PLANNING REPORT

59TH AVENUE BRIDGE
OVER THE ARIZONA CANAL DIVERSION CHANNEL
CONTRACT FDC 82-18

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

BENSON & GERDIN
CONSULTING ENGINEERS

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July 23, 1982

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3335 West Durango Street
Phoenix, Arizona 85009

Reference: Arizona Canal Diversion Channel
Bridges - 59th Avenue South of
Thunderbird Road
Contract No. FCD-82-18

Gentlemen:

Submitted herewith is the Planning Report for the referenced project.

This report contains the results of our field investigation, geotechnical investigation, our engineering analysis and our recommendations and estimates of costs regarding the design of the Arizona Canal Diversion Channel Bridge located on 59th Avenue.

The recommended bridge structure is approximately 590 feet in length with an estimated cost of $2,152,135. The structural system will consist of eight 118-foot span AASHTO Type VI prestressed concrete I girders, for a total of five spans. In addition, the estimated cost of the Arizona Canal Bridge, South Approach and Detour #1 is $382,945 bringing the total project cost to $2,535,080.

We will be happy to meet with you as soon as you have had an opportunity to review this report and to discuss any question you may have concerning its contents.

Yours very truly,

BENSON & GERDIN, INC.
CONSULTING ENGINEERS

Michael E. Kennelly, P.E.

MEK:pd
Encl.

PLANNING REPORT

59TH AVENUE BRIDGE
OVER THE ARIZONA CANAL DIVERSION CHANNEL
CONTRACT FDC 82-18

FLOOD CONTROL DISTRICT
of
Maricopa County

BOARD OF DIRECTORS

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July, 1982

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I. SCOPE

The scope of this report is to present the results of our field investigations and engineering analysis and to present our recommendations for a bridge crossing over the Arizona Canal Diversion Channel on 59th Avenue south of Thunderbird Road.

Our field investigations include a field survey of 59th Avenue from Sweetwater Avenue to Thunderbird Road and a geotechnical investigation which includes soil borings, soil classification, and recommendations for the design of the bridge foundations.

A two-span reinforced concrete slab bridge is proposed over the relocated Arizona Canal south of the main structure and is included in this report for information only. A submittal of preliminary plans for the Arizona Canal Bridge is being made at this time to expedite completion of the contract drawings for that structure and to permit construction of that structure prior to the end of the 1982 canal dry-up.

II. DESIGN

A. Approach

The goal of this study is to provide recommendations for the new structures and roadway that will provide the best economic solution while minimizing inconvenience to the motoring public as well as to the adjacent property owners.

In addition, the aesthetics of the structure is an important consideration, since the channel will be used as a recreation site, and the underside of the structure will be visible to the public.

The following parameters were used in determining the approach:

1. A temporary paved detour will be required.

2. The Arizona Canal will be relocated to the south of the Arizona Canal Diversion Channel.

3. The canal dry-up is scheduled for late November and early December.

4. Utility relocations will be designed by others. Construction of utility relocations will be coordinated with the bridge construction projects.

5. The bridge structures will be designed according to AASHTO Specifications using service loads and working stress design to accommodate an HS20-44 loading.

6. Horizontal and vertical alignment will be in accordance with "A Policy on Design of Urban Highways and Arterial Streets," AASHTO, 1973, and the Arizona Department of Transportation 1979 Roadway Standards.

7. Construction will be in accordance with the Maricopa Association of Governments' Specifications, including the Maricopa County Supplements.

8. Coordination will be required with the Salt River Valley Water Users Association, the City of Glendale, and other utilities operating in the vicinity of the project.

9. The Arizona Canal Bridge will be designed in accordance with the revised Salt River Valley Water Users Association "Bridge Design Guidelines and Specifications," dated September 3, 1975.

Based on the given parameters, the following approach was selected:

1. Provide two sets of contract documents as follows:

   a. The Arizona Canal Bridge to include the south approach roadway and Detour #1.

   b. The Arizona Canal Diversion Channel Bridge to include the balance of the roadway and Detour #2.

2. Consider the use of two detours as an alternative to a single detour with temporary bridges, and determine if this alternative will provide cost savings to the project.

3. Expedite the contract documents for the Arizona Canal Bridge so that construction is complete prior to the end of the annual dry-up.

4. Analyze five alternate structure types using post-tensioned box girders and AASHTO type prestressed I-girders (Note: Structural steel was eliminated, based on recent bidding experience).

5. Prepare a comparative cost estimate for both projects and make recommendations for the structural type selection.

B. Construction Sequence

1. Arizona Canal Bridge

   a. Construct Detour #1 around the site of the new canal bridge construction.

   b. Construct S.R.V.W.U.A. canal in 59th Avenue right of way.

   c. S.R.V.W.U.A. will construct new canal gate structure and lateral pipeline crossing south of canal bridge.

   d. Existing 12" water main, 4" gas main and telephone ducts may remain during construction of canal bridge. 42" irrigation pipe will be relocated west of canal bridge and extend beyond north bank of new canal.

e. Construct new canal bridge.

f. Construct roadway embankment south of new canal bridge, and construct the temporary approach north of the new canal bridge. The material will be borrowed from the A.C.D.C. channel east or west of the 59th Avenue right of way.

g. Complete pavement on south approach and temporary north approach.

h. Return traffic to 59th Avenue and complete canal east of 59th Avenue and canal lining.

2. A.C.D.C. Bridge

a. Divert water into new canal at end of dry-up. Plug 42" irrigation pipe under new canal.

b. Relocate existing utilities in the right of way.

c. Fill and compact the existing canal.

d. Construct Detour #2.

e. Complete A.C.D.C. excavation in the 59th Avenue right of way as required to complete the structure.

f. Construct A.C.D.C. bridge.

g. Construct north and south approach embankments.

h. Complete utility relocations to permanent location.

i. Complete roadway pavement.

j. Remove detour pavement (embankment to remain as a protective berm on east side of new bridge).

C. Detours

Two detours will be utilized during the construction of the project. The detours will be designed with two 12-foot traffic lanes, one in each direction, and the design speed will be 30 MPH. The posted construction speed limit will be 25 MPH (see Exhibits 7 & 8).

D. Traffic Control and Access

The design of traffic control and access will minimize inconvenience to the motoring public, local residents, utilities, and emergency vehicles during the construction phase, while providing a minimum cost for traffic control devices or personnel.

E. Arizona Canal Diversion Channel

The bridge alternatives are designed to span an earth-lined trapezoidal channel having a 220-foot

wide bottom and six to one side slopes, and crossing 59th Avenue at a skew of 41°48'17" right. The design flow is 29,000 cubic feet per second at a depth of 17 feet. Three feet of freeboard will be provided to the underside of the superstructure.

F. Geotechnical Investigation

The geotechnical investigation and report were completed by Western Technologies, Inc., on July 8, 1982. The report includes subsurface soil profiles, alternate foundation recommendations, analysis of the soils for use in fill zones and pavement design, and grain sizes to be used for scour analysis. The results of the geotechnical investigation are included in Appendix A.

G. Size and Type of Structure

The bridge deck will be designed for a 68-foot clear roadway. A five-foot sidewalk will be provided on each side of the bridge, separated from the roadway by a Jersey-type barrier. A seven-foot high chain link fence, designed to prevent anyone from throwing debris into the recreation area, will be included at the outside edge of each sidewalk.

The total length of the bridge will be such that the channel face of the abutment beams will not encroach on the water surface of maximum design flow. Five alternates will be analyzed in this report as follows:

Scheme A	AASHTO Type III Girders
Scheme B	AASHTO Type IV Girders
Scheme C	AASHTO Type VI Girders
Scheme D	5-Span Continuous Post-Tensioned Concrete Box Girder
Scheme E	4-Span Continuous Post-Tensioned Concrete Box Girder

H. Right of Way

The right of way required for the Arizona Canal Diversion Channel and the relocation of the Arizona Canal was determined under a separate contract by International Engineering Co., Inc. Additional right of way will not be required for the construction of this project. However, a temporary easement will be required on the east side of 59th Avenue north of the existing Arizona Canal for the construction of Detour No. 2 (see Exhibit 7). [Note: see section IX E page 33.]

III. ANALYSIS OF ALTERNATE STRUCTURES - ARIZONA CANAL DIVERSION CHANNEL

A. Bridge Deck

The roadway width will conform with the City of Glendale major arterial street section. The total roadway width is 68 feet, which will allow for one 12-foot wide and one 16-foot wide lane in each direction, separated by a 12-foot wide left turn channel. The two 5-foot wide sidewalks are separated from the roadway by a concrete barrier (2'-9" high), with a 1'-9" high metal handrail on

top. The total height of the barrier rail is 4'-6", which is the minimum required by AASHTO for pedestrian and bicycle traffic. A 7-foot high, curved, chain link fence will be used at the outer edge of the sidewalks.

The concrete deck surface will have a transverse slope of minus 2% each way from the centerline. Deck drains will not be used on the structure because a public recreation area is planned for the channel below the bridge.

The overall width of the bridge deck is 82'-6", and the surface of the deck is approximately 26 feet above the channel invert. The overall length of the bridge will be between 590 and 600 feet.

B. Alternatives

1. Scheme A

Scheme A is designed with AASHTO Type III prestressed concrete I-girders, spaced at 8'-0" on center, for a total of ten girders in each span. The deck slab will be 7" thick, and the deck section will have live load continuity over the supports.

The superstructure will be supported by a cast-in-place concrete cap beam resting on 4'-0" diameter concrete columns supported by spread footings as outlined in Foundations (III-C page 12).

The bridge will have nine spans of 65'-9", for a total length between abutment bearing centerlines of 591'-9".

Exhibit 2 shows the conceptual design. A preliminary cost estimate for Scheme A is on page 21.

2. Scheme B

Scheme B is designed with AASHTO Type IV pre-stressed concrete I-girders spaced at 9'-0" on center, for a total of nine girders in each span. The deck slab will be 7-1/2" thick, and the deck section will have live load continuity over the supports.

The superstructure will be supported by a cast-in-place concrete cap beam resting on 4'-6" diameter concrete columns supported by spread footings as outlined in Foundations (III-C page 12).

The bridge will have seven spans of 84'-6" for a total length between abutment bearing centerlines of 591'-6".

Exhibit 3 shows the conceptual design. A preliminary cost estimate for Scheme B is on page 22.

3. Scheme C

Scheme C is designed with AASHTO Type VI prestressed concrete I-girders spaced at 10'-0" on center for a total of eight girders in each span. The deck slab will be 8" thick, and the deck section will have live load continuity over the supports.

The superstructure will be supported by a cast-in-place concrete cap beam resting on 5'-0" diameter concrete columns supported by spread footings as outlined in Foundations (III-C page 12).

The bridge will have five spans of 118'-0" for a total length between abutment bearing centerlines of 590'-0".

Exhibit 4 shows the conceptual design. A preliminary cost estimate for Scheme C is on page 23.

4. Scheme D

Scheme D is a cast-in-place concrete post-tensioned box girder bridge. The box girder will be continuous for its full length. The top slab is 7-1/2" thick, and the total depth of the box girder is 5'-0".

The superstructure is supported by four columns at each pier, resting on spread footings as outlined in Foundations (III-C page 12).

The bridge will have two end spans of 99'-0" and three interior spans of 131'-0", for a total length between abutment bearing centerlines of 591'-0".

Exhibit 5 shows the conceptual design. A preliminary cost estimate for Scheme D is on page 24.

5. Scheme E

Scheme E is a cast-in-place concrete post-tensioned box girder bridge. The box girder will be continuous for its full length. The top slab is 7-1/2" thick, and the total depth of the box girder is 6'-0".

The superstructure is supported by four columns set each pier, resting on spread footings as outlined in Foundations (III-C page 12).

The bridge will have two end spans of 127'-0" and two interior spans of 169'-0", for a total length between abutment bearing centerlines of 592'-0".

Exhibit 5 shows the conceptual design. A preliminary cost estimate for Scheme E is on page 25.

C. Foundations

The proposed foundation system consists of straight shaft cast-in-place reinforced concrete

piling at the abutments and spread footings supporting the columns at the piers.

The abutment beams are cast integrally with the deck in each scheme and are supported on concrete friction piling. The following table lists the abutment foundation configuration for each scheme.

ABUTMENT PILING

Scheme	No. Piles	Diameter	Length in Feet
A	10	2'-0"	45
B	9	2'-0"	50
C	8	2'-6"	50
D	10	2'-0"	45
E	10	2'-6"	45

The pier columns are supported on spread footings. The footings will be located below the channel invert a minimum distance of 5 feet plus an allowance for scour and long term degradation of the channel bed. The final depth of footings will be established after reviewing the results of the Hydraulic Study. The following table lists the pier footings configuration for each scheme.

PIER FOOTINGS

Scheme	Length in Feet	Width in Feet	Thickness in Feet
A	14	14	4.5
B	14	14	4.5
C	14	14	4.5
D	13	8	5
E	15	15	6

The recommended size, depth and bearing capacity of the foundations is shown in the Geotechnical Report in Appendix A.

