.00			
	2	0.00			16.91			
		0.00	0.00	0.01				
		31.25	0.00	0.00				
		31.25			11.27			
	3	0.00			4.78			
		0.00	0.00	0.04				
		31.25	0.00	0.03				
		31.25			3.19			
	4	0.00			10.41			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			6.94			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 7
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		31.25			0.00			
	6	0.00			0.00			
		0.00	-4.07	381.60				
		31.25	-4.07	254.40				
		31.25			0.00			
111								
	1	0.00			0.00			
		0.00	234.35	25394.07				
		11.43	0.00	26733.53				
		31.25	-406.31	22707.29				
		31.25			0.00			
	2	0.00			11.27			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			5.64			
	3	0.00			3.19			
		0.00	0.00	0.03				
		31.25	0.00	0.01				
		31.25			1.59			
	4	0.00			6.94			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			3.47			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	-4.07	254.40				
		31.25	-4.07	127.20				
		31.25			0.00			
112								
	1	0.00			0.00			
		0.00	-406.31	22707.29				
		31.25	-1251.95	0.00				
		31.25			0.00			
	2	0.00			5.64			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	3	0.00			1.59			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 8
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.00	0.01				
		31.25	0.00	0.00				
		31.25			0.00			
	4	0.00			3.47			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00				
		31.25	0.00	0.00				
		31.25			0.00			
	6	0.00			0.00			
		0.00	-4.07	127.20				
		31.25	-4.07	0.00				
		31.25			0.00			
200								
	1	0.00			-3212.44			
		0.00	0.00	-0.01				
		8.93	0.00	-0.01				
		8.93			-3607.30			
	2	0.00			0.00			
		0.00	33.82	-0.02				
		8.93	35.97	311.61				
		8.93			0.00			
	3	0.00			0.00			
		0.00	9.56	-0.01				
		8.93	9.56	85.39				
		8.93			-0.45			
	4	0.00			0.00			
		0.00	21.43	-0.01				
		8.93	21.43	191.40				
		8.93			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	1479.73	
		8.93	0.00	0.00		-76.60	795.65	
		8.93			0.00			
	6	0.00			4.07			
		0.00	4.68	0.00				
		8.93	4.68	41.76				
		8.93			4.07			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 9
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
201								
	1	0.00			-3607.30			
		0.00	0.00	-0.01				
		3.00	0.00	-0.01				
		3.00			-3607.30			
	2	0.00			0.00			
		0.00	35.97	311.61				
		3.00	35.97	419.51				
		3.00			0.00			
	3	0.00			-0.45			
		0.00	9.56	85.39				
		3.00	9.56	114.08				
		3.00			-0.45			
	4	0.00			0.00			
		0.00	21.43	191.40				
		3.00	21.43	255.70				
		3.00			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	795.65	
		3.00	0.00	0.00		-76.60	565.84	
		3.00			0.00			
	6	0.00			4.07			
		0.00	4.68	41.76				
		3.00	4.68	55.79				
		3.00			4.07			
300								
	1	0.00			-3212.44			
		0.00	0.00	0.01				
		8.93	0.00	0.01				
		8.93			-3607.30			
	2	0.00			0.00			
		0.00	33.83	-0.02				
		8.93	35.97	311.61				
		8.93			0.00			
	3	0.00			0.00			
		0.00	9.56	-0.01				
		8.93	9.56	85.39				
		8.93			-0.46			
	4	0.00			0.00			
		0.00	21.43	-0.01				
		8.93	21.43	191.40				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 10
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		8.93			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	1479.73	
		8.93	0.00	0.00		-76.60	795.65	
		8.93			0.00			
	6	0.00			4.07			
		0.00	-4.68	0.00				
		8.93	-4.68	-41.76				
		8.93			4.07			
301								
	1	0.00			-3607.30			
		0.00	0.00	0.01				
		3.00	0.00	0.01				
		3.00			-3607.30			
	2	0.00			0.00			
		0.00	35.97	311.61				
		3.00	35.97	419.51				
		3.00			0.00			
	3	0.00			-0.46			
		0.00	9.56	85.39				
		3.00	9.56	114.08				
		3.00			-0.46			
	4	0.00			0.00			
		0.00	21.43	191.40				
		3.00	21.43	255.70				
		3.00			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	795.65	
		3.00	0.00	0.00		-76.60	565.84	
		3.00			0.00			
	6	0.00			4.07			
		0.00	-4.68	-41.76				
		3.00	-4.68	-55.79				
		3.00			4.07			
610								
	1	0.00			-3607.30			
DC		0.00	0.00	-0.01				
		2.31	0.00	-0.01				
		2.31			-3627.71			
	2	0.00			0.00			
		0.00	35.97	419.51				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 11
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
W		2.31	36.43	503.13				
		2.31			0.00			
	3	0.00			-0.45			
W on W		0.00	9.56	114.08				
		2.31	9.56	136.16				
		2.31			-0.45			
	4	0.00			0.00			
UF		0.00	21.43	255.70				
		2.31	21.43	305.22				
		2.31			0.00			
	5	0.00			0.00			
SF		0.00	0.00	0.00		-76.60	565.84	
		2.31	0.00	0.00		-76.60	388.89	
		2.31			0.00			
	6	0.00			4.07			
T		0.00	4.68	55.79				
		2.31	4.68	66.60				
		2.31			4.07			
611								
	1	0.00			-3627.71			
		0.00	0.00	-0.01				
		12.00	0.00	0.00				
		12.00			-3733.74			
	2	0.00			0.00			
		0.00	36.43	503.13				
		12.00	36.43	940.29				
		12.00			0.00			
	3	0.00			-0.45			
		0.00	9.56	136.16				
		12.00	9.56	250.91				
		12.00			-0.45			
	4	0.00			0.00			
		0.00	21.43	305.22				
		12.00	21.43	562.43				
		12.00			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	388.89	
		12.00	3.41	21.26		-29.07	-234.15	
		12.00			0.00			
	6	0.00			4.07			
		0.00	4.68	66.60				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 12
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		12.00	4.68	122.72				
		12.00			4.07			
612								
	1	0.00			-3733.74			
		0.00	0.00	0.00				
		14.40	0.00	0.00				
		14.40			-3860.98			
	2	0.00			0.00			
		0.00	36.43	940.29				
		14.40	36.43	1464.89				
		14.40			0.00			
	3	0.00			-0.45			
		0.00	9.56	250.91				
		14.40	9.56	388.61				
		14.40			-0.45			
	4	0.00			0.00			
		0.00	21.43	562.43				
		14.40	21.43	871.09				
		14.40			0.00			
	5	0.00			0.00			
		0.00	3.41	21.26		-29.07	-234.15	
		14.40	5.07	83.21		-6.00	-474.68	
		14.40			0.00			
	6	0.00			4.07			
		0.00	4.68	122.72				
		14.40	4.68	190.07				
		14.40			4.07			
613								
	1	0.00			-3860.98			
		0.00	0.00	0.00				
		29.66	0.00	0.00				
		29.66			-4374.63			
	2	0.00			0.00			
		0.00	36.43	1464.89				
		29.66	36.43	2545.41				
		29.66			0.00			
	3	0.00			-0.45			
		0.00	9.56	388.61				
		29.66	9.56	672.24				
		29.66			-0.45			
	4	0.00			0.00			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 13
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	21.43	871.09				
		29.66	21.43	1506.83				
		29.66			0.00			
	5	0.00			0.00			
		0.00	5.07	83.21		-6.00	-474.68	
		3.63	5.50	102.41		0.00	-485.32	
		29.66	6.94	270.54		20.10	-136.45	
		29.66			0.00			
	6	0.00			4.07			
		0.00	4.68	190.07				
		29.66	4.68	328.78				
		29.66			4.07			
614								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-3.06	2545.41				
		7.00	-3.06	2523.98				
		7.00			0.00			
	3	0.00			-0.45			
		0.00	-0.85	672.24				
		7.00	-0.85	666.26				
		7.00			-0.45			
	4	0.00			0.00			
		0.00	-1.91	1506.83				
		7.00	-1.91	1493.44				
		7.00			0.00			
	5	0.00			0.00			
		0.00	2.05	270.54		20.10	-136.45	
		7.00	2.05	284.91		20.10	4.28	
		7.00			0.00			
	6	0.00			4.07			
		0.00	-0.42	328.78				
		7.00	-0.42	325.86				
		7.00			4.07			
615								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 14
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	2	0.00			0.00			
		0.00	-44.17	2523.98				
		7.00	-44.17	2214.81				
		7.00			0.00			
	3	0.00			-0.45			
		0.00	-11.69	666.26				
		7.00	-11.69	584.40				
		7.00			-0.45			
	4	0.00			0.00			
		0.00	-26.21	1493.44				
		7.00	-26.21	1309.95				
		7.00			0.00			
	5	0.00			0.00			
		0.00	-3.16	284.91		20.10	4.28	
		7.00	-3.16	262.76		20.10	145.01	
		7.00			0.00			
	6	0.00			4.07			
		0.00	-5.72	325.86				
		7.00	-5.72	285.82				
		7.00			4.07			
616								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-60.66	2214.81				
		7.00	-60.66	1790.16				
		7.00			0.00			
	3	0.00			-0.45			
		0.00	-16.04	584.40				
		7.00	-16.04	472.11				
		7.00			-0.45			
	4	0.00			0.00			
		0.00	-35.96	1309.95				
		7.00	-35.96	1058.23				
		7.00			0.00			
	5	0.00			0.00			
		0.00	-5.32	262.76		20.10	145.01	
		7.00	-5.32	225.49		20.10	285.74	
		7.00			0.00			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 15
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	6	0.00			4.07			
		0.00	-7.85	285.82				
		7.00	-7.85	230.90				
		7.00			4.07			
617								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-64.20	1790.16				
		7.00	-64.20	1340.75				
		7.00			0.00			
	3	0.00			-0.45			
		0.00	-16.97	472.11				
		7.00	-16.97	353.28				
		7.00			-0.45			
	4	0.00			0.00			
		0.00	-38.05	1058.23				
		7.00	-38.05	791.89				
		7.00			0.00			
	5	0.00			0.00			
		0.00	-5.81	225.49		20.10	285.74	
		7.00	-5.81	184.81		20.10	426.46	
		7.00			0.00			
	6	0.00			4.07			
		0.00	-8.30	230.90				
		7.00	-8.30	172.78				
		7.00			4.07			
710								
	1	0.00			-3607.30			
		0.00	0.00	0.01				
		2.31	0.00	0.01				
		2.31			-3627.71			
	2	0.00			0.00			
		0.00	35.97	419.51				
		2.31	36.43	503.13				
		2.31			0.00			
	3	0.00			-0.46			
		0.00	9.56	114.08				
		2.31	9.56	136.16				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 16
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		2.31			-0.46			
	4	0.00			0.00			
		0.00	21.43	255.70				
		2.31	21.43	305.22				
		2.31			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	565.84	
		2.31	0.00	0.00		-76.60	388.89	
		2.31			0.00			
	6	0.00			4.07			
		0.00	-4.68	-55.79				
		2.31	-4.68	-66.60				
		2.31			4.07			
711								
	1	0.00			-3627.71			
		0.00	0.00	0.01				
		12.00	0.00	0.00				
		12.00			-3733.74			
	2	0.00			0.00			
		0.00	36.43	503.13				
		12.00	36.43	940.29				
		12.00			0.00			
	3	0.00			-0.46			
		0.00	9.56	136.16				
		12.00	9.56	250.91				
		12.00			-0.46			
	4	0.00			0.00			
		0.00	21.43	305.22				
		12.00	21.43	562.43				
		12.00			0.00			
	5	0.00			0.00			
		0.00	0.00	0.00		-76.60	388.89	
		12.00	3.41	21.26		-29.07	-234.15	
		12.00			0.00			
	6	0.00			4.07			
		0.00	-4.68	-66.60				
		12.00	-4.68	-122.72				
		12.00			4.07			
712								
	1	0.00			-3733.74			
		0.00	0.00	0.00				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 17
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		14.40	0.00	0.00				
		14.40			-3860.98			
	2	0.00			0.00			
		0.00	36.43	940.29				
		14.40	36.43	1464.89				
		14.40			0.00			
	3	0.00			-0.46			
		0.00	9.56	250.91				
		14.40	9.56	388.61				
		14.40			-0.46			
	4	0.00			0.00			
		0.00	21.43	562.43				
		14.40	21.43	871.09				
		14.40			0.00			
	5	0.00			0.00			
		0.00	3.41	21.26		-29.07	-234.15	
		14.40	5.07	83.21		-6.00	-474.68	
		14.40			0.00			
	6	0.00			4.07			
		0.00	-4.68	-122.72				
		14.40	-4.68	-190.07				
		14.40			4.07			
713								
	1	0.00			-3860.98			
		0.00	0.00	0.00				
		29.66	0.00	0.00				
		29.66			-4374.63			
	2	0.00			0.00			
		0.00	36.43	1464.89				
		29.66	36.43	2545.41				
		29.66			0.00			
	3	0.00			-0.46			
		0.00	9.56	388.61				
		29.66	9.56	672.24				
		29.66			-0.46			
	4	0.00			0.00			
		0.00	21.43	871.09				
		29.66	21.43	1506.83				
		29.66			0.00			
	5	0.00			0.00			
		0.00	5.07	83.21		-6.00	-474.68	

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 18
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		3.63	5.50	102.41		0.00	-485.32	
		29.66	6.94	270.54		20.10	-136.45	
		29.66			0.00			
	6	0.00			4.07			
		0.00	-4.68	-190.07				
		29.66	-4.68	-328.78				
		29.66			4.07			
714								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-3.06	2545.41				
		7.00	-3.06	2523.98				
		7.00			0.00			
	3	0.00			-0.46			
		0.00	-0.85	672.24				
		7.00	-0.85	666.26				
		7.00			-0.46			
	4	0.00			0.00			
		0.00	-1.91	1506.83				
		7.00	-1.91	1493.44				
		7.00			0.00			
	5	0.00			0.00			
		0.00	2.05	270.54		20.10	-136.45	
		7.00	2.05	284.91		20.10	4.28	
		7.00			0.00			
	6	0.00			4.07			
		0.00	0.42	-328.78				
		7.00	0.42	-325.86				
		7.00			4.07			
715								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-44.17	2523.98				
		7.00	-44.17	2214.81				
		7.00			0.00			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 19
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	3	0.00			-0.46			
		0.00	-11.69	666.26				
		7.00	-11.69	584.40				
		7.00			-0.46			
	4	0.00			0.00			
		0.00	-26.21	1493.44				
		7.00	-26.21	1309.95				
		7.00			0.00			
	5	0.00			0.00			
		0.00	-3.16	284.91		20.10	4.28	
		7.00	-3.16	262.76		20.10	145.01	
		7.00			0.00			
	6	0.00			4.07			
		0.00	5.72	-325.86				
		7.00	5.72	-285.82				
		7.00			4.07			
716								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-60.66	2214.81				
		7.00	-60.66	1790.16				
		7.00			0.00			
	3	0.00			-0.46			
		0.00	-16.04	584.40				
		7.00	-16.04	472.11				
		7.00			-0.46			
	4	0.00			0.00			
		0.00	-35.96	1309.95				
		7.00	-35.96	1058.23				
		7.00			0.00			
	5	0.00			0.00			
		0.00	-5.32	262.76		20.10	145.01	
		7.00	-5.32	225.49		20.10	285.74	
		7.00			0.00			
	6	0.00			4.07			
		0.00	7.85	-285.82				
		7.00	7.85	-230.90				
		7.00			4.07			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 20
PROGRAM:SAP90/FILE:7thavelo.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVELO"

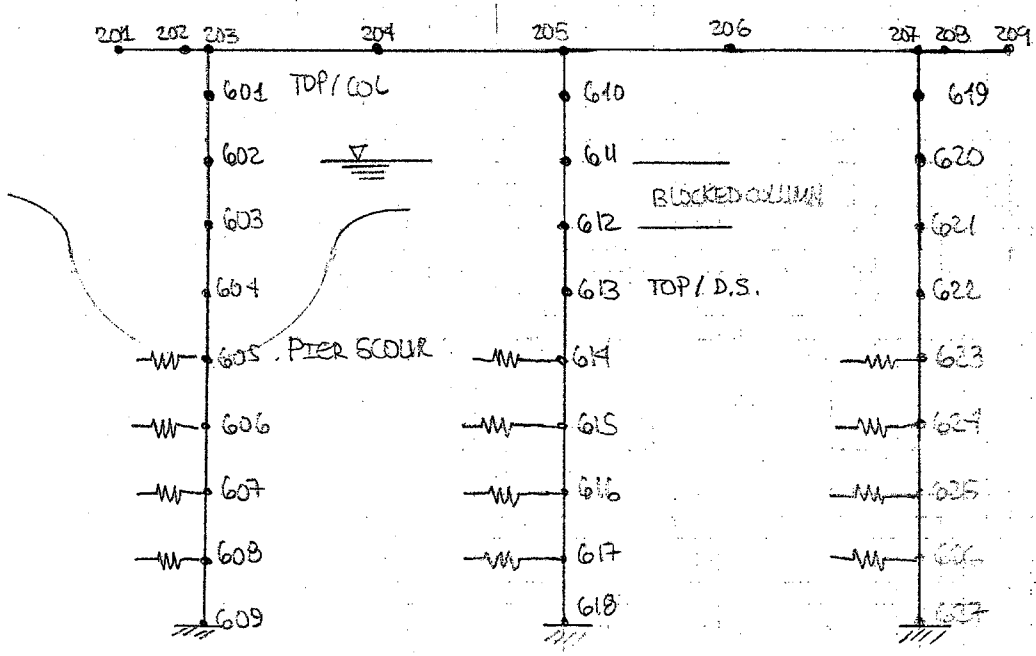
F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
717								
	1	0.00			-4374.63			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-4374.63			
	2	0.00			0.00			
		0.00	-64.20	1790.16				
		7.00	-64.20	1340.75				
		7.00			0.00			
	3	0.00			-0.46			
		0.00	-16.97	472.11				
		7.00	-16.97	353.28				
		7.00			-0.46			
	4	0.00			0.00			
		0.00	-38.05	1058.23				
		7.00	-38.05	791.89				
		7.00			0.00			
	5	0.00			0.00			
		0.00	-5.81	225.49		20.10	285.74	
		7.00	-5.81	184.81		20.10	426.46	
		7.00			0.00			
	6	0.00			4.07			
		0.00	8.30	-230.90				
		7.00	8.30	-172.78				
		7.00			4.07			

T·Y·LIN INTERNATIONAL

Projects: Salt River Bridges - Scour	Job No. 1317.00	Sheet:	of
Item: Seventh Avenue Bridge	Designer: VPD	Date: 9/17/99	
	Checker:	Date:	
		Grid: 1/8"	

CASE 3 - 100 YR FLOOD (TRANSVERSE)



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SALT RIVER BRIDGES - SCOUR  (7TH AVENUE BRIDGE)   "7THAVE"
C
C UNITS: KIPS, FEET, SECONDS
C
SYSTEM
C LOAD CONDITION 1, DEAD LOAD
C LOAD CONDITION 2, LIVE LOAD - 2 LANES
C LOAD CONDITION 3, LIVE LOAD - 5 LANES
C LOAD CONDITION 4, WIND ON STRUCTURE (TRANSVERSE, LONGITUDINAL & OVERTURNING)
C LOAD CONDITION 5, WIND ON LIVE LOAD
C LOAD CONDITION 6, LONGITUDINAL FORCE DUE TO LIVE LOAD
C LOAD CONDITION 7, STREAM FORCE ON COLUMN
C LOAD CONDITION 8, TEMPERATURE
C
L=9
C
JOINTS
C   PIER 1 - CAP
201  X=-42.509  Y=1065.21  Z=0.00
202  X=-34.250  Y=1064.21  Z=0.00
203  X=-31.750  Y=1064.21  Z=0.00
204  X=-15.875  Y=1064.21  Z=0.00
205  X=  0.000  Y=1064.21  Z=0.00
206  X= 15.875  Y=1064.21  Z=0.00
207  X= 31.750  Y=1064.21  Z=0.00
208  X= 34.250  Y=1064.21  Z=0.00
209  X= 42.509  Y=1065.21  Z=0.00
C   PIER 1 - COLUMNS
601  X=-31.750  Y=1061.21  Z=0.00
602  X=-31.750  Y=1058.90  Z=0.00
603  X=-31.750  Y=1046.90  Z=0.00
604  X=-31.750  Y=1032.50  Z=0.00
605  X=-31.750  Y=1002.84  Z=0.00
606  X=-31.750  Y=995.84   Z=0.00
607  X=-31.750  Y=988.84   Z=0.00
608  X=-31.750  Y=981.84   Z=0.00
609  X=-31.750  Y=974.84   Z=0.00
C
610  X=  0.000  Y=1061.21  Z=0.00
611  X=  0.000  Y=1058.90  Z=0.00
612  X=  0.000  Y=1046.90  Z=0.00
613  X=  0.000  Y=1032.50  Z=0.00
614  X=  0.000  Y=1002.84  Z=0.00
615  X=  0.000  Y=995.84   Z=0.00
616  X=  0.000  Y=988.84   Z=0.00
617  X=  0.000  Y=981.84   Z=0.00
618  X=  0.000  Y=974.84   Z=0.00
C
619  X= 31.750  Y=1061.21  Z=0.00
620  X= 31.750  Y=1058.90  Z=0.00
621  X= 31.750  Y=1046.90  Z=0.00
622  X= 31.750  Y=1032.50  Z=0.00
623  X= 31.750  Y=1002.84  Z=0.00
624  X= 31.750  Y=995.84   Z=0.00
625  X= 31.750  Y=988.84   Z=0.00
626  X= 31.750  Y=981.84   Z=0.00
627  X= 31.750  Y=974.84   Z=0.00

RESTRAINTS
C   PIER 1
201   R=0 0 1 0 0 0
202  208  1   R=0 0 1 1 1 0
209   R=0 0 1 0 0 0
C 601  608  1   R=0 0 1 1 1 0
609   R=1 1 1 1 1 1
C 610  617  1   R=0 0 1 1 1 0
```



```
618   R=1 1 1 1 1 1
C 619  626  1   R=0 0 1 1 1 0
627   R=1 1 1 1 1 1

SPRINGS
C
605 K=3285,0,0,0,0,0
606 K=6571,0,0,0,0,0
607 K=6571,0,0,0,0,0
608 K=6571,0,0,0,0,0
C
614 K=3285,0,0,0,0,0
615 K=6571,0,0,0,0,0
616 K=6571,0,0,0,0,0
617 K=6571,0,0,0,0,0
C
623 K=3285,0,0,0,0,0
624 K=6571,0,0,0,0,0
625 K=6571,0,0,0,0,0
626 K=6571,0,0,0,0,0

FRAMES
C
NM=7   NL=21  Y=-1 0 0 0 0 0 0 0 0
C
C  ALL MATERIALS CONCRETE:
C  ROADWAY, 6'-0" DEEP BY 79'-2" WIDE MODIFIED TYPE VI AASHTO GIRDER,
C  ADDITIONAL WEIGHT/MASSS EQUIVALENT TO 2.5" BY 79'-2" CONCRETE INCLUDED TO
C  ACCOUNT FOR FUTURE WEARING SURFACE AND BARRIERS.
C FIXED PIER DIAPHRAGM, 5'4" BY 4'-0"
1  A= 21.333 I= 28.444, 50.59 J= 61.36 AS= 21.333, 21.333 E=519120 TC=6E-6 W=3.20
0
C FIXED PIER DIAPHRAGM, 5'4" BY 4'-11"
2  A= 26.254 I= 59.607, 62.23 J= 98.67 AS= 26.254, 26.254 E=519120 TC=6E-6 W=3.93
8
C FIXED PIER DIAPHRAGM, 5'4" BY 6'-0"
3  A= 32.000 I= 96.000, 75.85 J=142.43 AS= 32.000, 32.000 E=519120 TC=6E-6 W=4.80
0
C COLUMN, 5' DIAMETER
4  A= 19.635 I= 30.680, 30.68 J= 61.36 AS= 19.635, 19.635 E=519120 TC=6E-6 W=2.94
5
C SHAFT, 7' DIAMETER
5  A= 38.485 I=117.859,117.86 J=235.72 AS= 38.485, 38.485 E=519120 TC=6E-6 W=5.77
3
C SHAFT, 7' DIAMETER
6  A= 38.485 I=117.859,117.86 J=235.72 AS= 38.485, 38.485 E=519120 TC=0E-6 W=0.00
0
C RIGID MEMBER LINK
7  A= 19.635 I= 30.680, 30.68 J= 61.36 AS= 19.635, 19.635 E=519120 TC=6E-6 W=0.00
0
C
C Load Case I DL (Super, Abut, Int & Pier Diaph Load, & SDL)
1  PLD= 3.648 -321.244  0
2  PLD= 1.524 -321.244  0 10.047 -321.244  0
3  PLD= 2.921 -321.244  0 11.557 -321.244  0
4  PLD= 4.317 -321.244  0 12.953 -321.244  0
5  PLD= 5.714 -321.244  0 14.350 -321.244  0
6  PLD= 4.611 -321.244  0
C
C Load Case II - LL+I (2 Lanes)
7  PLD= 1.524  -15.696  0 10.047  -52.224  0
8  PLD= 2.921  -65.328  0 11.557  -28.800  0
C
C Load Case III - LL+I (5 Lanes)
9  PLD= 1.524  -31.380  0 10.047  -39.599  0
10 PLD= 2.921  -36.859  0 11.557  -44.082  0
```

```
11 PLD= 4.317  -44.082  0 12.953  -36.859  0
12 PLD= 5.714  -39.599  0 14.350  -31.380  0
C
C Load Case IV WIND LOAD ON STRUCTURE
C
C wind on superstructure is load #13
C tran: 50 psf on 12.792' height (GLOBAL X DIR)
C long: 12 psf on 12.792' height (GLOBAL Z DIR)
C
13 WG=1.100  0.000  0.000
C
C wind on substructure is load #14 & #15
C Fixed Pier Cap
C tran: 40 psf on  5.33' width (axis 3 - X DIR)
C long: 40 psf on 85.04' width (axis 2 - Z DIR)
C
14 WG=0.015  0.000  0.000
C
C Column
C tran: 40 psf on  5.00' width (axis 3 - X DIR)
C long: 40 psf on  5.00' width (axis 2 - Z DIR)
C
15 WG=0.200  0.000  0.000
C
C Load Case V WIND LOAD ON LIVE LOAD
C
C wind on live load is load #16
C tran: 100 plf at 6' above deck plus half girder depth (axis 3 - X DIR)
C long:  40 plf at 6' above deck plus half girder depth (axis 1 - Z DIR)
C
16  WG= 0.201  0.000  0.000
C
C Load Case VI LONGITUDINAL FORCE ON LIVE LOAD
C
C longitudinal force on live load is load #17
C long: 0.05*no.lanes*(Red.Factor*0.640k/ft) at 6' above deck
C       plus half girder depth (Z-DIR)
C       0.05*no.lanes*(Red.Factor*18.0kip)*0.5(distributed at the piers only)
C       at 6' above deck plus half girder depth (Z-DIR)
C
17 WG= 0.093  0.000   0.000
C
C Load Case VII STREAM FORCE
C
C Blocked Column - 9' Diameter
C
18 TRAP=0.0 4.419 0.317 -1.00 3.504     0.252
C
C Column - 5' Diameter
C
19 TRAP=0.0 1.947 0.140 -1.00 1.257     0.090
C
C Drilled Shaft - 7' Diameter
C
20 TRAP=0.0 1.760 0.126 -1.00 0.000 0.000
C
C Load Case VIII TEMPERATURE
C
21 T=-40,0,0
C
C PIER 1 - CAP
201,201,202  LP=1,0       M=1,2 NSL=1  0  0 13  14  16  17   0  21
202,202,203               M=2,3 NSL=0  0  0 13  14  16  17   0  21
203,203,204               M=3   NSL=2  7  9 13  14  16  17   0  21
204,204,205               M=3   NSL=3  8 10 13  14  16  17   0  21
205,205,206               M=3   NSL=4  0 11 13  14  16  17   0  21
```



```
206,206,207               M=3   NSL=5  0 12 13  14  16  17   0  21
207,207,208               M=3,2 NSL=0  0  0 13  14  16  17   0  21
208,208,209               M=2,1 NSL=6  0  0 13  14  16  17   0  21
C PIER 1 - CAP TO COLUMN
209,203,601               M=7
210,205,610               M=7
211,207,619               M=7
C PIER 1 - COLUMN
601,601,602               M=4   NSL=0  0  0  0  15   0   0   0  21
602,602,603               M=4   NSL=0  0  0  0   0   0   0  18  21
603,603,604               M=4   NSL=0  0  0  0   0   0   0  19  21
604,604,605               M=5   NSL=0  0  0  0   0   0   0  20  21
605,605,606               M=6   NSL=0  0  0  0   0   0   0   0  21  G=3,1,1,1
610,610,611               M=4   NSL=0  0  0  0  15   0   0   0  21
611,611,612               M=4   NSL=0  0  0  0   0   0   0  18  21
612,612,613               M=4   NSL=0  0  0  0   0   0   0  19  21
613,613,614               M=5   NSL=0  0  0  0   0   0   0  20  21
614,614,615               M=6   NSL=0  0  0  0   0   0   0   0  21  G=3,1,1,1
619,619,620               M=4   NSL=0  0  0  0  15   0   0   0  21
620,620,621               M=4   NSL=0  0  0  0   0   0   0  18  21
621,621,622               M=4   NSL=0  0  0  0   0   0   0  19  21
622,622,623               M=5   NSL=0  0  0  0   0   0   0  20  21
623,623,624               M=6   NSL=0  0  0  0   0   0   0   0  21  G=3,1,1,1
C
LOADS
C Load Case III STREAM FORCE - BUOYANCY
602  L=8  F=0.000, 14.76, 0.000, 0.000, 0.000, 0.000
603  L=8  F=0.000, 20.01, 0.000, 0.000, 0.000, 0.000
604  L=8  F=0.000, 71.18, 0.000, 0.000, 0.000, 0.000
C Load Case IV WIND LOADS - OVERTURNING FORCE
C
204  L=4  F=0.000, 198.0, 0.000, 0.000, 0.000, 0.000
```

```
     $$$$$$$$    $$$$$$$$$$   $$$$$$$      $$$$$$$$      $$$$$$$
    $$$$$$$$$$  $$$$$$$$$$   $$$$$$$$$$   $$$$$$$$$$   $$$$$$$$$$
   $$          $$     $$   $$      $$  $$      $$   $$      $$
   $$          $$     $$   $$      $$  $$      $$   $$      $$
   $$$$$$$$   $$$$$$$$$$   $$$$$$$$$$  $$$$$$$$$$   $$      $$
        $$   $$     $$   $$                 $$   $$      $$
        $$   $$     $$   $$                 $$   $$      $$
$$$$$$$$$$   $$     $$   $$           $$$$$$$$$$   $$$$$$$$$$
$$$$$$$$    $$     $$   $$           $$$$$$$$      $$$$$$$
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STRUCTURAL ANALYSIS PROGRAMS

