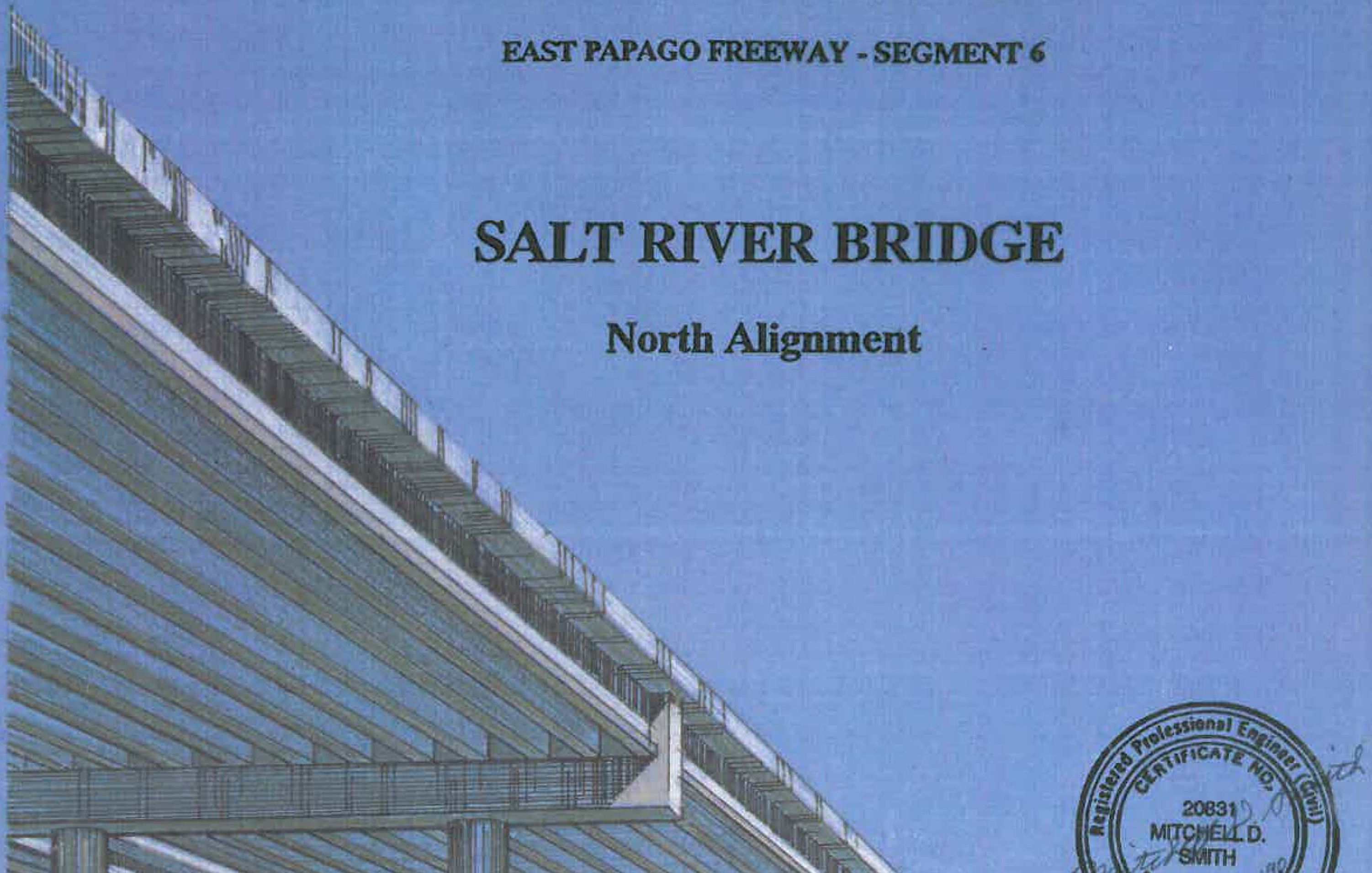
DICK PERREAULT
12/8/90

SUMMARY STRUCTURE SELECTION REPORT

EAST PAPAGO FREEWAY - SEGMENT 6

SALT RIVER BRIDGE

North Alignment



Registered Professional Engineer (Civil)
CERTIFICATE NO.
20831
MITCHELL D.
SMITH
Date Signed 8/9/90
ARIZONA, U.S.A.

ADOT CONTRACT 88-38

ARIZONA DEPARTMENT OF TRANSPORTATION Aug 1990

DEPARTMENT OF TRANSPORTATION
DOT
STATE OF ARIZONA

Gannett Fleming OF ARIZONA, INC.

T.Y. LIN INTERNATIONAL

DICK PERREAULT
13/8/90

Registered Professional Engineer (Civil)
CERTIFICATE NO.
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PREFACE

This report is a summary of the studies and events leading to the current alignment, span configuration and structure type of the Salt River Bridge on the East Papago Freeway.

Detailed information regarding previous studies and cost estimates are contained in our Structure Selection Reports - Salt River Bridge, dated August 1989 and November 1989. This report was prepared with design of the structure at 55%.

The precast girder type of structure was selected on the basis of estimated economy, timely availability of the girders and construction without falsework in the river. Span lengths and girder spacing were optimized within the general parameter of providing long span lengths to limit the number of piers in the river.

All preliminary studies were prepared concurrently with geotechnical investigations and hydraulic studies by others. Some preliminary estimates of drilled shaft capacities and scour depths conflicted with later values. The final foundation capacities will be based upon the results of drilled shaft load tests currently being performed and with the borings made at each pier.

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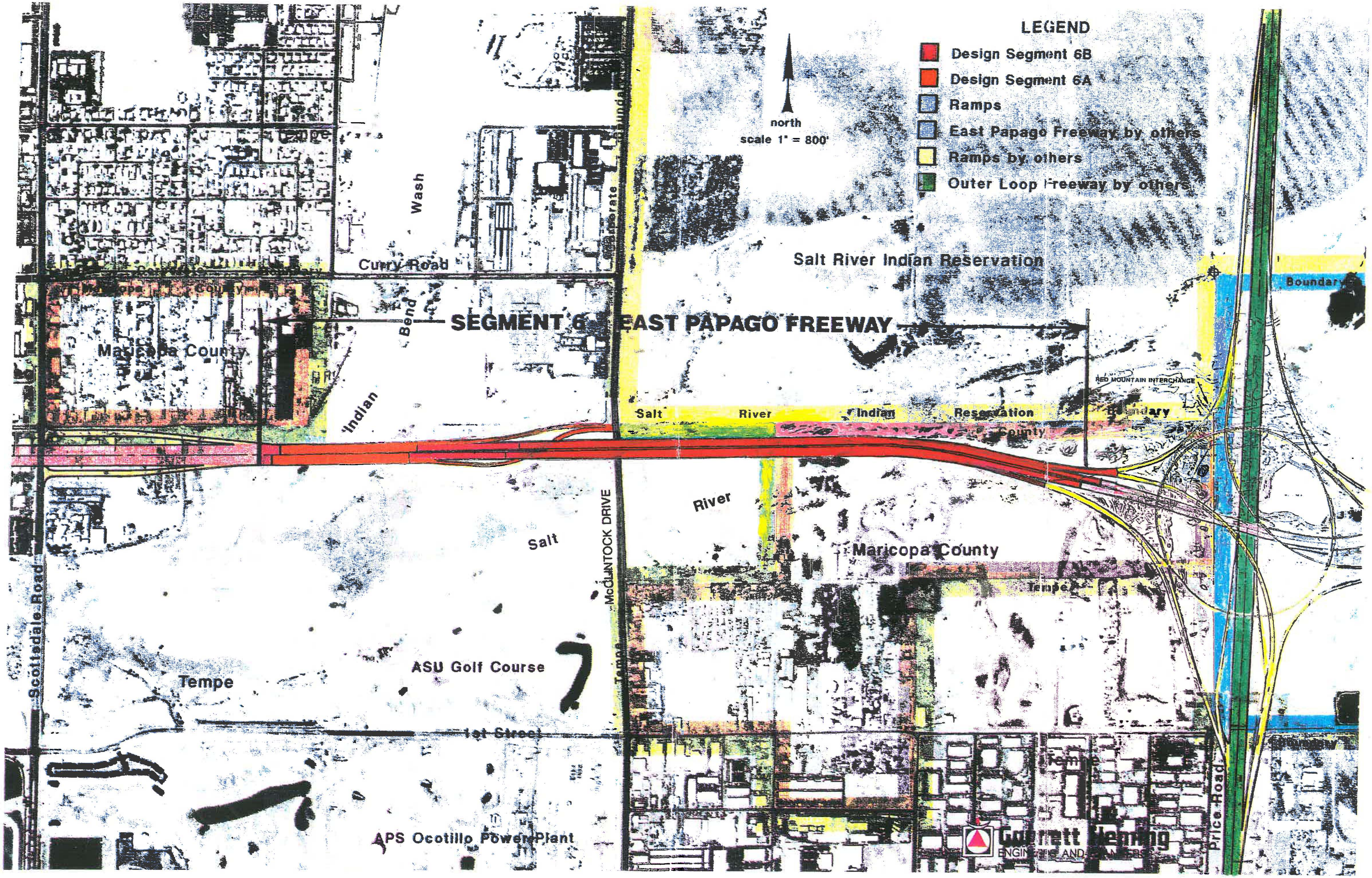


LOCATION PLAN

Figure 1

1. INTRODUCTION

1.1 SCOPE OF SUMMARY REPORT FOR THE SALT RIVER BRIDGE

This report is a summary of the information contained in two previous draft structure selection reports for the Salt River Bridge and presents the final selected structure type and span layout. Design information related to final foundation capacities was not available at the time this report was prepared.