IV. RELOCATED ARIZONA CANAL BRIDGE

No alternative structure type analysis was conducted for the new canal bridge. Since the length of time for construction is not limited to the duration of the canal dry-up, the structure type was selected and preliminary plans are being submitted along with this Planning Report.

The total roadway width is 68 feet, which will allow for one 12'-wide lane and one 16'-wide lane in each direction, separated by a 12'-foot left turn channel. A 10-inch high curb will separate the roadway from a 5-wide sidewalk on either side of the structure. A concrete edge beam with a steel barrier rail will be constructed at each edge of the deck. The deck will be a two-span reinforced concrete slab bridge, with each span being 31'-6". The abutment beam is cast integrally with the deck and is supported by belled caisson extending into the native material. The pier will be of the wall type, supported on a spread footing and extending into the native material.

The preliminary drawings for this structure are shown in Appendix E. The cost estimate is shown on page 29.

V. TRAFFIC CONTROL AND ACCESS

Local access to public and private property in the construction area will not be required on this project.

However, through traffic will be maintained during the construction phase. Access to S.R.V.W.U.A. facilities will be maintained from the detour to the area of new construction east of 59th Avenue.

Traffic control will be in accordance with the M.U.T.C.D. as modified by the requirements of M.A.G., Maricopa County, and the City of Glendale.

A. Alternate Detours

To expedite construction and also to eliminate the need for temporary bridges, it is recommended that the contracts be phased. Phase I will be the construction of the Arizona Canal Bridge and Detour 1. Phase II will be the construction of the Arizona Canal Diversion Channel Bridge and Detour 2. Exhibit 7 shows the two detour alignments.

Detour 1 utilizes the existing canal bridge and bypasses the new canal bridge construction site. Detour 2 utilizes the new canal bridge during the construction of the Arizona Canal Diversion Channel Bridge.

A cost estimate for each detour is included in its respective construction phase.

B. Traffic Counts and Detour Capacity

The traffic counts on 59th Avenue are as follows:

Total Daily Traffic (24-hour)	11,619 vehicles

Peak Hour Traffic

Time	Vehicle Count
6-7 AM	448
7-8 AM	1093
8-9 AM	802
9-10 AM	562
3-4 PM	922
4-5 PM	1064
5-6 PM	1149
6-7 PM	949

The capacity of the detour in one direction is determined from the following formulas:

$$N = \frac{5280\ V}{S}$$

$$S = V + 20$$

where N = number of vehicles per hour in one direction

V = velocity in MPH

$$S = 25 + 20 = 45$$

$$N = \frac{5280 \times 25}{45} = 2933 \text{ vehicles/hour}$$

Therefore, the proposed detour should be able to handle any increase in traffic that may occur during the design and construction of the project.

There is a City fire station located one-quarter mile north of Thunderbird Road on 59th Avenue, and emergency vehicles would use 59th Avenue to reach the area south of the construction site. The City of Glendale has a service yard at 6210 W. Myrtle and service vehicles use 59th Avenue.

VI COST ESTIMATES - PHASE II

A.C.D.C. Bridge

ARIZONA CANAL DIVERSION CHANNEL BRIDGE

ROADWAY ESTIMATE

PHASE II NORTH APPROACH

Item No.	Estimated Quantities		Item	Unit Price	Estimated Cost
New Roadway					
1	600	CY	Borrow Excavation	1.00	600
2	3,440	SY	Subgrade Preparation	3.00	10,320
3	1,500	TN	Select Material (8")	5.00	7,500
4	750	TN	ABC (4")	6.00	4,500
5	345	TN	Asphaltic Concrete C3/4 (1-3/4")	30.00	10,350
6	200	TN	Asphaltic Concrete E3/8 (1")	30.00	6,000
7	483	LF	New Concrete Curb & Gutter Mag 220-A	7.00	3,381
8	2,515	LF	New Concrete Sidewalk Mag 230	1.75	4,402
9	740	SF	New Concrete Driveway Entrance Mag 250	2.50	4,070
10	200	LF	New Concrete Barrier Transition	60.00	12,000
11	1	EA	Catch Basin Type M-1	2,000.00	2,000
12	400	LF	18" R.C.P.	30.00	13,800
13	1,276	SY	Remove Existing Concrete Pavement	2.00	2,552
14	14	EA	Remove Trees (10" dia.)	150.00	2,100
15	1	LS	Misc. Removal	35,000.00	35,000
			Total New Roadway		$118,575

ARIZONA CANAL DIVERSION CHANNEL BRIDGE

ROADWAY ESTIMATE

PHASE II NORTH APPROACH

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
Detour #2				
16	3,500 CY	Borrow Excavation	1.00	3,500
17	2,350 SY	Subgrade Preparation	3.00	7,050
18	510 TN	ABC (4")	6.00	3,060
19	270 TN	AC (2")	30.00	8,100
20	1 LS	Remove Detour	2,000.00	2,000
		Total Detour #2		$23,710
		TOTAL BRIDGE - NORTH APPROACH AND DETOUR #2		$142,285

59TH AVENUE BRIDGE OVER ARIZONA CANAL DIVERSION CHANNEL

STRUCTURE COST ESTIMATE

SCHEME A

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
21	900 LF	Drilling Shaft Foundations (2' dia.)	$ 150.00	$ 135,000
22	105 CY	Class AA Concrete (Modified)	100.00	10,500
23	2,077 CY	Class A Concrete (3000 PSI)	150.00	311,550
24	1,561 CY	Class AA Concrete (4000 PSI)	200.00	312,200
25	826,500 LBS	Reinforcing Steel	.40	330,600
26	90 EA	Prestressed Girders (65'-9") (AASHTO TYPE III)	5,800.00	522,000
27	1,300 LF	Steel Traffic Barrier Handrail	40.00	52,000
28	1,300 LF	Chain Link Fence (7' High)	40.00	52,000
		Subtotal - Structure		$1,725,850
		Removals, Detour, Roadway, and Channel		142,285
		Subtotal		1,868,135
		Engineering and Contingencies (15%)		280,220
		TOTAL FOR SCHEME A		$2,148,355

59TH AVENUE BRIDGE OVER ARIZONA CANAL DIVERSION CHANNEL

STRUCTURE COST ESTIMATE

SCHEME B

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
21	900 LF	Drilling Shaft Foundations (2' dia.)	$ 150.00	$ 135,000
22	105 CY	Class AA Concrete (Modified)	100.00	10,500
23	2,063 CY	Class A Concrete (3000 PSI)	150.00	309,450
24	1,664 CY	Class AA Concrete (4000 PSI)	200.00	332,800
25	806,000 LBS	Reinforcing Steel	0.40	322,400
26	63 EA	Prestressed Concrete Girders (84'-6") (AASHTO TYPE IV)	9,000.00	567,000
27	1,295 LF	Steel Traffic Barrier Handrail	40.00	51,800
28	1,295 LF	Chain Link Fence (7' High)	40.00	51,800
		Subtotal - Structure		$1,780,750
		Removals, Detour, Roadway, and Channel		142,285
		Subtotal		1,923,035
		Engineering and Contingencies (15%)		288,455
		TOTAL FOR SCHEME B		$2,211,450

59TH AVENUE BRIDGE OVER ARIZONA CANAL DIVERSION CHANNEL

STRUCTURE COST ESTIMATE

SCHEME C

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
21	800 LF	Drilling Shaft Foundations (2'-6" dia.)	$ 175.00	$ 140,000
22	145 CY	Class AA Concrete (Modified)	100.00	14,500
23	1,669 CY	Class A Concrete (3000 PSI)	150.00	250,350
24	1,701 CY	Class AA Concrete (4000 PSI)	200.00	340,200
25	771,600LBS	Reinforcing Steel	0.40	308,640
26	40 EA	Prestressed Concrete Girders (118'-0") (AASHTO TYPE VI)	14,300.00	572,000
27	1,292 LF	Steel Traffic Barrier Handrail	40.00	51,680
28	1,292 LF	Chain Link Fence (7' High)	40.00	51,680
		Subtotal - Structure		$1,729,050
		Removals, Detour, Roadway, and Channel		142,285
		Subtotal		1,871,335
		Engineering and Contingencies (15%)		280,700
		TOTAL FOR SCHEME C		$2,152,035

59TH AVENUE BRIDGE OVER ARIZONA CANAL DIVERSION CHANNEL

STRUCTURE COST ESTIMATE

SCHEME D

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
21	900 LF	Drilling Shaft Foundations (2' dia.)	$ 150.00	$ 135,000
22	105 CY	Class AA Concrete (Modified)	100.00	10,500
23	1,204 CY	Class A Concrete (3000 PSI)	150.00	180,600
24	3,330 CY	Class AA Concrete (4500 PSI)	250.00	832,500
25	1,007,000 LBS	Reinforcing Steel	.40	402,800
26	1 LS	Post-Tensioned Cast-in-Place Concrete	200,000.00	200,000
27	1,295 LF	Steel Traffic Barrier Handrail	40.00	51,800
28	1,295 LF	Chain Link Fence (7' High)	40.00	51,800
		Subtotal - Structure		$1,865,000
		Removals, Detour, Roadway, and Channel		142,285
		Subtotal		2,007,285
		Engineering and Contingencies (15%)		301,090
		TOTAL FOR SCHEME D		$2,308,375

59TH AVENUE BRIDGE OVER ARIZONA CANAL DIVERSION CHANNEL

STRUCTURE COST ESTIMATE

SCHEME E

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
21	900 LF	Drilling Shaft Foundations (2'-6" dia.)	$ 175.00	$ 157,500
22	164 CY	Class AA Concrete (Modified)	100.00	16,400
23	1,204 CY	Class A Concrete (3000 PSI)	150.00	180,600
24	3,500 CY	Class AA Concrete (4500 PSI)	250.00	875,000
25	1,096,000 LBS	Reinforcing Steel	0.40	438,400
26	1 LS	Post-Tensioned Cast-in-Place Concrete	200,000.00	200,000
27	1,300 LF	Steel Traffic Barrier Handrail	40.00	52,000
28	1,300 LF	Chain Link Fence (7' High)	40.00	52,000
		Subtotal - Structure		$1,971,900
		Removals, Detour, Roadway, and Channel		142,285
		Subtotal		2,114,185
		Engineering and Contingencies (15%)		317,130
		TOTAL FOR SCHEME E		$2,431,315

VII COST ESTIMATES - PHASE I

Arizona Canal Bridge

RELOCATED ARIZONA CANAL BRIDGE

ROADWAY ESTIMATE

PHASE I SOUTH APPROACH

Item No.	Estimated Quantities		Item	Unit Price	Estimated Cost
New Roadway					
1	16,300	CY	Borrow Eacavation	1.00	16,300
2	3,560	SY	Subgrade Preparation	3.00	10,680
3	1,550	TN	Select Material (8")	5.00	7,750
4	775	TN	ABC (4")	6.00	4,650
5	355	TN	Asphaltic Concrete C3/4 (1-3/4")	30.00	10,650
6	205	TN	Asphaltic Concrete E3/8 (1")	30.00	6,150
7	615	LF	Concrete Curb & Gutter Mag 220-A	7.00	4,305
8	2,830	SF	Concrete Sidewalk Mag 230	1.75	4,953
9	250	SF	Concrete Driveway Entrance Mag 250	2.50	625
10	2,000	SY	Concrete Canal Lining	25.00	50,000
11	554	LF	Remove Concrete Curb & Gutter	2.00	1,108
12	2,770	SF	Remove Concrete Sidewalk	1.00	2,770
13	160	SY	Remove Existing Concrete Pavement	2.00	320
14	1	LS	Misc. Removals	5,000.00	5,000
15	312.5	LF	New Guard Rail (A.D.O.T. Standard)	22.00	6,875
			Total New Roadway		$121,066

RELOCATED ARIZONA CANAL BRIDGE

ROADWAY ESTIMATE

PHASE I SOUTH APPROACH

Item No.	Estimated Quantities		Item	Unit Price	Estimated Cost
Detour #1					
16	1,350	CY	Borrow Excavation	1.00	1,350
17	2,100	SY	Subgrade Preparation	3.00	6,300
18	460	TN	ABC (4")	6.00	2,760
19	240	TN	AC (2")	30.00	7,200
20	1	LS	Removal of Detour	2,000.00	2,000
			Total Detour #1		$19,610
			TOTAL SOUTH APPROACH & DETOUR #1		$140,676

RELOCATED ARIZONA CANAL BRIDGE

STRUCTURE COST ESTIMATE

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
21	160 LF	Cast-in-Place Concrete Piles	$ 150.00	24,000
22	180 CY	Class A Concrete	150.00	27,000
23	440 CY	Class AA Concrete	200.00	88,000
24	120,000 LBS	Reinforcing Steel	0.40	48,000
25	133 LF	Steel Pedestrian Handrail	40.00	5,320
		Subtotal - Structure		$192,320
		Removals, Detour, Roadway, and Channel		140,676
		Subtotal		332,996
		Engineering and Contingencies (15%)		49,949
		TOTAL FOR ARIZONA CANAL BRIDGE, SOUTH APPROACH & DETOUR #1		$382,945

VIII ALTERNATE DETOUR

This report is based on the use of two detours in order to reduce the cost of the project by eliminating the need for temporary bridges. However, in order to make a recommendation on this approach, the alternate plan of using one detour and two temporary bridges was evaluated.