VERSION P5.31

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C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 1
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
201								
	1	0.00			0.00			
		0.00	0.00	0.00				
		3.65	-333.42	-21.86				
		8.32	-350.72	-1619.02				
		8.32			-3.57			
	2	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
	3	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
	4	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.13	0.55				
		8.32			-1.09			
	5	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.01				
		8.32			-0.01			
	6	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.02	0.10				
		8.32			-0.20			
	7	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.01	0.05				
		8.32			-0.09			
	8	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
	9	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
202								
	1	0.00			38.61			
		0.00	-348.61	-1619.02				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 2
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		2.50	-359.53	-2503.74				
		2.50			38.61			
	2	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
	3	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
	4	0.00			-1.10			
		0.00	0.00	0.55				
		2.50	0.00	0.55				
		2.50			-1.10			
	5	0.00			-0.01			
		0.00	0.00	0.01				
		2.50	0.00	0.01				
		2.50			-0.01			
	6	0.00			-0.20			
		0.00	0.00	0.10				
		2.50	0.00	0.10				
		2.50			-0.20			
	7	0.00			-0.09			
		0.00	0.00	0.05				
		2.50	0.00	0.05				
		2.50			-0.09			
	8	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
	9	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
203								
	1	0.00			34.08			
		0.00	743.41	-2707.72				
		1.52	414.85	-1580.31				
		10.05	52.70	1781.10				
		15.87	24.72	2006.69				
		15.87			34.08			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 3
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	2	0.00			-1.94			
		0.00	73.84	-92.28				
		1.52	58.14	20.25				
		10.05	5.92	515.79				
		15.87	5.92	550.27				
		15.87			-1.94			
	3	0.00			-1.62			
		0.00	66.33	-73.32				
		1.52	34.95	27.76				
		10.05	-4.65	325.63				
		15.87	-4.65	298.53				
		15.87			-1.62			
	4	0.00			2.64			
		0.00	-87.94	164.90				
		15.87	-87.94	-1231.19				
		15.87			2.64			
	5	0.00			-0.01			
		0.00	-0.51	10.40				
		15.87	-0.51	2.27				
		15.87			-0.01			
	6	0.00			-0.07			
		0.00	-0.17	3.52				
		15.87	-0.17	0.79				
		15.87			-0.07			
	7	0.00			-0.03			
		0.00	-0.08	1.63				
		15.87	-0.08	0.37				
		15.87			-0.03			
	8	0.00			-1.21			
		0.00	-54.93	1130.03				
		15.87	-54.93	258.00				
		15.87			-1.21			
	9	0.00			5.06			
		0.00	-5.59	131.00				
		15.87	-5.59	42.27				
		15.87			5.06			
204								
	1	0.00			34.08			
		0.00	24.72	2006.69				
		2.92	-310.54	2058.41				
		11.56	-673.24	-802.45				
		15.88	-693.97	-3754.22				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 4
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		15.88			34.08			
	2	0.00			-1.94			
		0.00	5.92	550.27				
		2.92	-59.41	567.56				
		11.56	-88.21	54.48				
		15.88	-88.21	-326.40				
		15.88			-1.94			
	3	0.00			-1.62			
		0.00	-4.65	298.53				
		2.92	-41.51	284.94				
		11.56	-85.59	-73.54				
		15.88	-85.59	-443.12				
		15.88			-1.62			
	4	0.00			2.64			
		0.00	110.06	-1231.19				
		15.88	110.06	515.98				
		15.88			2.64			
	5	0.00			-0.01			
		0.00	-0.51	2.27				
		15.88	-0.51	-5.87				
		15.88			-0.01			
	6	0.00			-0.07			
		0.00	-0.17	0.79				
		15.88	-0.17	-1.94				
		15.88			-0.07			
	7	0.00			-0.03			
		0.00	-0.08	0.37				
		15.88	-0.08	-0.90				
		15.88			-0.03			
	8	0.00			-1.21			
		0.00	-54.93	258.00				
		15.88	-54.93	-614.03				
		15.88			-1.21			
	9	0.00			5.06			
		0.00	-5.59	42.27				
		15.88	-5.59	-46.47				
		15.88			5.06			
205								
	1	0.00			34.02			
		0.00	695.72	-3756.47				
		4.32	353.76	-797.75				
		12.95	-8.94	2078.29				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 5
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		15.88	-22.97	2031.68				
		15.88			34.02			
	2	0.00			-0.15			
		0.00	7.82	-250.15				
		15.88	7.82	-126.00				
		15.88			-0.15			
	3	0.00			-1.62			
		0.00	85.74	-443.25				
		4.32	41.65	-73.12				
		12.95	4.80	286.61				
		15.88	4.80	300.62				
		15.88			-1.62			
	4	0.00			0.57			
		0.00	-13.76	417.48				
		15.88	-13.76	198.97				
		15.88			0.57			
	5	0.00			0.01			
		0.00	-0.51	5.87				
		15.88	-0.51	-2.27				
		15.88			0.01			
	6	0.00			0.07			
		0.00	-0.17	1.94				
		15.88	-0.17	-0.79				
		15.88			0.07			
	7	0.00			0.03			
		0.00	-0.08	0.90				
		15.88	-0.08	-0.37				
		15.88			0.03			
	8	0.00			0.94			
		0.00	-57.03	668.28				
		15.88	-57.03	-237.06				
		15.88			0.94			
	9	0.00			5.06			
		0.00	5.59	-46.47				
		15.88	5.59	42.27				
		15.88			5.06			
206	----------							
	1	0.00			34.02			
		0.00	-22.97	2031.68				
		5.71	-371.64	1822.08				
		14.35	-734.33	-1566.39				
		15.87	-741.65	-2691.79				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 6
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		15.87			34.02			
	2	0.00			-0.15			
		0.00	7.82	-126.00				
		15.87	7.82	-1.85				
		15.87			-0.15			
	3	0.00			-1.62			
		0.00	4.80	300.62				
		5.71	-34.80	328.02				
		14.35	-66.18	27.46				
		15.87	-66.18	-73.47				
		15.87			-1.62			
	4	0.00			0.57			
		0.00	-13.76	198.97				
		15.87	-13.76	-19.55				
		15.87			0.57			
	5	0.00			0.01			
		0.00	-0.51	-2.27				
		15.87	-0.51	-10.40				
		15.87			0.01			
	6	0.00			0.07			
		0.00	-0.17	-0.79				
		15.87	-0.17	-3.52				
		15.87			0.07			
	7	0.00			0.03			
		0.00	-0.08	-0.37				
		15.87	-0.08	-1.63				
		15.87			0.03			
	8	0.00			0.94			
		0.00	-57.03	-237.06				
		15.87	-57.03	-1142.39				
		15.87			0.94			
	9	0.00			5.06			
		0.00	5.59	42.27				
		15.87	5.59	131.00				
		15.87			5.06			
207	----------							
	1	0.00			38.61			
		0.00	359.53	-2484.36				
		2.50	348.61	-1599.64				
		2.50			38.61			
	2	0.00			0.00			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 7
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
	3	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
	4	0.00			1.10			
		0.00	0.00	-0.55				
		2.50	0.00	-0.55				
		2.50			1.10			
	5	0.00			0.01			
		0.00	0.00	-0.01				
		2.50	0.00	-0.01				
		2.50			0.01			
	6	0.00			0.20			
		0.00	0.00	-0.10				
		2.50	0.00	-0.10				
		2.50			0.20			
	7	0.00			0.09			
		0.00	0.00	-0.05				
		2.50	0.00	-0.05				
		2.50			0.09			
	8	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
	9	0.00			0.00			
		0.00	0.00	0.00				
		2.50	0.00	0.00				
		2.50			0.00			
208	----------							
	1	0.00			-3.57			
		0.00	350.72	-1599.64				
		4.61	12.39	-22.59				
		8.32	0.00	0.00				
		8.32			0.00			
	2	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 8
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	3	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
	4	0.00			1.09			
		0.00	0.13	-0.55				
		8.32	0.00	0.00				
		8.32			0.00			
	5	0.00			0.01			
		0.00	0.00	-0.01				
		8.32	0.00	0.00				
		8.32			0.00			
	6	0.00			0.20			
		0.00	0.02	-0.10				
		8.32	0.00	0.00				
		8.32			0.00			
	7	0.00			0.09			
		0.00	0.01	-0.05				
		8.32	0.00	0.00				
		8.32			0.00			
	8	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
	9	0.00			0.00			
		0.00	0.00	0.00				
		8.32	0.00	0.00				
		8.32			0.00			
209	----------							
	1	0.00			-1102.94			
		0.00	-4.54	203.98				
		3.00	-4.54	190.36				
		3.00			-1102.94			
	2	0.00			-73.84			
		0.00	-1.94	92.28				
		3.00	-1.94	86.48				
		3.00			-73.84			
	3	0.00			-66.33			
		0.00	-1.62	73.32				
		3.00	-1.62	68.46				
		3.00			-66.33			

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	4	0.00			87.94			
		0.00	3.74	-164.35				
		3.00	3.74	-153.12				
		3.00			87.94			
	5	0.00			0.51			
		0.00	0.00	-10.40				
		3.00	0.00	-10.40				
		3.00			0.51			
	6	0.00			0.17			
		0.00	0.13	-3.42				
		3.00	0.13	-3.03				
		3.00			0.17			
	7	0.00			0.08			
		0.00	0.06	-1.58				
		3.00	0.06	-1.40				
		3.00			0.08			
	8	0.00			54.93			
		0.00	-1.21	-1130.03		-5.34	58.16	
		3.00	-1.21	-1133.67		-5.34	42.14	
		3.00			54.93			
	9	0.00			5.59			
		0.00	5.06	-131.00				
		3.00	5.06	-115.83				
		3.00			5.59			
210	----------							
	1	0.00			-1389.69			
		0.00	-0.06	2.25				
		3.00	-0.06	2.08				
		3.00			-1389.69			
	2	0.00			-96.03			
		0.00	1.79	-76.25				
		3.00	1.79	-70.88				
		3.00			-96.03			
	3	0.00			-171.33			
		0.00	0.00	0.13				
		3.00	0.00	0.12				
		3.00			-171.33			
	4	0.00			123.82			
		0.00	-2.07	98.49				
		3.00	-2.07	92.28				
		3.00			123.82			

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	5	0.00			0.00			
		0.00	0.03	-11.73				
		3.00	0.03	-11.64				
		3.00			0.00			
	6	0.00			0.00			
		0.00	0.14	-3.88				
		3.00	0.14	-3.46				
		3.00			0.00			
	7	0.00			0.00			
		0.00	0.07	-1.80				
		3.00	0.07	-1.60				
		3.00			0.00			
	8	0.00			2.10			
		0.00	2.15	-1282.30		-5.34	58.16	
		3.00	2.15	-1275.84		-5.34	42.14	
		3.00			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		3.00	0.00	0.00				
		3.00			-11.18			
211	----------							
	1	0.00			-1101.18			
		0.00	4.60	-207.43				
		3.00	4.60	-193.64				
		3.00			-1101.18			
	2	0.00			7.82			
		0.00	0.15	-1.85				
		3.00	0.15	-1.42				
		3.00			7.82			
	3	0.00			-66.18			
		0.00	1.62	-73.47				
		3.00	1.62	-68.59				
		3.00			-66.18			
	4	0.00			-13.76			
		0.00	0.53	-19.00				
		3.00	0.53	-17.41				
		3.00			-13.76			
	5	0.00			-0.51			
		0.00	0.00	-10.40				
		3.00	0.00	-10.40				
		3.00			-0.51			

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	6	0.00			-0.17			
		0.00	0.13	-3.42				
		3.00	0.13	-3.03				
		3.00			-0.17			
	7	0.00			-0.08			
		0.00	0.06	-1.58				
		3.00	0.06	-1.40				
		3.00			-0.08			
	8	0.00			-57.03			
		0.00	-0.94	-1142.39		-5.34	58.16	
		3.00	-0.94	-1145.21		-5.34	42.14	
		3.00			-57.03			
	9	0.00			5.59			
		0.00	-5.06	131.00				
		3.00	-5.06	115.83				
		3.00			5.59			
601								
	1	0.00			-1102.94			
DL		0.00	-4.54	190.36				
		2.31	-4.54	179.88				
		2.31			-1109.74			
	2	0.00			-73.84			
		0.00	-1.94	86.48				
LL+I		2.31	-1.94	82.00				
		2.31			-73.84			
	3	0.00			-66.33			
LL+I		0.00	-1.62	68.46				
		2.31	-1.62	64.72				
		2.31			-66.33			
	4	0.00			87.94			
W		0.00	3.74	-153.12				
		2.31	3.74	-144.48				
		2.31			87.94			
	5	0.00			0.51			
W		0.00	0.00	-10.40				
		2.31	0.46	-9.86				
		2.31			0.51			
	6	0.00			0.17			
		0.00	0.13	-3.03				
W on LL		2.31	0.13	-2.72				
		2.31			0.17			

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	7	0.00			0.08			
		0.00	0.06	-1.40				
LF		2.31	0.06	-1.26				
		2.31			0.08			
	8	0.00			54.93			
		0.00	-1.21	-1133.67		-5.34	42.14	
SF		2.31	-1.21	-1136.47		-5.34	29.80	
		2.31			54.93			
	9	0.00			5.59			
T		0.00	5.06	-115.83				
		2.31	5.06	-104.15				
		2.31			5.59			
602								
	1	0.00			-1109.74			
		0.00	-4.54	179.88				
		12.00	-4.54	125.42				
		12.00			-1145.08			
	2	0.00			-73.84			
		0.00	-1.94	82.00				
		12.00	-1.94	58.78				
		12.00			-73.84			
	3	0.00			-66.33			
		0.00	-1.62	64.72				
		12.00	-1.62	45.27				
		12.00			-66.33			
	4	0.00			87.94			
		0.00	3.74	-144.48				
		12.00	3.74	-99.59				
		12.00			87.94			
	5	0.00			0.51			
		0.00	0.46	-9.86				
		12.00	0.46	-4.32				
		12.00			0.51			
	6	0.00			0.17			
		0.00	0.13	-2.72				
		12.00	0.13	-1.16				
		12.00			0.17			
	7	0.00			0.08			
		0.00	0.06	-1.26				
		12.00	0.06	-0.54				
		12.00			0.08			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 13
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	8	0.00			69.69			
		0.00	-1.21	-1136.47		-5.34	29.80	
		0.28	0.00	-1136.64		-5.25	28.35	
		12.00	46.32	-854.82		-1.93	-13.01	
		12.00			69.69			
	9	0.00			5.59			
		0.00	5.06	-104.15				
		12.00	5.06	-43.49				
		12.00			5.59			
603	----------							
	1	0.00			-1145.08			
		0.00	-4.54	125.42				
		14.40	-4.54	60.08				
		14.40			-1187.49			
	2	0.00			-73.84			
		0.00	-1.94	58.78				
		14.40	-1.94	30.91				
		14.40			-73.84			
	3	0.00			-66.33			
		0.00	-1.62	45.27				
		14.40	-1.62	21.93				
		14.40			-66.33			
	4	0.00			87.94			
		0.00	3.74	-99.59				
		14.40	3.74	-45.71				
		14.40			87.94			
	5	0.00			0.51			
		0.00	0.46	-4.32				
		14.40	0.46	2.34				
		14.40			0.51			
	6	0.00			0.17			
		0.00	0.13	-1.16				
		14.40	0.13	0.72				
		14.40			0.17			
	7	0.00			0.08			
		0.00	0.06	-0.54				
		14.40	0.06	0.33				
		14.40			0.08			
	8	0.00			89.70			
		0.00	46.32	-854.82		-1.93	-13.01	
		14.40	69.39	-9.73		-0.27	-27.96	

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		14.40			89.70			
	9	0.00			5.59			
		0.00	5.06	-43.49				
		14.40	5.06	29.32				
		14.40			5.59			
604	----------							
	1	0.00			-1187.49			
		0.00	-4.54	60.08				
		29.66	-4.54	-74.52				
		29.66			-1358.72			
	2	0.00			-73.84			
		0.00	-1.94	30.91				
		29.66	-1.94	-26.50				
		29.66			-73.84			
	3	0.00			-66.33			
		0.00	-1.62	21.93				
		29.66	-1.62	-26.14				
		29.66			-66.33			
	4	0.00			87.94			
		0.00	3.74	-45.71				
		29.66	3.74	65.25				
		29.66			87.94			
	5	0.00			0.51			
		0.00	0.46	2.34				
		29.66	0.46	16.05				
		29.66			0.51			
	6	0.00			0.17			
		0.00	0.13	0.72				
		29.66	0.13	4.60				
		29.66			0.17			
	7	0.00			0.08			
		0.00	0.06	0.33				
		29.66	0.06	2.13				
		29.66			0.08			
	8	0.00			160.88			
		0.00	69.39	-9.73		-0.27	-27.96	
		2.23	73.17	149.11		0.00	-28.26	
		29.66	95.49	2564.58		1.60	0.97	
		29.66			160.88			
	9	0.00			5.59			
		0.00	5.06	29.32				

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		29.66	5.06	179.27				
		29.66			5.59			
605								
	1	0.00			-1358.72			
		0.00	-2.60	-74.52				
		7.00	-2.60	-92.74				
		7.00			-1358.72			
	2	0.00			-73.84			
		0.00	-1.18	-26.50				
		7.00	-1.18	-34.72				
		7.00			-73.84			
	3	0.00			-66.33			
		0.00	-0.94	-26.14				
		7.00	-0.94	-32.69				
		7.00			-66.33			
	4	0.00			87.94			
		0.00	2.10	65.25				
		7.00	2.10	79.94				
		7.00			87.94			
	5	0.00			0.51			
		0.00	0.16	16.05				
		7.00	0.16	17.17				
		7.00			0.51			
	6	0.00			0.17			
		0.00	0.04	4.60				
		7.00	0.04	4.91				
		7.00			0.17			
	7	0.00			0.08			
		0.00	0.02	2.13				
		7.00	0.02	2.27				
		7.00			0.08			
	8	0.00			160.88			
		0.00	42.52	2564.58		1.60	0.97	
		7.00	42.52	2862.20		1.60	12.16	
		7.00			160.88			
	9	0.00			5.59			
		0.00	1.72	179.27				
		7.00	1.72	191.28				
		7.00			5.59			
606								
	1	0.00			-1358.72			

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PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	-0.44	-92.74				
		7.00	-0.44	-95.82				
		7.00			-1358.72			
	2	0.00			-73.84			
		0.00	-0.32	-34.72				
		7.00	-0.32	-36.94				
		7.00			-73.84			
	3	0.00			-66.33			
		0.00	-0.17	-32.69				
		7.00	-0.17	-33.87				
		7.00			-66.33			
	4	0.00			87.94			
		0.00	0.27	79.94				
		7.00	0.27	81.82				
		7.00			87.94			
	5	0.00			0.51			
		0.00	-0.16	17.17				
		7.00	-0.16	16.04				
		7.00			0.51			
	6	0.00			0.17			
		0.00	-0.05	4.91				
		7.00	-0.05	4.58				
		7.00			0.17			
	7	0.00			0.08			
		0.00	-0.02	2.27				
		7.00	-0.02	2.12				
		7.00			0.08			
	8	0.00			160.88			
		0.00	-15.16	2862.20		1.60	12.16	
		7.00	-15.16	2756.09		1.60	23.35	
		7.00			160.88			
	9	0.00			5.59			
		0.00	-1.87	191.28				
		7.00	-1.87	178.21				
		7.00			5.59			
607								
	1	0.00			-1358.72			
		0.00	0.50	-95.82				
		7.00	0.50	-92.28				
		7.00			-1358.72			
	2	0.00			-73.84			

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.06	-36.94				
		7.00	0.06	-36.51				
		7.00			-73.84			
	3	0.00			-66.33			
		0.00	0.17	-33.87				
		7.00	0.17	-32.70				
		7.00			-66.33			
	4	0.00			87.94			
		0.00	-0.53	81.82				
		7.00	-0.53	78.13				
		7.00			87.94			
	5	0.00			0.51			
		0.00	-0.30	16.04				
		7.00	-0.30	13.96				
		7.00			0.51			
	6	0.00			0.17			
		0.00	-0.09	4.58				
		7.00	-0.09	3.98				
		7.00			0.17			
	7	0.00			0.08			
		0.00	-0.04	2.12				
		7.00	-0.04	1.84				
		7.00			0.08			
	8	0.00			160.88			
		0.00	-39.59	2756.09		1.60	23.35	
		7.00	-39.59	2478.93		1.60	34.54	
		7.00			160.88			
	9	0.00			5.59			
		0.00	-3.36	178.21				
		7.00	-3.36	154.68				
		7.00			5.59			
608	----------							
	1	0.00			-1358.72			
		0.00	0.73	-92.28				
		7.00	0.73	-87.14				
		7.00			-1358.72			
	2	0.00			-73.84			
		0.00	0.15	-36.51				
		7.00	0.15	-35.43				
		7.00			-73.84			
	3	0.00			-66.33			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 18
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.25	-32.70				
		7.00	0.25	-30.96				
		7.00			-66.33			
	4	0.00			87.94			
		0.00	-0.72	78.13				
		7.00	-0.72	73.10				
		7.00			87.94			
	5	0.00			0.51			
		0.00	-0.33	13.96				
		7.00	-0.33	11.66				
		7.00			0.51			
	6	0.00			0.17			
		0.00	-0.09	3.98				
		7.00	-0.09	3.32				
		7.00			0.17			
	7	0.00			0.08			
		0.00	-0.04	1.84				
		7.00	-0.04	1.53				
		7.00			0.08			
	8	0.00			160.88			
		0.00	-45.29	2478.93		1.60	34.54	
		7.00	-45.29	2161.90		1.60	45.73	
		7.00			160.88			
	9	0.00			5.59			
		0.00	-3.70	154.68				
		7.00	-3.70	128.78				
		7.00			5.59			
610	----------							
	1	0.00			-1389.69			
		0.00	-0.06	2.08				
DL		2.31	-0.06	1.94				
		2.31			-1396.49			
	2	0.00			-96.03			
LLI		0.00	1.79	-70.88				
		2.31	1.79	-66.74				
		2.31			-96.03			
	3	0.00			-171.33			
LLI		0.00	0.00	0.12				
		2.31	0.00	0.11				
		2.31			-171.33			
	4	0.00			123.82			

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	-2.07	92.28				
W		2.31	-2.07	87.50				
		2.31			123.82			
	5	0.00			0.00			
		0.00	0.03	-11.64				
W		2.31	0.49	-11.04				
		2.31			0.00			
	6	0.00			0.00			
W out		0.00	0.14	-3.46				
		2.31	0.14	-3.13				
		2.31			0.00			
LF	7	0.00			0.00			
		0.00	0.07	-1.60				
		2.31	0.07	-1.45				
		2.31			0.00			
SF	8	0.00			2.10			
		0.00	2.15	-1275.84		-5.34	42.14	
		2.31	2.15	-1270.87		-5.34	29.80	
		2.31			2.10			
T	9	0.00			-11.18			
		0.00	0.00	0.00				
		2.31	0.00	0.00				
		2.31			-11.18			
611	----------							
	1	0.00			-1396.49			
		0.00	-0.06	1.94				
		12.00	-0.06	1.24				
		12.00			-1431.83			
	2	0.00			-96.03			
		0.00	1.79	-66.74				
		12.00	1.79	-45.26				
		12.00			-96.03			
	3	0.00			-171.33			
		0.00	0.00	0.11				
		12.00	0.00	0.08				
		12.00			-171.33			
	4	0.00			123.82			
		0.00	-2.07	87.50				
		12.00	-2.07	62.67				
		12.00			123.82			
	5	0.00			0.00			

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PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.49	-11.04				
		12.00	0.49	-5.14				
		12.00			0.00			
	6	0.00			0.00			
		0.00	0.14	-3.13				
		12.00	0.14	-1.44				
		12.00			0.00			
	7	0.00			0.00			
		0.00	0.07	-1.45				
		12.00	0.07	-0.67				
		12.00			0.00			
	8	0.00			2.10			
		0.00	2.15	-1270.87		-5.34	29.80	
		12.00	49.69	-948.82		-1.93	-13.01	
		12.00			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		12.00	0.00	0.00				
		12.00			-11.18			
612	----------							
	1	0.00			-1431.83			
		0.00	-0.06	1.24				
		14.40	-0.06	0.39				
		14.40			-1474.24			
	2	0.00			-96.03			
		0.00	1.79	-45.26				
		14.40	1.79	-19.48				
		14.40			-96.03			
	3	0.00			-171.33			
		0.00	0.00	0.08				
		14.40	0.00	0.04				
		14.40			-171.33			
	4	0.00			123.82			
		0.00	-2.07	62.67				
		14.40	-2.07	32.86				
		14.40			123.82			
	5	0.00			0.00			
		0.00	0.49	-5.14				
		14.40	0.49	1.94				
		14.40			0.00			
	6	0.00			0.00			

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PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.14	-1.44				
		14.40	0.14	0.58				
		14.40			0.00			
	7	0.00			0.00			
		0.00	0.07	-0.67				
		14.40	0.07	0.27				
		14.40			0.00			
	8	0.00			2.10			
		0.00	49.69	-948.82		-1.93	-13.01	
		14.40	72.76	-55.25		-0.27	-27.96	
		14.40			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		14.40	0.00	0.00				
		14.40			-11.18			
613	----------							
	1	0.00			-1474.24			
		0.00	-0.06	0.39				
		29.66	-0.06	-1.35				
		29.66			-1645.47			
	2	0.00			-96.03			
		0.00	1.79	-19.48				
		29.66	1.79	33.62				
		29.66			-96.03			
	3	0.00			-171.33			
		0.00	0.00	0.04				
		29.66	0.00	-0.05				
		29.66			-171.33			
	4	0.00			123.82			
		0.00	-2.07	32.86				
		29.66	-2.07	-28.53				
		29.66			123.82			
	5	0.00			0.00			
		0.00	0.49	1.94				
		29.66	0.49	16.52				
		29.66			0.00			
	6	0.00			0.00			
		0.00	0.14	0.58				
		29.66	0.14	4.76				
		29.66			0.00			
	7	0.00			0.00			

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PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		0.00	0.07	0.27				
		29.66	0.07	2.20				
		29.66			0.00			
	8	0.00			2.10			
		0.00	72.76	-55.25		-0.27	-27.96	
		2.23	76.53	111.09		0.00	-28.26	
		29.66	98.86	2618.92		1.60	0.97	
		29.66			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		29.66	0.00	0.00				
		29.66			-11.18			
614	----------							
	1	0.00			-1645.47			
		0.00	-0.03	-1.35				
		7.00	-0.03	-1.55				
		7.00			-1645.47			
	2	0.00			-96.03			
		0.00	0.98	33.62				
		7.00	0.98	40.45				
		7.00			-96.03			
	3	0.00			-171.33			
		0.00	0.00	-0.05				
		7.00	0.00	-0.06				
		7.00			-171.33			
	4	0.00			123.82			
		0.00	-1.25	-28.53				
		7.00	-1.25	-37.31				
		7.00			123.82			
	5	0.00			0.00			
		0.00	0.18	16.52				
		7.00	0.18	17.77				
		7.00			0.00			
	6	0.00			0.00			
		0.00	0.05	4.76				
		7.00	0.05	5.11				
		7.00			0.00			
	7	0.00			0.00			
		0.00	0.02	2.20				
		7.00	0.02	2.37				
		7.00			0.00			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 23
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	8	0.00			2.10			
		0.00	44.46	2618.92		1.60	0.97	
		7.00	44.46	2930.14		1.60	12.16	
		7.00			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-11.18			
615	----------							
	1	0.00			-1645.47			
		0.00	0.00	-1.55				
		7.00	0.00	-1.52				
		7.00			-1645.47			
	2	0.00			-96.03			
		0.00	0.07	40.45				
		7.00	0.07	40.94				
		7.00			-96.03			
	3	0.00			-171.33			
		0.00	0.00	-0.06				
		7.00	0.00	-0.07				
		7.00			-171.33			
	4	0.00			123.82			
		0.00	-0.33	-37.31				
		7.00	-0.33	-39.65				
		7.00			123.82			
	5	0.00			0.00			
		0.00	-0.16	17.77				
		7.00	-0.16	16.66				
		7.00			0.00			
	6	0.00			0.00			
		0.00	-0.05	5.11				
		7.00	-0.05	4.79				
		7.00			0.00			
	7	0.00			0.00			
		0.00	-0.02	2.37				
		7.00	-0.02	2.22				
		7.00			0.00			
	8	0.00			2.10			
		0.00	-14.81	2930.14		1.60	12.16	
		7.00	-14.81	2826.47		1.60	23.35	
		7.00			2.10			

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 24
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
	9	0.00			-11.18			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-11.18			
616	----------							
	1	0.00			-1645.47			
		0.00	0.02	-1.52				
		7.00	0.02	-1.40				
		7.00			-1645.47			
	2	0.00			-96.03			
		0.00	-0.32	40.94				
		7.00	-0.32	38.68				
		7.00			-96.03			
	3	0.00			-171.33			
		0.00	0.00	-0.07				
		7.00	0.00	-0.06				
		7.00			-171.33			
	4	0.00			123.82			
		0.00	0.07	-39.65				
		7.00	0.07	-39.15				
		7.00			123.82			
	5	0.00			0.00			
		0.00	-0.30	16.66				
		7.00	-0.30	14.55				
		7.00			0.00			
	6	0.00			0.00			
		0.00	-0.09	4.79				
		7.00	-0.09	4.18				
		7.00			0.00			
	7	0.00			0.00			
		0.00	-0.04	2.22				
		7.00	-0.04	1.94				
		7.00			0.00			
	8	0.00			2.10			
		0.00	-39.94	2826.47		1.60	23.35	
		7.00	-39.94	2546.88		1.60	34.54	
		7.00			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-11.18			

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
617								
	1	0.00			-1645.47			
		0.00	0.02	-1.40				
		7.00	0.02	-1.25				
		7.00			-1645.47			
	2	0.00			-96.03			
		0.00	-0.42	38.68				
		7.00	-0.42	35.77				
		7.00			-96.03			
	3	0.00			-171.33			
		0.00	0.00	-0.06				
		7.00	0.00	-0.06				
		7.00			-171.33			
	4	0.00			123.82			
		0.00	0.17	-39.15				
		7.00	0.17	-37.95				
		7.00			123.82			
	5	0.00			0.00			
		0.00	-0.33	14.55				
		7.00	-0.33	12.22				
		7.00			0.00			
	6	0.00			0.00			
		0.00	-0.10	4.18				
		7.00	-0.10	3.51				
		7.00			0.00			
	7	0.00			0.00			
		0.00	-0.04	1.94				
		7.00	-0.04	1.62				
		7.00			0.00			
	8	0.00			2.10			
		0.00	-45.81	2546.88		1.60	34.54	
		7.00	-45.81	2226.24		1.60	45.73	
		7.00			2.10			
	9	0.00			-11.18			
		0.00	0.00	0.00				
		7.00	0.00	0.00				
		7.00			-11.18			
619								
	1	0.00			-1101.18			
		0.00	4.60	-193.64				
		2.31	4.60	-183.02				

DL

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		2.31			-1107.99			
	2	0.00			7.82			
		0.00	0.15	-1.42				
		2.31	0.15	-1.08				
		2.31			7.82			
	3	0.00			-66.18			
		0.00	1.62	-68.59				
		2.31	1.62	-64.84				
		2.31			-66.18			
	4	0.00			-13.76			
		0.00	0.53	-17.41				
		2.31	0.53	-16.19				
		2.31			-13.76			
	5	0.00			-0.51			
		0.00	0.00	-10.40				
		2.31	0.46	-9.86				
		2.31			-0.51			
	6	0.00			-0.17			
		0.00	0.13	-3.03				
		2.31	0.13	-2.72				
		2.31			-0.17			
	7	0.00			-0.08			
		0.00	0.06	-1.40				
		2.31	0.06	-1.26				
		2.31			-0.08			
	8	0.00			-57.03			
		0.00	-0.94	-1145.21		-5.34	42.14	
		2.31	-0.94	-1147.38		-5.34	29.80	
		2.31			-57.03			
	9	0.00			5.59			
		0.00	-5.06	115.83				
		2.31	-5.06	104.15				
		2.31			5.59			
620								
	1	0.00			-1107.99			
		0.00	4.60	-183.02				
		12.00	4.60	-127.86				
		12.00			-1143.33			
	2	0.00			7.82			
		0.00	0.15	-1.08				
		12.00	0.15	0.66				