The initial report submitted in August 1989, was for a Southern alignment which was later abandoned in favor of a Northern alignment. The Northern alignment was adopted to avoid impacting the Old Scottsdale and Old Tempe Landfills on the south bank. The selection report for the Northern alignment was submitted in November 1989. Reference will be made to these earlier draft reports which contain more details.

In July 1990 the Northern alignment was revised to shift the structure away from conflicts with the north bank stabilization. This is the Final alignment described in this report.

1.2 DESCRIPTION OF PROJECT

The East Papago Freeway is the East-West link between the Papago Freeway from the Squaw Peak Parkway to the Outer Loop Freeway connecting with the Pima, Price and Red Mountain Freeways. It also provides access to Sky Harbor Airport via the Hohokam Expressway and Sky Harbor Boulevard. Segment 6 of the East Papago Freeway begins just west of Indian Bend Wash and terminates at the Outer Loop Freeway for a total length of approximately one and a half miles. The proposed alignment crosses Indian Bend Wash continuing easterly near the north bank of the Salt River, over the eastbound off-ramp and McClintock Drive, then crossing the Salt River to connect with the Red Mountain Traffic Interchange on the south bank. Eastbound-off and westbound-on connecting ramps are provided at McClintock Drive with directional ramps to the Red Mountain Traffic Interchange (see Figure 1).

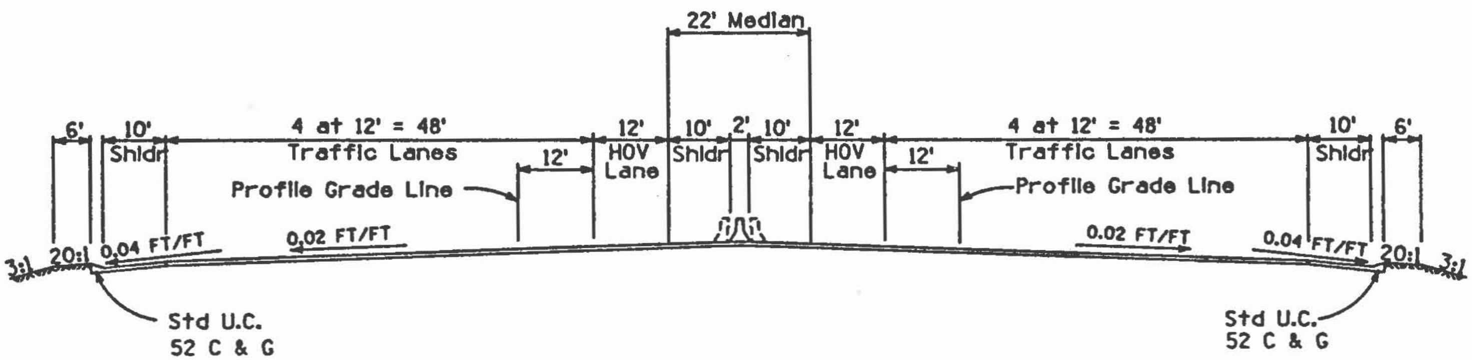
Throughout Segment 6 the Freeway consists of four 12 foot traffic lanes and a 12-foot High Occupancy Vehicle (HOV) -lane in each direction with 10-foot shoulders. The directional roadways are separated by a concrete traffic barrier in the median. This is the ultimate width of roadway with no provisions for future widening. The normal 22-foot median width is transitioned to 27-feet prior to the Salt River Bridge to accommodate similar profile grade lines located 37.5 feet either side of the construction centerline. The westbound and eastbound bridges are 3'-10" apart. Typical roadway and bridge cross-sections are shown in Figure 2.

The horizontal alignment of the Salt River Bridge consists of a 3749' tangent, a 1 degree 30 minute curve to the south and a tangent section connecting to the Red Mountain TI. The curve requires a maximum superelevation of 0.04' per foot which results in a vertical differential of 3.3 feet across each of the two 83-feet wide bridges. The alignment skew with the river is approximately 75 degrees. The profile grade is raised to provide clearance over the off-ramp to McClintock Drive (Ramp B) and the McClintock Drive Bridge and then rolled down to parallel the design water surface before continuing across the south bank levee as shown in Figure 3.

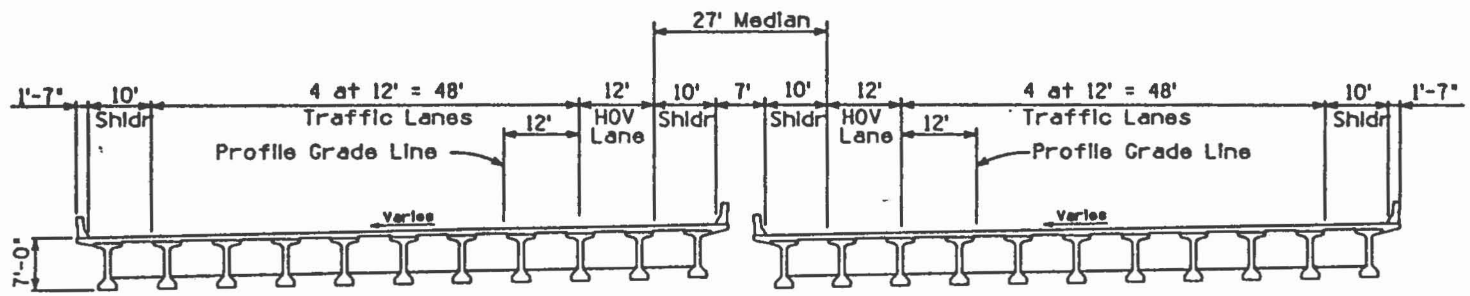
The west abutment (Abutment 1) locations are controlled by Ramp B's alignment; the east abutments (Abutment 2) are located behind the bank protection on the south side of the river. Mainline abutments are staggered with short retaining walls along the median to reduce the length of the structure. A retaining wall is required along the south side of eastbound Abutment 1, adjacent to Ramp B. The eastbound structure is 5406 feet long and the westbound structure 5285 feet long including the approach and anchor slabs. The piers and abutments are normal or radial to the centerline as shown in Figure 4.

Constraints to the pier layout occur at Ramp B, McClintock Drive Bridge and adjacent underground utilities which are shown in Figures 5 and 6.