The temporary bridges would be constructed of structural steel, with a metal open grate decking, and would be designed to be transported between sites. The bridges would be supported by concrete cap beams and drilled piers at each abutment. The cap beam and pile shafts would have to be removed to two feet below finished grade at the end of their use.

The cost estimate for this alternate is on page 34.

IX RECOMMENDATIONS

A. Arizona Canal Diversion Channel Bridge

Several alternative schemes consisting of prestressed concrete "I" girders and cast-in-place post-tensioned concrete box girders were analyzed. A structural steel alternate was not considered, based on recent bidding experience.

The total cost estimate of the five schemes, including contingencies, range from 2.1 million to 2.4 million, a difference of about fifteen percent. The range of costs is shown in the table below.

COST COMPARISON TABLE

Scheme	Total Estimated Cost
A	$2,148,355
B	2,211,450
C	2,152,035
D	2,308,375
E	2,431,315

Although Scheme A is the lowest estimate, we are recommending that Scheme C be used for the design. Scheme C is approximately $4,000.00 higher in cost than Scheme A. However, the elimination of four piers in the channel will provide a larger opening and place less obstructions in the channel that could trap debris during flood usage.

An alternate for a prestress, precast, deck unit will be included in the design. The elimination of the need to form the bottom deck could result in additional cost savings.

It should be noted that very little savings is available in the roadway estimate due to the reduced depth of superstructure between Scheme C and Scheme A (6'-8" to 4'-4"). The reason for this is that the grade line on 59th Avenue is controlled by the canal crossing. It is estimated that the savings in borrow excavation between Scheme C and Scheme A is approximately 500 CY.

Therefore, we recommend that the Flood Control District of Maricopa County accept Scheme C for the design of the Arizona Canal Diversion Channel Bridge at the 59th Avenue Crossing.

B. Relocated Arizona Canal Bridge

The relocated Arizona Canal Bridge is designed as a two-span continuous reinforced concrete slab bridge. The cost estimate for this bridge, including contingencies, is $382,945.00.

We feel that this is the most economical solution to the design of the canal bridge and are therefore recommending that the Flood Control District of Maricopa County accept this design for the Relocated Arizona Canal Bridge at the 59th Avenue Crossing.

C. Detour Alternate

The alternate of one detour has been evaluated and compared to the cost of two detours.

The total cost for one detour and two temporary bridges is $279,380.00. We have taken the salvage value of the bridges as the full cost for a total of $130,000.00, leaving a net cost to this project of $149,380.00.

The cost of building two detours is $19,610.00 for Detour #1 and $23,710.00 for Detour #2, for a total cost of $43,320.00. We therefore recommend that two detours be used, and the project be phased.

In the event that there is a delay in the schedule, and the canal bridge cannot be constructed prior to the end of the 1982 dry-up, this alternate may have to be adopted.

D. Additional Pavement

We are recommending that the curb and gutter and pavement be extended on the west side of 59th Avenue north of the A.C.D.C. Bridge. The curb and gutter would tie in to the existing curb and gutter. This would permit the full use of the west half of the new bridges.

E. Additional Right of Way

It is our understanding that right of way required for the additional pavement is presently owned by the City of Glendale. Therefore, the additional right of way should be available to the project at no additional cost.

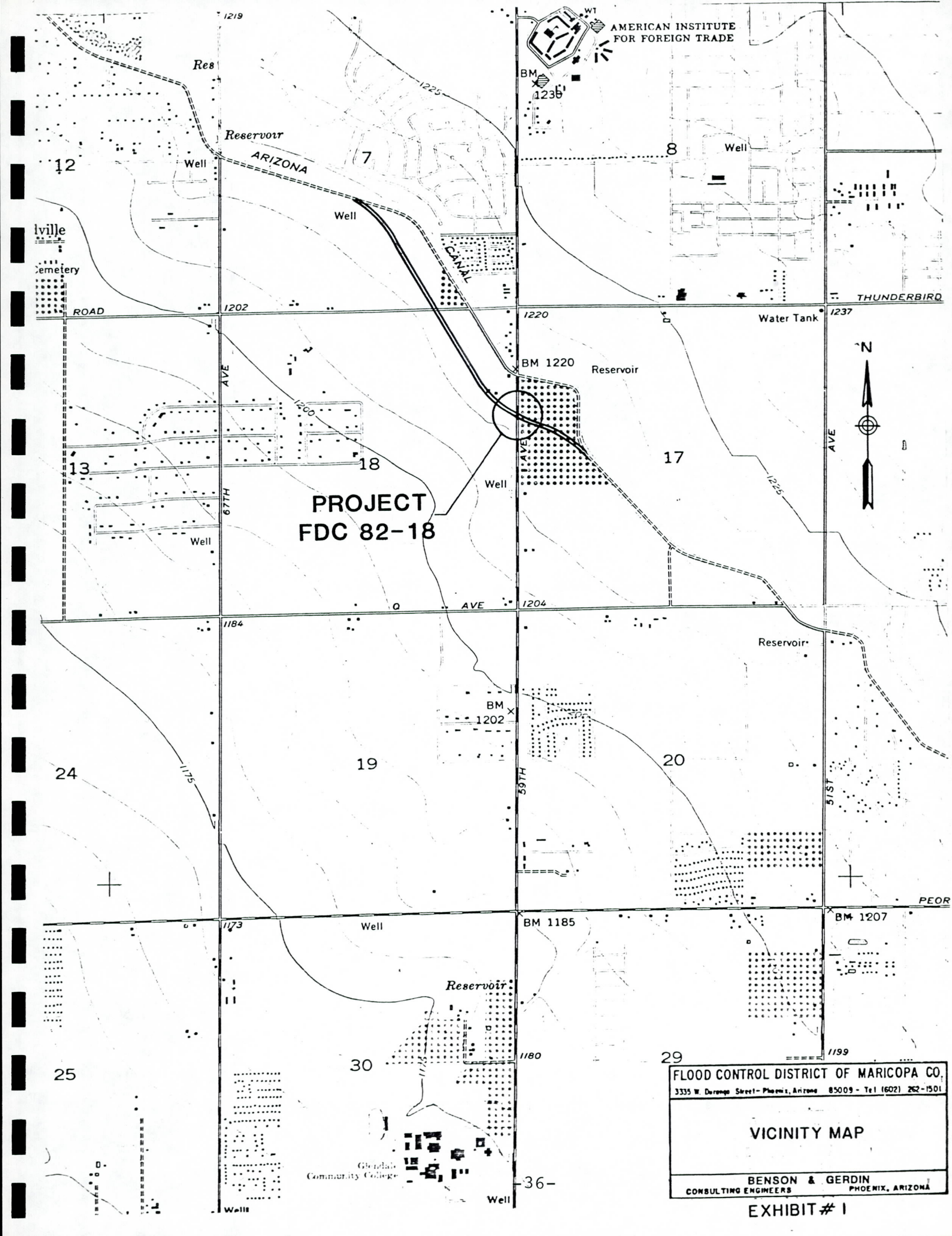
TEMPORARY BRIDGE ALTERNATE

DETOUR ROADWAY ESTIMATE

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
Alternate - One Detour				
1	4,000 CY	Borrow Excavation	1.00	4,000
2	2,700 SY	Subgrade Preparation	3.00	8,100
3	590 TN	ABC (4")	6.00	3,540
4	310 TN	Asphaltic Concrete (2")	30.00	9,300
5	1 LS	Remove Detour	2,500.00	2,500
		Total Alternate Detour		$27,440

TEMPORARY BRIDGE ALTERNATE ESTIMATE

Item No.	Estimated Quantities	Item	Unit Price	Estimated Cost
6	105 LF	Drilled Caissons (3' dia.)	150.00	15,750
7	100 CY	Class A Concrete (3000 PSI)	150.00	15,000
8	10,000 LBS	Reinforcing Steel	.50	5,000
9	130,000 LBS	Structural Steel Bridge	.50	65,000
10	1 LS	Install & Remove Bridges	4,000.00	4,000
11	1 LS	Remove Concrete (2' below fin. gr.)	3,000.00	3,000
		Total for One Bridge		$107,750
		Total for Two Bridges		215,500
		Total Detour		27,440
		Subtotal		242,940
		Engineering and Contingencies (15%)		36,440
		Total Cost for 2 Temporary Bridges and Detour		279,380
		Less Two Temporary Bridges Salvage at Full Value		130,000
		Net Cost of Alternate Detour		$149,380