UH

UH

W

W

W on LL

LF

SF

T

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SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		12.00			7.82			
3		0.00			-66.18			
		0.00	1.62	-64.84				
		12.00	1.62	-45.36				
		12.00			-66.18			
4		0.00			-13.76			
		0.00	0.53	-16.19				
		12.00	0.53	-9.85				
		12.00			-13.76			
5		0.00			-0.51			
		0.00	0.46	-9.86				
		12.00	0.46	-4.32				
		12.00			-0.51			
6		0.00			-0.17			
		0.00	0.13	-2.72				
		12.00	0.13	-1.16				
		12.00			-0.17			
7		0.00			-0.08			
		0.00	0.06	-1.26				
		12.00	0.06	-0.54				
		12.00			-0.08			
8		0.00			-57.03			
		0.00	-0.94	-1147.38		-5.34	29.80	
		12.00	46.60	-862.45		-1.93	-13.01	
		12.00			-57.03			
9		0.00			5.59			
		0.00	-5.06	104.15				
		12.00	-5.06	43.49				
		12.00			5.59			
621		----------						
1		0.00			-1143.33			
		0.00	4.60	-127.86				
		14.40	4.60	-61.67				
		14.40			-1185.73			
2		0.00			7.82			
		0.00	0.15	0.66				
		14.40	0.15	2.75				
		14.40			7.82			
3		0.00			-66.18			
		0.00	1.62	-45.36				
		14.40	1.62	-21.98				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 28
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		14.40			-66.18			
4		0.00			-13.76			
		0.00	0.53	-9.85				
		14.40	0.53	-2.23				
		14.40			-13.76			
5		0.00			-0.51			
		0.00	0.46	-4.32				
		14.40	0.46	2.34				
		14.40			-0.51			
6		0.00			-0.17			
		0.00	0.13	-1.16				
		14.40	0.13	0.72				
		14.40			-0.17			
7		0.00			-0.08			
		0.00	0.06	-0.54				
		14.40	0.06	0.33				
		14.40			-0.08			
8		0.00			-57.03			
		0.00	46.60	-862.45		-1.93	-13.01	
		14.40	69.67	-13.43		-0.27	-27.96	
		14.40			-57.03			
9		0.00			5.59			
		0.00	-5.06	43.49				
		14.40	-5.06	-29.32				
		14.40			5.59			
622		----------						
1		0.00			-1185.73			
		0.00	4.60	-61.67				
		29.66	4.60	74.67				
		29.66			-1356.96			
2		0.00			7.82			
		0.00	0.15	2.75				
		29.66	0.15	7.05				
		29.66			7.82			
3		0.00			-66.18			
		0.00	1.62	-21.98				
		29.66	1.62	26.18				
		29.66			-66.18			
4		0.00			-13.76			
		0.00	0.53	-2.23				
		29.66	0.53	13.45				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 29
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		29.66			-13.76			
	5	0.00			-0.51			
		0.00	0.46	2.34				
		29.66	0.46	16.05				
		29.66			-0.51			
	6	0.00			-0.17			
		0.00	0.13	0.72				
		29.66	0.13	4.60				
		29.66			-0.17			
	7	0.00			-0.08			
		0.00	0.06	0.33				
		29.66	0.06	2.13				
		29.66			-0.08			
	8	0.00			-57.03			
		0.00	69.67	-13.43		-0.27	-27.96	
		2.23	73.44	146.02		0.00	-28.26	
		29.66	95.77	2568.99		1.60	0.97	
		29.66			-57.03			
	9	0.00			5.59			
		0.00	-5.06	-29.32				
		29.66	-5.06	-179.27				
		29.66			5.59			
623	----------							
	1	0.00			-1356.96			
		0.00	2.65	74.67				
		7.00	2.65	93.19				
		7.00			-1356.96			
	2	0.00			7.82			
		0.00	0.03	7.05				
		7.00	0.03	7.23				
		7.00			7.82			
	3	0.00			-66.18			
		0.00	0.94	26.18				
		7.00	0.94	32.74				
		7.00			-66.18			
	4	0.00			-13.76			
		0.00	0.24	13.45				
		7.00	0.24	15.16				
		7.00			-13.76			
	5	0.00			-0.51			
		0.00	0.16	16.05				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 30
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		7.00	0.16	17.17				
		7.00			-0.51			
	6	0.00			-0.17			
		0.00	0.04	4.60				
		7.00	0.04	4.91				
		7.00			-0.17			
	7	0.00			-0.08			
		0.00	0.02	2.13				
		7.00	0.02	2.27				
		7.00			-0.08			
	8	0.00			-57.03			
		0.00	42.67	2568.99		1.60	0.97	
		7.00	42.67	2867.71		1.60	12.16	
		7.00			-57.03			
	9	0.00			5.59			
		0.00	-1.72	-179.27				
		7.00	-1.72	-191.28				
		7.00			5.59			
624	----------							
	1	0.00			-1356.96			
		0.00	0.47	93.19				
		7.00	0.47	96.45				
		7.00			-1356.96			
	2	0.00			7.82			
		0.00	-0.10	7.23				
		7.00	-0.10	6.53				
		7.00			7.82			
	3	0.00			-66.18			
		0.00	0.17	32.74				
		7.00	0.17	33.92				
		7.00			-66.18			
	4	0.00			-13.76			
		0.00	-0.07	15.16				
		7.00	-0.07	14.70				
		7.00			-13.76			
	5	0.00			-0.51			
		0.00	-0.16	17.17				
		7.00	-0.16	16.04				
		7.00			-0.51			
	6	0.00			-0.17			
		0.00	-0.05	4.91				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 31
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		7.00	-0.05	4.58				
		7.00			-0.17			
	7	0.00			-0.08			
		0.00	-0.02	2.27				
		7.00	-0.02	2.12				
		7.00			-0.08			
	8	0.00			-57.03			
		0.00	-15.13	2867.71		1.60	12.16	
		7.00	-15.13	2761.80		1.60	23.35	
		7.00			-57.03			
	9	0.00			5.59			
		0.00	1.87	-191.28				
		7.00	1.87	-178.21				
		7.00			5.59			
625	----------							
	1	0.00			-1356.96			
		0.00	-0.49	96.45				
		7.00	-0.49	93.04				
		7.00			-1356.96			
	2	0.00			7.82			
		0.00	-0.15	6.53				
		7.00	-0.15	5.47				
		7.00			7.82			
	3	0.00			-66.18			
		0.00	-0.17	33.92				
		7.00	-0.17	32.76				
		7.00			-66.18			
	4	0.00			-13.76			
		0.00	-0.20	14.70				
		7.00	-0.20	13.32				
		7.00			-13.76			
	5	0.00			-0.51			
		0.00	-0.30	16.04				
		7.00	-0.30	13.96				
		7.00			-0.51			
	6	0.00			-0.17			
		0.00	-0.09	4.58				
		7.00	-0.09	3.98				
		7.00			-0.17			
	7	0.00			-0.08			
		0.00	-0.04	2.12				

C S I / S A P 9 0 - - FINITE ELEMENT ANALYSIS OF STRUCTURES PAGE 32
PROGRAM:SAP90/FILE:7thavetr.F3F
SALT RIVER BRIDGES - SCOUR (7TH AVENUE BRIDGE) "7THAVE"

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		7.00	-0.04	1.84				
		7.00			-0.08			
	8	0.00			-57.03			
		0.00	-39.62	2761.80		1.60	23.35	
		7.00	-39.62	2484.44		1.60	34.54	
		7.00			-57.03			
	9	0.00			5.59			
		0.00	3.36	-178.21				
		7.00	3.36	-154.68				
		7.00			5.59			
626	----------							
	1	0.00			-1356.96			
		0.00	-0.72	93.04				
		7.00	-0.72	88.00				
		7.00			-1356.96			
	2	0.00			7.82			
		0.00	-0.16	5.47				
		7.00	-0.16	4.32				
		7.00			7.82			
	3	0.00			-66.18			
		0.00	-0.25	32.76				
		7.00	-0.25	31.02				
		7.00			-66.18			
	4	0.00			-13.76			
		0.00	-0.23	13.32				
		7.00	-0.23	11.72				
		7.00			-13.76			
	5	0.00			-0.51			
		0.00	-0.33	13.96				
		7.00	-0.33	11.66				
		7.00			-0.51			
	6	0.00			-0.17			
		0.00	-0.09	3.98				
		7.00	-0.09	3.32				
		7.00			-0.17			
	7	0.00			-0.08			
		0.00	-0.04	1.84				
		7.00	-0.04	1.53				
		7.00			-0.08			
	8	0.00			-57.03			
		0.00	-45.33	2484.44		1.60	34.54	

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		7.00	-45.33	2167.12		1.60	45.73	
		7.00			-57.03			
	9	0.00			5.59			
		0.00	3.70	-154.68				
		7.00	3.70	-128.78				
		7.00			5.59			

TYLIN INTERNATIONAL

Project:	Salt River Bridges Scour	Job No.	1317.00	Sheet:	
Item:	7th Avenue Bridge	Designer:	VPD	Date:	10/21/99
D:\My Documents\Projects\Salt River Bridges - Scour\7th Ave\excel\[col_top.xls]Sheet1		Checker:		Date:	

LOADS AT TOP OF COLUMN - PIER 1

LOAD FACTOR DESIGN:

GROUP-I = 1.30 [.75 DL + 1.67 LL+I + 1.0 SF]
GROUP-II = 1.30 [.75 DL + 1.0 SF + 1.0 W]
GROUP-III = 1.30 [.75 DL + 1.0 LL+I + 1.0 SF + 0.3 W + 1.0 WL + 1.0 LF]
GROUP-IV = 1.30 [.75 DL + 1.0 LL+I + 1.0 SF + 1.0 RST]
GROUP-V = 1.25 [.75 DL + 1.0 SF + 1.0 W + 1.0 RST]
GROUP-VI = 1.25 [.75 DL + 1.0 LL+I + 1.0 SF + 0.3 W + 1.0 WL + 1.0 LF + 1.0 RST]

CASE - 3 VERTICAL LOAD

	DL (KIPS)	LL+I (KIPS)	WIND (KIPS)	WL (KIPS)	LF (KIPS)	SF (KIPS)	RST (KIPS)
Col 1	1,103	74	(88)	(0)	(0)	(55)	(6)
Col 2	1,390	96	(124)	0	0	(2)	11
Col 3	1,101	66	14	0	0	57	(6)

	GRP-I (KIPS)	GRP-II (KIPS)	GRP-III (KIPS)	GRP-IV (KIPS)	GRP-V (KIPS)	GRP-VI (KIPS)
Pu	1,164	889	1,065	1,093	848	1,017
	1,561	1,191	1,429	1,492	1,159	1,388
	1,291	1,166	1,240	1,227	1,114	1,185

CASE - 3 SHEAR

	DL (KIPS)	LL+I (KIPS)	WIND (KIPS)	WL (KIPS)	LF (KIPS)	SF (KIPS)	RST (KIPS)
Col 1 - Vy	5	2	4	0	0	1	5
Col 1 - Vx	0	0	12	3	7	5	2
Col 2 - Vy	0	2	2	0	0	2	0
Col 2 - Vx	0	0	12	3	7	5	2
Col 3 - Vy	5	2	1	0	0	1	5
Col 3 - Vx	0	0	12	3	7	5	2

	GRP-I (KIPS)	GRP-II (KIPS)	GRP-III (KIPS)	GRP-IV (KIPS)	GRP-V (KIPS)	GRP-VI (KIPS)
Col 1 - Vy	10	11	10	15	17	16
Col 1 - Vx	7	23	25	9	24	26
Col 2 - Vy	7	6	6	5	5	6
Col 2 - Vx	7	23	25	9	24	26
Col 3 - Vy	9	6	8	14	12	14
Col 3 - Vx	7	23	25	9	24	26

TYLIN INTERNATIONAL

Project:	Salt River Bridges Scour	Job No.	1317.00	Sheet:	
Item:	7th Avenue Bridge	Designer:	VPD	Date:	10/21/99
D:\My Documents\Projects\Salt River Bridges - Scour\7th Ave\excel\[col_top.xls]Sheet1		Checker:		Date:	

LOADS AT TOP OF COLUMN - PIER 1 *(Cont.)*

CASE - 3 MOMENT

	DL (K-FT)	LL+I (K-FT)	WIND (K-FT)	WL (K-FT)	LF (K-FT)	SF (K-FT)	RST (K-FT)
Col 1 - My	190	86	164	3	1	1,134	116
Col 1 - Mx	0	0	140	38	85	42	19
Col 2 - My	2	71	104	3	2	1,276	0
Col 2 - Mx	0	0	140	38	85	42	19
Col 3 - My	194	69	28	3	1	1,145	116
Col 3 - Mx	0	0	140	38	85	42	19

	GRP-I (K-FT)	GRP-II (K-FT)	GRP-III (K-FT)	GRP-IV (K-FT)	GRP-V (K-FT)	GRP-VI (K-FT)
Col 1 - MVy	1,847	1,872	1,841	1,922	1,945	1,915
Col 1 - Mx	55	237	270	79	251	282
Col 2 - My	1,815	1,796	1,800	1,753	1,727	1,731
Col 2 - Mx	55	237	270	79	251	282
Col 3 - My	1,826	1,714	1,783	1,917	1,793	1,860
Col 3 - Mx	55	237	270	79	251	282

DRILLED SHAFT LOAD AT PIER 1

DRILLED SHAFT DIAMETER = 7 FT WT = 5.77 K/FT

LENGTH TO 100-YR FLOOD SCOUR = 57.93 FT WT = 334.4 KIPS

I = 0.20

	COL -1 (100-YR)	COL-2 (DRY)	COL-3 (100-YR)
LL+I =	73.84	171.33	66.18
LL =	62	143	55
DL =	1,359	1,645	1,357
SF+B =	(161)	(2)	57
DL+LL-B =	1,259	1,786	1,469

```
 SALT RIVER BRIDGES - 7TH AVENUE BRIDGE - PIER 1 COLUMN
        9
        4
        1        19
        0
        2       1.0       6.0         0     57.00      0.00      0.00
     3500  29000000    0.0030     60000
    60.00      0.00      0.00      0.00
    27.80                                   1.56        19
LOAD AT TOP                            NO    PILE
 0.99 0.50 0.00 0.00     20.00     78.37    1    1      3.00  AGS    B
    190       0    86     86    88    164    3    1     0   116  1134
      0       0     0      0     0    140   38   85     0    19    42
   1103       0    74     74    74    -89    0    0     0    -6   -55
                    0      0     0                      0
                    0      0     0                      0
                    0      0     0                      0
        0         0      0     0      0      0
        0         0      0     0      0      0
        0         0      0     0      0      0
```

```
TITLE   SALT RIVER BRIDGES - 7TH AVENUE BRIDGE                    PAGE  1

***************** Licensed to: T.Y. Lin International ****************
*                                                                    *
*              IAI RECOL-PC  - VERSION 2.1    06.26.89               *
*                                                                    *
**********************************************************************

COLUMN TYPE                    =  9  (CIRCULAR)
CONCRETE LOOPS                 =  1
TOTAL NO. OF CONCRETE COORD.   = 40
STEEL REBAR PATTERN            =  4  (CONCENTRIC LOOPS)
NUMBER OF STEEL REBAR LOOPS    =  1
TOTAL NO. OF STEEL REBARS      = 19
PLOT TYPE                      =  0  (NO PLOT)
DESIGN TYPE                    =  2  (CHECK)
PERCENT STEEL LIMITS           =     (1.00 % MIN.  6.00 % MAX.)

*************
* BENT DATA *
*****************************************************************************

NUMBER OF COLUMNS IN BENT                    =     0
OUT TO OUT DISTANCE (DIAMETER) OF SPIRAL     = 57.00 (INCHES)
DISTANCE FROM TOP COLUMN PLASTIC HINGE TO
CENTER OF GRAVITY OF THE SUPERSTRUCTURE      =  0.00 (FEET)
CENTER TO CENTER SPACING OF COLUMNS          =  0.00 (FEET)

******************************
* MATERIAL PROPERTIES  (PSI) *
*****************************************************************************

ULTIMATE CONCRETE COMPRESSIVE STRESS - FC =     3500.
YOUNG S MODULUS FOR CONCRETE         - EC =  3372165.
YOUNG S MODULUS FOR STEEL BARS       - ES = 29000000.
ULTIMATE CONCRETE COMPRESSIVE STRAIN - EO =      .003
YIELDING STRESS FOR STEEL BARS       - FY =    60000.
```

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 2

CIRCULAR CROSS-SECTION

HX
60.00

CONCRETE COORDINATES (INCHES)

COORD	X	Y
1	30.00	0.00
2	29.63	4.69
3	28.53	9.27
4	26.73	13.62
5	24.27	17.63
6	21.21	21.21
7	17.63	24.27
8	13.62	26.73
9	9.27	28.53
10	4.69	29.63
11	0.00	30.00
12	-4.69	29.63
13	-9.27	28.53
14	-13.62	26.73
15	-17.63	24.27
16	-21.21	21.21
17	-24.27	17.63
18	-26.73	13.62
19	-28.53	9.27
20	-29.63	4.69
21	-30.00	0.00
22	-29.63	-4.69
23	-28.53	-9.27
24	-26.73	-13.62
25	-24.27	-17.63
26	-21.21	-21.21
27	-17.63	-24.27
28	-13.62	-26.73
29	-9.27	-28.53
30	-4.69	-29.63
31	0.00	-30.00
32	4.69	-29.63
33	9.27	-28.53
34	13.62	-26.73
35	17.63	-24.27
36	21.21	-21.21
37	24.27	-17.63
38	26.73	-13.62
39	28.53	-9.27
40	29.63	-4.69

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 3

CONCENTRIC CIRCLE PATTERN

LOOP	RADIUS	AREA	BARS
1	27.80	1.56	19

STEEL REBAR COORDINATES (INCHES)

COORD	X	Y
1	27.80	0.00
2	26.29	9.03
3	21.94	17.08
4	15.21	23.27
5	6.82	26.95
6	-2.30	27.71
7	-11.17	25.46
8	-18.83	20.45
9	-24.45	13.23
10	-27.42	4.58
11	-27.42	-4.58
12	-24.45	-13.23
13	-18.83	-20.45
14	-11.17	-25.46
15	-2.30	-27.71
16	6.82	-26.95
17	15.21	-23.27
18	21.94	-17.08
19	26.29	-9.03

THE MAIN LONGITUDINAL STEEL IS ASSUMED TO BE # 11 BARS.

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 4

```
***************************
* INITIAL REFERENCE DATA *
***************************************************************************

TOTAL AREA OF THE SECTION                AG =     19.55 FT**2
NOMINAL AXIAL LOAD STRENGTH              PO =  10067.29 KIPS
TOTAL REINFORCEMENT AREA                AST =     29.64 IN**2
PERCENT STEEL                             =      1.05 %

GROSS MOMENT OF INERTIA ABOUT Y-AXIS   IYC =     30.43 FT**4
GROSS MOMENT OF INERTIA ABOUT X-AXIS   IXC =     30.43 FT**4

STEEL MOMENT OF INERTIA ABOUT Y-AXIS   IYS =    0.5523 FT**4
STEEL MOMENT OF INERTIA ABOUT X-AXIS   IXS =    0.5523 FT**4
```


TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 5

```
***************************
* COLUMN LOAD DATA (K-FT) *
***************************************************************************

LOAD NAME:          LOAD AT TOP
FOOTING DATA FILE:  NO
TYPE FOOTING:        PILE


     MOMENT DISTRIBUTION FACT            COLUMN     STEEL   LOCATION  DUCTILITY
 SEISMIC
     :---TOP---:---BOTTOM---:  PERCENT  LENGTH     TIE=1     TOP=1     FACTOR
  DESIGN      SPC
        DAY   DAX   DBY   DBX   IMPACT  (FEET)  SPIRAL=0  BOTTOM=0       (Z)
CRITERIA CATEGORY

       0.99  0.50  0.00  0.00    20.00   78.37        1         1       3.00
    AGS        B


     COLUMN GROUP LOADS - SERVICE (K-FT)

                          :---- LL+IMPACT ---:
                          CASE 1 CASE 2 CASE 3
              DEAD     PRE  TRANS   LONG  AXIAL
              LOAD  STRESS MY-MAX MX-MAX  N-MAX   WIND    WL    LF CF-MY  TEMP SF&
BY

     MY        190       0     86     86     88    164     3     1     0   116  11
34
     MX          0       0      0      0      0    140    38    85     0    19
42
     P        1103       0     74     74     74    -89     0     0     0    -6  -
55
     PMY                        0      0      0                          0
     PMX                        0      0      0                          0
     P                          0      0      0                          0


     COLUMN SEISMIC AND ARBITRARY LOADS (K-FT)

          (ARS) UNREDUCED SEISMIC     ARBITRARY LOADS     ARBITRARY LOADS
                CASE 1    CASE 2   SERVICE   SERVICE  FACTORED  FACTORED
               MAX TRAN  MAX LONG      AL1       AL2       AL1       AL2

     MY TRAN        0.        0.       0.        0.        0.        0.
     MX LONG        0.        0.       0.        0.        0.        0.
     P AXIAL        0.        0.       0.        0.        0.        0.
```

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 6

****
* FACTORED LOADS FOR COLUMN DESIGN CHECK (KIP-FT) *
****

APPLIED FACTORED MOMENTS ARE MAGNIFIED FOR SLENDERNESS IN ACCORDANCE WITH CALTRANS BRIDGE DESIGN SPECIFICATIONS. (ART 8.16.5)

LENGTH = 78.37 FT FC = 3.50 KSI FY = 60.00 KSI
STEEL = 1.05 % AST = 29.64 SQ IN

GROUP	CASE	:------ APPLIED FACTORED ------: TRANS MY	LONG MX	COMB M	AXIAL P	CAPACITY (PHI*MN) MU	PHI	RATIO MU/M	
IH	1	2852.	260.	2864.	1164.	4132.	0.73	1.44	OK
IH	2	2852.	260.	2864.	1164.	4132.	0.73	1.44	OK
IH	3	3631.	352.	3648.	1523.	4271.	0.70	1.17	OK
IP	1	2396.	220.	2406.	1004.	4059.	0.76	1.69	OK
IP	2	2396.	220.	2406.	1004.	4059.	0.76	1.69	OK
IP	3	3014.	310.	3030.	1362.	4183.	0.71	1.38	OK
II		2561.	257.	2574.	888.	3999.	0.77	1.55	OK
III	1	2718.	297.	2734.	1065.	4088.	0.75	1.50	OK
III	2	2718.	297.	2734.	1065.	4088.	0.75	1.50	OK
III	3	3419.	326.	3435.	1424.	4203.	0.70	1.22	OK
IV	1	2868.	242.	2878.	1092.	4101.	0.74	1.43	OK
IV	2	2868.	242.	2878.	1092.	4101.	0.74	1.43	OK
IV	3	3606.	333.	3622.	1451.	4223.	0.70	1.17	OK
V		2613.	272.	2627.	847.	3977.	0.78	1.51	OK
VI	1	2763.	311.	2781.	1017.	4065.	0.76	1.46	OK
VI	2	2763.	311.	2781.	1017.	4065.	0.76	1.46	OK
VI	3	3419.	321.	3434.	1362.	4183.	0.71	1.22	OK
VII	1	2013.	231.	2027.	1048.	3824.	0.69	1.89	OK
VII	2	2013.	231.	2027.	1048.	3824.	0.69	1.89	OK

NOTE: FOR CALTRANS AND SPC-C AND SPC-D ONLY THE UNREDUCED SEISMIC MOMENTS ARE REDUCED BY THE Z OR R FACTOR. FOR SPC-B BOTH THE UNREDUCED SEISMIC AXIAL AND MOMENTS ARE REDUCED BY THE Z OR R FACTOR.

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 7

****
* MOMENT MAGNIFICATION AND BUCKLING CALCULATIONS *
****

REFERENCE: "CALTRANS BRIDGE DESIGN SPECIFICATIONS" (ART 8.16.5)
(COLUMN ASSUMED TO BE UNBRACED AGAINST SIDESWAY.)

MAGY = MOMENT MAGNIFACTION FACTOR ABOUT Y-AXIS
MAGX = MOMENT MAGNIFACTION FACTOR ABOUT X-AXIS

PCY = CRITICAL BUCKLING LOAD ABOUT Y-AXIS
PCX = CRITICAL BUCKLING LOAD ABOUT X-AXIS

KY = EFFECTIVE LENGTH FACTOR ABOUT Y-AXIS = 2.10
KX = EFFECTIVE LENGTH FACTOR ABOUT X-AXIS = 1.19

KY*L/R = SLENDERNESS RATIO ABOUT Y-AXIS =132.
KX*L/R = SLENDERNESS RATIO ABOUT X-AXIS = 75.

IYS = STEEL MOMENT OF INERTIA ABOUT Y-AXIS = 0.5523 FT**4
IXS = STEEL MOMENT OF INERTIA ABOUT X-AXIS = 0.5523 FT**4

GR	CA	:-MOMENT MAGNIFICATION-: TRAN MAGY	LONG MAGX	COMB MAG	:--CRACKED TRANSFORMED SECTION--: E*IY	E*IX	:-----CRITICAL BUCKLING----: TRAN PCY	LONG PCX	AXIAL LOAD P
IH	1	1.545	1.116	1.539	9056699.	9965672.	3300.	11231.	1164.
IH	2	1.545	1.116	1.539	9056699.	9965672.	3300.	11231.	1164.
IH	3	1.899	1.157	1.885	8825474.	9965672.	3216.	11231.	1523.
IP	1	1.444	1.098	1.439	8964885.	9965672.	3267.	11231.	1004.
IP	2	1.444	1.098	1.439	8964885.	9965672.	3267.	11231.	1004.
IP	3	1.751	1.138	1.739	8715020.	9965672.	3176.	11231.	1362.
II		1.368	1.086	1.364	9068566.	9965672.	3304.	11231.	888.
III	1	1.477	1.105	1.470	9054288.	9965672.	3299.	11231.	1065.
III	2	1.477	1.105	1.470	9054288.	9965672.	3299.	11231.	1065.
III	3	1.795	1.145	1.784	8821709.	9965672.	3215.	11231.	1424.
IV	1	1.492	1.108	1.488	9089596.	9965672.	3312.	11231.	1092.
IV	2	1.492	1.108	1.488	9089596.	9965672.	3312.	11231.	1092.
IV	3	1.816	1.148	1.804	8863525.	9965672.	3230.	11231.	1451.
V		1.343	1.082	1.339	9099289.	9965672.	3316.	11231.	847.
VI	1	1.443	1.100	1.437	9086499.	9965672.	3311.	11231.	1017.
VI	2	1.443	1.100	1.437	9086499.	9965672.	3311.	11231.	1017.
VI	3	1.730	1.138	1.720	8858618.	9965672.	3228.	11231.	1362.
VII	1	1.521	1.103	1.512	8398816.	9965672.	3060.	11231.	1048.
VII	2	1.521	1.103	1.512	8398816.	9965672.	3060.	11231.	1048.

*** WARNING KL/R = 132. ABOUT THE Y-AXIS IS GREATER THAN 100.
REDESIGN THE COLUMN WITH A LARGER CROSS-SECTION OR
PERFORM A SPECIAL SECOND ORDER ANALYSIS AS DEFINED
IN ART 8.16.5.1.1 OF AASHTO.

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 8

COLUMN SERVICE LOADS (K-FT) AND MAXIMUM WORKING STRESSES (PSI)

YOUNG S MODULUS FOR CONCRETE - EC = 3372165. PSI
MODULAR RATIO (ES/EC) - N = 8.6

		:---- SERVICE LOADS (K-FT) ----:				:---- MAX STRESS (PSI) ----:		
GP	CASE	TRANS MY	LONG MX	COMB M	AXIAL P	CONC COMP	STEEL TEN	STEEL COMP
IH	1	1410.	42.	1411.	1122.	1177.	4156.	9580.
IH	2	1410.	42.	1411.	1122.	1177.	4156.	9580.
IH	3	1412.	42.	1413.	1122.	1179.	4176.	9593.
II		1190.	146.	1199.	767.	1018.	5784.	8153.
III	1	1171.	166.	1182.	876.	989.	4171.	7961.
III	2	1171.	166.	1182.	876.	989.	4171.	7961.
III	3	1172.	166.	1184.	876.	990.	4189.	7972.
IV	1	1221.	49.	1222.	893.	1022.	4403.	8286.
IV	2	1221.	49.	1222.	893.	1022.	4403.	8286.
IV	3	1222.	49.	1223.	893.	1024.	4422.	8297.
V		1146.	144.	1155.	681.	993.	6509.	7916.
VI	1	1128.	161.	1139.	778.	960.	4813.	7692.
VI	2	1128.	161.	1139.	778.	960.	4813.	7692.
VI	3	1129.	161.	1141.	778.	961.	4832.	7702.
DL		190.	0.	190.	1103.	458.	0.	3878.

TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 9

****
* PROBABLE PLASTIC MOMENT (1.3 X NOMINAL MOMENT) (KIP-FT) *
****

CODE (8.16.4.4) AND MEMO TO DESIGNERS 15-10

FC = 3.50 KSI FY = 60.00 KSI
EO = 0.0030 IN/IN AST = 29.64 SQ IN

ANGLE	TRANS MPY	LONG MPX	COMB MP	AXIAL P	P-BALANCE (APPROX)
90.0	0.7469E+04	-.9322E+00	0.7469E+04	0.6040E+04	3774
	0.8217E+04	-.4714E+00	0.8217E+04	0.5033E+04	
	0.8657E+04	0.8477E-01	0.8657E+04	0.4026E+04	
	0.8511E+04	0.6584E+00	0.8511E+04	0.3021E+04	
	0.7778E+04	0.1129E+01	0.7778E+04	0.2014E+04	
	0.6649E+04	0.1327E+01	0.6649E+04	0.1104E+04	
	0.6499E+04	0.1373E+01	0.6499E+04	0.1007E+04	
	0.4666E+04	0.1339E+01	0.4666E+04	0.9655E+00	
	0.3538E+04	0.9246E+00	0.3538E+04	-.5027E+03	
	0.2237E+04	0.1068E+01	0.2237E+04	-.1006E+04	

** NOTE: THE NUMBER OF COLUMNS EQUALS ZERO.
THEREFORE, NO PLASTIC HINGING ANALYSIS IS PERFORMED.

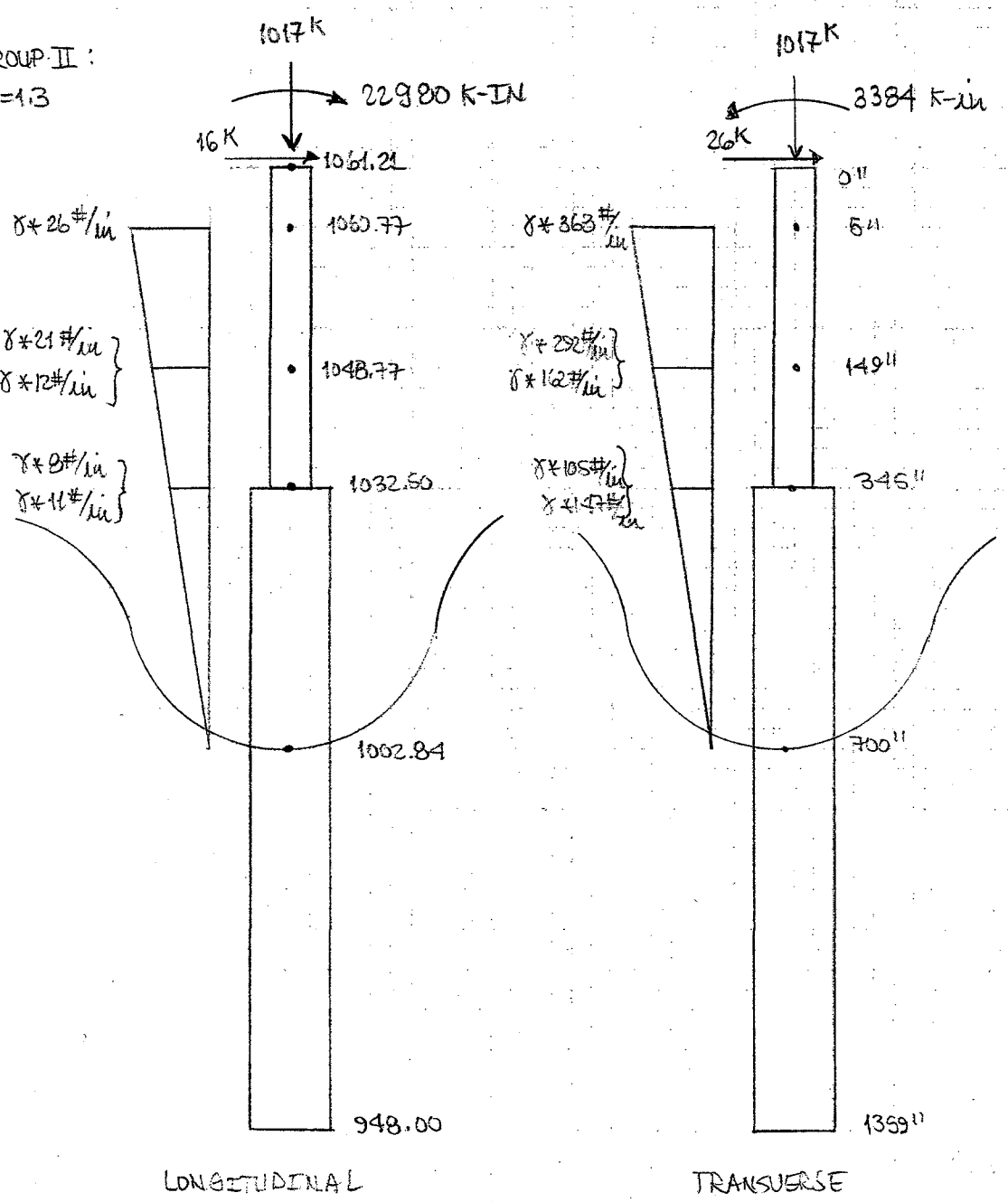
TITLE SALT RIVER BRIDGES - 7TH AVENUE BRIDGE PAGE 10

T·Y·LIN INTERNATIONAL

Projects: Salt River Bridges - Scour	Job No. 1317.00	Sheet:	of
Item: Seventh Avenue Bridge	Designer: VPD	Date: 10/21/99	
	Checker:	Date:	
		Grid: 1/8"	

DESIGN LOAD = 1786 K
CAPACITY =

GROUP II :
$\gamma = 1.3$



```
SALT RIVER BRIDGES-SCOUR 7TH AVE BRIDGE (LONG CASE-3) "P-7-DSL3"
   1
  99     4   700.0000   1359.0000
   0.0000    60.0000      636174.00000000        2827.00000000        3372165
 345.0000    60.0000      636174.00000000        2827.00000000        3372165
 345.0000    84.0000     2443920.00000000        5542.00000000        3372165
1359.0000    84.0000     2443920.00000000        5542.00000000        3372165
   1     2     2     0     0
   4   730.0000  1359.0000      500.000000
 700.0000    0.04500
1359.0000    0.04500
 700.0000     0.0000    42.0000   0.000000
1359.0000     0.0000    42.0000   0.000000
   6     1     0.000
   5.0000    34.0000
 149.0000    27.0000
 149.0000    16.0000
 345.0000    10.0000
 345.0000    14.0000
 700.0000     0.0000
   1
   1    16000.0 22980000.0  1017000.0
   0
   1     1     0
 100   0.000010      480.000000
```

```
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```

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SALT RIVER BRIDGES-SCOUR 7TH AVE BRIDGE (LONG CASE-3) "P-7-DSL3"

UNITS--ENGLISH UNITS

INPUT INFORMATION

THE LOADING IS STATIC

PILE GEOMETRY AND PROPERTIES

PILE LENGTH = 1359.00 IN
4 POINTS

X IN	DIAMETER IN	MOMENT OF INERTIA IN**4	AREA IN**2	MODULUS OF ELASTICITY LBS/IN**2
.00	60.000	.636D+06	.283D+04	.337D+07
345.00	60.000	.636D+06	.283D+04	.337D+07
345.00	84.000	.244D+07	.554D+04	.337D+07
1359.00	84.000	.244D+07	.554D+04	.337D+07

SOILS INFORMATION

X AT THE GROUND SURFACE = 700.00 IN

1 LAYER(S) OF SOIL

LAYER 1
THE SOIL IS A SAND
X AT THE TOP OF THE LAYER = 700.00 IN

X AT THE BOTTOM OF THE LAYER = 1359.00 IN
MODULUS OF SUBGRADE REACTION = .500D+03 LBS/IN**3

DISTRIBUTION OF EFFECTIVE UNIT WEIGHT WITH DEPTH
2 POINTS

X,IN	WEIGHT,LBS/IN**3
700.00	.45D-01
1359.00	.45D-01

DISTRIBUTION OF STRENGTH PARAMETERS WITH DEPTH
2 POINTS

X,IN	C,LBS/IN**2	PHI,DEGREES	E50
700.00	.000D+00	.420D+02	-----
1359.00	.000D+00	.420D+02	-----

BOUNDARY AND LOADING CONDITIONS

DISTRIBUTED LOAD CURVE 6 POINTS

X,IN	LOAD,LBS/IN
5.00	.340D+02
149.00	.270D+02
149.00	.160D+02
345.00	.100D+02
345.00	.140D+02
700.00	.000D+00

LOADING NUMBER 1

BOUNDARY-CONDITION CODE = 1
LATERAL LOAD AT THE PILE HEAD = .160D+05 LBS
MOMENT AT THE PILE HEAD = .230D+08 IN-LBS
AXIAL LOAD AT THE PILE HEAD = .102D+07 LBS

FINITE-DIFFERENCE PARAMETERS

NUMBER OF PILE INCREMENTS = 99
DEFLECTION TOLERANCE ON DETERMINATION OF CLOSURE = .100D-04 IN
MAXIMUM NUMBER OF ITERATIONS ALLOWED FOR PILE ANALYSIS = 100
MAXIMUM ALLOWABLE DEFLECTION = .48D+03 IN

OUTPUT CODES

KOUTPT = 1
KPYOP = 0
INC = 1

OUTPUT INFORMATION

DISTRIBUTED LOAD CURVE 6 POINTS

X,IN	LOAD,LBS/IN
5.00	.340D+02
149.00	.270D+02
149.00	.160D+02
345.00	.100D+02
345.00	.140D+02

700.00 .000D+00

LOADING NUMBER 1

BOUNDARY CONDITION CODE = 1
LATERAL LOAD AT THE PILE HEAD = .160D+05 LBS
MOMENT AT THE PILE HEAD = .230D+08 IN-LBS
AXIAL LOAD AT THE PILE HEAD = .102D+07 LBS

X IN	DEFLECTION IN	MOMENT LBS-IN	SHEAR LBS	SOIL REACTION LBS/IN	TOTAL STRESS LBS/IN**2	FLEXURAL RIGIDITY LBS-IN**2
*****	**********	**********	**********	**********	**********	**********
.00	.253D+01	.230D+08	.160D+05	.000D+00	.144D+04	.215D+13
13.73	.243D+01	.233D+08	.162D+05	.000D+00	.146D+04	.215D+13
27.45	.234D+01	.236D+08	.167D+05	.000D+00	.147D+04	.215D+13
41.18	.225D+01	.239D+08	.171D+05	.000D+00	.149D+04	.215D+13
54.91	.216D+01	.243D+08	.176D+05	.000D+00	.150D+04	.215D+13
68.64	.207D+01	.246D+08	.180D+05	.000D+00	.152D+04	.215D+13
82.36	.198D+01	.249D+08	.184D+05	.000D+00	.154D+04	.215D+13
96.09	.190D+01	.253D+08	.188D+05	.000D+00	.155D+04	.215D+13
109.82	.182D+01	.256D+08	.192D+05	.000D+00	.157D+04	.215D+13
123.55	.174D+01	.260D+08	.196D+05	.000D+00	.158D+04	.215D+13
137.27	.166D+01	.263D+08	.200D+05	.000D+00	.160D+04	.215D+13
151.00	.159D+01	.267D+08	.203D+05	.000D+00	.162D+04	.215D+13
164.73	.152D+01	.270D+08	.205D+05	.000D+00	.163D+04	.215D+13
178.45	.145D+01	.274D+08	.207D+05	.000D+00	.165D+04	.215D+13
192.18	.138D+01	.277D+08	.209D+05	.000D+00	.167D+04	.215D+13
205.91	.131D+01	.281D+08	.211D+05	.000D+00	.168D+04	.215D+13
219.64	.125D+01	.285D+08	.213D+05	.000D+00	.170D+04	.215D+13
233.36	.119D+01	.288D+08	.215D+05	.000D+00	.172D+04	.215D+13
247.09	.113D+01	.292D+08	.217D+05	.000D+00	.174D+04	.215D+13
260.82	.108D+01	.295D+08	.219D+05	.000D+00	.175D+04	.215D+13
274.55	.103D+01	.299D+08	.220D+05	.000D+00	.177D+04	.215D+13
288.27	.976D+00	.302D+08	.222D+05	.000D+00	.179D+04	.215D+13
302.00	.929D+00	.306D+08	.224D+05	.000D+00	.180D+04	.215D+13
315.73	.884D+00	.309D+08	.225D+05	.000D+00	.182D+04	.215D+13
329.45	.842D+00	.313D+08	.227D+05	.000D+00	.184D+04	.215D+13
343.18	.803D+00	.316D+08	.228D+05	.000D+00	.185D+04	.215D+13
356.91	.767D+00	.320D+08	.230D+05	.000D+00	.733D+03	.824D+13
370.64	.732D+00	.323D+08	.231D+05	.000D+00	.739D+03	.824D+13
384.36	.697D+00	.327D+08	.233D+05	.000D+00	.745D+03	.824D+13
398.09	.663D+00	.331D+08	.235D+05	.000D+00	.752D+03	.824D+13
411.82	.630D+00	.334D+08	.236D+05	.000D+00	.758D+03	.824D+13
425.55	.597D+00	.338D+08	.238D+05	.000D+00	.764D+03	.824D+13
439.27	.566D+00	.341D+08	.239D+05	.000D+00	.770D+03	.824D+13
453.00	.535D+00	.345D+08	.241D+05	.000D+00	.776D+03	.824D+13
466.73	.505D+00	.349D+08	.242D+05	.000D+00	.782D+03	.824D+13
480.45	.475D+00	.352D+08	.243D+05	.000D+00	.789D+03	.824D+13
494.18	.447D+00	.356D+08	.245D+05	.000D+00	.795D+03	.824D+13
507.91	.419D+00	.359D+08	.246D+05	.000D+00	.801D+03	.824D+13
521.64	.392D+00	.363D+08	.247D+05	.000D+00	.808D+03	.824D+13
535.36	.366D+00	.367D+08	.248D+05	.000D+00	.814D+03	.824D+13
549.09	.341D+00	.370D+08	.248D+05	.000D+00	.820D+03	.824D+13
562.82	.317D+00	.374D+08	.249D+05	.000D+00	.826D+03	.824D+13
576.55	.293D+00	.378D+08	.250D+05	.000D+00	.833D+03	.824D+13
590.27	.270D+00	.381D+08	.250D+05	.000D+00	.839D+03	.824D+13
604.00	.249D+00	.385D+08	.251D+05	.000D+00	.845D+03	.824D+13
617.73	.228D+00	.389D+08	.252D+05	.000D+00	.852D+03	.824D+13
631.45	.208D+00	.392D+08	.252D+05	.000D+00	.858D+03	.824D+13
645.18	.189D+00	.396D+08	.252D+05	.000D+00	.864D+03	.824D+13

658.91	.170D+00	.400D+08	.253D+05	.000D+00	.870D+03	.824D+13
672.64	.153D+00	.403D+08	.253D+05	.000D+00	.877D+03	.824D+13
686.36	.137D+00	.407D+08	.253D+05	.000D+00	.883D+03	.824D+13
700.09	.121D+00	.411D+08	.253D+05	-.190D+01	.889D+03	.824D+13
713.82	.107D+00	.414D+08	.231D+05	-.309D+03	.895D+03	.824D+13
727.55	.934D-01	.417D+08	.166D+05	-.639D+03	.901D+03	.824D+13
741.27	.808D-01	.419D+08	.561D+04	-.965D+03	.904D+03	.824D+13
755.00	.692D-01	.419D+08	-.987D+04	-.129D+04	.904D+03	.824D+13
768.73	.585D-01	.417D+08	-.296D+05	-.159D+04	.899D+03	.824D+13
782.45	.488D-01	.411D+08	-.532D+05	-.184D+04	.890D+03	.824D+13
796.18	.400D-01	.402D+08	-.790D+05	-.192D+04	.875D+03	.824D+13
809.91	.321D-01	.390D+08	-.104D+06	-.176D+04	.853D+03	.824D+13
823.64	.251D-01	.374D+08	-.127D+06	-.155D+04	.826D+03	.824D+13
837.36	.190D-01	.355D+08	-.147D+06	-.131D+04	.793D+03	.824D+13
851.09	.137D-01	.333D+08	-.163D+06	-.104D+04	.757D+03	.824D+13
864.82	.918D-02	.310D+08	-.175D+06	-.756D+03	.717D+03	.824D+13
878.55	.534D-02	.285D+08	-.184D+06	-.477D+03	.674D+03	.824D+13
892.27	.216D-02	.260D+08	-.188D+06	-.208D+03	.630D+03	.824D+13
906.00	-.429D-03	.234D+08	-.189D+06	.442D+02	.585D+03	.824D+13
919.73	-.248D-02	.208D+08	-.187D+06	.273D+03	.541D+03	.824D+13
933.45	-.406D-02	.182D+08	-.182D+06	.474D+03	.497D+03	.824D+13
947.18	-.522D-02	.158D+08	-.174D+06	.645D+03	.455D+03	.824D+13
960.91	-.602D-02	.135D+08	-.165D+06	.785D+03	.415D+03	.824D+13
974.64	-.651D-02	.113D+08	-.153D+06	.894D+03	.377D+03	.824D+13
988.36	-.674D-02	.926D+07	-.140D+06	.972D+03	.343D+03	.824D+13
1002.09	-.677D-02	.743D+07	-.127D+06	.102D+04	.311D+03	.824D+13
1015.82	-.662D-02	.578D+07	-.112D+06	.104D+04	.283D+03	.824D+13
1029.55	-.634D-02	.434D+07	-.986D+05	.965D+03	.258D+03	.824D+13
1043.27	-.596D-02	.308D+07	-.860D+05	.871D+03	.236D+03	.824D+13
1057.00	-.551D-02	.198D+07	-.742D+05	.850D+03	.217D+03	.824D+13
1070.73	-.501D-02	.104D+07	-.628D+05	.818D+03	.201D+03	.824D+13
1084.45	-.449D-02	.252D+06	-.518D+05	.776D+03	.188D+03	.824D+13
1098.18	-.397D-02	-.387D+06	-.415D+05	.726D+03	.190D+03	.824D+13
1111.91	-.345D-02	-.889D+06	-.319D+05	.670D+03	.199D+03	.824D+13
1125.64	-.296D-02	-.126D+07	-.230D+05	.625D+03	.205D+03	.824D+13
1139.36	-.249D-02	-.152D+07	-.150D+05	.548D+03	.210D+03	.824D+13
1153.09	-.206D-02	-.168D+07	-.802D+04	.467D+03	.212D+03	.824D+13
1166.82	-.167D-02	-.174D+07	-.214D+04	.389D+03	.213D+03	.824D+13
1180.55	-.131D-02	-.174D+07	.270D+04	.316D+03	.213D+03	.824D+13
1194.27	-.100D-02	-.167D+07	.656D+04	.247D+03	.212D+03	.824D+13
1208.00	-.725D-03	-.156D+07	.953D+04	.184D+03	.210D+03	.824D+13
1221.73	-.485D-03	-.141D+07	.117D+05	.127D+03	.208D+03	.824D+13
1235.45	-.277D-03	-.124D+07	.130D+05	.743D+02	.205D+03	.824D+13
1249.18	-.981D-04	-.105D+07	.137D+05	.269D+02	.202D+03	.824D+13
1262.91	.573D-04	-.860D+06	.138D+05	-.161D+02	.198D+03	.824D+13
1276.64	.193D-03	-.672D+06	.133D+05	-.557D+02	.195D+03	.824D+13
1290.36	.313D-03	-.495D+06	.123D+05	-.925D+02	.192D+03	.824D+13
1304.09	.422D-03	-.335D+06	.108D+05	-.128D+03	.189D+03	.824D+13
1317.82	.524D-03	-.199D+06	.880D+04	-.162D+03	.187D+03	.824D+13
1331.55	.621D-03	-.936D+05	.634D+04	-.196D+03	.185D+03	.824D+13
1345.27	.715D-03	-.250D+05	.341D+04	-.231D+03	.184D+03	.824D+13
1359.00	.809D-03	.000D+00	.000D+00	-.267D+03	.184D+03	.824D+13

OUTPUT VERIFICATION

THE MAXIMUM MOMENT IMBALANCE FOR ANY ELEMENT = .309D-04 IN-LBS
THE MAX. LATERAL FORCE IMBALANCE FOR ANY ELEMENT = -.130D-05 LBS

OUTPUT SUMMARY

PILE-HEAD DEFLECTION = .253D+01 IN
COMPUTED SLOPE AT PILE HEAD = .710D-02
MAXIMUM BENDING MOMENT = .419D+08 LBS-IN

MAXIMUM SHEAR FORCE = -.189D+06 LBS
NO. OF ITERATIONS = 11
NO. OF ZERO DEFLECTION POINTS = 2

S U M M A R Y T A B L E
****

BOUNDARY CONDITION BC1	BOUNDARY CONDITION BC2	AXIAL LOAD LBS	PILE HEAD DEFLECTION IN	MAX. MOMENT IN-LBS	MAX. SHEAR LBS
.1600D+05	.2298D+08	.1017D+07	.2531D+01	.4191D+08	-.1894D+06

$M_u = 0.4191 \times 10^8$ lb-in $\div 12000 = 3492.50$ K-Ft

$V_u = 0.1894 \times 10^6$ lbs $\div 1000 = 189.40$ Kips.

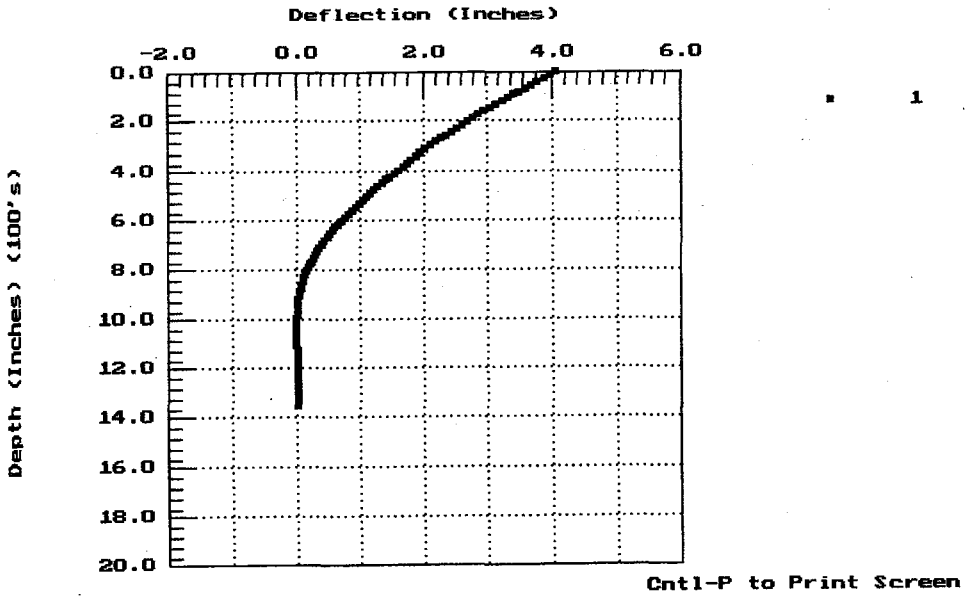
TY·LIN INTERNATIONAL

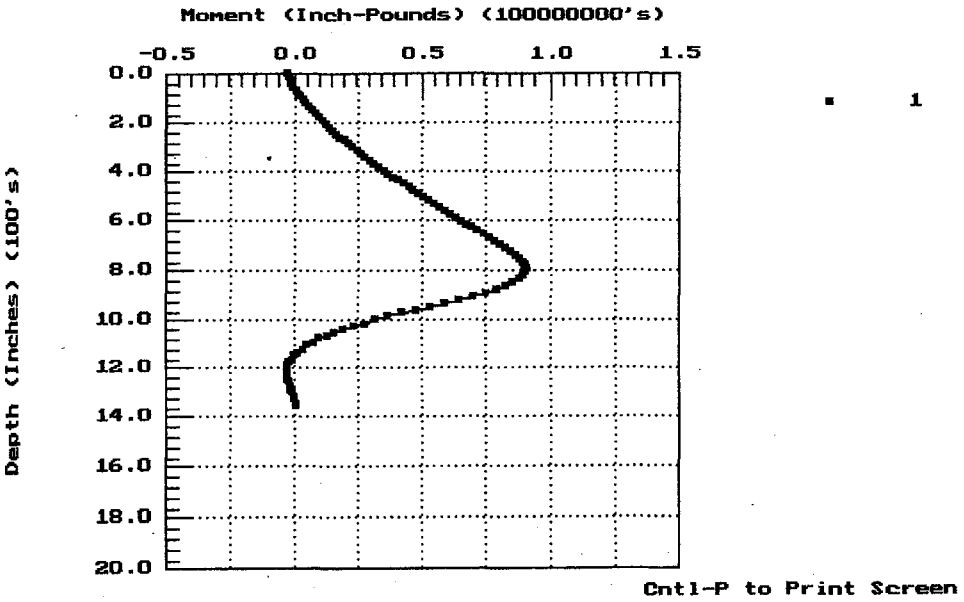
Projects: Salt River Bridges - Scour | Job No. 1317.00 | Sheet: of

Item: Seventh Avenue Bridge | Designer: VPD | Date: 10/20/99

Checker: | Date:

Case 3 - Longitudinal | Grid: 1/10"





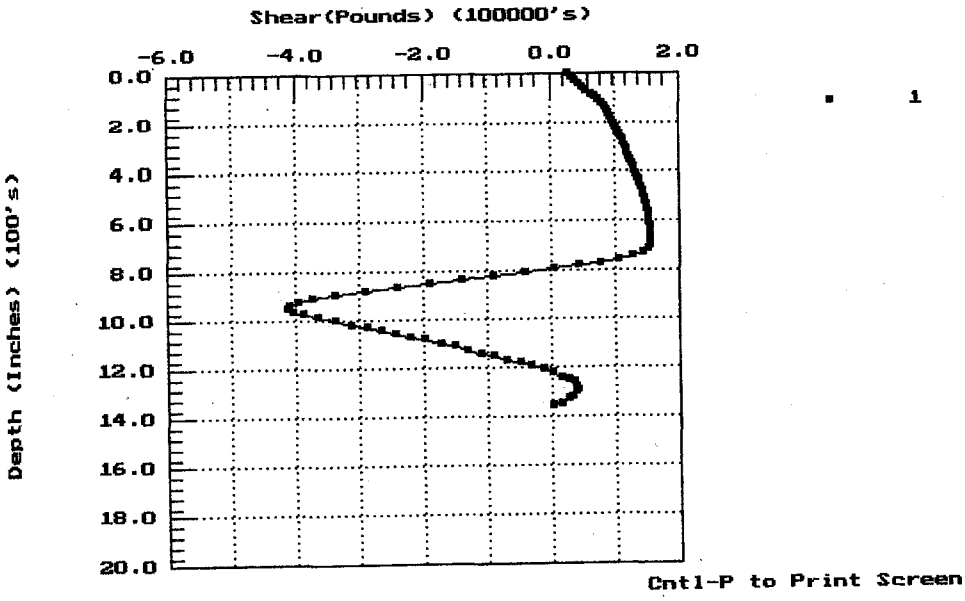
TY·LIN INTERNATIONAL

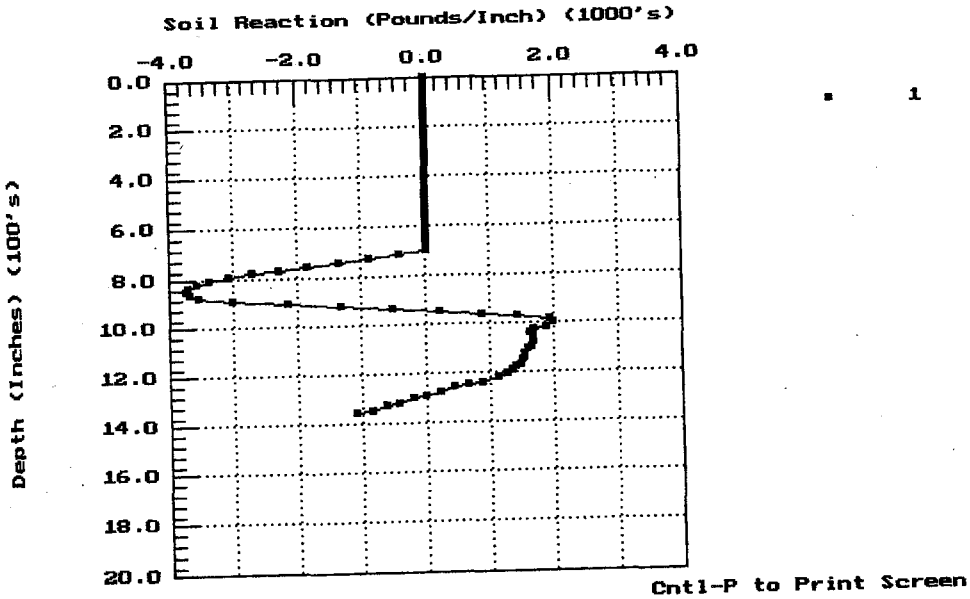
Projects: Salt River Bridges-Scour | Job No. 1317.00 | Sheet: of

Item: Seventh Avenue Bridge | Designer: VPD | Date: 10/20/99.

Checker: | Date:

Case 3 - Longitudinal | Grid: 1/10"





```
SALT RIVER BRIDGES-SCOUR 7TH AVE BRIDGE (TRAN CASE-3) "P-7-DST3"
   1
  99     4   700.0000  1359.0000
   0.0000    60.0000      636174.00000000        2827.00000000        3372165
 345.0000    60.0000      636174.00000000        2827.00000000        3372165
 345.0000    84.0000     2443920.00000000        5542.00000000        3372165
1359.0000    84.0000     2443920.00000000        5542.00000000        3372165
   1     2     2     0     0
   4   730.0000  1359.0000      500.000000
 700.0000    0.04500
1359.0000    0.04500
 700.0000     0.0000    42.0000   0.000000
1359.0000     0.0000    42.0000   0.000000
   6     1     0.000
   5.0000   478.0000
 149.0000   380.0000
 149.0000   211.0000
 345.0000   137.0000
 345.0000   191.0000
 700.0000     0.0000
   1
   1    26000.0 -3384000.0  1017000.0
   0
   1     1     0
 100   0.000010      480.000000
```

```
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SALT RIVER BRIDGES-SCOUR 7TH AVE BRIDGE (TRAN CASE-3) "P-7-DST3"

UNITS--ENGLISH UNITS

INPUT INFORMATION

THE LOADING IS STATIC

PILE GEOMETRY AND PROPERTIES

PILE LENGTH = 1359.00 IN
4 POINTS

X	DIAMETER	MOMENT OF INERTIA	AREA	MODULUS OF ELASTICITY
IN	IN	IN**4	IN**2	LBS/IN**2
.00	60.000	.636D+06	.283D+04	.337D+07
345.00	60.000	.636D+06	.283D+04	.337D+07
345.00	84.000	.244D+07	.554D+04	.337D+07
1359.00	84.000	.244D+07	.554D+04	.337D+07

SOILS INFORMATION

X AT THE GROUND SURFACE = 700.00 IN

1 LAYER(S) OF SOIL

LAYER 1
THE SOIL IS A SAND
X AT THE TOP OF THE LAYER = 700.00 IN

X AT THE BOTTOM OF THE LAYER = 1359.00 IN
MODULUS OF SUBGRADE REACTION = .500D+03 LBS/IN**3

DISTRIBUTION OF EFFECTIVE UNIT WEIGHT WITH DEPTH
2 POINTS

X,IN	WEIGHT,LBS/IN**3
700.00	.45D-01
1359.00	.45D-01

DISTRIBUTION OF STRENGTH PARAMETERS WITH DEPTH
2 POINTS

X,IN	C,LBS/IN**2	PHI,DEGREES	E50
700.00	.000D+00	.420D+02	-----
1359.00	.000D+00	.420D+02	-----

BOUNDARY AND LOADING CONDITIONS

DISTRIBUTED LOAD CURVE 6 POINTS

X,IN	LOAD,LBS/IN
5.00	.478D+03
149.00	.380D+03
149.00	.211D+03
345.00	.137D+03
345.00	.191D+03
700.00	.000D+00

LOADING NUMBER 1

BOUNDARY-CONDITION CODE = 1
LATERAL LOAD AT THE PILE HEAD = .260D+05 LBS
MOMENT AT THE PILE HEAD = -.338D+07 IN-LBS
AXIAL LOAD AT THE PILE HEAD = .102D+07 LBS

FINITE-DIFFERENCE PARAMETERS
NUMBER OF PILE INCREMENTS = 99
DEFLECTION TOLERANCE ON DETERMINATION OF CLOSURE = .100D-04 IN
MAXIMUM NUMBER OF ITERATIONS ALLOWED FOR PILE ANALYSIS = 100
MAXIMUM ALLOWABLE DEFLECTION = .48D+03 IN

OUTPUT CODES
KOUTPT = 1
KPYOP = 0
INC = 1

OUTPUT INFORMATION

DISTRIBUTED LOAD CURVE 6 POINTS

X,IN	LOAD,LBS/IN
5.00	.478D+03
149.00	.380D+03
149.00	.211D+03
345.00	.137D+03
345.00	.191D+03

700.00 .000D+00

LOADING NUMBER 1

BOUNDARY CONDITION CODE = 1
LATERAL LOAD AT THE PILE HEAD = .260D+05 LBS
MOMENT AT THE PILE HEAD = -.338D+07 IN-LBS
AXIAL LOAD AT THE PILE HEAD = .102D+07 LBS