TYPICAL SECTIONS



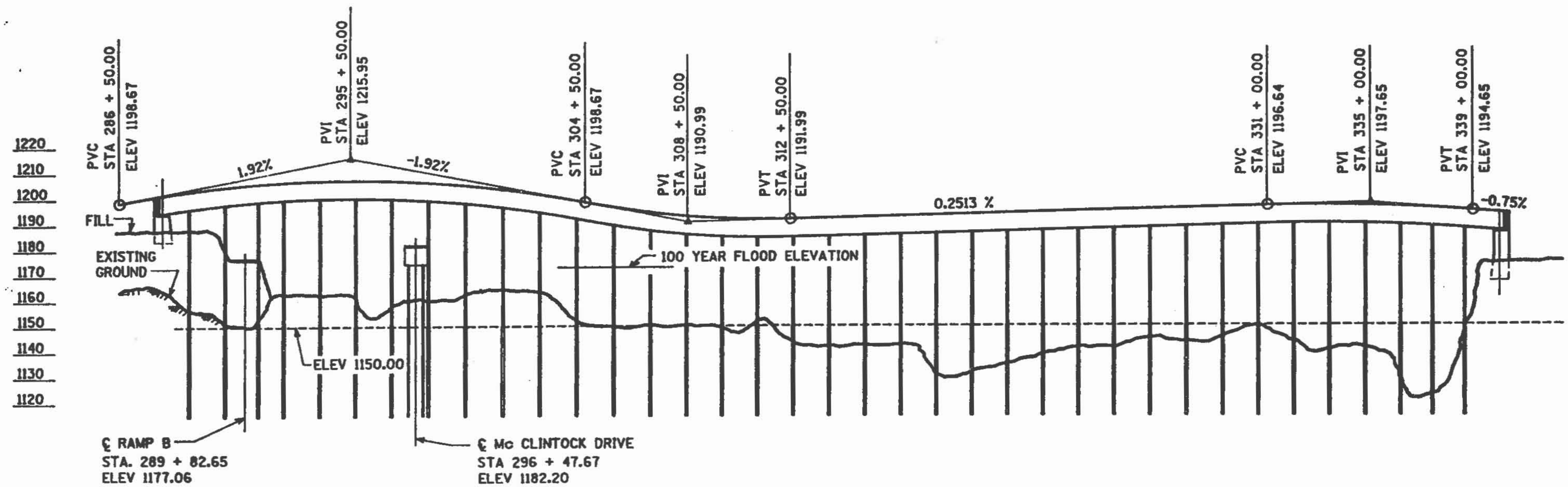
ROADWAY SECTION



AASHTO VI GIRDERS

Figure 2

SALT RIVER BRIDGE



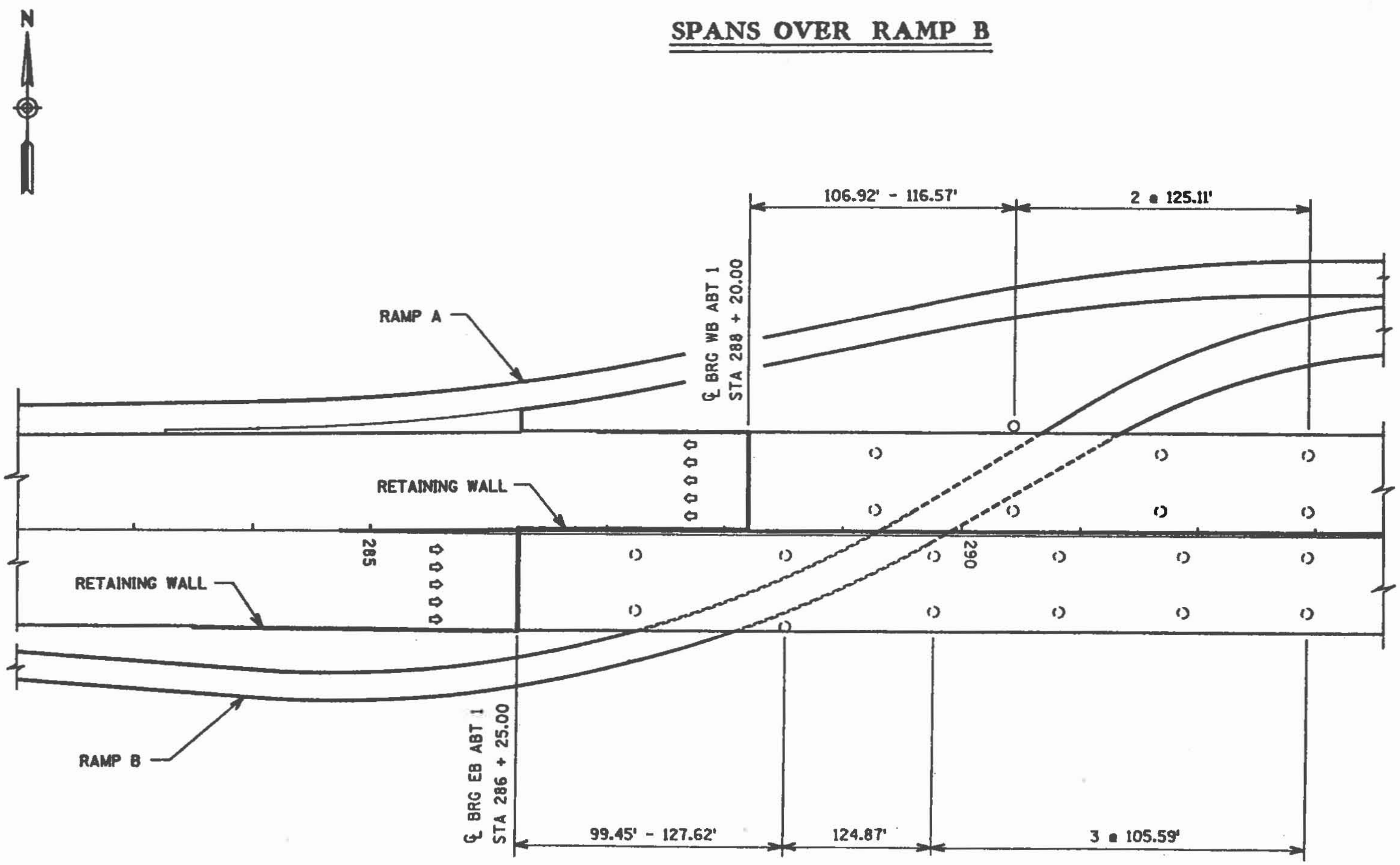
MAIN LINE PROFILE

Figure 3

AASHTO VI GIRDER SPANS LAYOUT

Figure 4

SPANS OVER RAMP B



PARTIAL PLAN

Figure 5

UTILITY LOCATIONS

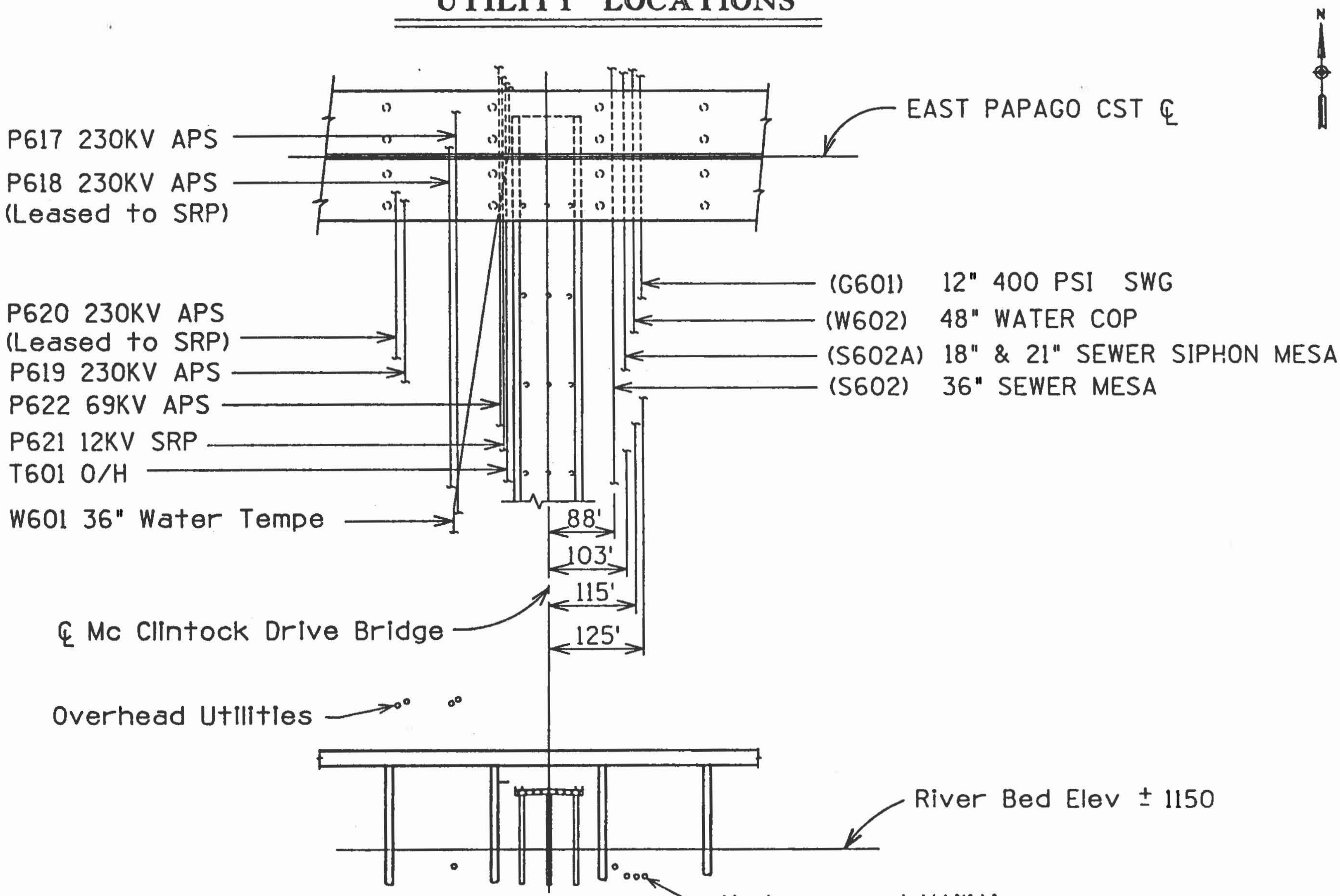


Figure 6

2. STRUCTURE SELECTION STUDIES

Preliminary designs were performed and cost estimates developed for three types of superstructure; twin and single column piers; and drilled shaft foundations with and without footings. These studies, described in detail in the previous reports, were based upon very preliminary soils information and hydraulic data. Both the geotechnical investigations and hydraulic analysis of the river were performed concurrently with the structural studies. As a result, some of the parameters used in earlier analyses do not agree with later values. The most significant of these was drilled shaft capacity which was reduced by approximately 45% and scour depths which were increased by 20%.