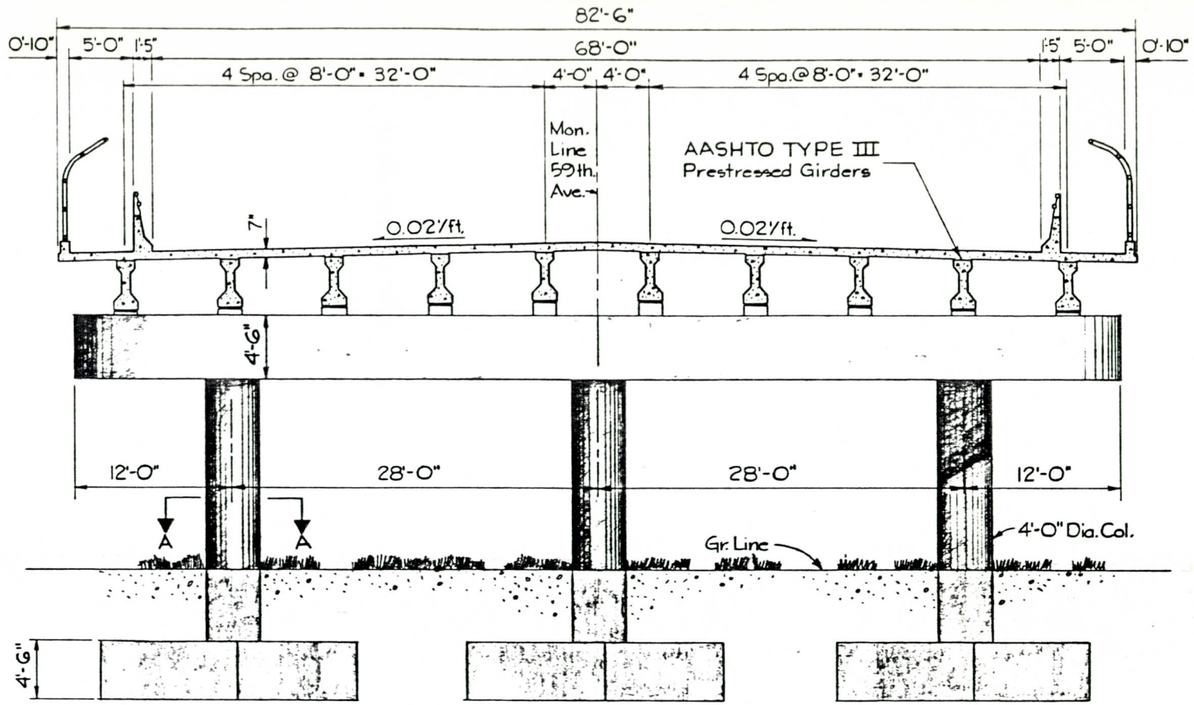


FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

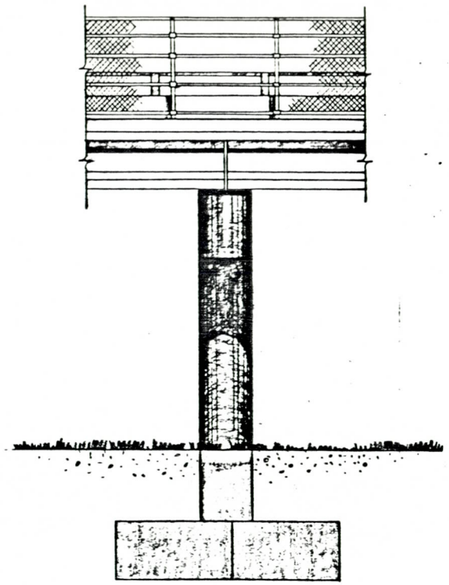
VICINITY MAP

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

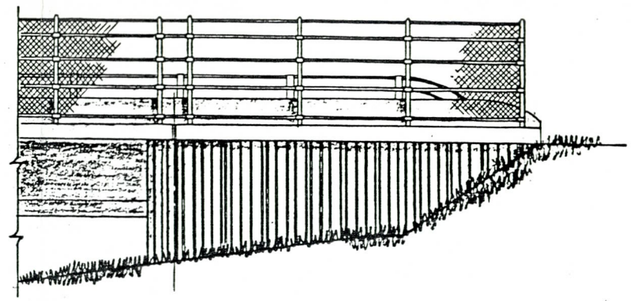
EXHIBIT # 1



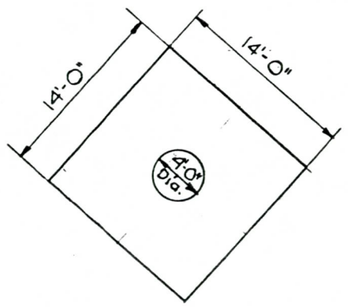
TYPICAL SECTION



ELEVATION

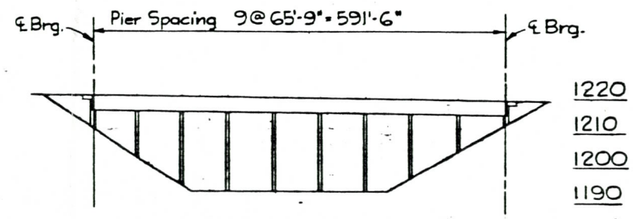


ABUTMENT ELEVATION



SECTION A-A

NOTE: All Dimensions Shown Normal To Mon. Line



PIER SPACING DIAGRAM

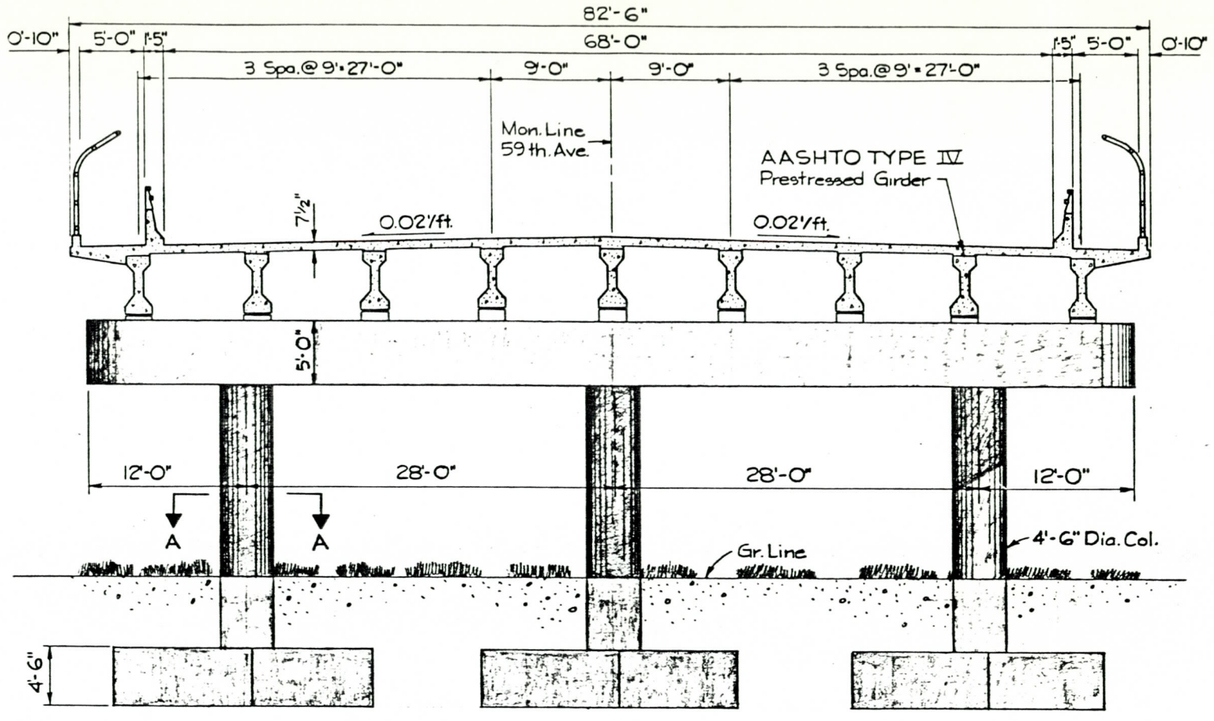
SCHEME - A

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE SCHEMES

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

EXHIBIT #2



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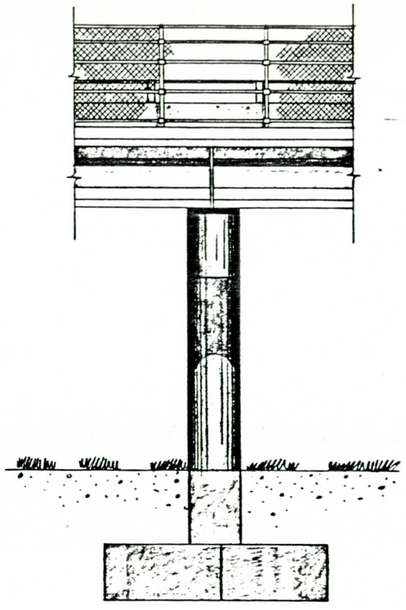
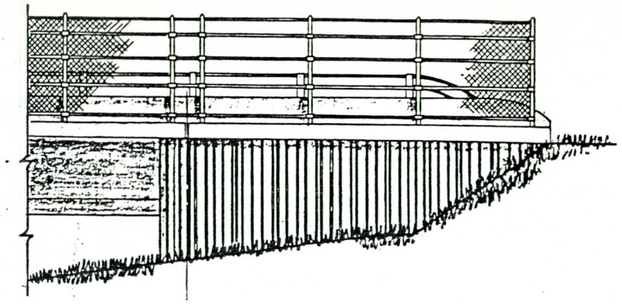
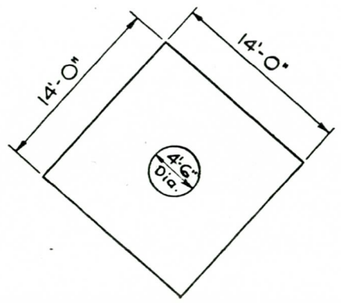


ELEVATION

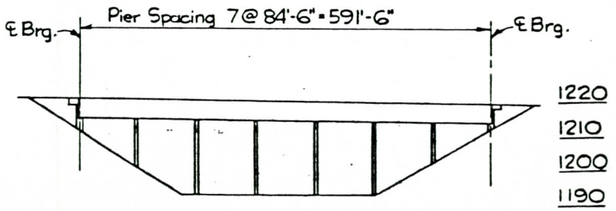


ABUTMENT ELEVATION

NOTE: All Dimensions Shown Normal To Mon. Line.



SECTION A-A



PIER SPACING DIAGRAM

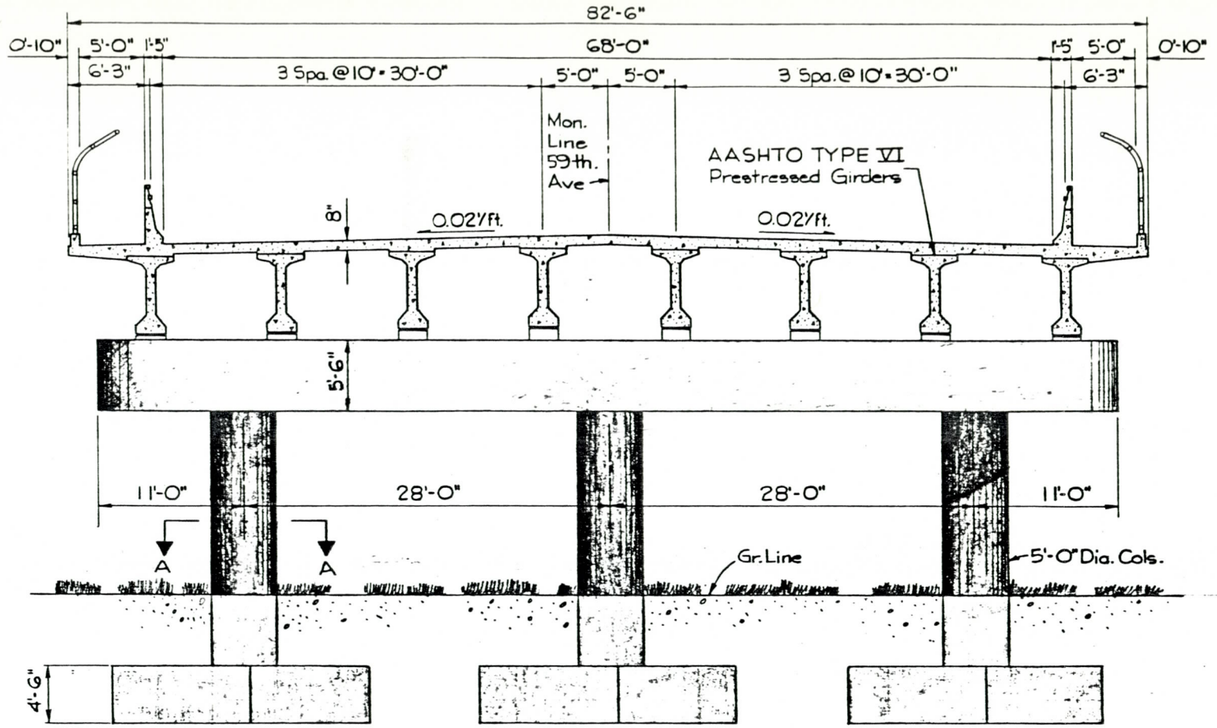
SCHEME - B

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE SCHEMES

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

EXHIBIT #3



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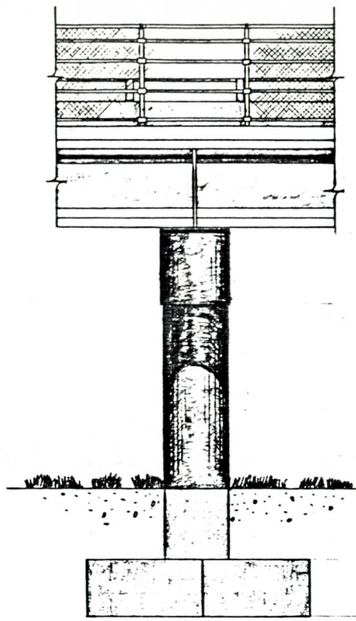

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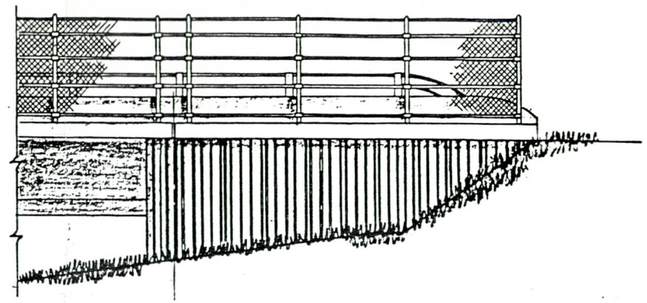
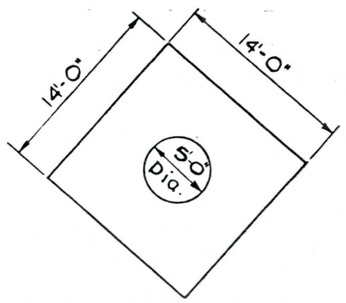
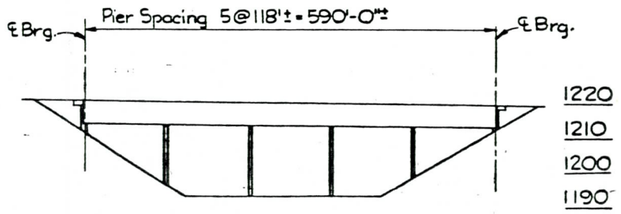