X IN	DEFLECTION IN	MOMENT LBS-IN	SHEAR LBS	SOIL REACTION LBS/IN	TOTAL STRESS LBS/IN**2	FLEXURAL RIGIDITY LBS-IN**2
*****	**********	**********	**********	**********	**********	**********
.00	.404D+01	-.338D+07	.260D+05	.000D+00	.519D+03	.215D+13
13.73	.395D+01	-.293D+07	.292D+05	.000D+00	.498D+03	.215D+13
27.45	.385D+01	-.239D+07	.357D+05	.000D+00	.473D+03	.215D+13
41.18	.376D+01	-.177D+07	.419D+05	.000D+00	.443D+03	.215D+13
54.91	.367D+01	-.106D+07	.481D+05	.000D+00	.410D+03	.215D+13
68.64	.358D+01	-.259D+06	.541D+05	.000D+00	.372D+03	.215D+13
82.36	.348D+01	.619D+06	.600D+05	.000D+00	.389D+03	.215D+13
96.09	.339D+01	.158D+07	.658D+05	.000D+00	.434D+03	.215D+13
109.82	.330D+01	.261D+07	.715D+05	.000D+00	.483D+03	.215D+13
123.55	.321D+01	.373D+07	.770D+05	.000D+00	.535D+03	.215D+13
137.27	.312D+01	.491D+07	.824D+05	.000D+00	.591D+03	.215D+13
151.00	.303D+01	.617D+07	.865D+05	.000D+00	.651D+03	.215D+13
164.73	.293D+01	.747D+07	.893D+05	.000D+00	.712D+03	.215D+13
178.45	.284D+01	.881D+07	.921D+05	.000D+00	.775D+03	.215D+13
192.18	.276D+01	.102D+08	.948D+05	.000D+00	.840D+03	.215D+13
205.91	.267D+01	.116D+08	.974D+05	.000D+00	.906D+03	.215D+13
219.64	.258D+01	.130D+08	.100D+06	.000D+00	.975D+03	.215D+13
233.36	.249D+01	.145D+08	.103D+06	.000D+00	.104D+04	.215D+13
247.09	.241D+01	.160D+08	.105D+06	.000D+00	.112D+04	.215D+13
260.82	.233D+01	.176D+08	.107D+06	.000D+00	.119D+04	.215D+13
274.55	.224D+01	.191D+08	.110D+06	.000D+00	.126D+04	.215D+13
288.27	.216D+01	.207D+08	.112D+06	.000D+00	.134D+04	.215D+13
302.00	.209D+01	.224D+08	.114D+06	.000D+00	.141D+04	.215D+13
315.73	.201D+01	.240D+08	.116D+06	.000D+00	.149D+04	.215D+13
329.45	.193D+01	.257D+08	.118D+06	.000D+00	.157D+04	.215D+13
343.18	.186D+01	.274D+08	.120D+06	.000D+00	.165D+04	.215D+13
356.91	.179D+01	.291D+08	.122D+06	.000D+00	.684D+03	.824D+13
370.64	.172D+01	.309D+08	.125D+06	.000D+00	.715D+03	.824D+13
384.36	.166D+01	.327D+08	.127D+06	.000D+00	.746D+03	.824D+13
398.09	.159D+01	.345D+08	.129D+06	.000D+00	.777D+03	.824D+13
411.82	.152D+01	.364D+08	.131D+06	.000D+00	.809D+03	.824D+13
425.55	.145D+01	.383D+08	.134D+06	.000D+00	.841D+03	.824D+13
439.27	.139D+01	.402D+08	.135D+06	.000D+00	.874D+03	.824D+13
453.00	.133D+01	.421D+08	.137D+06	.000D+00	.907D+03	.824D+13
466.73	.126D+01	.441D+08	.139D+06	.000D+00	.941D+03	.824D+13
480.45	.120D+01	.461D+08	.141D+06	.000D+00	.975D+03	.824D+13
494.18	.114D+01	.481D+08	.142D+06	.000D+00	.101D+04	.824D+13
507.91	.108D+01	.501D+08	.144D+06	.000D+00	.104D+04	.824D+13
521.64	.102D+01	.522D+08	.145D+06	.000D+00	.108D+04	.824D+13
535.36	.963D+00	.542D+08	.146D+06	.000D+00	.112D+04	.824D+13
549.09	.906D+00	.563D+08	.148D+06	.000D+00	.115D+04	.824D+13
562.82	.851D+00	.584D+08	.149D+06	.000D+00	.119D+04	.824D+13
576.55	.797D+00	.605D+08	.150D+06	.000D+00	.122D+04	.824D+13
590.27	.745D+00	.626D+08	.151D+06	.000D+00	.126D+04	.824D+13
604.00	.694D+00	.647D+08	.151D+06	.000D+00	.130D+04	.824D+13
617.73	.644D+00	.669D+08	.152D+06	.000D+00	.133D+04	.824D+13
631.45	.596D+00	.690D+08	.153D+06	.000D+00	.137D+04	.824D+13
645.18	.550D+00	.711D+08	.153D+06	.000D+00	.141D+04	.824D+13

658.91	.505D+00	.733D+08	.153D+06	.000D+00	.144D+04	.824D+13
672.64	.462D+00	.754D+08	.154D+06	.000D+00	.148D+04	.824D+13
686.36	.420D+00	.776D+08	.154D+06	.000D+00	.152D+04	.824D+13
700.09	.381D+00	.797D+08	.154D+06	-.255D+01	.155D+04	.824D+13
713.82	.343D+00	.819D+08	.151D+06	-.422D+03	.159D+04	.824D+13
727.55	.307D+00	.840D+08	.142D+06	-.886D+03	.163D+04	.824D+13
741.27	.273D+00	.859D+08	.126D+06	-.136D+04	.166D+04	.824D+13
755.00	.241D+00	.875D+08	.104D+06	-.185D+04	.169D+04	.824D+13
768.73	.211D+00	.888D+08	.759D+05	-.231D+04	.171D+04	.824D+13
782.45	.183D+00	.896D+08	.413D+05	-.272D+04	.172D+04	.824D+13
796.18	.157D+00	.900D+08	.144D+04	-.309D+04	.173D+04	.824D+13
809.91	.133D+00	.897D+08	-.429D+05	-.338D+04	.173D+04	.824D+13
823.64	.111D+00	.888D+08	-.907D+05	-.358D+04	.171D+04	.824D+13
837.36	.914D-01	.873D+08	-.141D+06	-.372D+04	.168D+04	.824D+13
851.09	.736D-01	.850D+08	-.192D+06	-.376D+04	.164D+04	.824D+13
864.82	.577D-01	.820D+08	-.243D+06	-.369D+04	.159D+04	.824D+13
878.55	.437D-01	.784D+08	-.293D+06	-.356D+04	.153D+04	.824D+13
892.27	.315D-01	.740D+08	-.338D+06	-.303D+04	.146D+04	.824D+13
906.00	.210D-01	.691D+08	-.374D+06	-.216D+04	.137D+04	.824D+13
919.73	.120D-01	.638D+08	-.398D+06	-.132D+04	.128D+04	.824D+13
933.45	.455D-02	.582D+08	-.411D+06	-.531D+03	.118D+04	.824D+13
947.18	-.161D-02	.525D+08	-.413D+06	.199D+03	.109D+04	.824D+13
960.91	-.656D-02	.469D+08	-.406D+06	.856D+03	.989D+03	.824D+13
974.64	-.104D-01	.414D+08	-.390D+06	.143D+04	.895D+03	.824D+13
988.36	-.134D-01	.362D+08	-.367D+06	.193D+04	.805D+03	.824D+13
1002.09	-.155D-01	.313D+08	-.340D+06	.196D+04	.722D+03	.824D+13
1015.82	-.169D-01	.268D+08	-.314D+06	.185D+04	.645D+03	.824D+13
1029.55	-.177D-01	.227D+08	-.290D+06	.168D+04	.574D+03	.824D+13
1043.27	-.179D-01	.189D+08	-.267D+06	.162D+04	.508D+03	.824D+13
1057.00	-.178D-01	.154D+08	-.245D+06	.166D+04	.448D+03	.824D+13
1070.73	-.172D-01	.122D+08	-.222D+06	.167D+04	.393D+03	.824D+13
1084.45	-.164D-01	.928D+07	-.199D+06	.166D+04	.343D+03	.824D+13
1098.18	-.154D-01	.670D+07	-.176D+06	.163D+04	.299D+03	.824D+13
1111.91	-.142D-01	.444D+07	-.154D+06	.158D+04	.260D+03	.824D+13
1125.64	-.130D-01	.246D+07	-.133D+06	.154D+04	.226D+03	.824D+13
1139.36	-.117D-01	.781D+06	-.112D+06	.153D+04	.197D+03	.824D+13
1153.09	-.103D-01	-.615D+06	-.912D+05	.150D+04	.194D+03	.824D+13
1166.82	-.899D-02	-.173D+07	-.709D+05	.146D+04	.213D+03	.824D+13
1180.55	-.770D-02	-.256D+07	-.513D+05	.140D+04	.228D+03	.824D+13
1194.27	-.647D-02	-.314D+07	-.325D+05	.133D+04	.237D+03	.824D+13
1208.00	-.531D-02	-.346D+07	-.149D+05	.124D+04	.243D+03	.824D+13
1221.73	-.423D-02	-.355D+07	.121D+04	.110D+04	.244D+03	.824D+13
1235.45	-.323D-02	-.343D+07	.147D+05	.865D+03	.242D+03	.824D+13
1249.18	-.231D-02	-.315D+07	.250D+05	.635D+03	.238D+03	.824D+13
1262.91	-.147D-02	-.274D+07	.322D+05	.412D+03	.231D+03	.824D+13
1276.64	-.680D-03	-.226D+07	.364D+05	.196D+03	.222D+03	.824D+13
1290.36	.534D-04	-.175D+07	.376D+05	-.158D+02	.214D+03	.824D+13
1304.09	.747D-03	-.123D+07	.360D+05	-.226D+03	.205D+03	.824D+13
1317.82	.141D-02	-.760D+06	.314D+05	-.436D+03	.197D+03	.824D+13
1331.55	.206D-02	-.370D+06	.240D+05	-.650D+03	.190D+03	.824D+13
1345.27	.270D-02	-.103D+06	.135D+05	-.871D+03	.185D+03	.824D+13
1359.00	.334D-02	.000D+00	.000D+00	-.110D+04	.184D+03	.824D+13

OUTPUT VERIFICATION

THE MAXIMUM MOMENT IMBALANCE FOR ANY ELEMENT = .811D-04 IN-LBS
THE MAX. LATERAL FORCE IMBALANCE FOR ANY ELEMENT = .308D-05 LBS

OUTPUT SUMMARY

PILE-HEAD DEFLECTION = .404D+01 IN
COMPUTED SLOPE AT PILE HEAD = .666D-02
MAXIMUM BENDING MOMENT = .900D+08 LBS-IN

MAXIMUM SHEAR FORCE = -.413D+06 LBS
NO. OF ITERATIONS = 16
NO. OF ZERO DEFLECTION POINTS = 2

S U M M A R Y T A B L E
****

BOUNDARY CONDITION BC1	BOUNDARY CONDITION BC2	AXIAL LOAD LBS	PILE HEAD DEFLECTION IN	MAX. MOMENT IN-LBS	MAX. SHEAR LBS
.2600D+05	-.3384D+07	.1017D+07	.4037D+01	.8997D+08	-.4128D+06

$M_u = 0.8997 \times 10^8$ lbs-in $\div$ 12000 = 7497.50 K-Ft

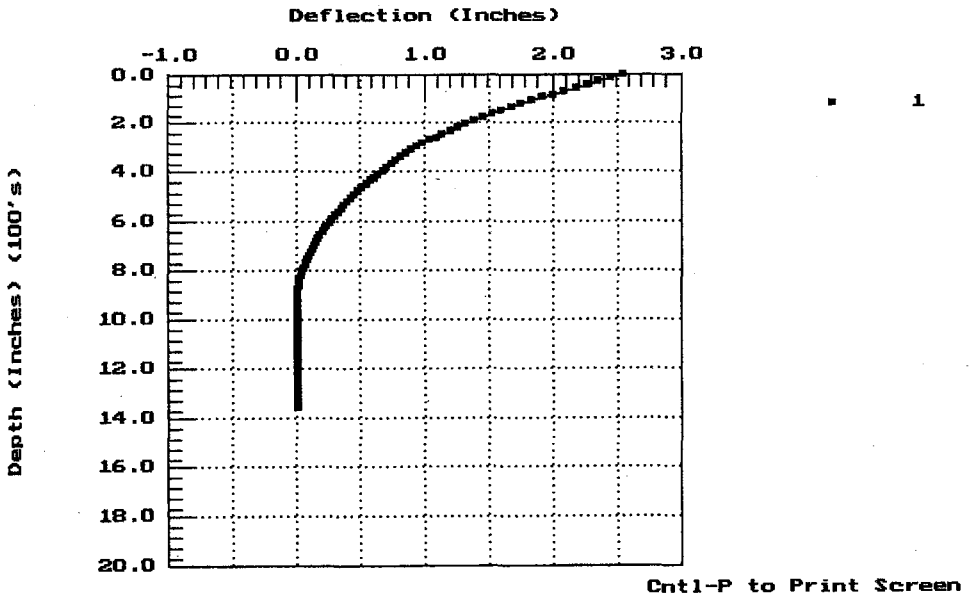
$V_u = 0.4128 \times 10^6$ lbs $\div$ 1000 = 412.80 Kips

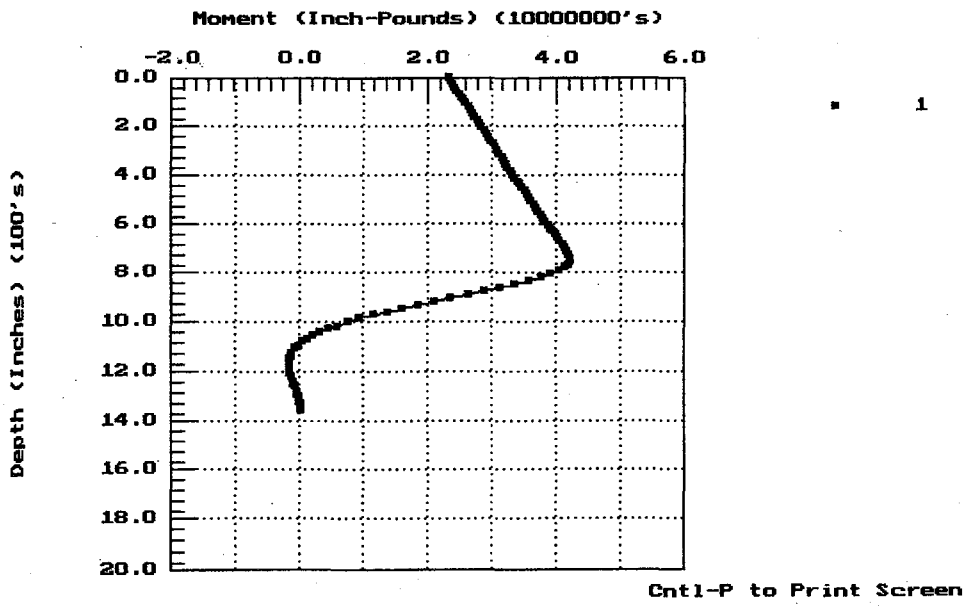
$M_u = \sqrt{(3492.50)^2 + (7407.50)^2} = 8271.04$ K-Ft.

$V_u = \sqrt{(189.4)^2 + (412.8)^2} = 454.18$ Kips.

TY·LIN INTERNATIONAL

Projects: Salt River Bridges- Scour	Job No. 1317.00	Sheet:	of
Item: Seventh Avenue Bridge	Designer: UPD	Date: 10/20/99	
	Checker:	Date:	
Case 3 - Transverse		Grid: 1/10"	





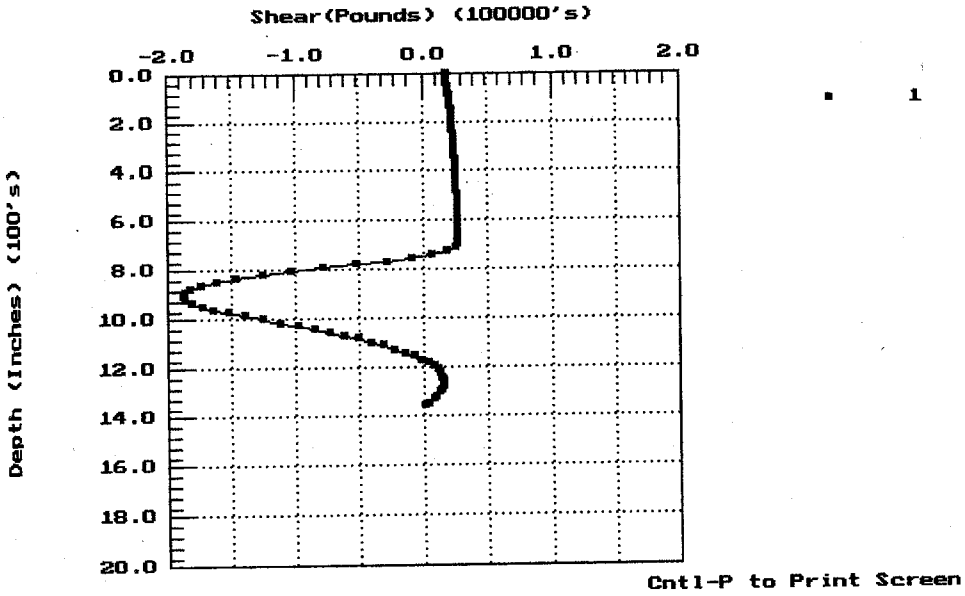
TY·LIN INTERNATIONAL

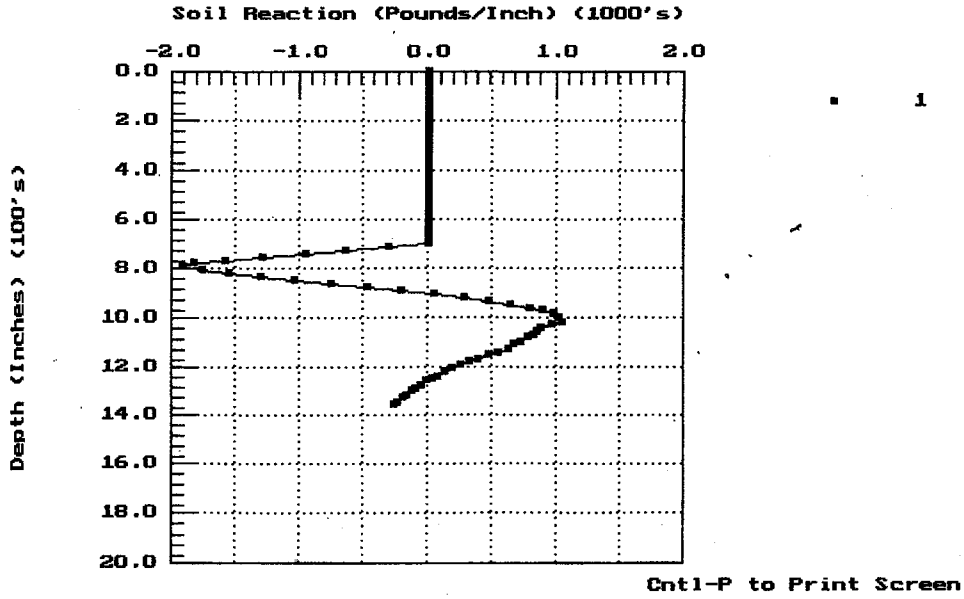
Projects: Salt River Bridges - Scour | Job No. 1317.00 | Sheet: of

Item: Seventh Avenue Bridge | Designer: VPD | Date: 10/20/99

Checker: | Date:

Case 3 - Transverse | Grid: 1/10"





T.Y. LIN INTERNATIONAL

Project:	SALT RIVER BRIDGES-SCOUR	Job No.	1317.00	Sheet:	of
Item:	7TH AVENUE BRIDGE	Designer:	VPD	Date:	Oct-99
	DRILLED SHAFT	Checker:		Date:	

SHEAR REINFORCEMENT:

FOR Vu <= 0.5 phi Vc, NO SHEAR REINFORCEMENT IS REQ'D

FOR 0.5 phi Vc < Vu <= phi Vc, MIN. SHEAR REINFORCEMENT IS REQ'D
MIN. phi Vs = phi 50 b d, MAX SPACING, s <= d/2 <= 24 IN

FOR phi Vc < Vu <= (phi Vc + MIN phi Vs), MIN. SHEAR REINF. IS REQ'D
MIN. phi Vs = phi 50 b d, MAX SPACING, s = d/2 <= 24 IN

FOR (phi Vc + MIN phi Vs) < Vu <= (phi Vc + phi 4 SQRT(f'c) b d),
REQ'D phi Vs = Vu - phi Vc MAX SPAC'G, s = d/2 <= 24 IN
PROV'D phi Vs = phi Av fy d / s

FOR (phi Vc+ phi 4 SQRT(f'c) bd) < Vu <= (phi Vc+ phi 8 SQRT(f'c) b d)
REQ'D phi Vs = Vu - phi Vc MAX SPAC'G, s = d/4 <= 12 IN
PROV'D phi Vs = phi Av fy d / s

7' DRILLED SHAFT

			Vu =	454	KIPS
f'c =	3,500	PSI			
fy =	60,000	PSI	b =	84.00	IN
			VERT BAR PATTERN RADIUS, R =	38.15	IN
phi =	0.85		d = b/2 + 2 * R / PI =	66.29	IN
d/2 =	33.14	IN	d/4 =	16.57	IN
			phi Vc = phi [2 SQRT(f'c) b d] =	560	KIPS
			0.5 phi Vc =	280	KIPS
			MIN phi Vs = phi (50 b d) =	237	KIPS
			MAX phi Vs (FOR s=d/2) = phi [4 SQRT(f'c) b d]=	1,120	KIPS
			MAX phi Vs (FOR s=d/4) = phi [8 SQRT(f'c) b d]=	2,240	KIPS
			REQ'D phi Vs = Vu - phi Vc =	0	KIPS
			USE MIN. phi Vs		
SPIRAL SIZE: NO.	6				
NO. OF BARS =	1.5		Av =	0.66	IN^2
			s = phi Av fy d / phi Vs =	N/A	
			MAX s (FOR MIN Av) = Av fy /(50 b)=	9.43	IN
			PROV'D SPACING, s =	8.00	IN
			PROV'D phi Vs = phi Av fy d / s =	279	KIPS

```
7TH AVENUE BRIDGE PIER-1 DRILLED SHAFT  "P-7DS"
         9
         4
         1        25
         0
         2       1.0       6.0         1     78.00      0.00      0.00
      3500  29000000    0.0030     60000
     84.00      0.00      0.00      0.00
     38.15                                   2.25        25
                                     NO      PILE
 0.99 0.99 0.00 0.00      0.00     84.50    1    1      3.00  AGS    B
      0    8271      0      0      0      0    0      0      0      0
      0       0      0      0      0      0    0      0      0      0
      0    1017      0      0      0      0    0      0      0      0
                     0      0      0                           0
                     0      0      0                           0
                     0      0      0                           0
         0         0        0         0         0         0
         0         0        0         0         0         0
         0         0        0         0         0         0
```

```
*************************************************************************
*                                                                       *
*              PC YIELDED FACE COLUMN DESIGN PROGRAM                    *
*                                                                       *
*                  (C) Copyright, PCLINKS, Inc.                         *
*                       All Rights Reserved.                            *
*                                                                       *
*                  2330 Alhambra Blvd., Suite 140                       *
*                       Sacramento, CA 95817                            *
*                          (916) 456-4336                               *
*                                                                       *
*    Licensed to : T.Y.Lin International (SF)  Serial No. : 1034985     *
*                                                                       *
*                      VER. : 2.04   03/12/91                           *
*                                                                       *
*************************************************************************
1 *******************************************
  YOUR PC YIELD FILE NAME IS : p-7ds
  *******************************************

  |...+....1....+....2....+....3....+....4....+....5....+....6....+....7....+...
.8
  7TH AVENUE BRIDGE PIER-1 DRILLED SHAFT  "P-7DS"
          9
          4
          1        25
          0
          2      1.0       6.0        1     78.00      0.00      0.00
       3500  29000000    0.0030     60000
      84.00      0.00      0.00      0.00
      38.15                                  2.25        25
                                     NO      PILE
   0.99 0.99 0.00 0.00      0.00     84.50    1   1      3.00  AGS    B
       0    8271     0      0      0      0     0     0     0     0
       0       0     0      0      0      0     0     0     0     0
       0    1017     0      0      0      0     0     0     0     0
                     0      0      0                          0
                     0      0      0                          0
                     0      0      0                          0
          0         0        0        0        0        0
```



```
          0         0        0        0        0        0
          0         0        0        0        0        0
1     JOB : 7TH AVENUE BRIDGE PIER-1 DRILLED SHAFT
      PC CONCRETE COLUMN DESIGN PGM --- PCLINKS,Inc.  09:36:00  10/21/99  PAGE 1

      T. Y. Lin  I n t e r n a t i o n a l ,  S a n  F r a n c i s c o ,  C
A

      COLUMN TYPE                    =  9  (CIRCULAR)
      CONCRETE LOOPS                 =  1
      TOTAL NO. OF CONCRETE COORD.   = 40
      STEEL REBAR PATTERN            =  4  (CONCENTRIC LOOPS)
      NUMBER OF STEEL REBAR LOOPS    =  1
      TOTAL NO. OF STEEL REBARS      = 25
      PLOT TYPE                      =  0  (NO PLOT)
      DESIGN TYPE                    =  2  (CHECK)
      PERCENT STEEL LIMITS           =     (1.00 % MIN.  6.00 % MAX.)

      *************
      * BENT DATA *
      *************************************************************************

      NUMBER OF COLUMNS IN BENT                    =     1
      OUT TO OUT DISTANCE (DIAMETER) OF SPIRAL     = 78.00 (INCHES)
      DISTANCE FROM TOP COLUMN PLASTIC HINGE TO
      CENTER OF GRAVITY OF THE SUPERSTRUCTURE      =  0.00 (FEET)
      CENTER TO CENTER SPACING OF COLUMNS          =  0.00 (FEET)

      ******************************
      * MATERIAL PROPERTIES  (PSI) *
      *************************************************************************

      ULTIMATE CONCRETE COMPRESSIVE STRESS - FC =     3500.
      YOUNG S MODULUS FOR CONCRETE         - EC =  3372165.
      YOUNG S MODULUS FOR STEEL BARS       - ES = 29000000.
      ULTIMATE CONCRETE COMPRESSIVE STRAIN - EO =      .003
      YIELDING STRESS FOR STEEL BARS       - FY =    60000.
1     PC CONCRETE COLUMN DESIGN PGM --- PCLINKS,Inc.  09:36:00  10/21/99  PAGE 2

      T. Y. Lin  I n t e r n a t i o n a l ,  S a n  F r a n c i s c o ,  C
A

      CIRCULAR CROSS-SECTION

            HX
         84.00

      CONCRETE COORDINATES  (INCHES)

      COORD       X         Y
```

1	42.00	0.00
2	41.48	6.57
3	39.94	12.98
4	37.42	19.07
5	33.98	24.69
6	29.70	29.70
7	24.69	33.98
8	19.07	37.42
9	12.98	39.94
10	6.57	41.48
11	0.00	42.00
12	-6.57	41.48
13	-12.98	39.94
14	-19.07	37.42
15	-24.69	33.98
16	-29.70	29.70
17	-33.98	24.69
18	-37.42	19.07
19	-39.94	12.98
20	-41.48	6.57
21	-42.00	0.00
22	-41.48	-6.57
23	-39.94	-12.98
24	-37.42	-19.07
25	-33.98	-24.69
26	-29.70	-29.70
27	-24.69	-33.98
28	-19.07	-37.42
29	-12.98	-39.94
30	-6.57	-41.48
31	0.00	-42.00
32	6.57	-41.48
33	12.98	-39.94
34	19.07	-37.42
35	24.69	-33.98
36	29.70	-29.70
37	33.98	-24.69
38	37.42	-19.07
39	39.94	-12.98
40	41.48	-6.57

1 PC CONCRETE COLUMN DESIGN PGM --- PCLINKS,Inc. 09:36:00 10/21/99 PAGE 3

T. Y. Lin International, San Francisco, C
A

CONCENTRIC CIRCLE PATTERN

LOOP	RADIUS	AREA	BARS
1	38.15	2.25	25

STEEL REBAR COORDINATES (INCHES)

COORD	X	Y
1	38.15	0.00
2	36.95	9.49
3	33.43	18.38
4	27.81	26.12
5	20.44	32.21
6	11.79	36.28

7	2.40	38.07
8	-7.15	37.47
9	-16.24	34.52
10	-24.32	29.40
11	-30.86	22.42
12	-35.47	14.04
13	-37.85	4.78
14	-37.85	-4.78
15	-35.47	-14.04
16	-30.86	-22.42
17	-24.32	-29.40
18	-16.24	-34.52
19	-7.15	-37.47
20	2.40	-38.07
21	11.79	-36.28
22	20.44	-32.21
23	27.81	-26.12
24	33.43	-18.38
25	36.95	-9.49

THE MAIN LONGITUDINAL STEEL IS ASSUMED TO BE # 14 BARS.

***WARNING: THE CONCRETE COVER IS GREATER THAN 2 INCHES
IN THE X-DIRECTION

***WARNING: THE CONCRETE COVER IS GREATER THAN 2 INCHES
IN THE Y-DIRECTION

1 PC CONCRETE COLUMN DESIGN PGM --- PCLINKS,Inc. 09:36:00 10/21/99 PAGE 4

T. Y. Lin International, San Francisco, C
A

****
* INITIAL REFERENCE DATA *
****

TOTAL AREA OF THE SECTION	AG =	38.33	FT**2
NOMINAL AXIAL LOAD STRENGTH	PO =	19626.70	KIPS
TOTAL REINFORCEMENT AREA	AST =	56.25	IN**2
PERCENT STEEL	=	1.02	%
GROSS MOMENT OF INERTIA ABOUT Y-AXIS	IYC =	116.89	FT**4
GROSS MOMENT OF INERTIA ABOUT X-AXIS	IXC =	116.89	FT**4
STEEL MOMENT OF INERTIA ABOUT Y-AXIS	IYS =	1.9740	FT**4
STEEL MOMENT OF INERTIA ABOUT X-AXIS	IXS =	1.9740	FT**4

1 PC CONCRETE COLUMN DESIGN PGM --- PCLINKS,Inc. 09:36:00 10/21/99 PAGE 5

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A

****
* COLUMN LOAD DATA (K-FT) *

```
*************************************************************************

LOAD NAME:
FOOTING DATA FILE:  NO
TYPE FOOTING:        PILE


MOMENT DISTRIBUTION FACT            COLUMN     STEEL    LOCATION  DUCTILITY
:---TOP---:---BOTTOM---:  PERCENT  LENGTH     TIE=1      TOP=1     FACTOR
   DAY   DAX   DBY   DBX   IMPACT  (FEET)  SPIRAL=0   BOTTOM=0        (Z)

  0.99  0.99  0.00  0.00     0.00   84.50         1          1       3.00


COLUMN GROUP LOADS - SERVICE (K-FT)

                    :---- LL+IMPACT ---:
                    CASE 1 CASE 2 CASE 3
       DEAD     PRE  TRANS   LONG  AXIAL
       LOAD  STRESS MY-MAX MX-MAX  N-MAX   WIND    WL    LF CF-MY  TEMP

MY        0    8271      0      0      0      0     0     0     0     0
MX        0       0      0      0      0      0     0     0     0     0
P         0    1017      0      0      0      0     0     0     0     0
PMY                      0      0      0                         0
PMX                      0      0      0                         0
P                        0      0      0                         0


COLUMN SEISMIC AND ARBITRARY LOADS (K-FT)

     (ARS) UNREDUCED SEISMIC     ARBITRARY LOADS     ARBITRARY LOADS
           CASE 1    CASE 2   SERVICE   SERVICE  FACTORED  FACTORED
         MAX TRAN  MAX LONG       AL1       AL2       AL1       AL2

MY TRAN        0.        0.        0.        0.        0.        0.
MX LONG        0.        0.        0.        0.        0.        0.
P AXIAL        0.        0.        0.        0.        0.        0.
```



```
*****************************************************
* FACTORED LOADS FOR COLUMN DESIGN CHECK  (KIP-FT) *
*************************************************************************

APPLIED FACTORED MOMENTS ARE MAGNIFIED FOR SLENDERNESS IN ACCORDANCE WITH

CALTRANS BRIDGE DESIGN SPECIFICATIONS. (ART 8.16.5)

LENGTH =  84.50 FT    FC  =   3.50 KSI      FY  = 60.00 KSI
STEEL  =   1.02 %     AST =  56.25 SQ IN

             :------ APPLIED FACTORED ------: CAPACITY
GROUP CASE  TRANS     LONG     COMB    AXIAL (PHI*MN)  PHI RATIO
             MY       MX        M        P       MU        MU/M

  IH    1   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  IH    2   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
```



```
  IH    3  10019.     290.   10024.    1017.    9938. 0.83 0.99 NG**
  IP    1   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  IP    2   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  IP    3  10019.     290.   10024.    1017.    9938. 0.83 0.99 NG**
  II        9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  III   1   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  III   2   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  III   3  10019.     290.   10024.    1017.    9938. 0.83 0.99 NG**
  IV    1   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  IV    2   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  IV    3  10019.     290.   10024.    1017.    9938. 0.83 0.99 NG**
  V         9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  VI    1   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  VI    2   9993.     290.    9997.    1017.    9938. 0.83 0.99 NG**
  VI    3  10019.     290.   10024.    1017.    9938. 0.83 0.99 NG**
  VII   1   8271.     264.    8275.    1017.   12173. 1.06 1.47 OK
  VII   2   8271.     264.    8275.    1017.   12173. 1.06 1.47 OK

NOTE: THE AXIAL (ARS) UNREDUCED SEISMIC LOADS (P) ARE NOT DIVIDED
BY THE DUCTILITY FACTOR Z
```



```
*************************************************
* MOMENT MAGNIFICATION AND BUCKLING CALCULATIONS *
*************************************************************************

REFERENCE: "CALTRANS BRIDGE DESIGN SPECIFICATIONS" (ART 8.16.5)
          (COLUMN ASSUMED TO BE UNBRACED AGAINST SIDESWAY.)

MAGY   = MOMENT MAGNIFACTION FACTOR ABOUT Y-AXIS
MAGX   = MOMENT MAGNIFACTION FACTOR ABOUT X-AXIS

PCY    = CRITICAL BUCKLING LOAD ABOUT Y-AXIS
PCX    = CRITICAL BUCKLING LOAD ABOUT X-AXIS

KY     = EFFECTIVE LENGTH FACTOR ABOUT Y-AXIS =  2.10
KX     = EFFECTIVE LENGTH FACTOR ABOUT X-AXIS =  2.10

KY*L/R = SLENDERNESS RATIO ABOUT Y-AXIS       =102.
KX*L/R = SLENDERNESS RATIO ABOUT X-AXIS       =102.

IYS    = STEEL MOMENT OF INERTIA ABOUT Y-AXIS =1.9740 FT**4
IXS    = STEEL MOMENT OF INERTIA ABOUT X-AXIS =1.9740 FT**4

            MOMENT              CRACKED              CRITICAL
       :-MAGNIFICATION-:--TRANSFORMED SECTION--:-----BUCKLING----:  AXIAL
GR  CA  TRAN  LONG  COMB        E*IY        E*IX     TRAN     LONG  LOAD
         MAGY  MAGX   MAG                             PCY      PCX     P
IH  1  1.208 1.096 1.208   18830126.   37189524.    5902.   11657.  1017.

IH  2  1.208 1.096 1.208   18830126.   37189524.    5902.   11657.  1017.

IH  3  1.211 1.096 1.211   18594749.   37189524.    5828.   11657.  1017.

IP  1  1.208 1.096 1.208   18830126.   37189524.    5902.   11657.  1017.

IP  2  1.208 1.096 1.208   18830126.   37189524.    5902.   11657.  1017.
```

IP	3	1.211	1.096	1.211	18594749.	37189524.	5828.	11657.	1017.
II		1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
III	1	1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
III	2	1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
III	3	1.211	1.096	1.211	18594749.	37189524.	5828.	11657.	1017.
IV	1	1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
IV	2	1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
IV	3	1.211	1.096	1.211	18594749.	37189524.	5828.	11657.	1017.
V		1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
VI	1	1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
VI	2	1.208	1.096	1.208	18830126.	37189524.	5902.	11657.	1017.
VI	3	1.211	1.096	1.211	18594749.	37189524.	5828.	11657.	1017.
VII	1	1.000	1.000	1.000	18594749.	37189524.	5828.	11657.	1017.
VII	2	1.000	1.000	1.000	18594749.	37189524.	5828.	11657.	1017.