The ideal structure type and configuration for severely skewed wide river crossings, such as this alignment across the Salt River, would be the longest spans that are economical with as few piers as practical. Economic span length studies were developed for both concrete and steel superstructures supported on piers with dual and single columns. These studies indicated that span lengths in the 175- to 200-foot range were economical. Preliminary designs were prepared for post-tensioned concrete box girder and steel plate girder layouts with these spans. In addition, a layout was developed using the longest spans available for precast AASHTO girders. (See August 1989 Structure Selection Report)

Data from the preliminary soil borings revealed the typical sand, gravel and cobble strata (SGC) in the Salt River bed was underlain with thin interbedded layers of clay, silt and fine grained sand with discontinuous lenses of sand and gravel. Depths through the SGC to the clay ranged from 70 to 117 feet. These soil conditions, coupled with the large scour depths estimated at the piers, suggest single drilled shaft foundations under each column. It was determined that single column piers were not feasible with the soil conditions at this site. All estimates for the various alternative structure types were then based on dual column piers.

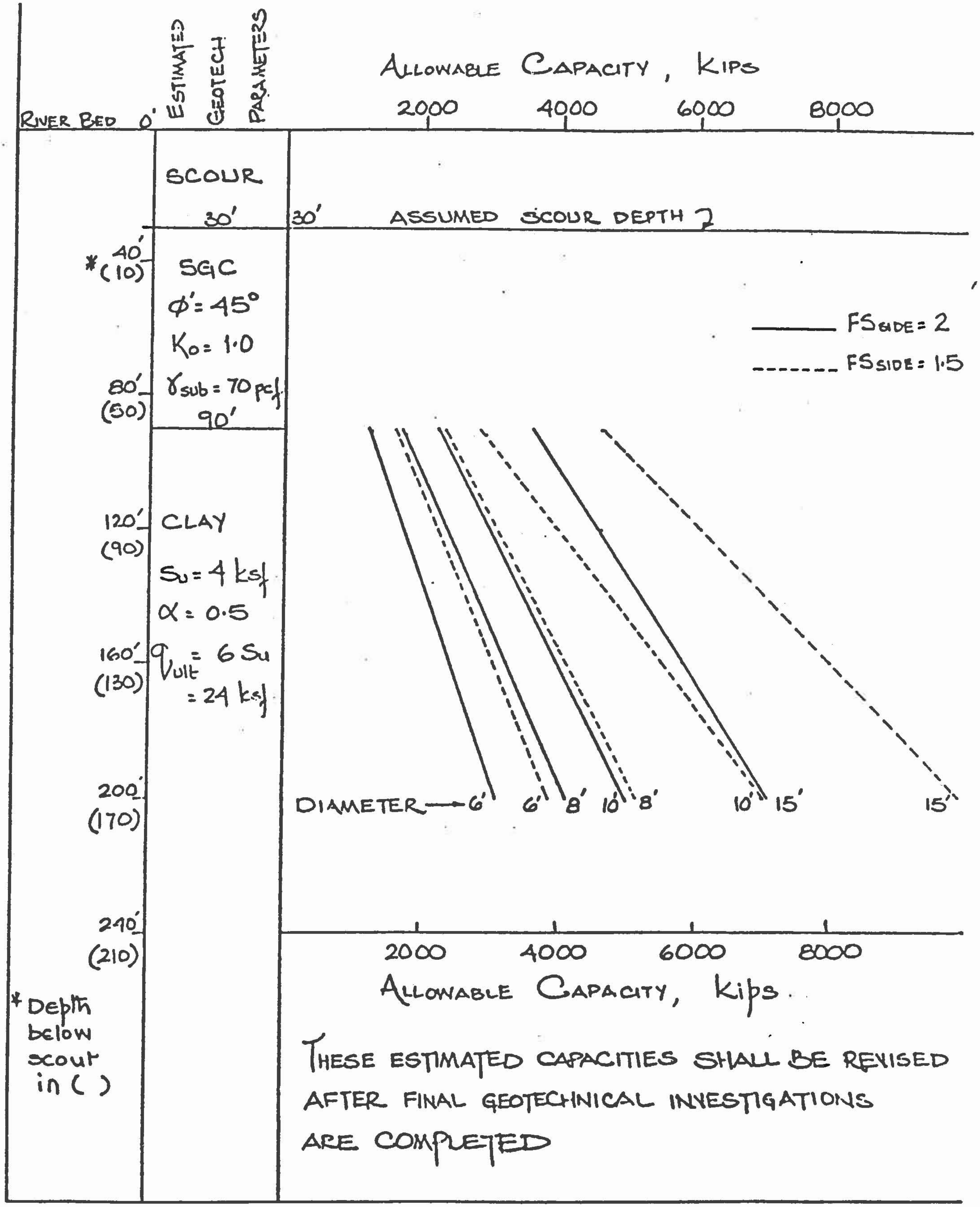
Construction of the post-tensioned concrete box girder structures required extensive falsework or use of trusses between piers as construction platforms. Since falsework in the river would be subject to flooding with very little warning time before releases from the upstream reservoirs, its application was rejected. The curved alignment, particularly the Southern location, would have made use of construction trusses very difficult and expensive. The revised Final Alignment with a long tangent section simplifies the use of traveler erection trusses and makes this method of construction more competitive.

Structural steel plate girders could be erected without the falsework risks of a cast-in-place concrete superstructure. This project, however, is on a fast track schedule with construction time limited in order to open the Freeway to traffic as planned. Some recent Arizona projects have been delayed several months due to the inability of out-of-state fabricators to deliver structural steel on schedule. This, coupled with a slightly higher preliminary cost estimate for a steel structure, resulted in elimination of this alternative type.

Subsequent to completion of the Structure Selection Reports for the Southern and Northern alignments, additional soil borings were completed and laboratory tests run. The laboratory tests indicated significantly less strength than originally estimated from the Standard Penetration Tests (SPT) and Pressure Meter Tests (PMT) upon which the initial drilled shaft capacities were based. These additional borings also indicated the occasional presence of soft zones interbedded within the generally stiff to hard clay. This discrepancy between field and laboratory tests and the required increase in factor-of-safety from 1.5 to 2.0 resulted in significantly less unit drilled shaft capacity as indicated by a comparison of the charts shown in Figures 7 and 8. The decreased foundation capacities would require three column piers for the long span concrete alternates. These additional columns would increase scour due to overlapping, increase the water surface elevations upstream of the structure and create potential debris buildup. The higher costs of the foundations to support the heavier long span superstructures and the undesirable three column piers lead to the conclusion that shorter spans are indicated.

Precast AASHTO girder spans have proven to be economical and with girders readily available from local sources, a tight construction schedule is achievable. To minimize the undesirable effects of more piers in the river, the span lengths should be as long as practical. Type VI precast girders can be designed to provide span lengths of approximately 140-feet with pier spacing of 146-feet. Slightly shorter span lengths with wider girder spacing proved to be the optimum layout at this site.