ABUTMENT ELEVATION

NOTE: All Dimensions Shown Normal to Mon. Line



SECTION A-A



PIER SPACING DIAGRAM

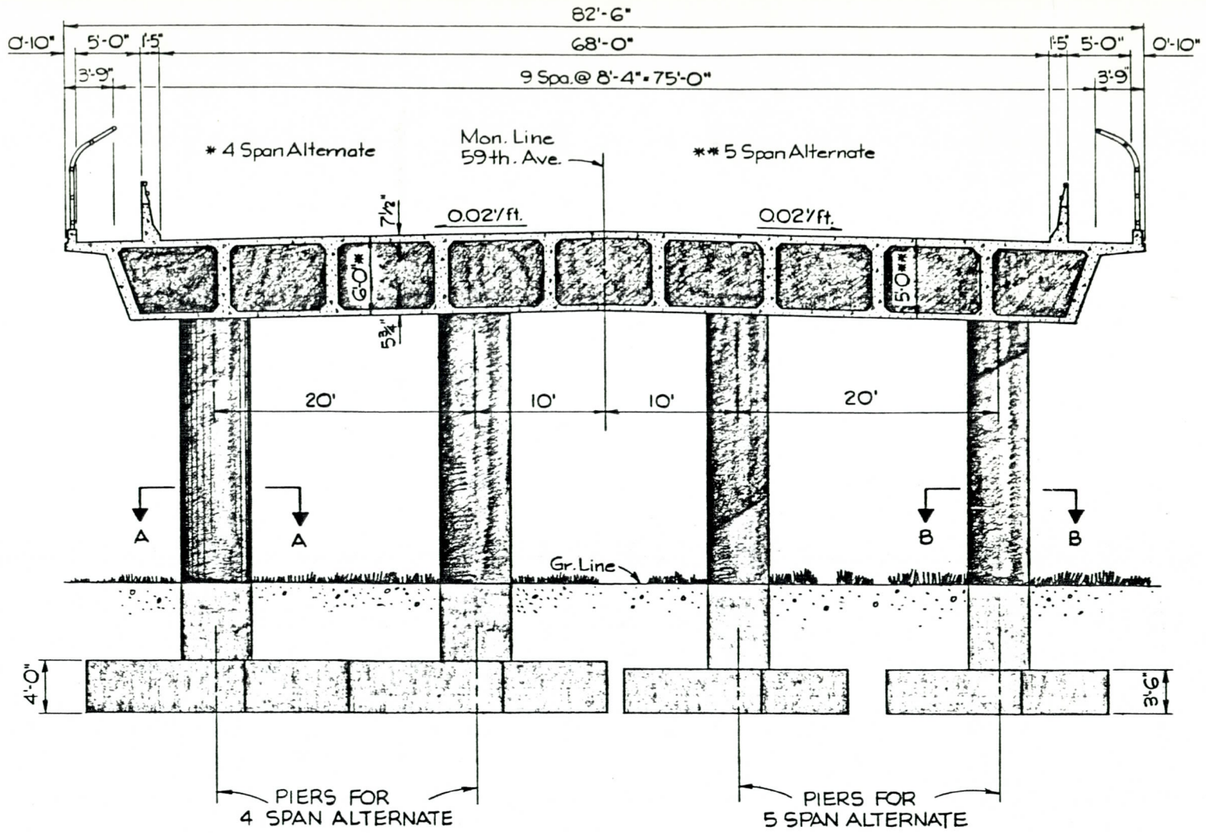
SCHEME - C

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE SCHEMES

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

EXHIBIT #4



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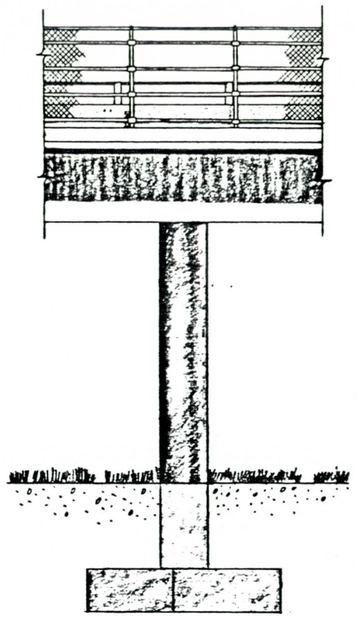

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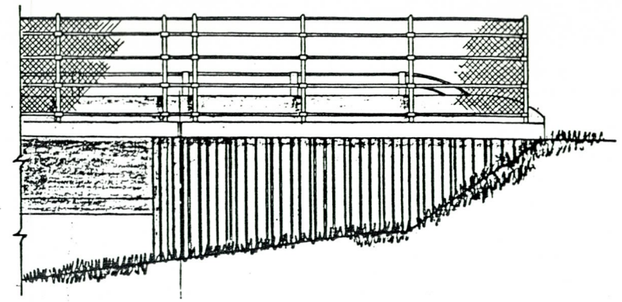

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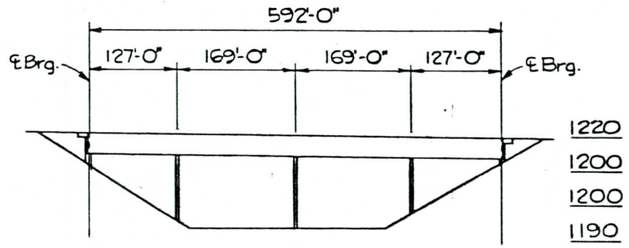
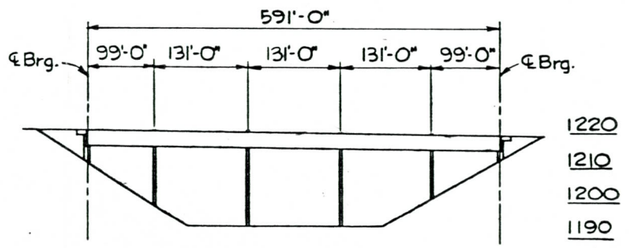


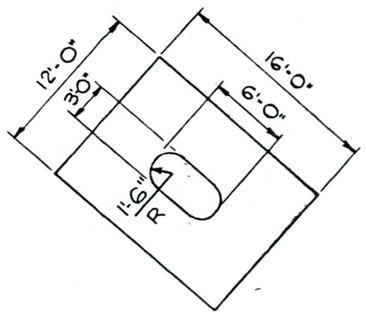
4 SPAN ALTERNATE



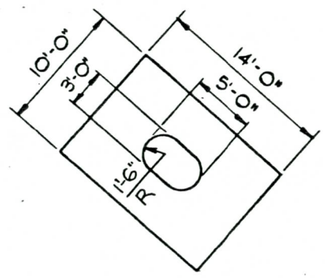
5 SPAN ALTERNATE

PIER SPACING DIAGRAM

NOTE: All Dimensions Shown
Normal To Mon. Line



SECTION A-A



SECTION B-B

SCHEME - D & SCHEME - E

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE SCHEMES

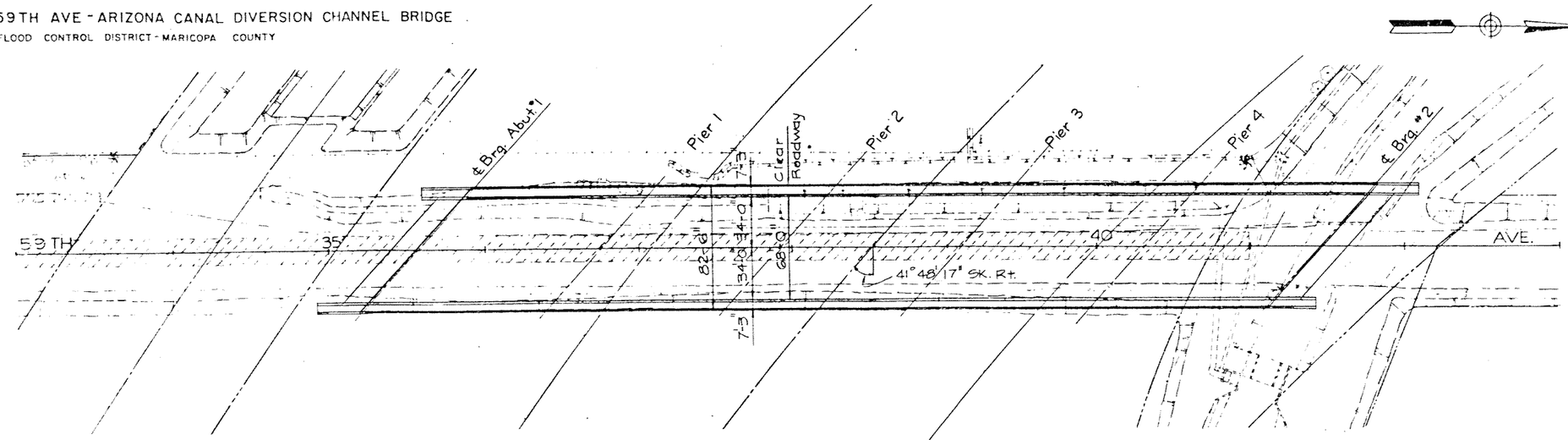
BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

EXHIBIT #5

59TH AVE - ARIZONA CANAL DIVERSION CHANNEL BRIDGE

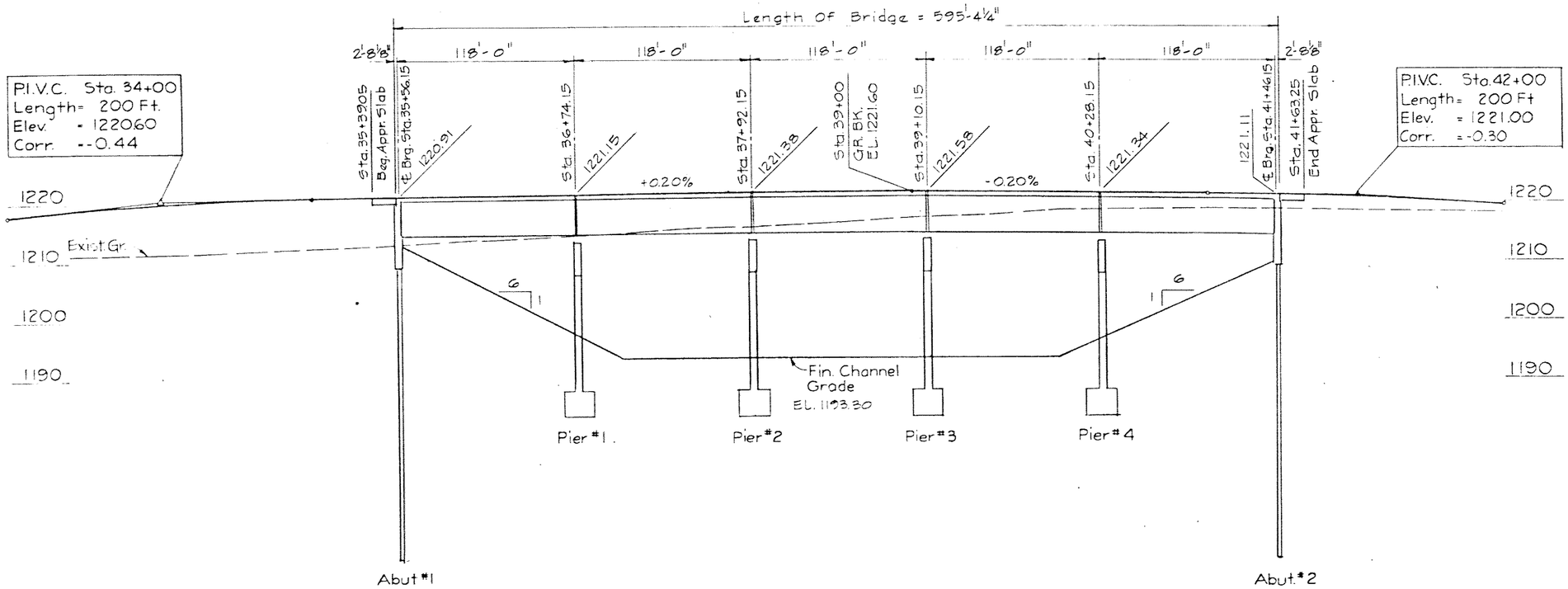
FLOOD CONTROL DISTRICT - MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				



LOCATION PLAN

New 5 Span Prestressed Concrete Girder Bridge
68 Foot Cl. Rdwy - 41° 48' 17" Skew Rt.
Scale: 1"=40'



SECTION ON CONSTRUCTION ℄

Scale: 1"=40' Horizontal
1"=10' Vertical

PRELIMINARY

LOCATION PLAN

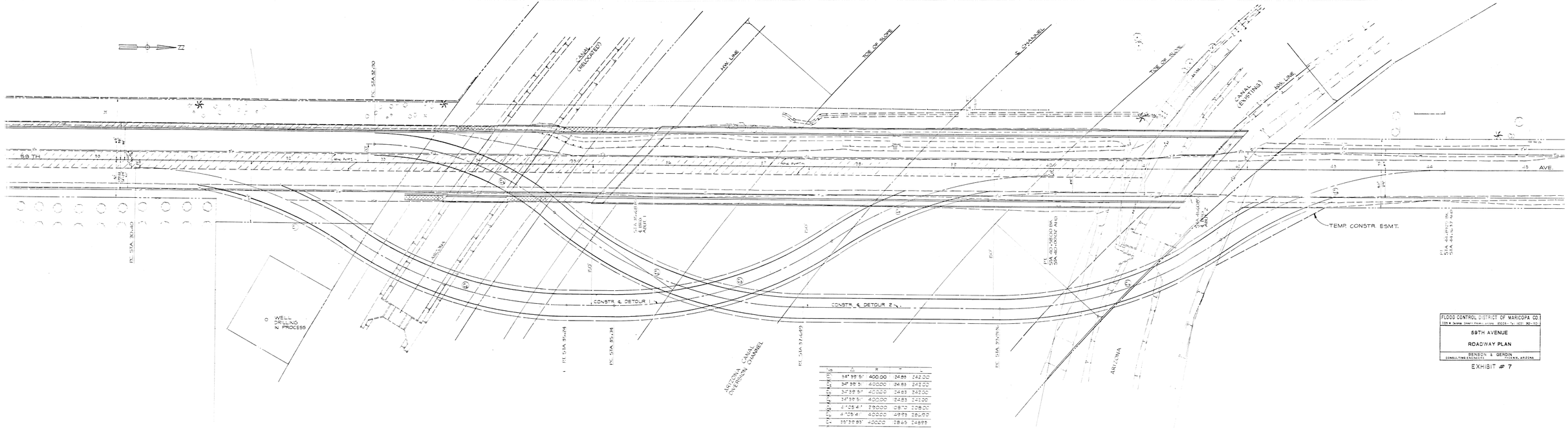
FLOOD CONTROL DISTRICT OF MARICOPA CO.
1335 N. Dwight Street - Phoenix, Arizona 85009 - Tel. (602) 262-1501