*** WARNING KL/R = 102. ABOUT THE X-AXIS IS GREATER THAN 100.
REDESIGN THE COLUMN WITH A LARGER CROSS-SECTION OR
PERFORM A SPECIAL SECOND ORDER ANALYSIS AS DEFINED
IN ART 8.16.5.1.1 OF AASHTO.

*** WARNING KL/R = 102. ABOUT THE Y-AXIS IS GREATER THAN 100.
REDESIGN THE COLUMN WITH A LARGER CROSS-SECTION OR
PERFORM A SPECIAL SECOND ORDER ANALYSIS AS DEFINED
IN ART 8.16.5.1.1 OF AASHTO.

1 PC CONCRETE COLUMN DESIGN PGM --- PCLINKS,Inc. 09:36:00 10/21/99 PAGE 8

T. Y. Lin International, San Francisco, C
A

COLUMN SERVICE LOADS (K-FT) AND MAXIMUM WORKING STRESSES (PSI)

YOUNG S MODULUS FOR CONCRETE - EC = 3372165. PSI
MODULAR RATIO (ES/EC) - N = 8.6

		:---- SERVICE LOADS (K-FT) ----:---- MAX STRESS (PSI) ----:						
		TRANS	LONG	COMB	AXIAL	CONC	STEEL	STEEL
GP	CASE	MY	MX	M	P	COMP	TEN	COMP
IH	1	8271.	0.	8271.	1017.	3114.	53559.	22906.
IH	2	8271.	0.	8271.	1017.	3114.	53559.	22906.
IH	3	8271.	0.	8271.	1017.	3114.	53559.	22906.
II		6617.	0.	6617.	814.	2491.	42847.	18324.
III	1	6617.	0.	6617.	814.	2491.	42847.	18324.
III	2	6617.	0.	6617.	814.	2491.	42847.	18324.
III	3	6617.	0.	6617.	814.	2491.	42847.	18324.
IV	1	6617.	0.	6617.	814.	2491.	42847.	18324.
IV	2	6617.	0.	6617.	814.	2491.	42847.	18324.

IV	3	6617.	0.	6617.	814.	2491.	42847.	18324.
V		5908.	0.	5908.	726.	2224.	38257.	16361.
VI	1	5908.	0.	5908.	726.	2224.	38257.	16361.
VI	2	5908.	0.	5908.	726.	2224.	38257.	16361.
VI	3	5908.	0.	5908.	726.	2224.	38257.	16361.
DL		8271.	0.	8271.	1017.	3114.	53559.	22906.

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T. Y. Lin International, San Francisco, C
A

****
* PROBABLE PLASTIC MOMENT (1.3 X NOMINAL MOMENT) (KIP-FT) *
****

CODE (8.16.4.4) AND MEMO TO DESIGNERS 15-10

FC = 3.50 KSI FY = 60.00 KSI
EO = 0.0030 IN/IN AST = 56.25 SQ IN

ANGLE	TRANS MPY	LONG MPX	COMB MP	AXIAL P	P-BALANCE (APPROX)
90.0	20165.	-4.	20165.	11775.	7358
	22157.	-2.	22157.	9812.	
	23318.	0.	23318.	7850.	
	22865.	3.	22865.	5890.	
	20829.	5.	20829.	3927.	
	17349.	6.	17349.	1964.	
	12306.	17.	12306.	2.	
	12306.	17.	12306.	2.	
	9191.	6.	9191.	-980.	
	5677.	3.	5677.	-1962.	

** NOTE: THE AXIAL DEAD LOAD EQUALS ZERO. THEREFORE,
NO PLASTIC HINGING ANALYSIS IS PERFORMED.

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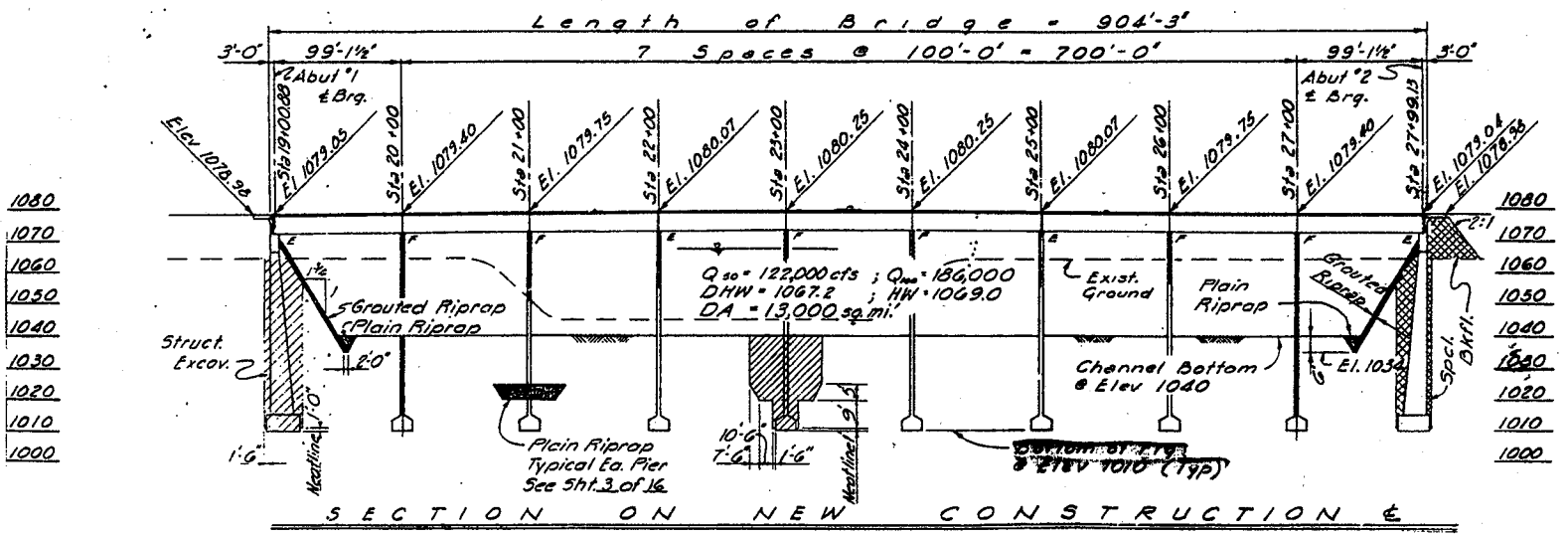
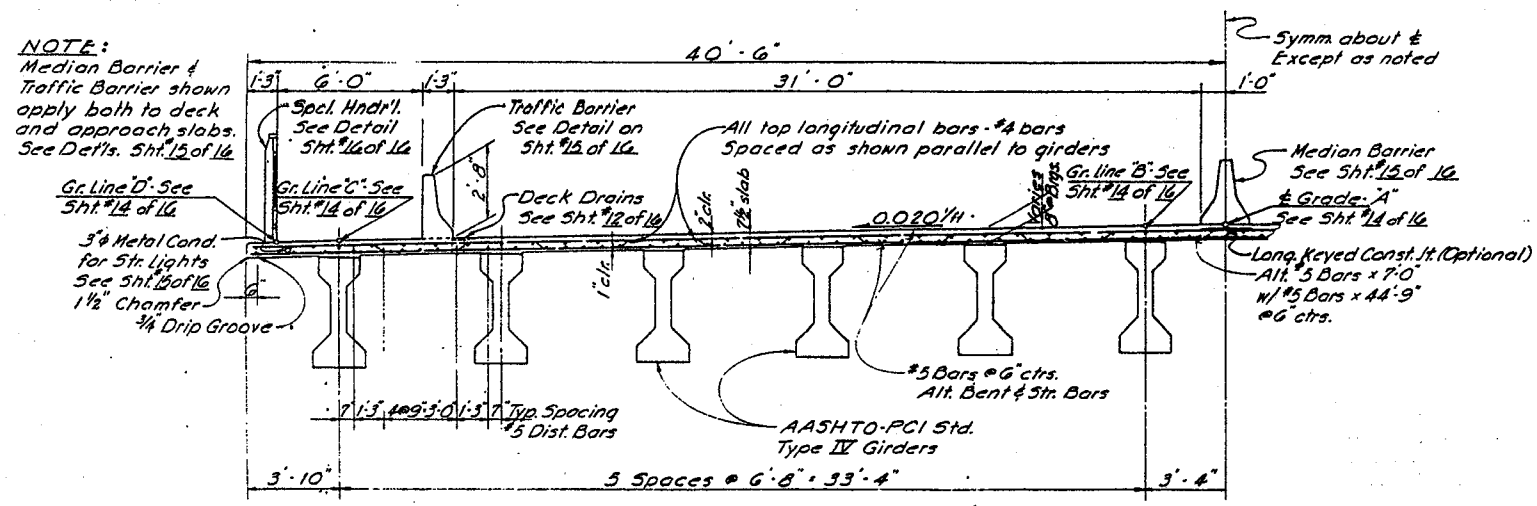




TYPICAL DECK SECTION

FYLIN INTERNATIONAL

Project: Salt River Bridges - Scour

Item: South Central Avenue

Job No. 1317.00

Designer: VPD

Date: 9/15/99

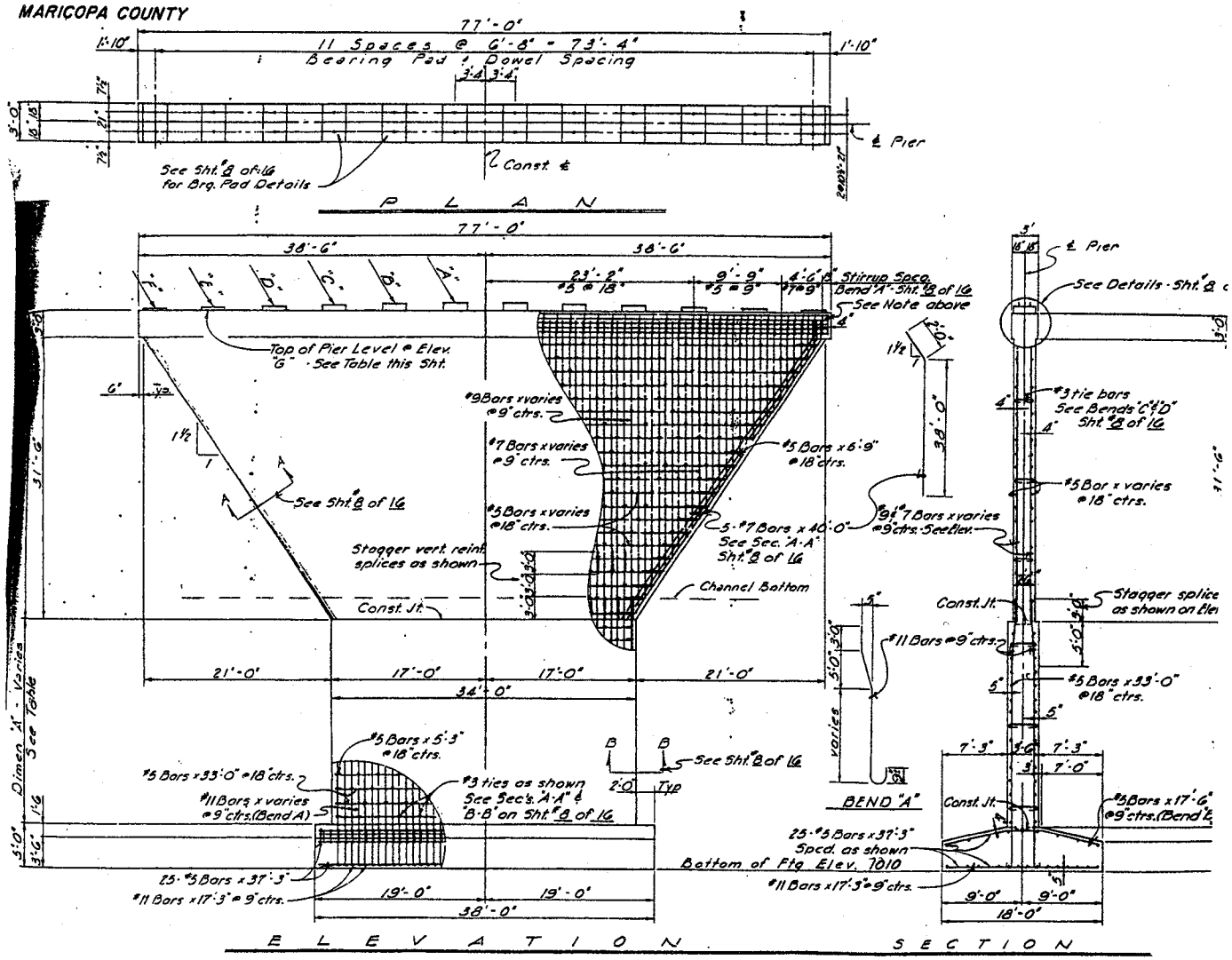
Sheet: of

Checker:

Date:

Grid: 1/8"

SOUTH CENTRAL AVENUE — PHOENIX
BRIDGE OVER SALT RIVER
MARICOPA COUNTY



Project: Salt River Bridges - Scour
Item: South Central Avenue
Designer: VPD
Checker:
Date:
Grid: 1/8"
Job No. 1317.00
Date: 2/15/99
Sheet: of

PYLON INTERNATIONAL

TYLIN INTERNATIONAL

Projects: Salt River Bridges - Scour | Job No. 13170.00 | Sheet: of
Item: South Central Avenue | Designer: VPD | Date: 9/15/99
Checker: | Date:
Grid: 1/8"

- DESIGN CONDITIONS

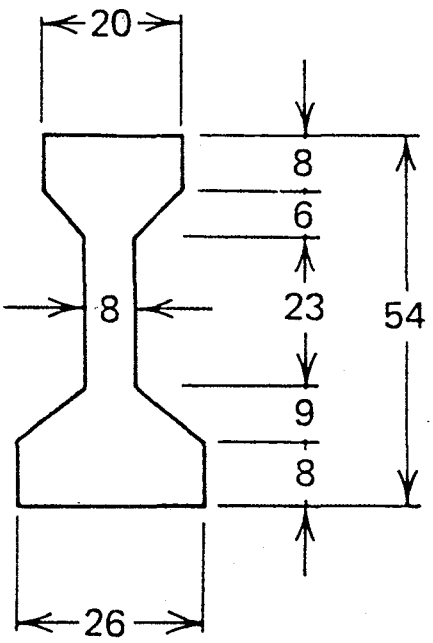
- 3 - THREE SPAN UNITS OF 100 ft x 81'-0" WIDTH
- HS20 LIVE LOAD - 4 LANES
- 12 AASHTO - PCI Std. TYPE IV GIRDERS
- ALLOW FOR 25 PSF FUTURE WEARING SURFACE

- MATERIALS

- CONCRETE : NORMAL WEIGHT
  CLASS "A", $f'c = 2{,}500$ PSI - BARRIERS AND APPROACH SLAB
  CLASS "D", $f'c = 3{,}000$ PSI - DECK SLAB, DIAPHRAGMS, ABUTMENTS & PIERS
  $f_c = 1200$ PSI
  CLASS "S", $f'c = 5250$ PSI - PRECAST AASHTO TYPE IV GIRDERS
  $f'ci = 4150$ PSI

- REINFORCEMENT
  ALL REINFORCING BARS ARE A615 DEFORM BILLET STEEL GRADE 40 OR 60
  F_y MIN = 40,000 psi or 60,000 psi
  $f_s = 20{,}000$ psi or 24,000 psi
  $f_s = 20{,}000$ psi - DECK AND DIAPHRAGMS ONLY.

- GIRDER SELECTION



SECTION PROPERTIES

$A_c = 789 \text{ in}^2$
$I = 260{,}741 \text{ in}^4$
$y_b = 24.73 \text{ in}$
$S_b = 10543.510 \text{ in}^3$
$S_t = 8908.131 \text{ in}^3$
$w_o = 822$ plf

TYLIN INTERNATIONAL

Projects: Salt River Bridges - Scour | Job No. 1317.00 | Sheet: of
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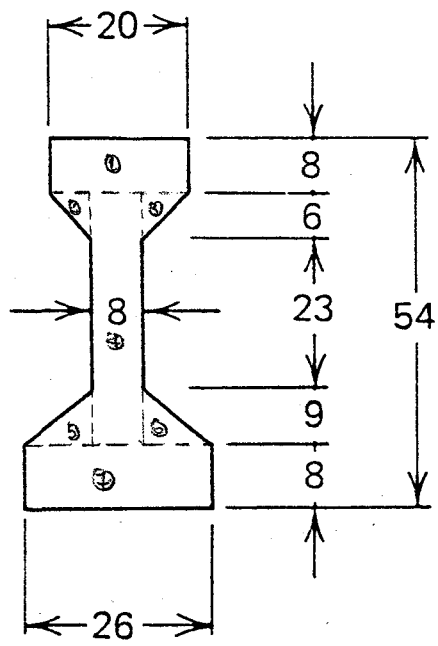
I_{yy}



SECTION	AREA (Ft^2)	X bot (Ft)	Area * X bot (Ft^3)	Area $(\bar{X}-X_{bot})^2$ (Ft^4)	I_o (Ft^4)
1	1.111	1.083	1.2037	0.00	0.2572
2	0.125	0.91667	0.11458	0.00344	0.00174
3	0.125	1.250	0.15625	0.00349	0.00174
4	2.111	1.083	2.28704	0.00	0.07819
5	0.28125	0.833	0.23438	0.01758	0.00879
6	0.28125	1.333	0.3750	0.01758	0.00879
7	1.444	1.083	1.56481	0.00	0.56507
	Σ 5.4785		Σ 5.93576	Σ 0.04209	Σ 0.92151

$$\bar{X} = \frac{\Sigma \text{ Area} * X \text{ bot}}{\Sigma \text{ Area}} = \frac{5.93576}{5.4785} = 1.083 \text{ Ft}$$

$$I_{yy} = 0.04209 + 0.92151 = 0.9636 \text{ Ft}^4$$

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Concrete Properties

F'c (slab):	3000	PSI
F'c (girder):	5250	PSI
No.Girders:	12	

Left Outside distance:	3.833	ft
Girder Spacing:	6.667	ft
Right outside distance:	3.833	ft

Girder Properties:

Area:	5.479	ft^2
Yb:	2.061	ft^2
Yt:	2.439	ft^2
H:	4.500	ft^2
Ix:	12.574	ft^4
St:	5.155	ft^3
Sb:	6.102	ft^3

Section Properties for Superstructure:

Area:	117.208	ft^2
Ycb:	3.285	ft^2
Yct:	1.882	ft^2
Hc:	5.167	ft^2
Izz:	346	ft^4
Iyy:	56092	ft^4
Ixx:	37.475	ft^4

Izz

	Location	X ft	Width ft	Thickness ft	E ksf	Area ft^2	y ft	Area*y ft^3	A(y-ycb)^2 ft^4	I ft^4	E(I+Ay^2) ksf-ft^4
0.0 L	SLAB	0.000	81.000	0.625	449571	50.63	4.85	245.74	124.68	1.65	56793471
	HAUNCH		1.667	0.042	449571	0.83	4.52	3.77	1.27	0.00	572398
	G1				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G2				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G3				594726	5.48	2.06	11.29	8.21	12.57	12360201
Girders	G4				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G5				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G6				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G7				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G8				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G9				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G10				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G11				594726	5.48	2.06	11.29	8.21	12.57	12360201
	G12				594726	5.48	2.06	11.29	8.21	12.57	12360201
					Sum:	117.21		385.01			205688279
							ycb=	3.28 ft			

Iyy

	Location	X ft	Width ft	Thickness ft	E ksf	Area ft^2	y ft	Area*y ft^3	A(y-ycb)^2 ft^4	I ft^4	E(I+Ay^2) ksf-ft^4
0.0 L	SLAB	0.000	0.625	81.000	449571	50.63	40.50	2050.31	0.00	27679.22	12443765062
	HAUNCH		0.042	1.667	449571	0.83	40.50	33.75	441.36	0.193	198508348
	G1	36.667			594726	5.48	3.83	21.00	7366.44	0.964	4381584359
	G2	30.000			594726	5.48	10.50	57.53	4931.25	0.964	2933316167
	G3	23.333			594726	5.48	17.17	94.06	2983.10	0.964	1774701613
Girders	G4	16.667			594726	5.48	23.83	130.59	1521.99	0.964	905740698
	G5	10.000			594726	5.48	30.50	167.11	547.92	0.964	326433421
	G6	3.333			594726	5.48	37.17	203.64	60.88	0.964	36779783
	G7	3.333			594726	5.48	43.83	240.17	60.88	0.964	36779783
	G8	23.333			594726	5.48	50.50	276.70	547.92	0.964	326433421
	G9	30.000			594726	5.48	57.17	313.23	1521.99	0.964	905740698
	G10	23.333			594726	5.48	63.83	349.75	2983.10	0.964	1774701613
	G11	16.667			594726	5.48	70.50	386.28	4931.25	0.964	2933316167
	G12	36.667			594726	5.48	77.17	422.81	7366.44	0.964	4381584359
					Sum:	117.21		4746.94			33359385493
							ycb=	40.50 ft			

Ixx

	Location	Width ft	Thickness ft	E ksf	E*W*T^3 ksf-ft^4
0.0 L	SLAB	81.000	0.625	449571	8890436
	HAUNCH	1.667	0.042	449571	650
Girders	G1 to G12	4.500	1.218	594726	57971795
				Sum:	66862882
					3

SLAB HAUNCH GIRDERS

$$EI=\frac{(E*W1*T1^3+E*No.\ Girders*W2*T2^3+E*No.\ Girders*W3*T3^3)}{3}$$

EI= 22287627

Ixx= 37.475 ft^4

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SECTION PROPERTIES

HAUNCH PROPERTIES

Location	X ft	Width ft	Thickness ft	E ksf	Area ft^2	y ft	Area*y ft^3	A(y-ycb)^2 ft^4	I ft^4	E(I+Ay^2) ft^4
G1	36.667	0.042	1.667	449571	0.069	3.83	0.27	93.36	0.016	41981032
G2	30.000	0.042	1.667	449571	0.069	10.50	0.73	62.50	0.016	28105394
G3	23.333	0.042	1.667	449571	0.069	17.17	1.19	37.81	0.016	17004884
G4	16.667	0.042	1.667	449571	0.069	23.83	1.66	19.29	0.016	8679501
G5	10.000	0.042	1.667	449571	0.069	30.50	2.12	6.94	0.016	3129245
G6	3.333	0.042	1.667	449571	0.069	37.17	2.58	0.77	0.016	354118
G7	3.333	0.042	1.667	449571	0.069	43.83	3.04	0.77	0.016	354118
G8	23.333	0.042	1.667	449571	0.069	50.50	3.51	6.94	0.016	3129245
G9	30.000	0.042	1.667	449571	0.069	57.17	3.97	19.29	0.016	8679501
G10	23.333	0.042	1.667	449571	0.069	63.83	4.43	37.81	0.016	17004884
G11	16.667	0.042	1.667	449571	0.069	70.50	4.90	62.50	0.016	28105394
G12	36.667	0.042	1.667	449571	0.069	77.17	5.36	93.36	0.016	41981032
					0.833		33.75	441	0.193	198508348
						ycb=	40.500	ft		

ADDITIONAL DEAD LOAD ADDED

DIAPHRAGMS

Location	Total Load kips
ABUT 1	26.22
PIER 1	68.72
PIER 2	68.72
PIER 3	75.45
PIER 4	68.72
PIER 5	68.72
PIER 6	75.45
PIER 7	68.72
PIER 8	68.72
ABUT 2	26.22

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WALL COLUMN X-SECTION PROPERTIES

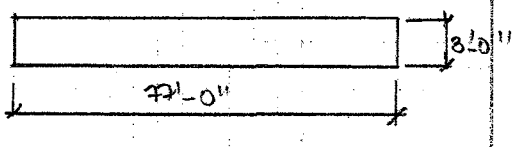
(2) AREA = 77.00' * 3.00' = 231 Ft²

$I_x = \frac{1}{12} * 77.00' * (3.00')^3 = 173.25$ Ft⁴

$I_y = \frac{1}{12} * 3.00' * (77.00')^3 = 114133.25$ Ft⁴

$J = 0.333 * 77.00 * (3.00)^3 = 692.307$ Ft⁴

$w = 231$ Ft² * 0.150 kcf = 34.65 K/Ft



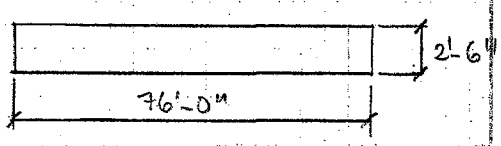
(3) AREA = 76.00' * 2.50' = 190 Ft²

$I_x = \frac{1}{12} * 76.00' * (2.50')^3 = 98.96$ Ft⁴

$I_y = \frac{1}{12} * 2.50' * (76.00')^3 = 91453.33$ Ft⁴

$J = 0.333 * 76.00' * (2.50')^3 = 395.438$ Ft⁴

$w = 190$ Ft² * 0.150 kcf = 28.50 K/Ft



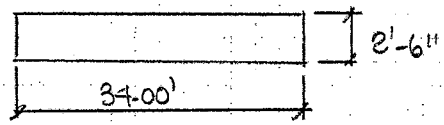
(6) AREA = 34.00' * 2.50' = 85.0 Ft²

$I_x = \frac{1}{12} * 34.00 * (2.50)^3 = 44.27$ Ft⁴

$I_y = \frac{1}{12} * 2.50 * (34.00)^3 = 8188.33$ Ft⁴

$J = 0.333 * 34.00 * (2.50)^3 = 176.906$ Ft⁴

$w = 85$ Ft² * 0.150 kcf = 12.75 K/Ft



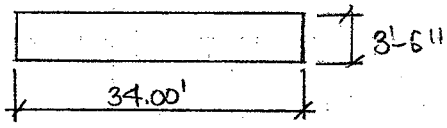
(7) AREA = 34.00' * 3.50' = 119.00 Ft²

$I_x = \frac{1}{12} * 34.00 * (3.50)^3 = 121.48$ Ft⁴

$I_y = \frac{1}{12} * 3.50 * (34.00)^3 = 11463.67$ Ft⁴

$J = 0.333 * 34.00 * (3.50)^3 = 485.431$ Ft⁴

$w = 119$ Ft² * 0.150 kcf = 17.85 K/Ft



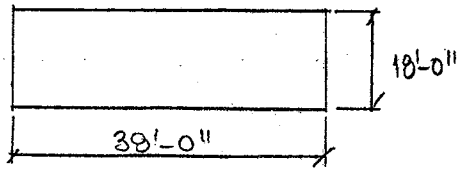
(9) AREA = 38.00' * 18.00' = 684 Ft²

$I_x = \frac{1}{12} * 38.00' * (18.00)^3 = 18468$ Ft⁴

$I_y = \frac{1}{12} * 18.00' * (38.00)^3 = 82308$ Ft⁴

$J = 0.333 * 38.00' * (18.00)^3 = 73798.128$ Ft⁴

$w = 684.0$ Ft² * 0.150 kcf = 102.60 K/Ft



TYLIN INTERNATIONAL

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COORDINATES & SECTION PROPERTIES