DRILLED SHAFT CAPACITY ESTIMATES



SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

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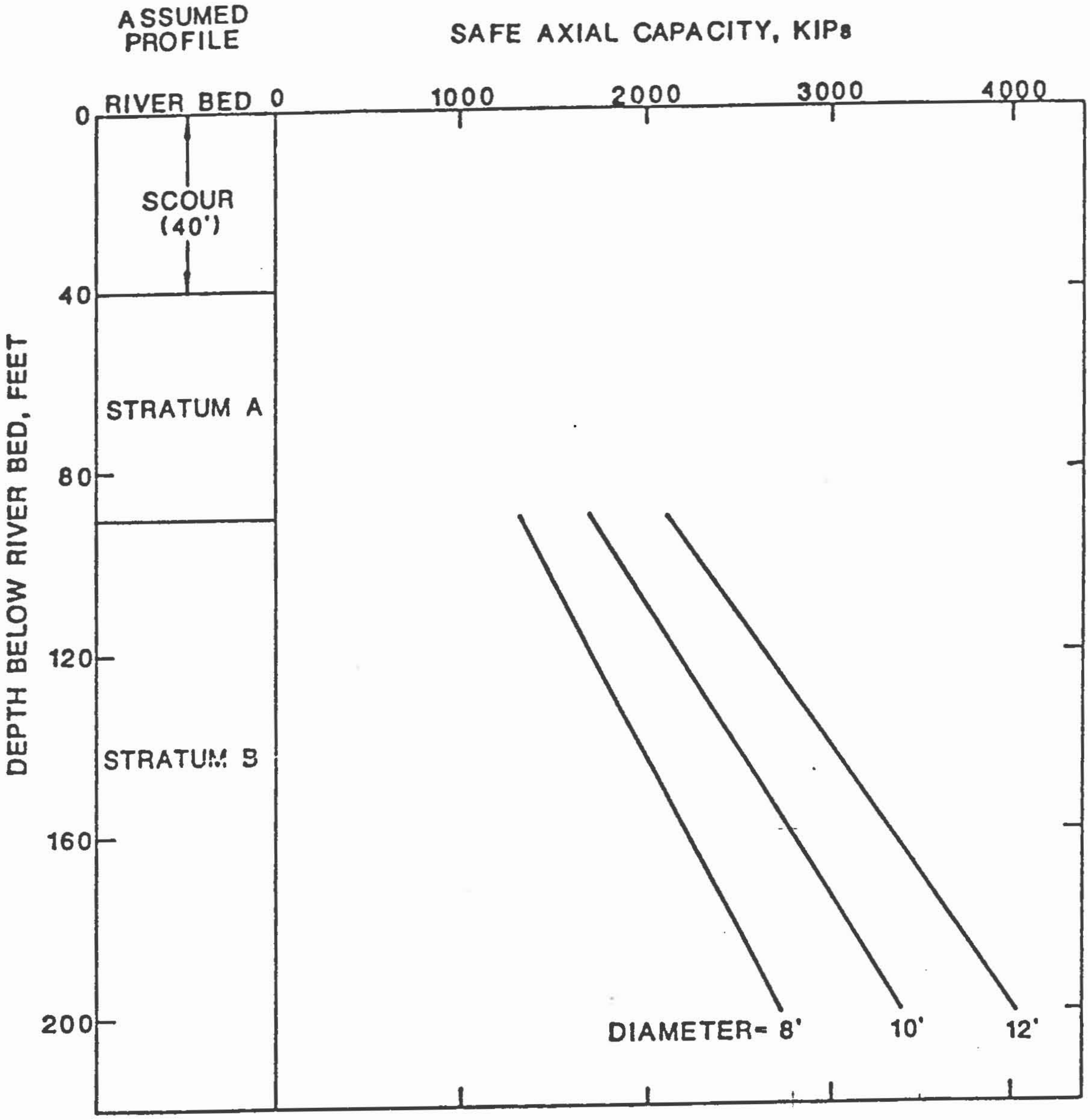
Project: E. PAPAGO-HOHOKAM-SKY HARBOR

Job No: E87-56

Computed by: AH Ckd. by:

Figure 7



ESTIMATED SAFE AXIAL CAPACITY OF
DRILLED PIERS IN COMPRESSION (40' SCOUR)

East Papago - Hohokam -
Sky Harbor Freeways
ADOT Project No. 202L MA H 0855 01D
Arizona Department of Transportatio
Maricopa County, Arizona
SHB Job No. E87-56
Letter No. 523

SERGENT, HAUSKINS & BECKWITH

Figure 8

3. HYDRAULICS, DRAINAGE AND SCOUR

3.1 HYDRAULICS

The hydrology and scour parameters for this project were provided by Simons, Li and Associates, Inc. (SLA). Selected tables and charts from their Addendum No. 4 to "Preliminary Hydraulic Analysis of the Salt River" study are included in this report. More complete explanation of the procedures and assumptions used is contained in the referenced reports.

The concept conditions for the hydraulic study were:

(1) the alignment of the East Papago Freeway is entirely on structure;

(2) a leveed embankment on the south side of the Salt River which prevents flow in the south overbank;

(3) a protected north bank to an elevation of 1170.0 ft.;

(4) the effect of gravel pits removed;

(5) the best estimate of the Red Mountain T.I. configuration.

Water surface profiles for the 100-year peak discharge of 215,000 cfs were determined with debris buildup on the pier columns plus two feet of debris overhang on each side of the columns. The results are presented in Table 1.

Table 2 presents computed differences in water surface elevations, average velocities, and top widths between concept conditions and baseline conditions. Table 3 shows the water surface elevations for the superflood of 250,000 cfs with debris buildup on the piers.

The SLA Report indicates that "the state-of-the-art of river mechanics is such that flow depths on the order of those which exist within the Salt River cannot realistically be predicted more accurately than plus or minus 10%." To assure the safety of the structure under the most extreme circumstances, vulnerable piers and continuous structural units will be analyzed for stability assuming the cap beams submerged 4-feet, with full debris loading at the stream velocities predicted during the superflood.

3.2 DECK DRAINAGE

The bridge deck will be drained through scuppers in the deck, except over Ramp B and McClintock Drive. The scuppers will be located along the low gutter line to drain directly into the river.

3.3 SCOUR

The minimum predicted scour invert elevations for both the 100-year frequency and superflood events are given in Table 4. The total scour, assumed for structural design, includes general; bed-form; pier; and long term degradation plus an additional 30% depth for a safety factor. The pier scour component was computed assuming two feet of debris width on each side of the columns as previously noted for the water surface elevations. Gravel mining will not be permitted within the channel in this reach of the river, therefore headcutting is not included in the scour estimates.

The structure is being designed for stability under total scour and flood streamflow conditions. Pier foundations consist of deep, large-diameter drilled shafts founded in clay strata well below any potential scour.

TABLE 1

Channel Invert Elevations and Freeboard Requirements for Alternative 4, Q = 215,000 cfs

EAST PAPAGO STATION	CROSS-SECTION NUMBER	CHANNEL INVERT ELEVATION (feet)	WATER SURFACE ELEVATION (feet)	ELEVATION WITH FREEBOARD* (feet)	PHYSICAL FEATURE
294+90	227.10	1148.2	1171.7	1173.7	McClintock Road
295+75	227.40	1148.3	1172.6	1174.6	
299+20	228.00	1148.5	1173.0	1175.0	
303+50	229.00	1148.9	1173.1	1175.1	
307+50	230.00	1149.2	1173.2	1175.2	
311+50	231.00	1149.5	1173.7	1175.7	Old Scottsdale Landfill
316+20	232.00	1149.8	1174.5	1175.5	
320+20	233.00	1150.1	1175.5	1177.5	
324+20	234.00	1150.5	1176.5	1178.5	
328+20	235.00	1150.8	1177.4	1179.4	
332+45	236.00	1151.0	1178.3	1180.3	Old Tempe Landfill
336+50	237.00	1151.4	1178.9	1180.9	
342+25	238.00	1151.8	1179.9	1181.9	
347+00	239.00	1152.2	1180.1	1182.1	
	240.00	1152.6	1180.2	1182.2	Outer Loop Highway
	241.00	1153.0	1181.1	1183.1	
	242.00	1153.5	1181.7	1183.7	
	243.00	1153.8	1182.0	1184.0	
	244.00	1154.2	1182.0	1184.0	
	245.00	1154.7	1182.2	1184.2	
	246.00	1155.1	1182.5	1184.5	Evergreen Road
	247.00	1155.6	1182.5	1182.5	
	248.00	1156.0	1183.2	1185.2	
	249.00	1156.4	1183.3	1185.3	
	250.00	1156.8	1183.4	1185.4	
	251.00	1157.3	1183.4	1185.4	
	252.00	1159.1	1184.1	1186.1	Dobson Road

* Water-Surface Elevation + 2 feet

TABLE 2

Hydraulic Information -- Baseline and Concept Conditions for Alternative 4, 100-Year With Debris Buildup