BRIDGE ON 59TH AVENUE
OVER
ARIZONA CANAL DIVERSION CHANNEL

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

DES.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DRN.	CK.			
DATE	DATE			

EXHIBIT #6



	Δ	R	T	L
1	34°39'51"	400.00	247.88	242.00
2	34°39'51"	400.00	247.88	242.00
3	34°39'51"	400.00	247.88	242.00
4	34°39'51"	400.00	247.88	242.00
5	41°25'41"	280.00	211.70	202.50
6	41°25'41"	400.00	302.43	289.00
7	35°39'51"	400.00	256.69	248.95
8	35°39'51"	400.00	256.69	248.95

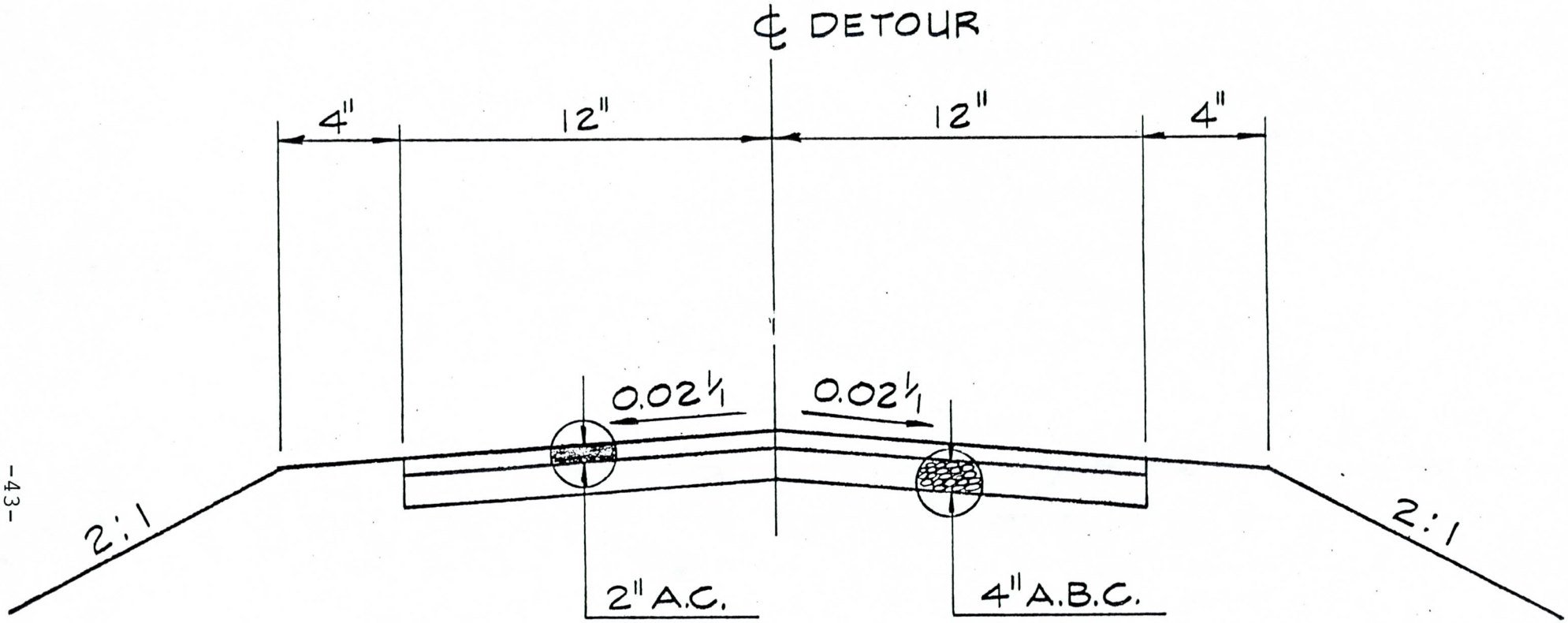
FLOOD CONTROL DISTRICT OF MARICOPA CO.
1204 W. Durango Street, Phoenix, Arizona 85009 - Tel. (602) 262-1501

59TH AVENUE

ROADWAY PLAN

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

EXHIBIT # 7



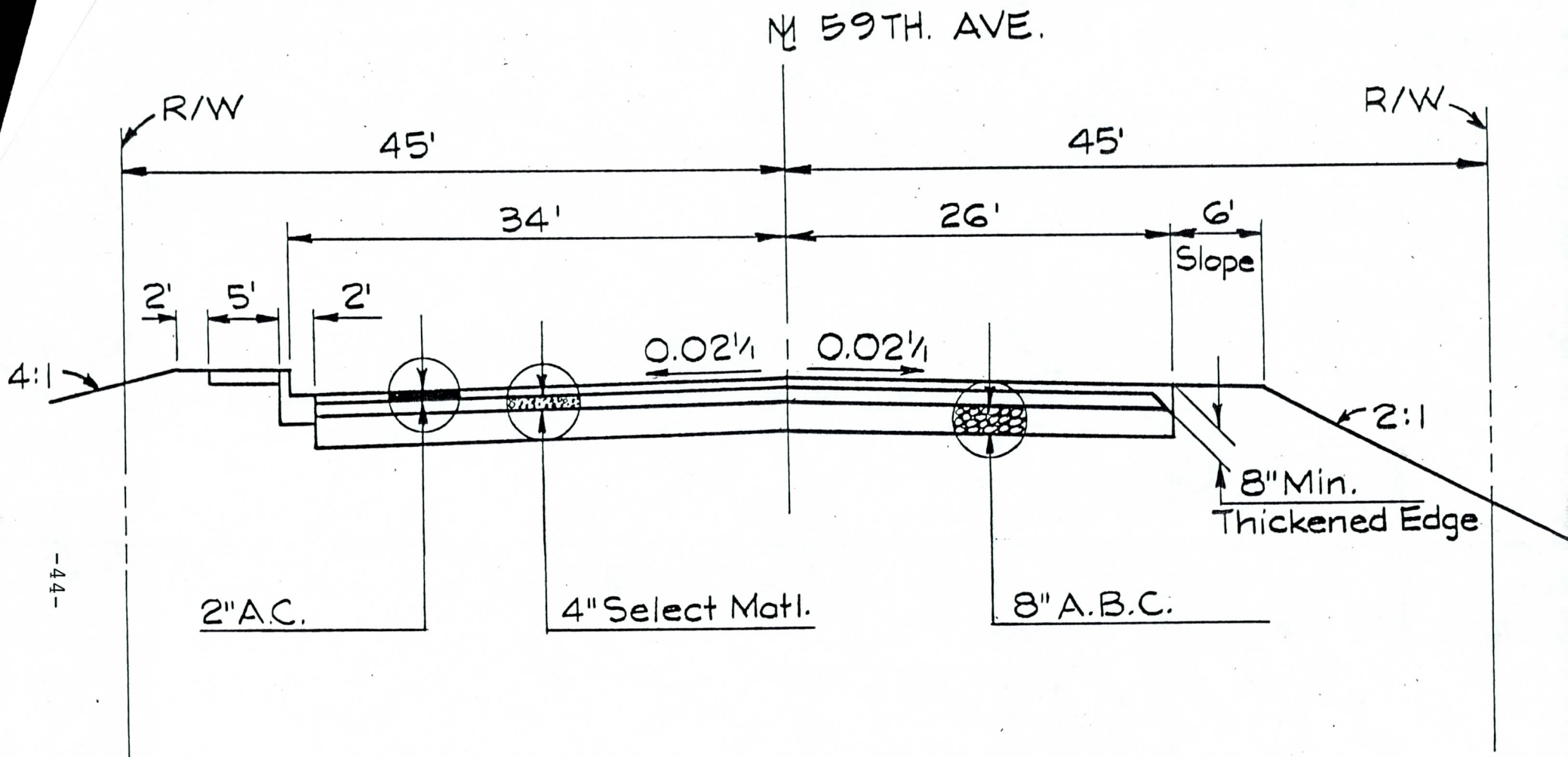
TYPICAL DETOUR SECTION

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel. (602) 262-1501

DETOUR ROADWAY
CROSS SECTION

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

EXHIBIT #8



TYPICAL ROADWAY SECTION

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

59TH AVENUE

ROADWAY CROSS SECTION

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

EXHIBIT #9

GEOTECHNICAL REPORT

ARIZONA CANAL DIVERSION
CHANNEL BRIDGES PROJECT
59th Avenue and
The Arizona Canal
Glendale, Arizona

8 July 1982

WESTERN TECHNOLOGIES, INC.

Phoenix
3737 East Broadway Road
P.O. Box 21387
Phoenix, Arizona 85036
(602) 268-1381

Flagstaff
2400 East Huntington Drive
Flagstaff, Arizona 86001
(602) 774-8708

Tucson
423 South Olsen Avenue
Tucson, Arizona 85719
(602) 624-8894

Farmington
400 South Lorena
Farmington, New Mexico 87401
(505) 327-4966

Las Vegas
300 West Boston Avenue
Las Vegas, Nevada 89102
(702) 382-7483

Grand Junction
P.O. Box 177
3224 Highway 6 & 24, No. 3
Clifton, Colorado 81520
(303) 434-9873

WESTERN TECHNOLOGIES, INC.

3737 East Broadway Road
P.O. Box 21387
Phoenix, Arizona 85036
(602) 268-1381

8 July 1982

Benson & Gerdin
Consulting Engineers
3150 North 7th Street
Phoenix, Arizona 85014

Attention: Mr. Harold Gerdin

Project: Arizona Canal Diversion Channel
Bridges Project
59th Avenue and The Arizona Canal
Glendale, Arizona

Job No. 2122J085
Inv. No. 21220142

In accordance with your request, this firm has conducted geotechnical engineering services for the proposed bridges over the Arizona Canal Diversion Channel (ACDC) and the relocated Arizona Canal located along 59th Avenue south of the existing Arizona Canal between Thunderbird Road and Sweetwater Avenue in Glendale, Arizona. The purpose of these services is to provide engineering recommendations relative to the design of foundation elements and procedures relative to earthwork for approach fills.

The ACDC project along 59th Avenue will include the construction of a bridge over the proposed diversion channel, a bridge over the relocated Arizona Canal, relocation of the Arizona Canal, and approach roads. The bridge over the diversion channel will be approximately 620 feet long and 78 feet wide and will have 4 to 8 spans. This structure will be either precast, prestressed concrete girder structure or a box girder structure

with pier loads of 1200 to 2400 kips, respectively. The diversion channel will be an earth-lined trapezoidal section cut approximately 15 to 25 feet into the existing ground surface. The channel will have a 220 foot wide bottom and 6 to 1 (horizontal to vertical) side slopes. The bridge over the relocated Arizona Canal will be approximately 70 feet long and 78 feet wide and will have one or two spans. Pier and abutment loads will be on the order of 300 to 500 kips. The relocated canal will be a concrete-lined trapezoidal section cut into the approach fill on the south side of the diversion channel. The Arizona Canal will be relocated from its present location along the north bridge abutment of the proposed diversion channel to the south side of the diversion channel. The approach fill on the north side of diversion channel will be approximately 150 feet long, while the approach fill on the south side of the channel will be approximately 600 feet long.

Geologic Setting: In general the site is located in the Phoenix Basin in the Basin and Range Physiographic Province. The near surface geologic units at the site are Quaternary-Tertiary Aged interbedded alluvial deposits. The deposits are loose at the surface to very dense at relatively shallow depths. At the time of exploration, the site condition was occupied by a two lane asphaltic concrete paved roadway, a two lane concrete bridge, the Arizona Canal, two irrigation ditches on the west side of the existing roadway and numerous underground and overhead utilities. The existing Arizona Canal was constructed by cutting the channel and placing 3 to 4 feet of fill along the north and south banks of the channel.

Field Explorations and Subsurface Conditions: Twelve test borings were drilled at the locations shown on the accompanying site plan with a CME 75 drill rig using hollow stem auger. In addition, four subgrade samples were obtained from the approach

road area. During test drilling, subsoils were visually examined and sampled at selected intervals. Surface soils in Test Borings 1, 3, 5, 7 and 9 to depths of 2 to 3 feet are roadway approach and canal embankment fill materials. These fills consisted of sand, clay and gravel mixed soils. Along the ACDC bridge alignment soils encountered to the depth of anticipated channel excavation (15 to 25 feet deep) consisted of medium dense to very dense clayey sands, sands, silty sands and gravelly sands with lightly to moderately cemented zones. The soils encountered below the anticipated channel depth are dense to very dense gravelly sands and sands containing a variable percent of silt and clay. Along the relocated Arizona Canal bridge alignment the soils encountered to depths of 19 to 23 feet consist of interbedded sandy clay and clayey sand containing a trace to some gravel and an occasional gravelly sand lens. The underlying material consisted of gravelly sands containing a variable percentage of silt and clay. Test boring depths ranged from 26 to 51 feet below existing grade. No groundwater was encountered in any test boring at the time of exploration.