Description	Location	Joint No.	X ft	Y ft	Z ft	Area ft^2	Iz ft^4	Iy ft^4	Ix ft^4
ABUT 1	0.00 L	101	0.00	0.00	1078.37	117.208	345.854	56092	37.475
	0.25 L	102	25.00	0.00	1078.37	117.208	345.854	56092	37.475
	0.50 L	103	50.00	0.00	1078.37	117.208	345.854	56092	37.475
	0.75 L	104	75.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 1	1.00 L	105	100.00	0.00	1078.37	117.208	345.854	56092	37.475
	1.25 L	106	125.00	0.00	1078.37	117.208	345.854	56092	37.475
	1.50 L	107	150.00	0.00	1078.37	117.208	345.854	56092	37.475
	1.75 L	108	175.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 2	2.00 L	109	200.00	0.00	1078.37	117.208	345.854	56092	37.475
	2.25 L	110	225.00	0.00	1078.37	117.208	345.854	56092	37.475
	2.50 L	111	250.00	0.00	1078.37	117.208	345.854	56092	37.475
	2.75 L	112	275.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 3	3.00 L	113	300.00	0.00	1078.37	117.208	345.854	56092	37.475
	3.25 L	114	325.00	0.00	1078.37	117.208	345.854	56092	37.475
	3.50 L	115	350.00	0.00	1078.37	117.208	345.854	56092	37.475
	3.75 L	116	375.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 4	4.00 L	117	400.00	0.00	1078.37	117.208	345.854	56092	37.475
	4.25 L	118	425.00	0.00	1078.37	117.208	345.854	56092	37.475
	4.50 L	119	450.00	0.00	1078.37	117.208	345.854	56092	37.475
	4.75 L	120	475.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 5	5.00 L	121	500.00	0.00	1078.37	117.208	345.854	56092	37.475
	5.25 L	122	525.00	0.00	1078.37	117.208	345.854	56092	37.475
	5.50 L	123	550.00	0.00	1078.37	117.208	345.854	56092	37.475
	5.75 L	124	575.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 6	6.00 L	125	600.00	0.00	1078.37	117.208	345.854	56092	37.475
	6.25 L	126	625.00	0.00	1078.37	117.208	345.854	56092	37.475
	6.50 L	127	650.00	0.00	1078.37	117.208	345.854	56092	37.475
	6.75 L	128	675.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 7	7.00 L	129	700.00	0.00	1078.37	117.208	345.854	56092	37.475
	7.25 L	130	725.00	0.00	1078.37	117.208	345.854	56092	37.475
	7.50 L	131	750.00	0.00	1078.37	117.208	345.854	56092	37.475
	7.75 L	132	775.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 8	8.00 L	133	800.00	0.00	1078.37	117.208	345.854	56092	37.475
	8.25 L	134	825.00	0.00	1078.37	117.208	345.854	56092	37.475
	8.50 L	135	850.00	0.00	1078.37	117.208	345.854	56092	37.475
	8.75 L	136	875.00	0.00	1078.37	117.208	345.854	56092	37.475
ABUT 2	9.00 L	137	900.00	0.00	1078.37	117.208	345.854	56092	37.475
PIER 4	Top/Pier	401	400.00	0.00	1073.91	231.000	173.250	114133	692.307
	Top/Column	402	400.00	0.00	1070.91	190.000	98.960	91453	395.438
	HWL	403	400.00	0.00	1063.08	163.892	85.361	70749	341.100
	Blocked Col	404	400.00	0.00	1051.08	123.879	64.520	39019	257.823
	Const Jt	405	400.00	0.00	1039.42	85.000	44.270	8188	176.906
	Groundline	406	400.00	0.00	1025.84	119.000	121.480	11464	485.431
	Top/Footing	407	400.00	0.00	1015.00	119.000	121.480	11464	485.431
	Footing	408	400.00	0.00	1013.50	684.000	18468.0	82380	73798.1
	Bot/Footing	409	400.00	0.00	1010.00	684.000	18468.0	82380	73798.1
PIER 5	Top/Pier	501	600.00	0.00	1073.91	231.000	173.250	114133	692.307
	Top/Column	502	600.00	0.00	1070.91	190.000	98.960	91453	395.438
	HWL	503	600.00	0.00	1060.00	153.622	80.012	62605	319.726
	Blocked Col	504	600.00	0.00	1051.08	123.879	64.520	39019	257.823
	Const Jt	505	600.00	0.00	1039.42	85.000	44.270	8188	176.906
	Groundline	506	600.00	0.00	1025.84	119.000	121.480	11464	485.431
	Top/Footing	507	600.00	0.00	1015.00	119.000	121.480	11464	485.431
	Footing	508	600.00	0.00	1013.50	684.000	18468.0	82380	73798.1
	Bot/Footing	509	600.00	0.00	1010.00	684.000	18468.0	82380	73798.1

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- DESIGN LOADS - Per GIRDER

- GALVANIZED METAL HANDRAIL ≅ 50 lbs/ft * 2 ÷ 1000 ÷ 12 girders = 0.00833 Klf
- CONCRETE BARRIER = 0.372 K/Ft * 2 ÷ 12 girders = 0.0620 Klf
- CONCRETE MEDIAN = 0.477 K/Ft ÷ 12 girders = 0.03976 Klf
- SLAB = 81.00 Ft * $\frac{7.5}{12}$ in * 0.150 Kcf ÷ 12 girders = 0.63281 Klf
- FWS = 31.0 Ft * 2 * 25 psf ÷ 1000 ÷ 12 girders = 0.12917 Klf
- GIRDER = 0.822 Klf
- BUILDUP = $\frac{0.5}{12}$ in * $\frac{20}{12}$ in * 0.150 Kcf = 0.01042 Klf

≅ 1.70449 Klf

- ADDITIONAL DEAD LOADS

- PIER DIAPHRAGM

FIXED PIER = [1.833 Ft * [11 * 6.667 Ft * 3.833 Ft] + (4.0347 Ft² * 1.833 Ft) − (12 * 2 * 4.0347 Ft² * 0.667 Ft)] * 0.150 Kcf = 68.717 Kips

5.479 Ft² − 1.444 Ft²

EXPANSION PIER = [0.667 Ft * [11 * 6.667 Ft * 3.833 Ft] + (4.0347 Ft² * 0.667 Ft) − (12 * 4.0347 Ft² * 0.667 Ft)] * 0.150 Kcf = 37.725 Kips

- ABUTMENT DIAPHRAGM

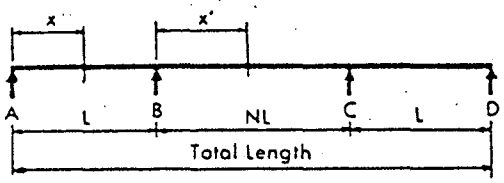
EXPANSION ABUTMENT = [0.667 Ft * 81.00 Ft * 3.833 Ft] − [12 * 4.0347 Ft² * 0.667 Ft]
= 174.792 Ft³ * 0.150 Kcf = 26.219 Kips

- INT. DIAPHRAGM = [0.667 Ft * (6.667 * 3.833 Ft) − (4.0347 Ft² * 0.667)] * 11
= 157.892 Ft³ * 0.150 Kcf = 23.684 Kips

TABLE 3.0

Symmetrical three-span continuous beam.
Constant moment of inertia.
AASHO HS20-44 loading.

N=1.0



Total Length Ft.	Exter. Span Length "L"	Max. Reaction Kips.		Max. Shear Kips.		Max. Moment Kip.-ft.			Impact Coefficient				Dist.-Ft.	
		at A	at B	in AB at B	in BC at B or C	in AB at X	at B	in BC at X'	I	II	III	IV	X	X'
90	30.0	46.2	62.3	-53.0	49.6	228.1	-184.4	179.6	.300	.300	.300	.270	10.6	14.0
105	35.0	49.3	64.7	-56.5	53.1	286.6	-219.5	231.6	.300	.300	.300	.256	12.6	16.0
120	40.0	51.8	66.4	-59.0	55.7	352.4	-254.2	285.9	.300	.300	.300	.244	16.0	18.5
135	45.0	53.9	67.5	-60.8	57.8	422.2	-299.2	342.1	.294	.294	.294	.233	18.0	21.0
150	50.0	55.5	68.4	-62.3	59.4	492.8	-351.1	399.7	.286	.286	.286	.222	20.1	23.5
165	55.0	56.9	69.1	-63.4	60.8	564.0	-406.8	458.2	.278	.278	.278	.213	22.2	26.0
180	60.0	58.1	72.1	-64.3	61.9	635.7	-466.2	517.5	.270	.270	.270	.204	24.2	28.5
195	65.0	59.2	75.9	-65.1	62.8	707.6	-529.3	577.3	.263	.263	.263	.196	26.3	31.0
210	70.0	60.0	79.8	-65.7	63.6	779.9	-596.1	637.6	.256	.256	.256	.189	28.4	33.5
225	75.0	60.8	83.6	-66.2	64.2	852.3	-666.7	698.2	.250	.250	.250	.182	30.5	36.0
240	80.0	61.5	87.4	-66.6	64.8	924.9	-741.0	759.2	.244	.244	.244	.175	32.6	38.5
255	85.0	62.1	91.3	-67.0	66.3	997.6	-819.1	820.3	.238	.238	.238	.169	34.8	41.0
270	90.0	62.6	95.1	-67.4	65.7	1070.5	-900.9	881.7	.233	.233	.233	.164	36.9	43.5
285	95.0	63.1	99.0	-67.7	66.1	1143.4	-986.4	943.2	.227	.227	.227	.159	39.0	46.0
300	100.0	63.6	102.8	-67.9	66.4	1216.5	-1075.6	1004.9	.222	.222	.222	.154	41.1	48.5
315	105.0	64.0	106.6	-68.2	66.7	1289.6	-1168.6	1066.8	.217	.217	.217	.149	43.3	51.0
330	110.0	64.3	110.5	-69.4	67.1	1362.7	-1265.3	1128.7	.213	.213	.213	.145	45.4	53.5
345	115.0	64.6	114.3	-71.4	68.9	1436.0	-1365.8	1190.7	.208	.208	.208	.141	47.5	56.0
360	120.0	64.9	118.2	-73.4	70.8	1509.2	-1469.9	1252.8	.204	.204	.204	.137	49.6	58.5
Impact		I	IV	I	III	I	II	III						
Dead Load		.4000 x wL	1.1000 x wL	-.6000 x wL	.5000 x wL	.0800 x wL^2	-.1000 x wL^2	.0250 x wL^2					.4000 x L	.5000 x L

Reaction due to live load

- Live load Distribution Factors for front and Rear Axles.

"As per AASHTO 3.23.1, Lateral distribution of wheel loads at the ends of the beam shall be that produced by assuming the floor to act as a simple span between beam. For wheels or axles in other positions in the span, the lateral distribution shall be as per Table 3.23.1"

Span length $l_{span} = 100.00$ Ft

Impact factor $I = \frac{50}{l_{span}+125} = \frac{50}{100+125} = 0.222$

Beam spacing $S_{beam} = 6.667$ Ft

Spacing of axle $S_{axle} = 14$ Ft

Spacing of wheel $S_{wheel} = 6$ Ft

Reaction of front axle $R_{front} = 8$ Kips

Reaction of rear axle $R_{rear} = 32$ Kips

Distribution factor

For front and Rear axle $DF_F = \frac{S_{beam}}{11} = 0.606$

For middle axle $DF_M = \frac{S_{beam} - S_{wheel}}{S_{beam}} + 1 = 1.100$

Maximum live load Reaction

$$R_{max} = \frac{R_{rear}}{2} * DF_m + (R_{Rear} + R_{Front}) * \frac{(l_{span} - S_{axle})}{l_{span}} * DF_F$$

$$R_{max} = \frac{32.0}{2} * 1.10 + (32+8) * \frac{(100-14)}{100} * 0.606 = 38.448 \text{ Kips}$$

Reaction to the adjacent Beams

(the reaction to the adjacent beam will be conservatively placed as to maximize the effects being investigated)

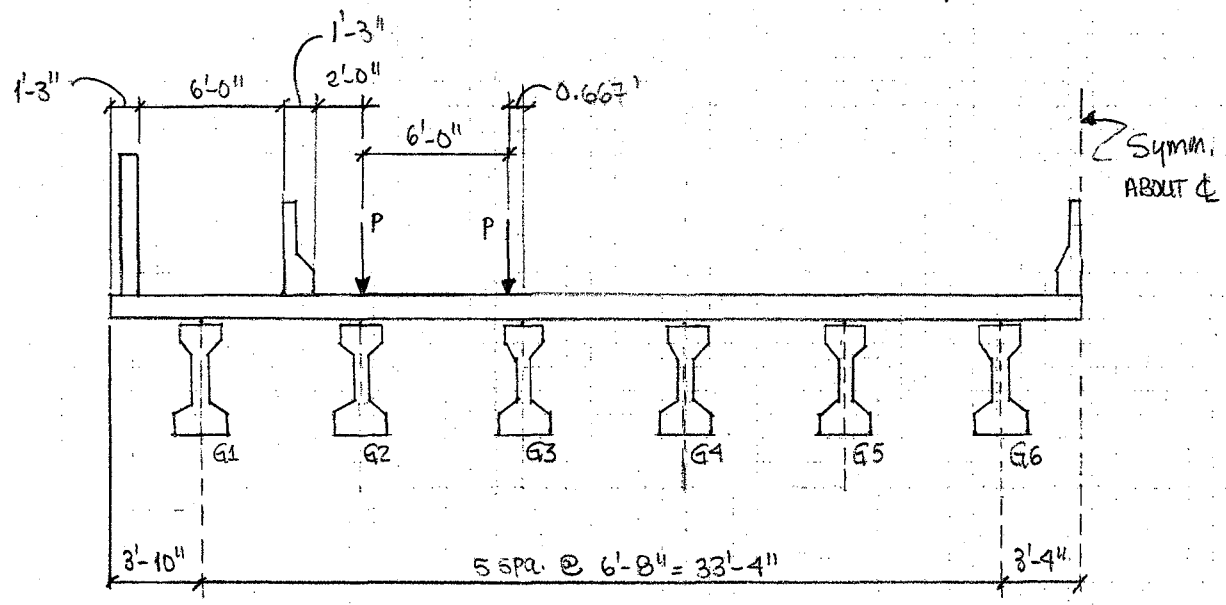
$$R_{adj} = \frac{R_{rear}}{2} * \left(\frac{S_{wheel}}{S_{beam}}\right) + (R_{rear} + R_{Front}) * \left(\frac{l_{span} - S_{axle}}{l_{span}}\right)(1 - DF_F)$$

$$R_{adj} = \frac{32.0}{2} * \left(\frac{6.00}{6.667}\right) + (32+8) * \left(\frac{100-14}{100}\right)(1 - 0.606) = 27.953 \text{ Kips}$$

$R_{live\ load} = 38.448$ Kips $+ 27.953$ Kips $= 66.401$ Kips $\div 2 = 33.201$ Kips $* 1.222$
$= 40.571$ Kips/wheel

Reaction due to 1 live load lane

P = 40.571 Kips



GIRDER 2

$$R_{G2} = \frac{R_{live}}{S_{beam}} * (S_{beam} - S_{wheel}) + R_{live}$$

$$R_{G2} = \frac{40.571}{6.667} * (6.667 - 6.000) + 40.571 = 44.630 \text{ Kips}$$

GIRDER 3

$$R_{G3} = \frac{R_{live}}{S_{beam}} * (S_{beam} - 0.667)$$

$$R_{G3} = \frac{40.571}{6.667} * (6.667 - 0.667) = 36.512 \text{ Kips}$$

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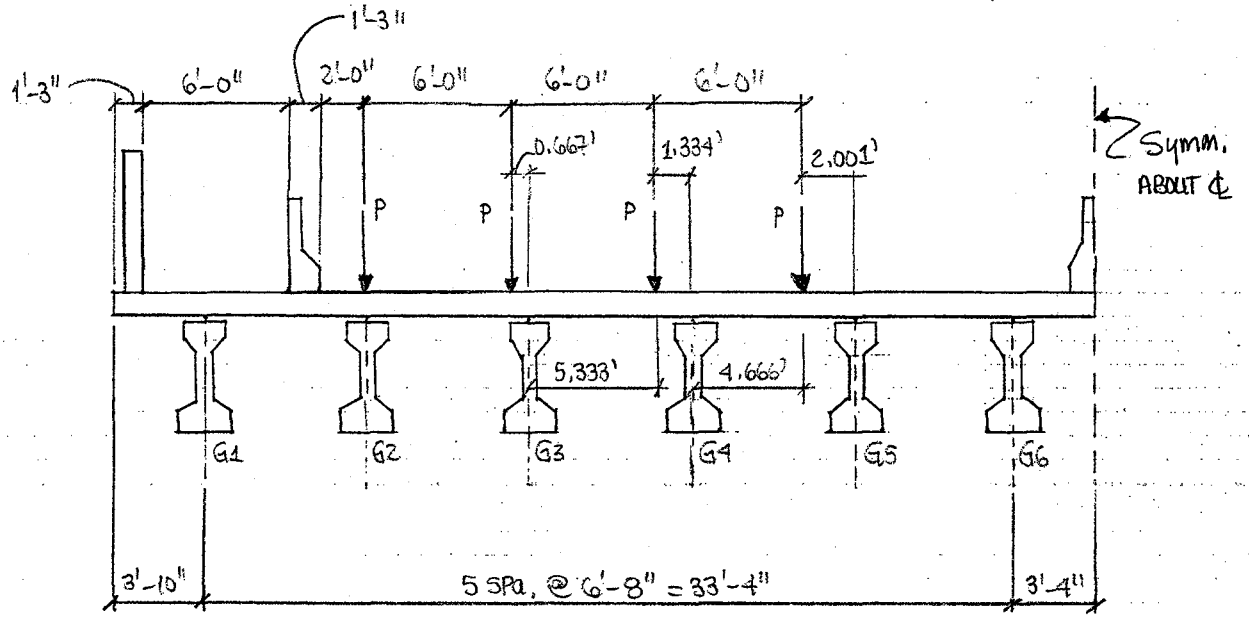
Reaction due to 2 live load lanes

P = 40.571 Kips



GIRDER 2

$$R_{G2} = \frac{R_{live}}{S_{beam}} * (S_{beam} - S_{wheel}) + R_{live}$$

$$R_{G2} = \frac{40.571}{6.667}(6.667 - 6.000) + 40.571 = 44.630 \text{ Kips}$$

GIRDER 3

$$R_{G3} = \frac{R_{live}}{S_{beam}} * (S_{beam} - 0.667) + \frac{R_{live}}{S_{beam}} * (S_{beam} - 5.333')$$

$$R_{G3} = \frac{40.571}{6.667} * (6.667 - 0.667) + \frac{40.571}{6.667} * (6.667 - 5.333) = 44.630 \text{ Kips}$$

GIRDER 4

$$R_{G4} = \frac{R_{live}}{S_{beam}} * (S_{beam} - 1.334) + \frac{R_{live}}{S_{beam}} * (S_{beam} - 4.666')$$

$$R_{G4} = \frac{40.571}{6.667} * (6.667 - 1.334) + \frac{40.571}{6.667} * (6.667 - 4.666') = 44.630 \text{ Kips}$$

GIRDER 5

$$R_{G5} = \frac{R_{live}}{S_{beam}} * (S_{beam} - 2.001)$$

$$R_{G5} = \frac{40.571}{6.667} * (6.667 - 2.001) = 28.394 \text{ Kips}$$

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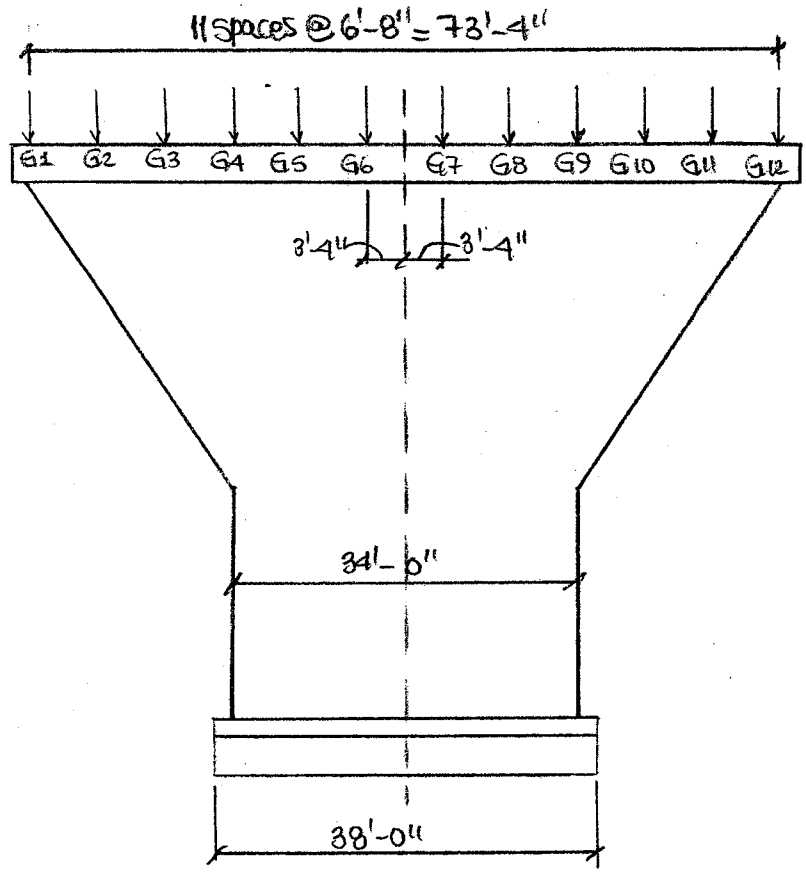
LIVE LOAD MOMENT @ BOTTOM OF WALL COLUMN.



- MOMENT DUE TO 1 live load lane.

$M = 44.63^K * (4*6.667 + 3.333) + 36.512^K * (3*6.667 + 3.333)$

$M = 2190.92$ K-Ft

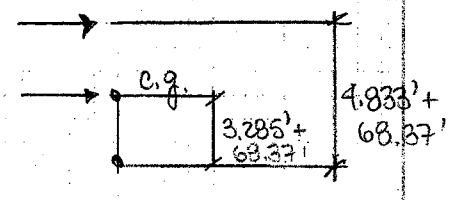
- MOMENT DUE TO 2 LIVE LOAD LANE

$M = 44.63^K * (4*6.667 + 3.333) + 44.63^K * (3*6.667 + 3.333) + 44.63^K (2*6.667 + 3.333) + 28.394^K * (1*6.667 + 3.333)$

$M = 3408.13$ K-Ft.

- WIND LOADS

- ON SUPERSTRUCTURE



WIND LOAD = $W_{\substack{TRANS \\ LONG}}$ * h_{WIND}

$h_{WIND} = 4.50\ Ft + \frac{0.5''}{12} + \frac{7.5''}{12} + 4.50\ Ft = 9.667\ Ft$

POINT OF APPLICATION = $\frac{h_{WIND}}{2} = \frac{9.667}{2} = 4.833\ Ft$

$WIND\ LOAD_{TRANS} = 0.050\ KSF * 9.667\ Ft = 0.4833\ K/Ft * 1.0216 = 0.494\ K/Ft * 100\ Ft = 49.40\ Kips$

$WIND\ LOAD_{LONG} = 0.012\ KSF * 9.667\ Ft = 0.1160\ K/Ft * 1.0216 = 0.119\ K/Ft$

- OVERTURNING FORCES

$F_{WIND} = W_{OVER} * WIDTH_SUPERSTRUCTURE * LENGTH$

$W_{OVER} = 20\ Lbs/Ft^2$

POINT OF APPLICATION = 1/4 * WIDTH_SUPERSTRUCTURE

$F_{WIND} = 0.020\ KSF * 81.00\ Ft = 1.62\ K/Ft * 100\ Ft = 162.00\ Kips$

$M_{WIND} = 0.020\ KSF * 81.00\ Ft * \left(\frac{1}{4} * 81.00\ Ft\right) = 32.805\ \frac{K\text{-}Ft}{Ft}$

$M_{WIND}(P4) = 32.805\ K\text{-}Ft/Ft * 100.0\ Ft = 3280.50\ K\text{-}Ft$

$M_{WIND}(P5) = 3280.50\ K\text{-}Ft$

- ON SUBSTRUCTURE

WIND LOAD = $W_{\substack{TRANS \\ LONG}}$ * $WIDTH_{\substack{TRANS \\ LONG}}$

$\left.\begin{array}{l} WIND_{TRANS} = 40\ Lbs/Ft^2 \\ WIND_{LONG} = 40\ Lbs/Ft^2 \end{array}\right\}$ BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

- WALL_COLUMN SEC. 1

$WIND_{TRANS} = 0.040\ KSF * 3.00\ Ft = 0.120\ K/Ft$

$WIND_{LONG} = 0.040\ KSF * 77.00\ Ft = 3.08\ K/Ft$

- WALL_COLUMN SEC. 2

$WIND_{TRANS} = 0.040\ KSF * 2.50\ Ft = 0.100\ K/Ft$

$WIND_{LONG} = 0.040\ KSF * (76.00 + 65.560') = 2.831\ K/Ft$

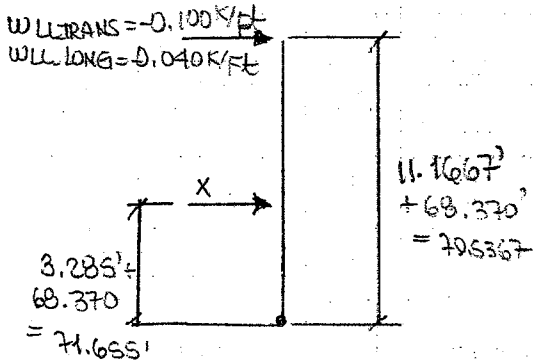
- WIND ON LIVE LOAD

WIND ON LIVE LOAD = W LIVE LOAD_TRANS
- LONG

POINT OF APPLICATION = 6.00' FROM FLOOR SLAB

$W_{LL_TRANS} = 100$ Lbs/Ft
$W_{LL_LONG} = 40$ Lbs/Ft
} BOTH FORCES SHALL BE APPLIED SIMULTANEOUSLY

DISTANCE TO LOAD $= 4.50\,Ft + \frac{0.5''}{12} + \frac{7.50''}{12} + 6.00\,Ft =$



EQUIVALENT FORCES:

$W_{LL\,TRANS} = -0.100 * \frac{79.537}{71.655} = -0.111$ K/Ft $\times 100$ $= 11.10$ Kips

1.11

$W_{LL\,LONG} = 0.040 * 1.11 = 0.0444$ K/Ft

- LONGITUDINAL FORCES FROM LIVE LOAD

L.F. LIVE LOAD = 5% NO. OF LANES [R.F. * (0.640 * LENGTH + 18 K)]

POINT OF APPLICATION = 6.00 Ft ABOVE THE FLOOR SLAB

NO. LANES = 31.00' ÷ 12 = 2.58 lanes Use 2 lanes *2 = 4 lanes (TOTAL WIDTH)

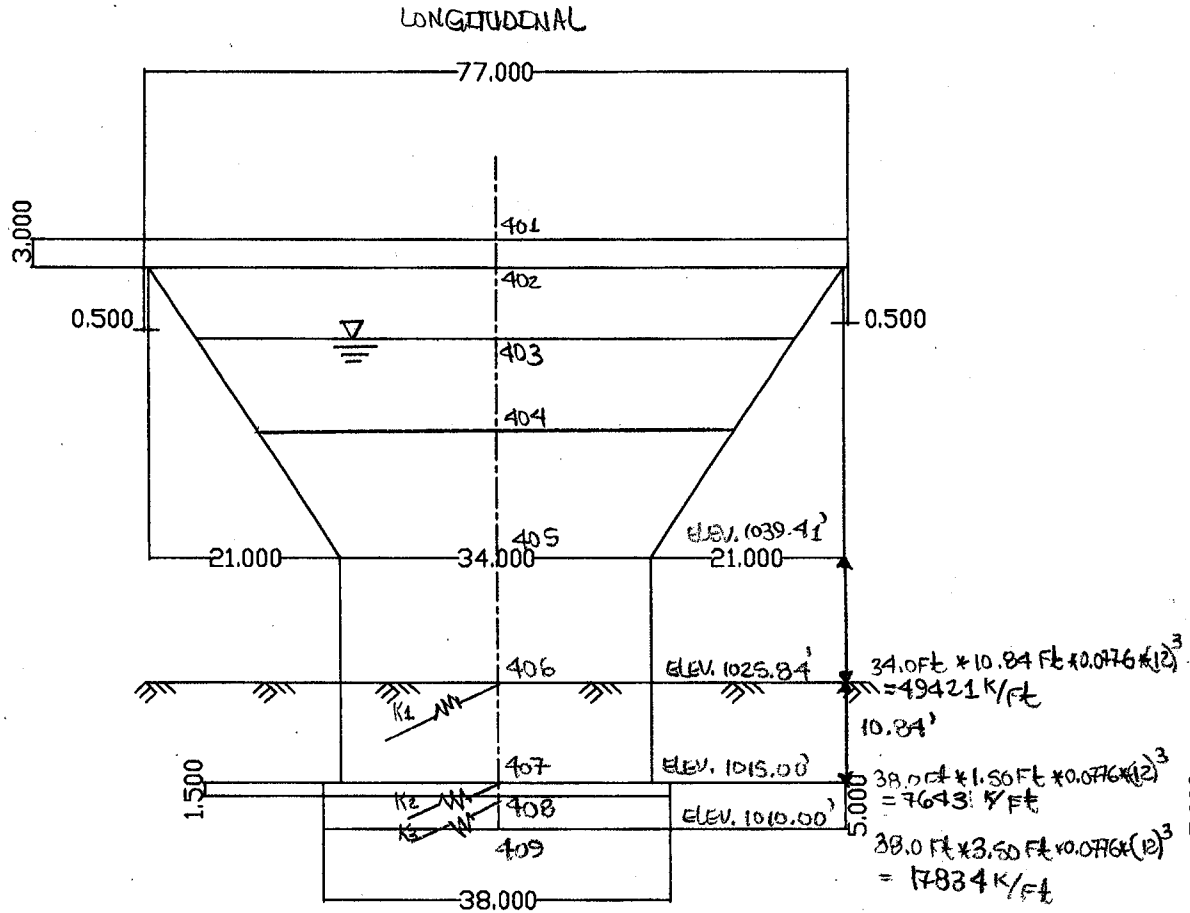
L.F. = 0.05 * 2 LANES * 1.00 * 0.640 K/Ft = 0.064 K/Ft * 1.11 = 0.07104 K/Ft