		----- BASELINE CONDITION -----				----- CONCEPT CONDITION -----				
PROJECT STATION (ft)	CROSS-SECTION NUMBER	CALCULATED WATER SURFACE ELEV. (ft)	HYDRAULIC DEPTH (ft)	CHANNEL VELOCITY (fps)	TOPWIDTH (ft)	CALCULATED WATER SURFACE ELEV. (ft)	HYDRAULIC DEPTH (ft)	CHANNEL VELOCITY (fps)	TOPWIDTH (ft)	PHYSICAL FEATURE
36263	225.00	1170.5	17.6	10.6	2180	1171.2	22.8	8.2	1344	
36660	226.00	1171.3	17.6	10.7	2252	1171.5	22.9	7.8	1223	
37027	227.10	1171.8	17.1	11.0	1571	1171.7	22.4	8.4	1537	Hayden Road Bridge
37116	227.40	1171.8	14.2	13.2	1496	1172.6	23.2	8.1	1737	
37436	228.00	1173.8	18.7	10.5	2426	1173.0	22.7	7.3	2181	
37836	229.00	1174.9	22.7	7.7	2430	1173.1	22.0	9.0	2098	
38236	230.00	1175.0	22.6	8.7	2655	1173.2	21.3	11.6	2038	
38635	231.00	1175.0	21.3	12.8	2059	1173.7	21.6	12.6	1793	Old Scottsdale
39042	232.00	1175.4	22.8	13.0	2093	1174.5	21.4	12.9	1741	Landfill
39444	233.00	1177.3	15.4	9.1	2311	1175.5	22.0	12.5	1482	
39840	234.00	1177.7	24.6	8.4	1987	1176.5	22.7	11.8	1620	
40246	235.00	1177.7	22.3	10.8	1603	1177.4	23.9	11.1	1535	
40647	236.00	1178.6	24.6	9.1	1875	1178.3	23.8	9.9	1645	Old Tempe Landfill
41043	237.00	1179.1	24.6	8.6	1472	1178.9	24.5	9.3	1322	
41553	238.00	1179.6	25.2	7.8	1456	1179.9	26.3	7.4	1564	
42018	239.00	1179.8	16.5	8.9	1438	1180.1	26.5	7.5	1554	
42568	240.00	1180.4	25.0	8.0	1461	1180.3	26.4	8.8	946	Outer Loop Highway
43073	241.00	1181.0	22.9	6.8	1826	1181.1	27.1	6.8	1187	
43588	242.00	1181.5	25.0	5.1	2324	1181.7	23.9	5.5	2064	
44058	243.00	1181.7	25.7	4.0	2482	1182.0	24.8	4.3	2182	
44528	244.00	1181.8	19.2	4.5	2532	1182.0	19.2	4.7	2438	
45078	245.00	1181.9	16.1	4.8	2868	1182.2	16.3	4.9	2731	
45693	246.00	1182.2	16.9	4.2	3146	1182.5	16.9	4.1	3148	Evergreen Road
46197	247.00	1182.2	13.6	6.9	2354	1182.5	13.7	6.7	2392	
46736	248.00	1183.0	17.0	4.1	3177	1183.2	17.3	4.0	3180	
47237	249.00	1183.1	19.5	4.4	2579	1183.3	19.4	4.4	2581	
47757	250.00	1183.2	17.7	5.1	2450	1183.5	18.2	4.9	2455	
48364	251.00	1183.2	13.0	9.1	1861	1183.5	13.4	8.8	1862	
48862	252.00	1183.9	15.1	9.4	1558	1184.1	15.2	9.3	1559	Dobson Road
49506	253.00	1185.3	11.8	8.8	2121	1185.5	11.9	8.7	2122	
49980	254.00	1185.5	9.5	15.0	1545	1185.6	9.6	14.9	1547	
50487	255.00	1189.7	12.8	11.1	1541	1189.7	12.8	11.1	1541	
50957	256.00	1191.5	18.4	7.5	1586	1191.5	18.4	7.5	1586	
51491	257.00	1191.5	13.2	11.2	1496	1191.5	13.2	11.2	1496	
51910	258.00	1192.6	17.3	11.0	1162	1192.6	17.3	11.0	1162	
52496	259.00	1194.3	15.5	9.1	1565	1194.3	15.5	9.1	1565	
53001	260.00	1195.3	17.8	8.0	1662	1195.3	17.8	8.0	1662	
53445	261.00	1195.9	20.9	6.9	2069	1195.9	20.9	6.9	2069	
53954	262.00	1195.9	17.2	11.7	1820	1195.9	17.2	11.7	1820	
54478	263.00	1196.9	13.1	11.7	2145	1196.9	13.1	11.7	2145	
55034	264.00	1198.2	12.2	12.2	1871	1198.2	12.2	12.2	1871	
55471	265.00	1199.6	13.4	11.0	2008	1199.6	13.4	11.0	2008	Alma School Road

SALT RIVER BRIDGE

TABLE 3

Water-Surface Elevations for Alternative 4 with Q = 250,000 cfs

EAST PAPAGO STATION	CROSS-SECTION NUMBER	CHANNEL INVERT ELEVATION (feet)	WATER SURFACE ELEVATION (feet)	PHYSICAL FEATURE
286+75	225.00	1147.6	1172.5	
291+00	226.00	1147.9	1172.9	
294+90	227.10	1148.2	1173.2	Hayden Road Bridge
295+75	227.40	1148.3	1174.0	
299+20	228.00	1148.5	1174.6	
303+50	229.00	1148.9	1174.7	
307+50	230.00	1149.2	1174.8	
311+50	231.00	1149.5	1175.4	Old Scottsdale Landfill
316+20	232.00	1149.8	1176.1	
320+20	233.00	1150.1	1176.9	
324+20	234.00	1150.5	1177.8	
328+20	235.00	1150.8	1179.0	
332+45	236.00	1151.0	1180.0	Old Tempe Landfill
336+50	237.00	1151.4	1180.8	
342+25	238.00	1151.8	1181.6	
347+00	239.00	1152.2	1181.9	
	240.00	1152.6	1182.0	Outer Loop Highway
	241.00	1153.0	1183.0	
	242.00	1153.5	1183.6	
	243.00	1153.8	1183.9	
	244.00	1154.2	1184.0	
	245.00	1154.7	1184.2	
	246.00	1155.1	1184.5	Evergreen Road
	247.00	1155.6	1184.5	
	248.00	1156.0	1185.1	
	249.00	1156.4	1185.2	
	250.00	1156.8	1185.3	
	251.00	1157.3	1185.3	
	252.00	1159.1	1185.8	Dobson Road

TABLE 4

TABLE A. EAST PAPAGO BRIDGE PIERS GROUPED INTO ZONES.		
PIER ZONE	EASTBOUND PIER #	WESTBOUND PIER #
1	1,2,3,4,5,6,7,8	1,2,3,4,5,6
2	9,10,11,12	7,8,9,10
3	13,14,15,16,17,18	11,12,13,14,15,16
4	19,20,21,22,23,24	17,18,19,20,21,22
5	25 thru 35	23 thru 33
6	36,37	34,35,36
7		37,38

TABLE B. PREDICTED SCOUR INVERT ELEVATION - EAST PAPAGO CROSSING OF SALT RIVER		
PIER ZONE	PREDICTED SCOUR INVERT ELEV. (ft.)	
	Q = 215,000 cfs	Q = 250,000 cfs
1	N/A*	1160
2	1105	1102
3	1101	1098
4	1093	1092
5	1102	1100
6	1093	1091
7	1093	1091

* A plot of the toe of the North Levee shows that all piers within Zone 1 either penetrate the levee or are located behind the levee.

4. GEOTECHNICAL

The preliminary geotechnical investigations for Segment 6 were performed by Sergent, Hauskins and Beckwith (SH & B). Selected figures and charts from their reports are included. Explanation of the boring and laboratory procedures used along with the detailed boring logs are given in their "Preliminary Geotechnical Investigation Report - Design Section 6". Due to right-of-way restrictions, only four soil borings were drilled for the Southern alignment. Preliminary capacity charts (Figure 7) for various diameters of drilled shafts were developed and became the basis for all the preliminary foundation estimates for both the Southern and Northern alignments. Eight additional borings were drilled for the Northern alignment, however, the results were not available to be included in that Structure Selection Report. Generalized logs of these borings are shown in Figure 9.

The preliminary borings in the river bed reveal the typical unconsolidated alluvium consisting of sand, gravel, cobble (SGC) and some boulders down to about Elevation 1050. The strata below the SGC consists of thin interbedded layers of clay, silt and fine grained sand with localized horizontally discontinuous lenses of sand and gravel. The SRP-78 landfill consisting of soil deposits overlying construction debris and refuse was encountered on the alignment west of McClintock Drive. The refuse consists predominantly of wood, concrete, asphalt, tree trimmings, wire, metal, plastic, and brick.

Supplementary geotechnical investigations are currently being performed by Thomas-Hartig and Associates (THA). This program consists of 170 to 200 feet deep borings located near each proposed pier and soil samples taken in the clay strata.

Since the capacity of the drilled shaft foundation is so critical to the design and construction cost of this structure, it was decided to conduct a load test program. This program consists of loading a 36" diameter drilled shaft to failure in side friction at each of two sites along the alignment. An observation shaft and two full size (10' diameter) production shafts were also drilled. The results of the two load tests will be used along with the boring logs and laboratory test data to determine the final design capacity of the drilled shaft foundations.