Laboratory Testing: Laboratory test results indicate that native subsoils at foundation level exhibit relatively low compressibility at natural moisture contents and a very slight tendency to compress additionally under an increased moisture condition. The dense to very dense granular soils exhibit moderate to high shear strength characteristics.

Foundations: Due to the variable nature of bearing soils, and the anticipated grading scheme, foundation alternates consisting of shallow footings bearing upon undisturbed soils, drilled piers designed on either an end bearing or a skin friction basis or a combination of shallow footings and drilled piers appears feasible for support of the structures. Other methods

of support can be evaluated and recommendaltions presented, if requested.

The recommended allowable bearing capacities apply to dead load plus design live load conditions. A one-third increase in allowable bearing capacity is permissible when considering total loads, including wind or seismic. Recommended minimum width for shallow footings is 36 inches. The recommended minimum diameter for drilled piers is 24 inches. Finish grade references should be considered as lowest adjacent grade as measured at the perimeter of the footings. Lowest adjacent grade should be measured from the bottom of the anticipated scour.

Foundation elements on slopes should have the outside edge of the footings at least 5 feet from the face of slope and should be founded such that an imaginary line extending down at 45 degrees from the perimeter footing edge does not lie above or intersect the slope.

It is recommended that foundation excavations into undisturbed soils be inspected by the geotechnical engineer and deepened if loose or disturbed soils are encountered. If the soil conditions encountered are significantly different than those presented in this report, this firm should be contacted for verification and/or supplemental recommendations.

The following tabulation presents the relationship between foundation depth, allowable bearing capacity and estimated settlements under maximum load conditions for shallow footings and end bearing drilled piers.

Foundation Depth (Feet) Below Finished Grade	Foundation Depth (Feet) Below Existing Grade (min)	Foundation Type	Allowable Bearing Capacity(PSF)	Estimated Settlement (Inches)
2	2	SF	3000*	1/4 - 1/2
10	2	DP	7000*	1/4 - 1/2
5	5	SF	5000*	1/4 - 3/8
10	5	DP	10000*	1/4 - 3/8
3	15	SF	7000	3/4 - 1
10	15	DP	10000	1/4 - 1/2
15	15	DP	15000	< 3/8
10	25	DP	15000	< 1/4
15	25	DP	20000	< 1/4

SF = Shallow footing

DP = Drilled piers

* Applies to Arizona Canal Bridge only

Drilled piers designed on a skin friction basis should be straight shaft elements which extend at least 20 feet below finished grade. The following tabulation presents the relationship between foundation depth and load capacity for various depths. The total allowable load may be computed by multiplying the load by the diameter of the drilled shaft.

Depth Below Existing Grade (feet)	Length Below Finished Grade (feet)	Load x Diameter (kips)
0-20	20	14.5
0-25	25	28.0
0-30	30	45.5
0-35	35	66.0
0-40	40	89.5
0-45	45	116.5
0-50	50	147.0
20-40	20	26.5
20-45	25	41.0
20-50	30	59.0
20-55	35	81.0
20-60	40	106.0
20-65	45	134.0
20-70	50	165.0

Estimated settlements for drilled piers designed on a skin friction basis are 3/4 inch or less for maximum concentrated loadings. Little additional settlement is anticipated even if moisture penetrates into soils underlying drilled piers.

It is our opinion that drilling and/or belling within the near surface and subsoil deposits to depths of 10 to 20 may be readily accomplished with conventional rotary or bucket augers. Significant caving or raveling is not anticipated to these depths unless sand or gravelly sand lenses of substantial thickness are encountered. Some caving or raveling is anticipated and stabilizing techniques (slurry drilling or casing) may be required to maintain open shafts below depths of 10 to 20 feet, and belling in these soils is not recommended. Foundation concrete quantities will probably somewhat exceed ideal geometric volumes.

The bearing surface of drilled foundation elements designed on an end-bearing basis must be cleaned prior to concrete placement. Adequacy of cleaning and verification of pier configuration should be established by inspection of drilled elements. Drilled piers designed on a skin friction basis should be machine cleaned. Applicable safety codes require casing for personnel protection during cleaning and inspection.

Design Consideration for Lateral Loads: Drilled piers resist lateral load (horizontal loads or moments) by deflecting until the necessary reaction in the surrounding soil is mobilized. Behavior of the foundation under such loading conditions depends essentially on the relative stiffnesses of the pier and the soil. The allowable lateral soil resistance acting on the drilled pier sections are 2.0 KSF/ft for piers extending 0 to 20 feet below existing grade and 4.5 KSF/ft for piers extending below 20 feet.

As an alternate the following laterial subgrade modulus may be used:

Material	Lateral Subgrade Modulus (pounds/cu.in.)
Undisturbed Granular Soils	65
Granular Fill (min. 95% ASTM D1557)	65
Granular Fill (85% to 90% ASTM D1557)	24

The recommended design factors to assess lateral earth pressures against shallow footings and abutments are presented in the following tabulation:

Equivalent active soil pressure:
Undisturbed ---------- 30 psf/ft.
Compacted granular soils:
Lateral Pressures (yielding structure - 30 psf/ft.
Lateral Pressures (rigid structure) --- 55 psf/ft.

Equivalent passive soil pressure:
Compacted granular or in-situ
granular soils:
Shallow continuous footings ------- 350 psf/ft.

Coefficient of base friction ---------- 0.30*

*The coefficient of base friction may be used in conjunction with passive pressures.

All backfill against the bridge abutments should consist of free draining granular material. Backfill should be placed in horizontal lifts consistent with the maximum material size and type of compaction equipment in use and to a minimum of 95% of the maximum density at an optimum moisture content plus or minus 3% as determined in accordance with ASTM D1557. Compaction equipment should be maintained at least 2 feet from the walls to minimize the possibility of developing excessive stresses.

Lateral movements of bridge deck which are transmitted to the abutment as the result of thermal expansion will result in passive resistance equal to or greater than those presented above. The development of passive resistance at the interface between fill zone and abutments may be reduced by the installation of a resilient material (preferred), or alternately styrofoam or corrugated cardboard filler. This material should be installed along all vertical faces of the abutment.

Roadways and Approach Fills Site Preparation: The following procedure is recommended for placement and compaction of fill and approach fill zones in roadway areas.

1. Completely remove all loose soil, vegetation, any roadside debris and existing structures within proposed fill areas.

2. Depressions, ditches and the existing canal should be cleaned of all loose or wet soils and widened to accommodate compaction equipment and sloping areas should be benched to provide a level surface for fill placement.

3. Scarify, moisten or dry as required, all exposed subgrade surface to a minimum depth of 8 inches.

4. Place required fill in compacted horizontal lifts to subbase level. Soils obtained during site grading or comparable soils borrowed from adjacent sites which are free of vegetation and debris may be utilized in approach and roadway fills. All fills should be placed and compacted in lifts consistent with type of compaction equipment in use to achieve uniform density. Compaction should be to a minimum of 95% of the maximum density as determined in accordance with ASTM D1557 within a moisture content range of plus or minus 3% of optimum.

Stability of Cut and Fill Slopes: It is anticipated that the compacted fill materials will consist of on-site soils. As such, the recommended side slopes for fill are as follows:

Fill Slopes

Above high water level ---- 1-1/2 to 1 (horizontal to vertical)

Below high water level ---- 2-1/2 to 1 (horizontal to vertical)

Cut Slopes

Material Type	Cut Slope (Horizontal to Vertical)
Alluvial Soils	1-1/2 to 1

Approach Fill Settlements: For approach fills of 5 to 10 feet in height, a total settlement of approximately 1 to 1-1/2 inches is expected which will be comprised of settlement of the approach fill itself and compression of the underlying foundation materials due to the weight of the approach fill.

Temporary Excavations for Spread Foundations: Excavations for shallow foundations through the alluvial soils should be possible with conventional excavation equipment. Due to the granular nature of the alluvial subsoils, caving and/or sloughing is anticipated for temporary construction slopes. Therefore, excavations for shallow footings at pier locations will require shoring and bracing to provide protection for personnel. If shoring and bracing is not utilized, trench slopes should be cut to an approximate 1-1/4 to 1 slope (horizontal to vertical). Flatter slopes may be required where clean poorly graded sand and gravel lenses or seams are encountered.

Pavement Design: Pavement design for 59th Avenue should be based on the minus No. 200 sieve analysis and plasticity index (attached).

If you should have any questions regarding the contents of this report, or if we may be of additional service to you in any way, please do not hesitate to contact us.

Sincerely yours,
WESTERN TECHNOLOGIES, INC.
Geotechnical Services

Kenneth L. Ricker, P.E. Reviewed by: Glen K. Copeland, P.E.
/kb
copies to: Addressee (5)

DEFINITION OF TERMINOLOGY

ALLOWABLE SOIL BEARING CAPACITY ALLOWABLE FOUNDATION PRESSURE	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
BACKFILL	A specified material placed and compacted in a confined area.
BASE COURSE	A layer of specified material placed on a subgrade or subbase.
BASE COURSE GRADE	Top of base course.
BENCH	A horizontal surface in a sloped deposit.
CAISSON	A concrete foundation element cast in a circular excavation which may have an enlarged base. Sometimes referred to as a cast-in-place pier.
CONCRETE SLABS-ON-GRADE	A concrete surface layer cast directly upon a base, subbase or subgrade.
CRUSHED ROCK BASE COURSE	A base course composed of crushed rock of a specified gradation.
DIFFERENTIAL SETTLEMENT	Unequal settlement between or within foundation elements of a structure.
ENGINEERED FILL	Specified material placed and compacted to specified density and/or moisture conditions under observation of a representative of a soil engineer.
EXISTING FILL	Materials deposited through the action of man prior to exploration of the site.
EXISTING GRADE	The ground surface at the time of field exploration.
EXPANSIVE POTENTIAL	The potential of a soil to expand (increase in volume) due to the absorption of moisture.
FILL	Materials deposited by the action of man.
FINISHED GRADE	The final grade created as a part of the project.
GRAVEL BASE COURSE	A base course composed of naturally occurring gravel with a specified gradation.
HEAVE	Upward movement.
NATIVE GRADE	The naturally occurring ground surface.
NATIVE SOIL	Naturally occurring on-site soil.
ROCK	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
SAND AND GRAVEL BASE	A base course of sand and gravel of a specified gradation.
SAND BASE COURSE	A base course composed primarily of sand of a specified gradation.
SCARIFY	To mechanically loosen soil or break down existing soil structure.
SETTLEMENT	Downward movement.
SOIL	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
STRIP	To remove from present location.
SUBBASE	A layer of specified material placed to form a layer between the subgrade and base course.
SUBBASE GRADE	Top of subbase.
SUBGRADE	Prepared native soil surface.

Job No. 2122J085

Boring No.	Depth, ft.	Soil Class.	Expansion/Compression					Water Soluble Matter, %		Shear Strength					Consolidation		
			Initial Dry Density pcf	Initial Moisture Content, %	Surcharge KSF	+ Expan. - Comp. %	Max. Swell Pressure KSF	Salts	Sulfates	Test Method	Initial Moisture Content, %	Dry Density pcf	C KSF	∅ Deg.	Initial Void Ratio	Surcharge KSF	Consol. %
2	15-16	SM	118.0	6.6	1.10	-0.6											
2	15-16	SM	118.0	6.6	2.22	-1.1											
2	15-16	SM	118.0	6.6	2.22(5)	-1.7											
2	15-16	SM	118.0	6.6	4.42(5)	-2.6											
2	15-16	SM	118.0	6.6	8.84(5)	-3.9											
1	20-21	SP/SW							1	DS	15.9	110.2	0	39			
7	30-31	SP/SW							1	DS	12.5	113.7	0.3	35.5			
12	5-6	SC	105.5	12.4	3.0	-1.1											
12	5-6	SC	105.5	12.4	3.0(5)	-1.2											

Boring No.	Depth, ft.	Remarks

LEGEND

Shear Strength Test Method
- DS Direct Shear
- DS Direct Shear (saturated)
- UC Unconfined Compression
- UU Unconsolidated Undrained
- CU Consolidated Undrained w/pore press
- CU Consolidated Undrained
- CD Consolidated Drained
- CR Cyclic Consolidated Undrained w/pore press

REMARKS

1. In-situ density.
2. Compacted density (Approx. 95% of ASTM:D698 max. density at moisture content slightly below optimum).
3. Compacted density (Approx. 95% of ASTM:D1557 max. density at moisture content slightly below optimum).
4. In-situ moisture.
5. Submerged to approximate saturation.
6. Consolidation % upon saturation.
7.