L.F. = 0.05 * 2 LANES * 1.00 * 18 K/Ft * 0.20 = 0.36 Kips * 1.11 = 0.3996 Kips

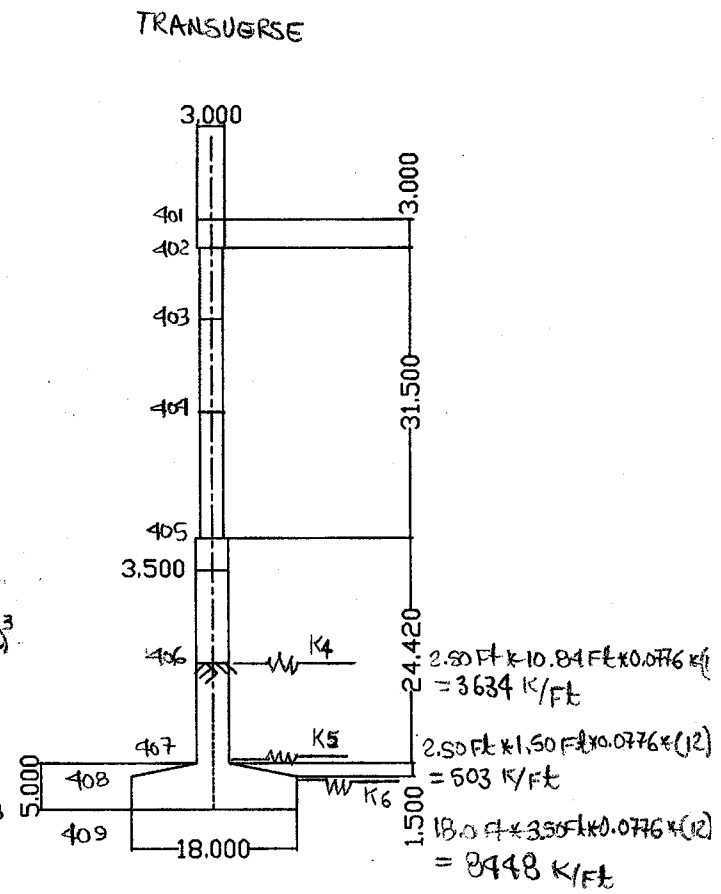
DISTRIBUTED @ THE 5 PIERS

CASE 3 - PIER SCOUR

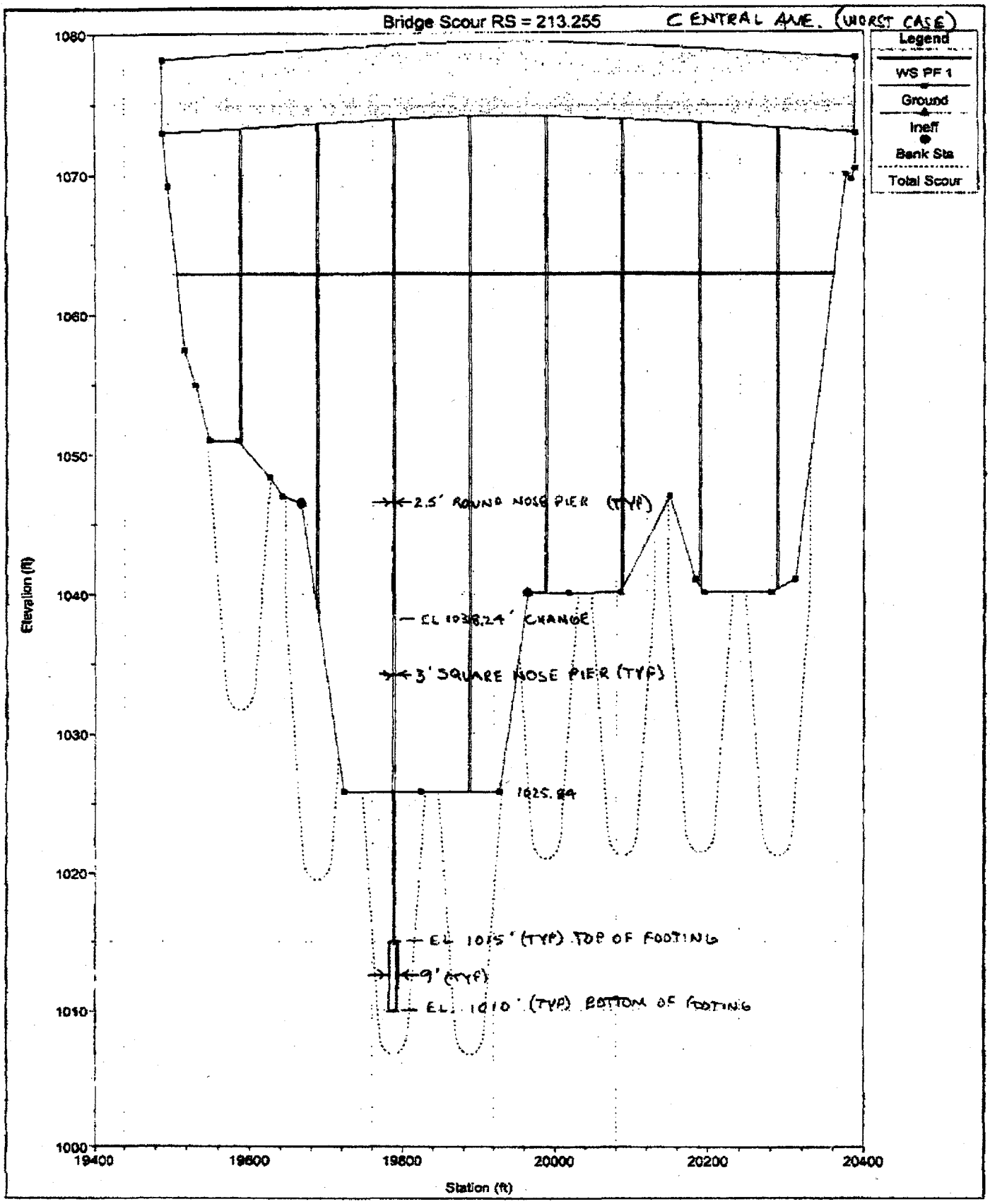
SOIL SPRING CONSTANTS

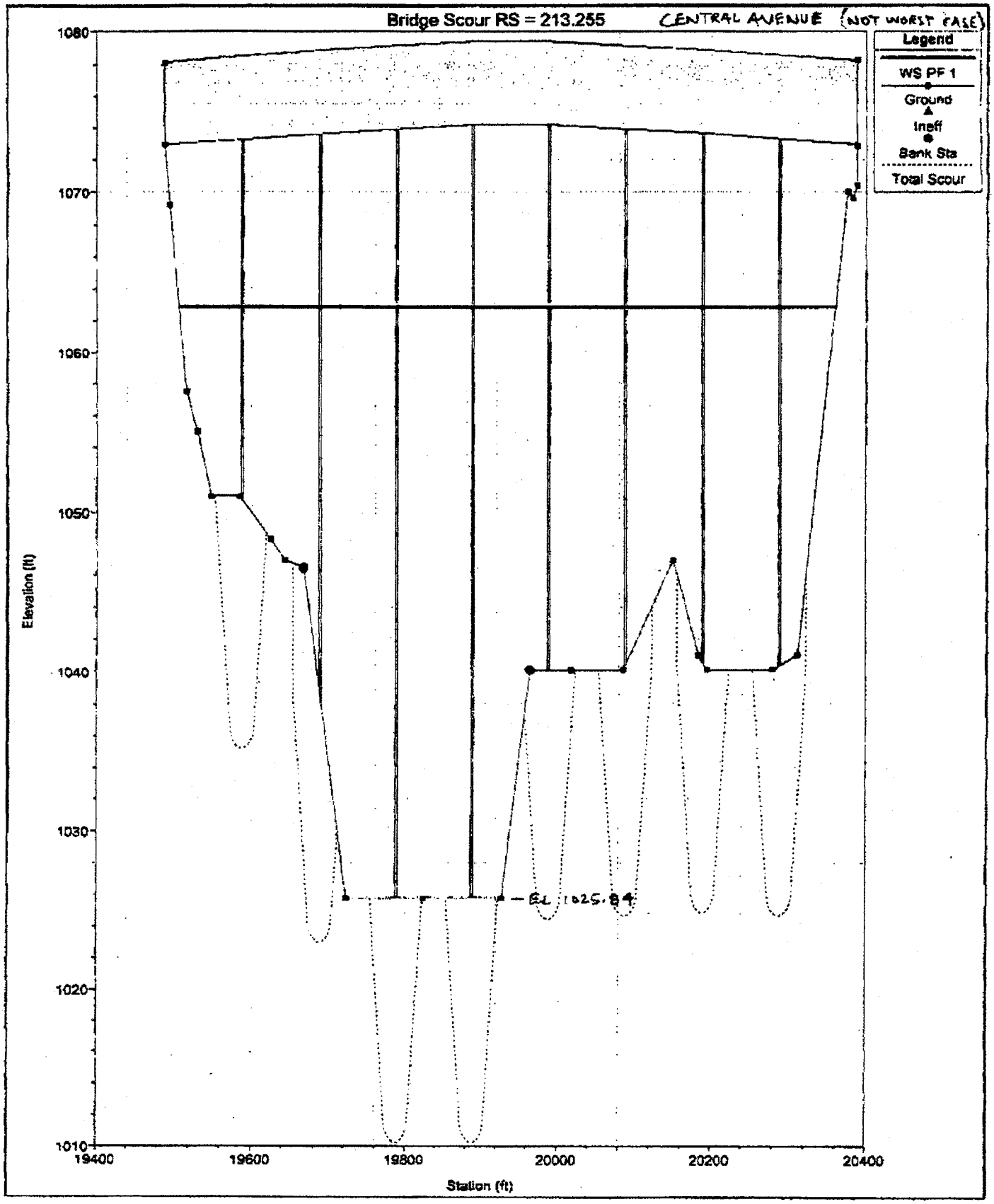


ELEVATION



SECTION


Bridge Scour RS = 213.255
CENTRAL AVE. (WORST CASE)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Total Scour
Elevation (ft)
Station (ft)
1080
1070
1060
1050
1040
1030
1020
1010
1000
19400
19600
19800
20000
20200
20400
2.5' ROUND NOSE PIER (TYP)
EL 1038.24' CHANGE
3' SQUARE NOSE PIER (TYP)
1025.84
EL 1015' (TYP) TOP OF FOOTING
9' (TYP)
EL 1010' (TYP) BOTTOM OF FOOTING


Bridge Scour RS = 213.255
CENTRAL AVENUE (NOT WORST CASE)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Total Scour
Elevation (ft)
Station (ft)
1080
1070
1060
1050
1040
1030
1020
1010
19400
19600
19800
20000
20200
20400
EL 1025.84

Alternative 1 Bridge Scour With Long Term Degradation, River Station 213.255, Central Avenue Bridge

Results Computed Using HEC-RAS Version 2.2 and HEC-18 Guidelines

Hydraulic Design Data

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Round nose
Pier Width (ft):	6.5
Grain Size D50 (ft):	0.0787
Depth Upstream (ft):	37.24
Velocity Upstream (ft/s):	14.33 maximum velocity
K1 Nose Shape:	1
Pier Angle:	0
Pier Length (ft):	151.22
K2 Angle Coef:	1
K3 Bed Cond Coef:	1.1
Grain Size D90 (ft):	0.5741
K4 Armouring Coef:	1

Results

Scour Depth Ys (ft):	**15.6**
Froude #:	0.41
Equation:	CSU equation

Pier Scour Limited to Maximum of Ys = 2.4 * a

Alternative case analysis:

Yf	Y1	Yf/Y >>	Vf/V1	V1	Vf
12.4	37.24	0.3330	0.82	14.33	11.75

Hydraulic Design Data

Pier Scour

All piers have the same scour depth

Input Data

Pier Shape:	Square nose
Pier Width (ft):	7
Grain Size D50 (ft):	0.0787
Depth Upstream (ft):	37.24
Velocity Upstream (ft/s):	11.75
K1 Nose Shape:	1.1
Pier Angle:	0
Pier Length (ft):	151.22
K2 Angle Coef:	1
K3 Bed Cond Coef:	1.1
Grain Size D90 (ft):	0.5741
K4 Armouring Coef:	1

Results

Scour Depth Ys (ft):	**19.1**
Froude #:	0.34
Equation:	CSU equation

Note: Two feet of bulking is added to each side of piers less than 6' wide.

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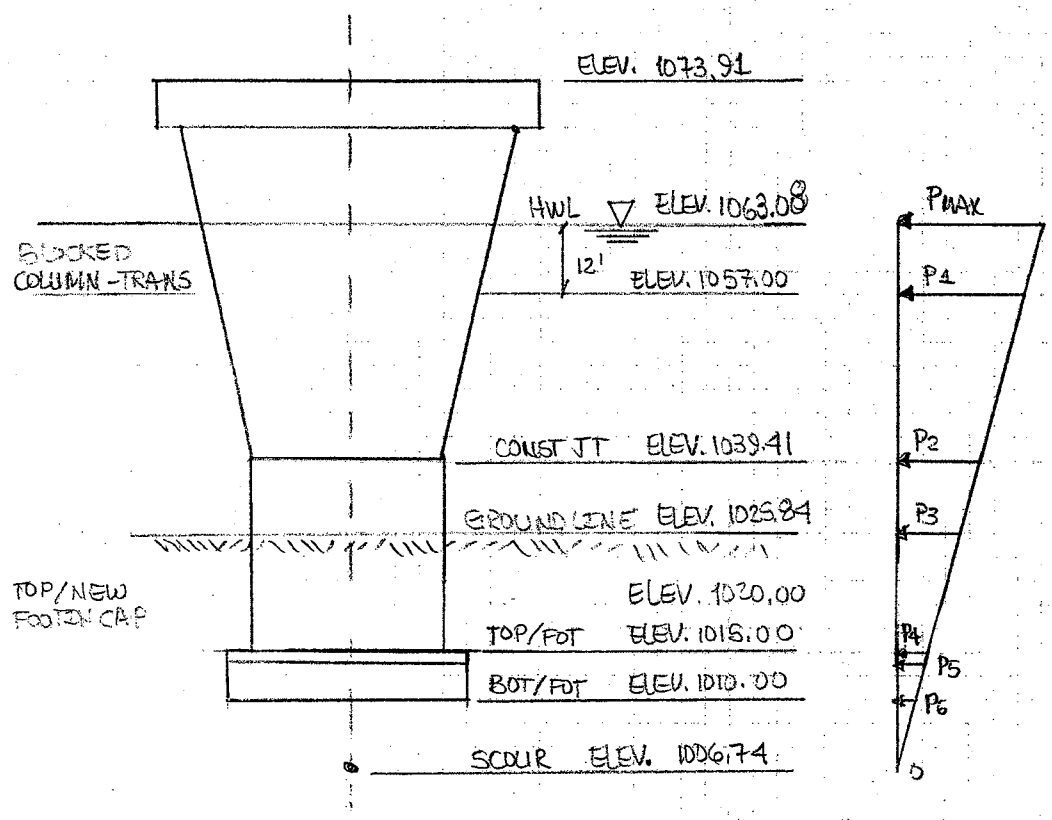
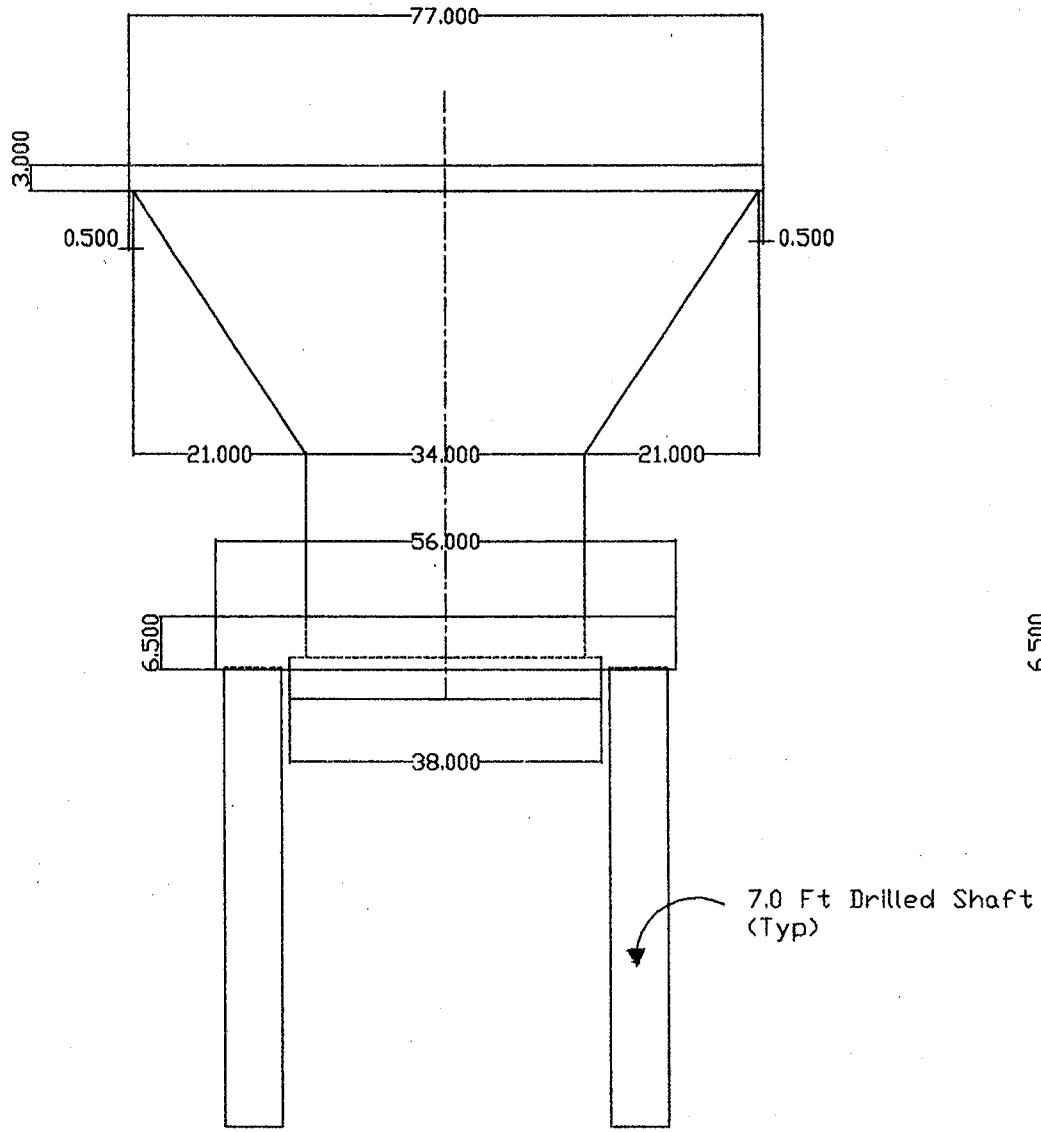
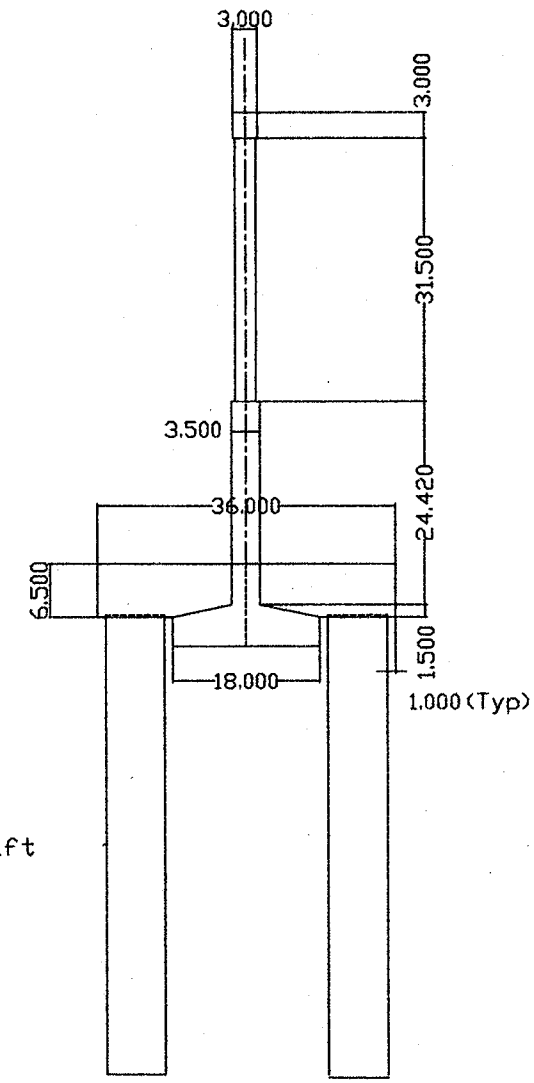
Grid: 1/8"

STREAM FLOW FORCES:





ELEVATION

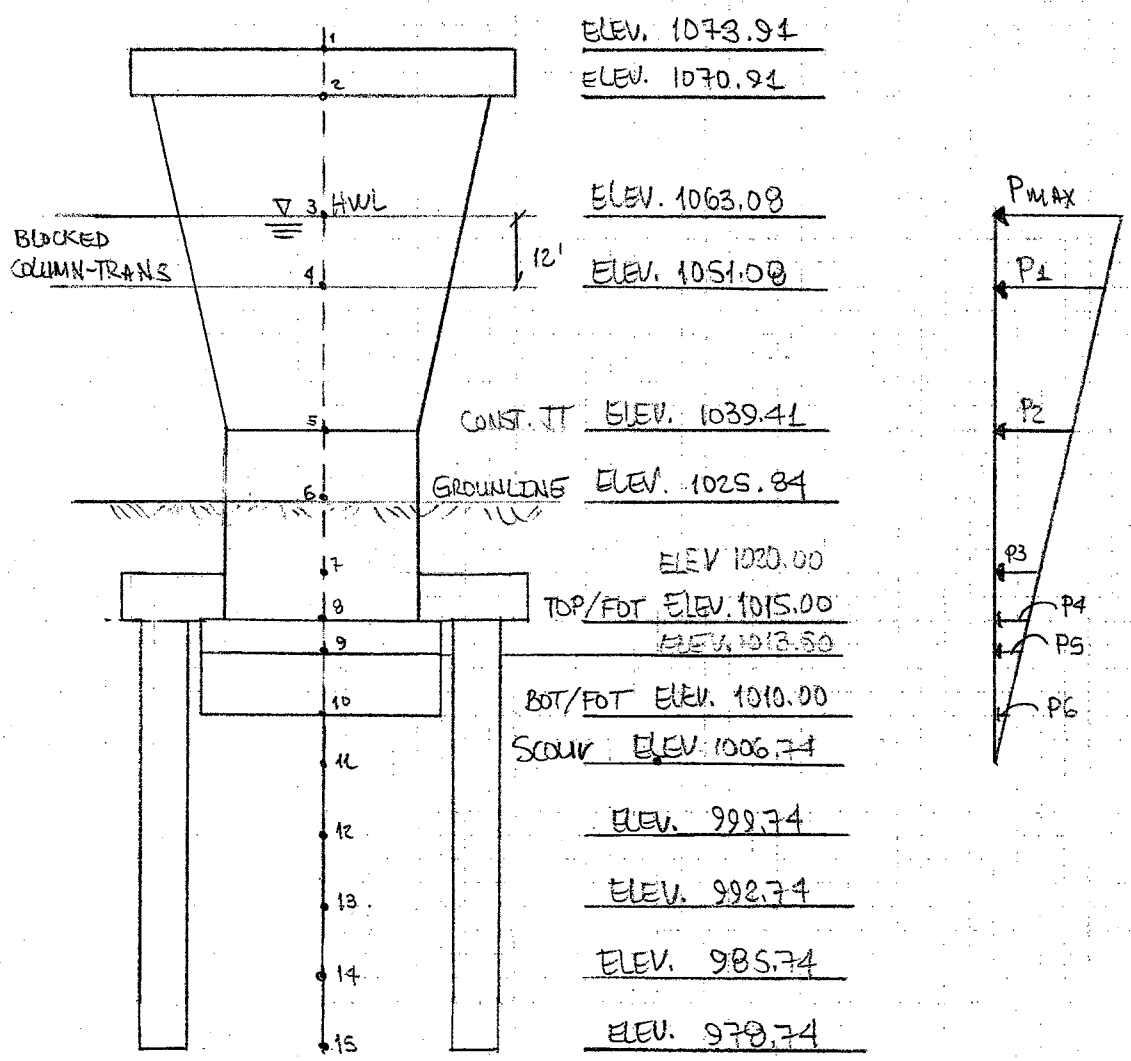


SECTION

TYLIN INTERNATIONAL

Projects: Salt River Bridges - Scour | Job No. 1317.00 | Sheet: of
Item: South Central Avenue | Designer: VPD | Date: 9/20/99
Checker: | Date:
Grid: 1/8"

STREAM FLOW FORCES

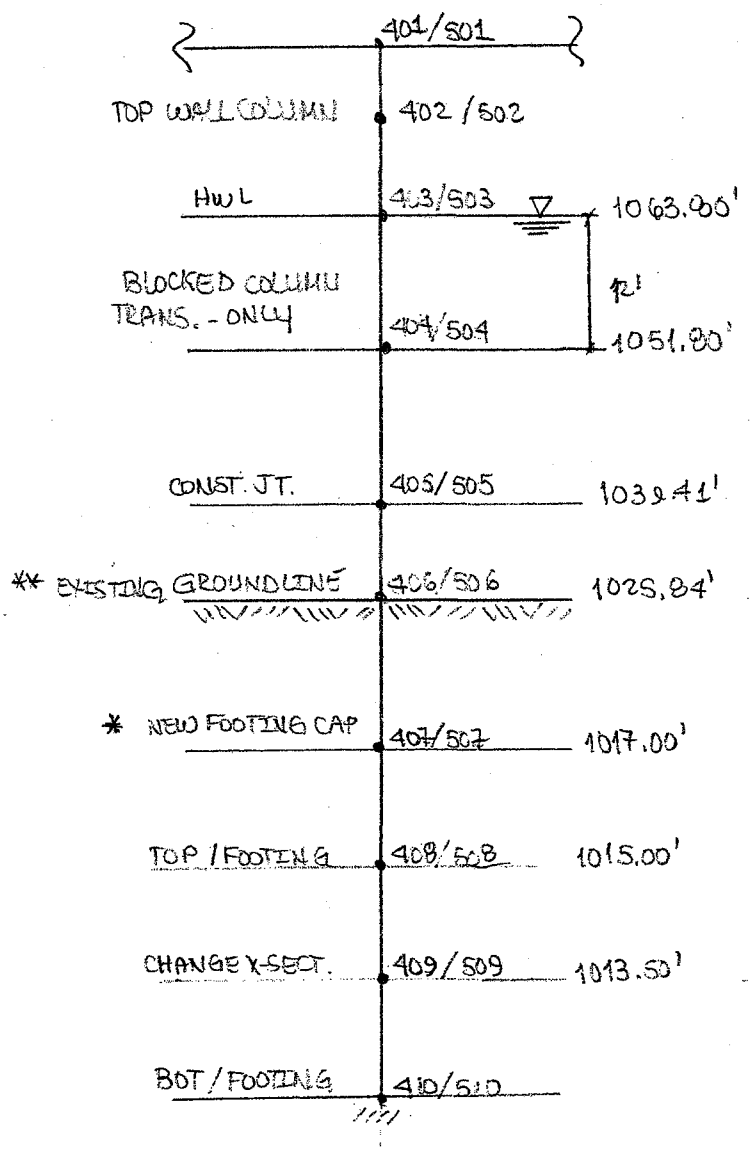


T·Y·LIN INTERNATIONAL

Projects: Salt River Bridges - Scour | Job No. 1317.00 | Sheet of
Item: South Central Avenue | Designer: VPD | Date: 9/29/99
Checker: | Date:
Grid: 1/10"

SOIL SPRINGS

CASE 3 - PIER SCOUR



SOIL PARAMETERS:

$\gamma_{soil} = 140$ pcf

$\gamma_{sub} = 77.6$ pcf

$\phi = 42°$

$c = 0$

$K = 500$ pci

(Subgrade Modulus)

* FOR THE ESTIMATE OF THE NUMBER OF DRILLED SHAFTS NEEDED, THE X-SECTION OF THE PROPOSED FOOTING CAP WILL BE INCLUDED.

** ALTHOUGH, THERE IS AN EXISTING GROUNDLINE, THIS ELEVATION WILL BE MUCH LOWER WHEN PIER SCOUR OCCURS. THEREFORE NO SOIL SPRINGS WILL BE CALCULATED SINCE THE SOIL IS GONE

TYLIN INTERNATIONAL

Project: Salt River Bridges - Scour

Item: South Central Avenue

Job No. 1317.00

Designer: VPD

Date: 4/15/99

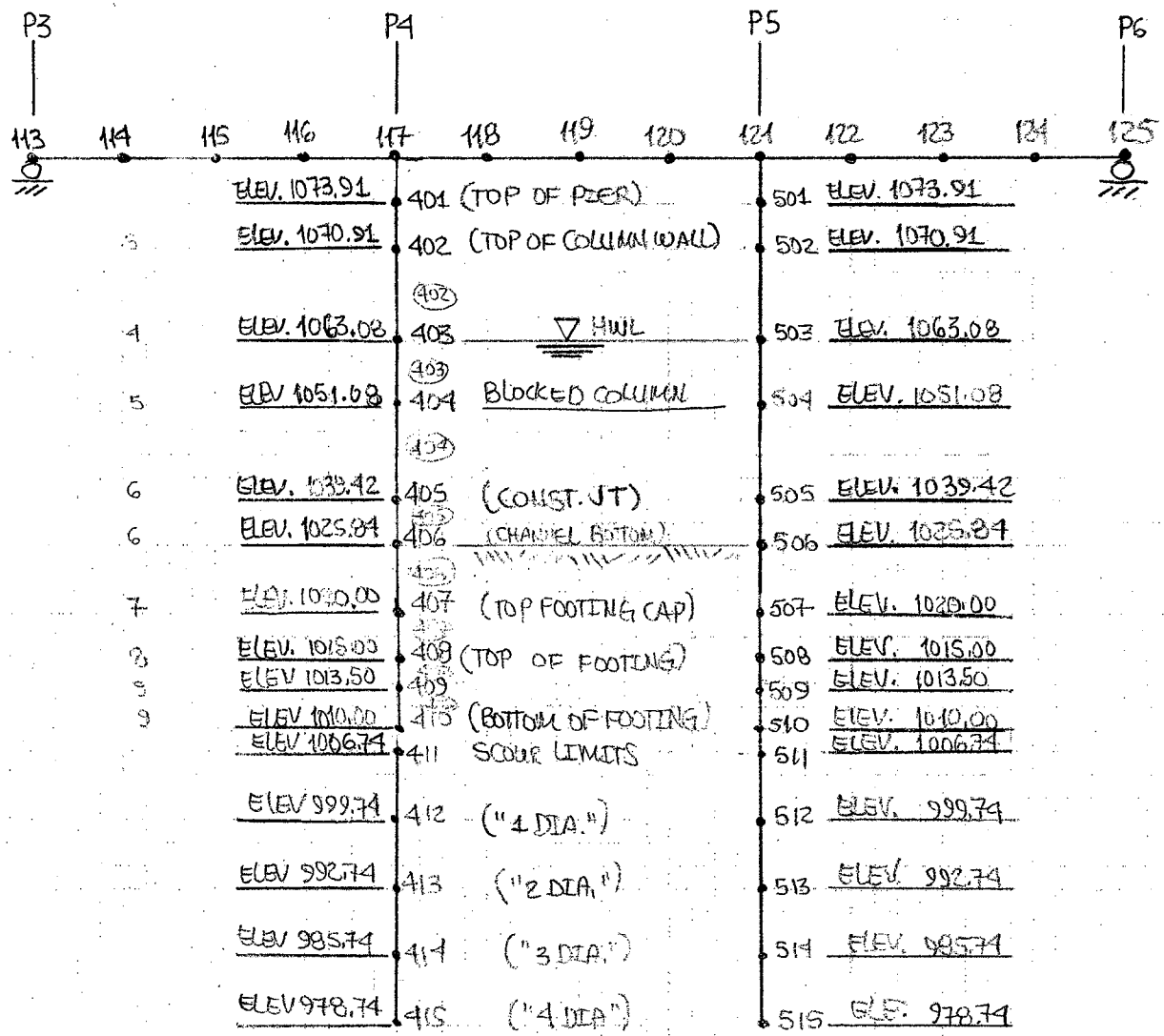
Sheet: of

Checker:

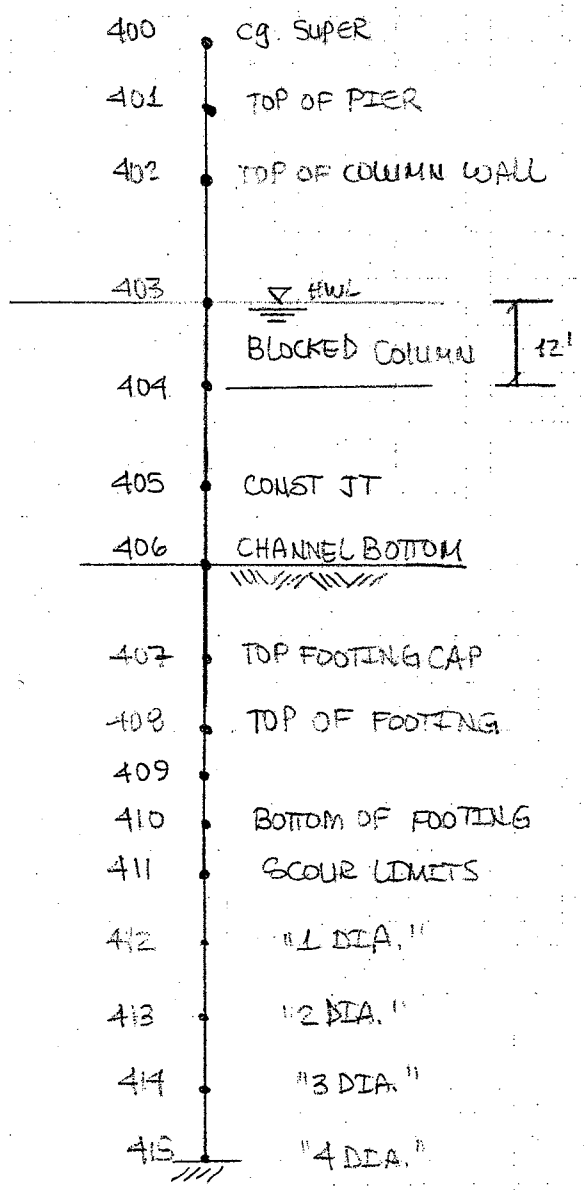
Date:

Grid: 1/8"

NODAL NUMBERS FOR SAP MODEL - LONGITUDINAL



T·Y·LIN INTERNATIONAL

Projects: Salt River Bridges - Scour	Job No. 1317.00	Sheet:	of
Item: South Central Avenue	Designer: VPD	Date: 9/16/99	
	Checker:	Date:	
		Grid: 1/8"	

NODAL NUMBERS FOR SAP MODEL - TRANSVERSE