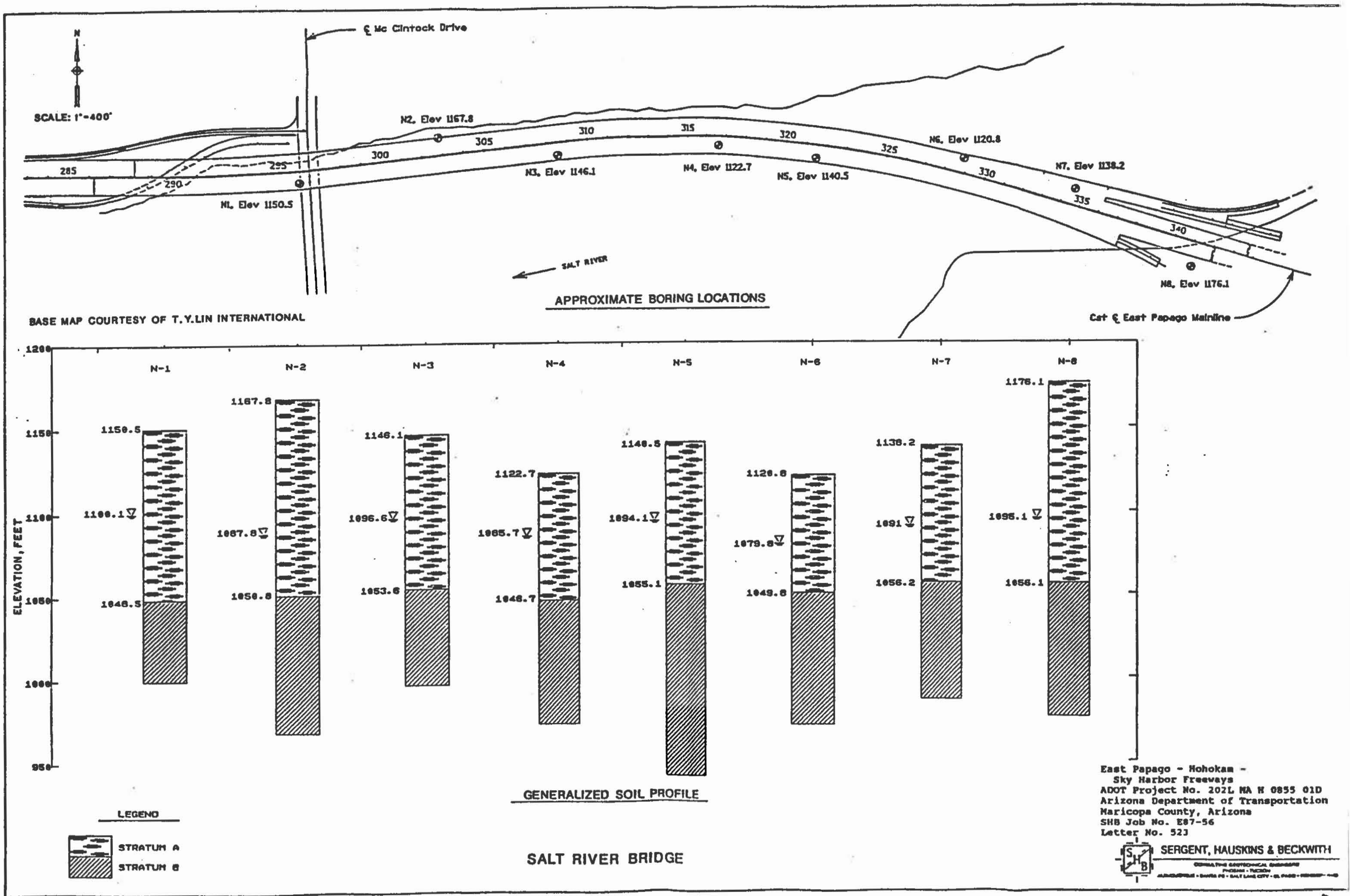

N
SCALE: 1"=400'
℄ Mc Clintock Drive
N1, Elev 1150.5
N2, Elev 1167.8
N3, Elev 1146.1
N4, Elev 1122.7
N5, Elev 1140.5
N6, Elev 1120.8
N7, Elev 1138.2
N8, Elev 1176.1
285
290
295
300
305
310
315
320
325
330
335
340
SALT RIVER
APPROXIMATE BORING LOCATIONS
BASE MAP COURTESY OF T.Y.LIN INTERNATIONAL
Cst ℄ East Papago Mainline
ELEVATION, FEET
1200
1150
1100
1050
1000
950
N-1
N-2
N-3
N-4
N-5
N-6
N-7
N-8
1150.5
1100.1
1048.5
1167.8
1087.8
1050.8
1146.1
1096.6
1053.6
1122.7
1085.7
1048.7
1140.5
1094.1
1055.1
1120.8
1079.8
1049.8
1138.2
1091
1056.2
1176.1
1095.1
1056.1
GENERALIZED SOIL PROFILE
LEGEND
STRATUM A
STRATUM B
SALT RIVER BRIDGE
East Papago - Hohokam -
Sky Harbor Freeways
ADOT Project No. 202L MA H 0855 01D
Arizona Department of Transportation
Maricopa County, Arizona
SHB Job No. E87-56
Letter No. 523
SERGENT, HAUSKINS & BECKWITH

Figure 9

5. REFINEMENT OF SELECTED STRUCTURE TYPE

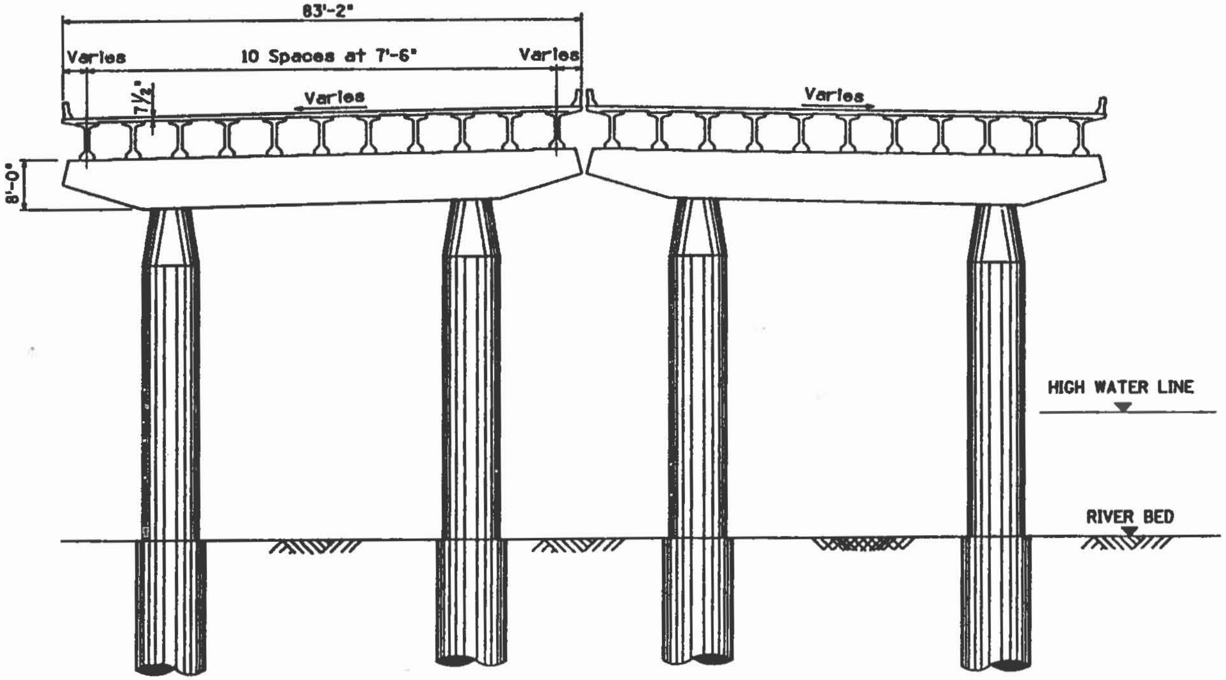
Upon selection of the precast girder type of structure, studies were made to optimize the layout. Cost estimates for different span lengths and girder spacing were derived and combined with substructure costs to produce the most economical total structure. The final layout and cross section are shown in Figures 4 and 10.

The location and alignment of the proposed south hard bank (levee) were adjusted to reduce the length of structure without any significant effect on the river hydraulics. The profile was adjusted to provide minimum vertical clearances over Ramp B and McClintock Drive, then rolled down to keep the cap beams just above the design flood as shown in Figure 3.

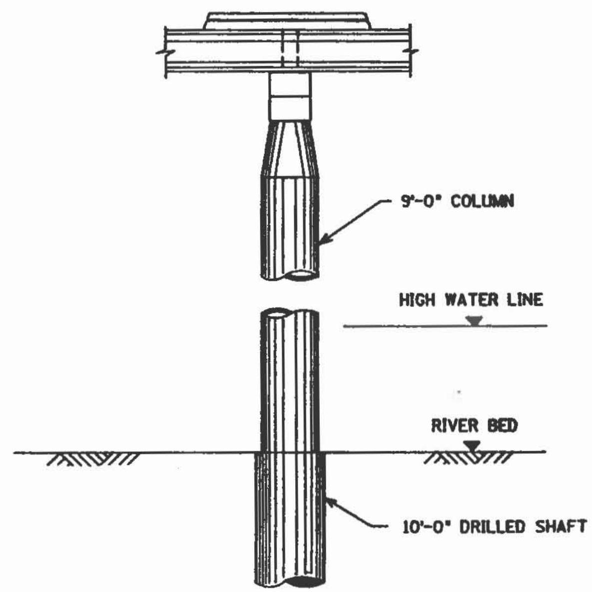
In order to reduce dead load on the foundations consideration was given to hollow column and cap beam sections. Further study indicated the preferable solution would be to reduce the size of the cap beam rather than to provide internal voids. A truncated cone column section is used as a transition between the larger column diameter and narrow cap beam. Preliminary design indicates 8' to 9' diameter columns will be required. The typical column will be hollow with walls 15 to 18 inches thick. Post-tensioned segmental columns will be detailed on the plans and permitted as a contractor option. The two piers that straddle Ramp B may require post-tensioned caps. Inverted "T" pier caps supporting simple girders without positive moment connections were considered, but it was decided to use the standard continuous girder details. Continuous units were limited to three spans to permit the use of economical strip-seal expansion joints.

The standard East Papago Freeway fluted surface treatment (rustication) will be used for the abutments and retaining walls to provide visual continuity with other structures on the Freeway.

AASHTO VI GIRDERS



TYPICAL SECTION



ELEVATION AT PIER

TWO COLUMN BENT

Figure 10

6. CONSTRUCTION

The approximately 185 drilled shaft foundations can be constructed using slurry, if needed, to stabilize the hole through the SGC layer. Total length of the 10 foot diameter drilled shafts are estimated to range from 130 to 150 feet. Concrete would be deposited from the bottom up by a tremie with removable sections or a pump line.

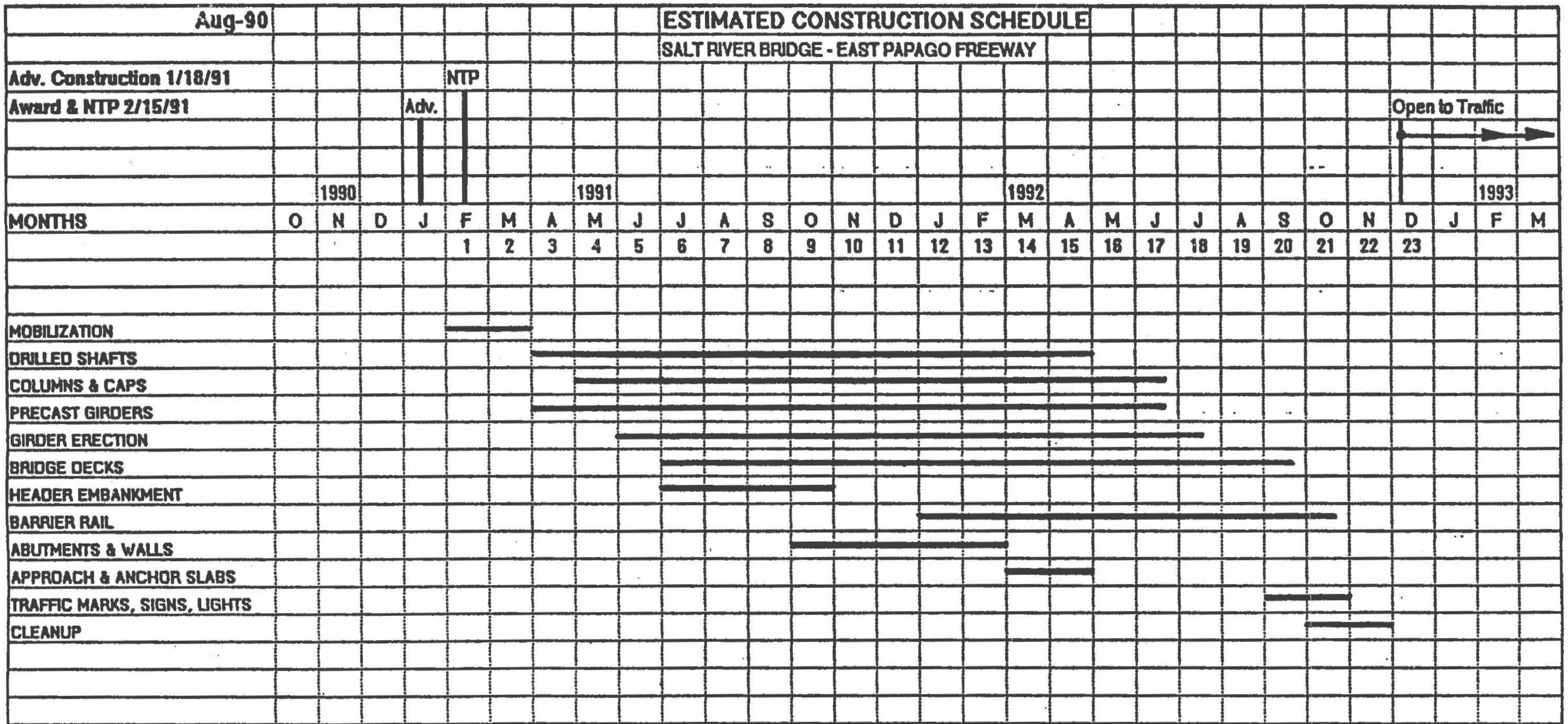
Columns may be cast-in-place or post-tensioned precast . The hollow columns would be cast in reusable steel forms. The optional precast segmental columns would be match-cast in approximately 8 foot long sections, erected on the drilled shaft foundations, grouted and partially post-tensioned prior to erection of forms for the cap beams. Final post-tensioning will secure the caps to the columns. Caps will be graded to match the roadway cross slope.

The precast girders will be erected by cranes working from the ground. The layout is arranged to span McClintock Drive with a minumum disruption of traffic, by scheduling the erection of these girders, during off-peak hours.

Some 230 KV transmission lines running parallel to McClintock Drive must be raised to provide construction clearances. The 69 KV and smaller lines must be temporarily rerouted for construction.

6.1 CONSTRUCTION SCHEDULE

The diagrammatic construction schedule presented on Figure 11 assumes that construction activities will be continuously and vigorously pursued from Notice-to-Proceed. It does not include delays due to flooding or inclement weather. Work must proceed on both structures simultaneously to complete the project within the schedule.



BASIS OF ESTIMATE - CRITICAL PATH ITEMS

ITEMS	QUANTITIES		RATE OF CONSTRUCTION /WEEK	
DRILLED SHAFTS	164=	24,600 LIN. FT	3=	439 LIN. FT.
COLUMNS	164=	8,300 C.Y.	3=	155 C.Y.
PIER CAPS	80=	12,100 C.Y.	1.4=	208 C.Y.
PRECAST GIRDERS	883=	118,743 LIN FT.	15=	1915 LIN. FT.
BRIDGE DECK & DIAPHRAGMS		31,200 C.Y.	520 C.Y.=	AVERAGE

Figure 11

7. COST ESTIMATE

East Papago Section 6 Salt River Bridge
QUANTITIES AND COST ESTIMATE 2-Aug-90
Precast AASHTO Type VI And IV Std Grdrs
(140' span c to c piers max)
(164- 9' dia columns and 10' drilled shafts)
(21- 6' drilled shafts)

Item	Quantity	Unit	Unit $	Cost $
SUPERSTRUCTURE:				
Deck concrete	24,540	CY	$200.00	$4,908,000
AASHTO VI GRDR (878)	118,288	LF	$94.00	$11,119,072
AASHTO IV GRDR(5)	455	LF	$80.00	$36,400
Diaphragm concrete	6,637	CY	$200.00	$1,327,400
Reinforcing	8,491,900	LB	$0.40	$3,396,760
Barrier concrete	2,043	CY	$215.00	$439,245
Expansion joints	2,628	LF	$200.00	$525,600
P/T CAP BRGS (SLIDE)	2	Each	$150.00	$300
POST- TENSIONING	34,650	LB	$1.30	$45,045
Bearings (Std)	1,766	Each	$150.00	$264,900
Vert Restrainers	1,602	Each	$75.00	$120,150
SUPERSTRUCTURE TOTAL				$22,182,872
SUBSTRUCTURE:				
Approach slab concrete	234	CY	$150.00	$35,100
Anchor slab concrete	784	CY	$150.00	$117,600
Pier cap concrete	12,136	CY	$200.00	$2,427,200
Pier concrete	8,300	CY	$200.00	$1,660,000
Abutment concrete	782	CY	$150.00	$117,300
Wingwall Concrete	543	CY	$150.00	$81,450
Reinforcing	5,680,000	LB	$0.40	$2,272,000
Drilled Shafts (10')	24,600	LF	$750.00	$18,450,000
Drilled shaft (6')	3,150	LF	$300.00	$945,000
Slope paving	1,215	SY	$25.00	$30,375
Structural excavation	1,385	CY	$10.00	$13,850
Structural backfill	9,440	CY	$15.00	$141,600
SUBSTRUCTURE TOTAL				$26,291,475
SUBTOTAL (TOTAL STRUCTURAL COST)				$48,474,347
MOBILIZATION (5%)				$2,423,717
SUBTOTAL				$50,898,064
CONTINGENCIES (15%)				$7,634,710
SCHEME TOTAL				$58,532,774

UNIT PRICE PER SCHEME: (912,622 SF)

Superstructure	$29.35
Substructure	$34.79
Total	$64.14