SOIL PROPERTIES

Type of Material Subsoils Job No. 2122J085

Source of Material As noted below

Test Procedure ASTM D422, D423, D424, C114D Tested/Calc. By MA Date 7/2/82

Reviewed By KR Date 7/7/82

Hole No.	Location	Depth	Classification		LL	PI	Sieve Analysis - Accum % Passing												Lab No./I.D.
			AASHTO	Unified			200	100	40	16	10	4	¼	⅜	¾	1	1½	2	3	
A	Sta 30+00	0-1½'		SC	28	13	41	*												
B	Sta 32+00	0-1½'		CL	31	13	59	*												
C	Sta 44+00	0-1½'		SC	33	14	40	*												
D	Sta 46+00	0- ½'		CL	33	15	54	*												
3	See site plan	25-26½'		SC	29	8	16	19	31	56	64	72	83	90	100					
7	See site plan	20-21'		SM	27	5	12	13	30	61	74	88	90	92	100					

*Minus No. 200 Sieve determination only

TABULATION OF TEST RESULTS

SOIL CLASSIFICATION AND LEGEND

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size.
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	

FINE-GRAINED SOIL

MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILTCLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

NOTE — Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols

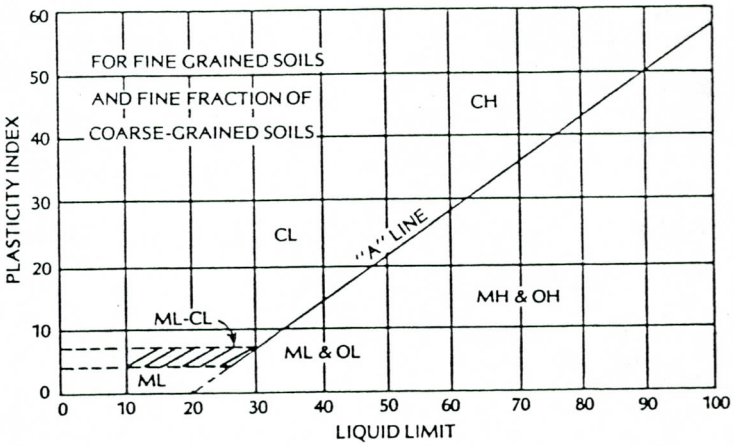
SOIL FRACTIONS

Component	Size Range
Boulders	Above 12 in.
Cobbles	3 in to 12 in.
Gravel	3 in. to No. 4 sieve
Coarse Gravel	3 in. to ¾ in.
Fine Gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

Soil Classification: ASTM D2487

Classification is visual unless accompanied by mechanical analysis and Atterberg limits. Percentage shown on log denotes visual approximation ± 5%.

PLASTICITY CHART



LEGEND OF BORING OPERATIONS

ST - Sample Type

R = 2.42" I.D. ring sampler, driven with 140 pound hammer with 30" free fall; RF = more than 100 blows

N = 2.0 inch O.D. split barrel sampler (ASTM D1586), driven with 140 pound hammer with 30" free fall; RF = more than 100 blows

C = 2.0 inch O.D. bullnose, driven with 140 pound hammer with 30" free fall; RF = more than 100 blows

T = Thin wall tube sampler, either pushed into the soil or driven with 140 pound hammer with 30" free fall

G = Grab sample from cuttings or spoil

B = Block sample

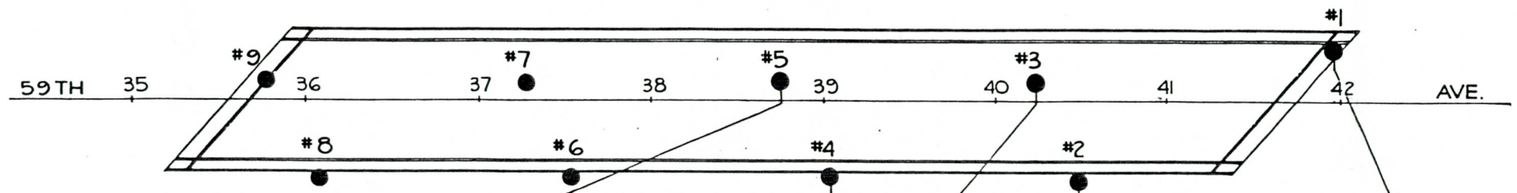
DD - dry density
MC - moisture content
RF - refusal
NR - no recovery
P - pushed
HSA - hollow stem auger
SSA - solid stem auger
RW - rotary wash
CNX - NX-size diamond coring
CBX - BX-size diamond coring
CHQ - HQ-size diamond coring
RK - bedrock
RA - rotary air
RAF - rotary air with foam

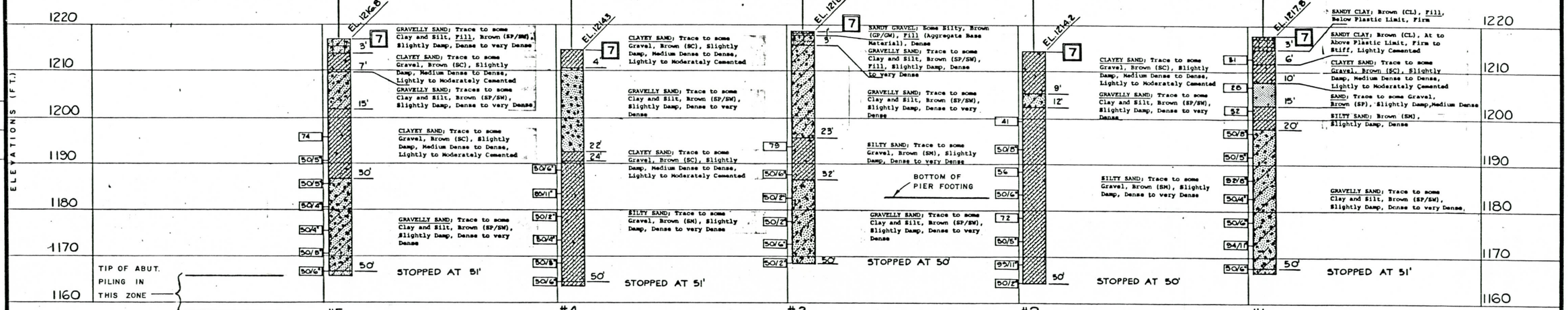
Note: The data presented on the following log of boring sheet(s) represents conditions at the location on the date the field work was performed and should not be inferred to represent other locations or dates. Such data have been obtained exclusively for design purposes and should not be construed as part of the construction plans or as defining construction technique.

59TH AVE. – ARIZONA CANAL DIVERSION CHANNEL BRIDGE

FLOOD CONTROL DISTRICT – MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZONA				



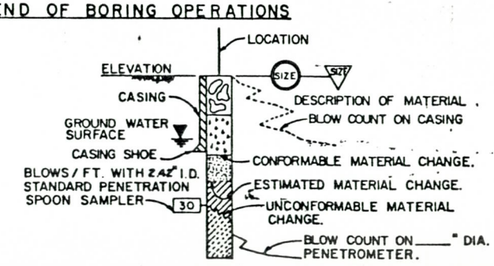


LEGEND OF SOIL SYMBOLS

- COBBLES OR BOULDERS
- GRAVEL
- SAND
- SILT
- CLAY
- VOLCANIC CINDERS, ASH OR TUFF
- LIME
- FILL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- (NX) CASING
- (STT) ____" DIA. PENETROMETER
- (SIZE) AUGER BORING (DRY)
- (SIZE) ____" DIA. BLUE DEMON ROTARY BORING (WET)
- (AX) CORE BORING (WET)
- (SIZE) ____" DIA. TRICONE ROTARY BORING (WET)
- TEST PIT



NOTES

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NX CASING AND THE 3" DIA. PENETROMETER ARE DRIVEN WITH 342 POUND HAMMER, WITH 30" FREE FALL, NO CUSHION.
STANDARD PENETRATION SPOON SAMPLER AND THE 2" DIAMETER PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, WITH 30" FREE FALL, NO CUSHION.

THE BORING LOGS RECORDED ON THIS DRAWING ARE TAKEN FROM INFORMATION FURNISHED BY WESTERN TECHNOLOGIES, INC. DATED 7-08-82.

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street – Phoenix, Arizona 85009 – Tel (602) 262-1501

BRIDGE ON 59TH AVENUE
OVER
ARIZONA CANAL DIVERSION CHANNEL

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT

NO.	REVISION–REDRAWN	DATE	BLUE PRINT RECORDS	DATE
1			MB	
2			PDR	
3			MB	
4			PDR	
5			MB	

DESIGNED BY ARIZONA DEPARTMENT OF HIGHWAYS
DRAWN BY WEB 5-75
CHECKED BY

59TH AVE.- ARIZONA CANAL DIVERSION CHANNEL BRIDGE

FLOOD CONTROL DISTRICT - MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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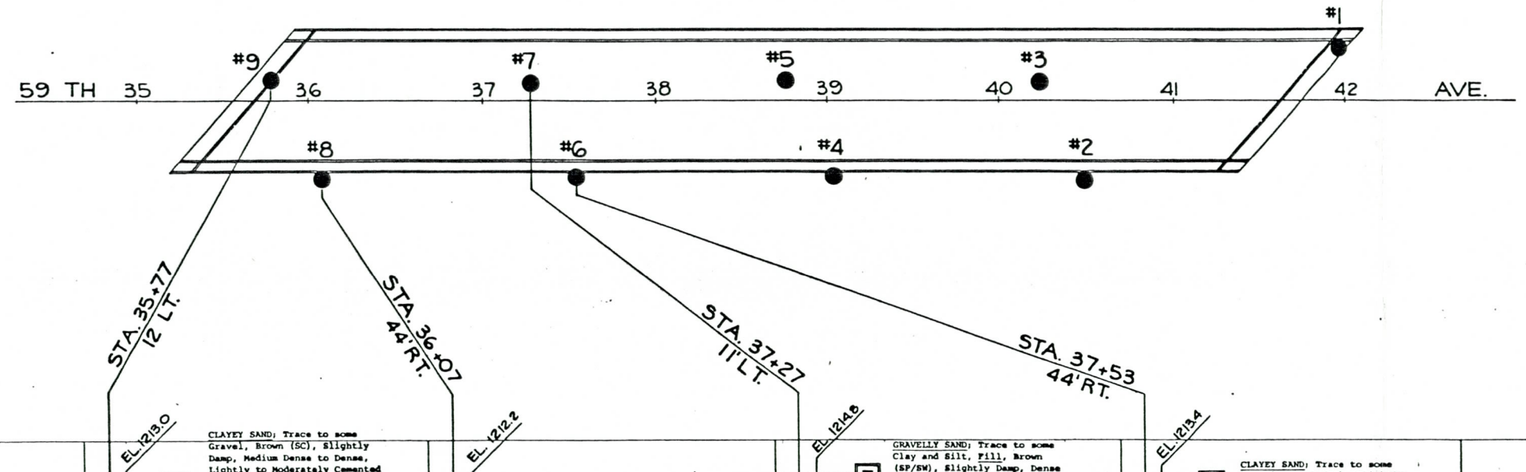

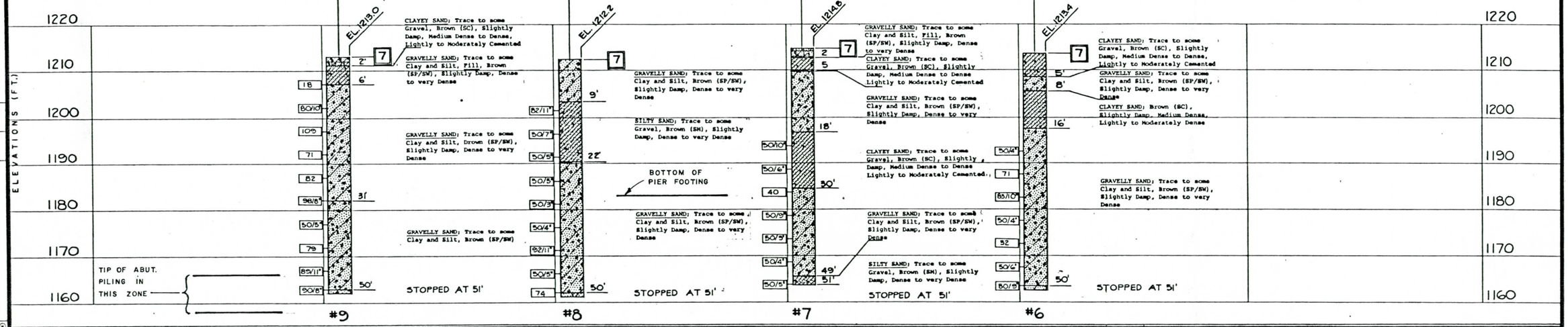

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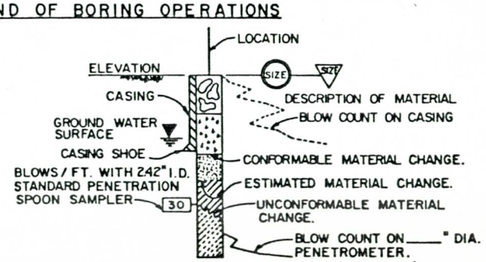

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STANDARD PENETRATION SPOON SAMPLER AND THE 2" DIAMETER PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, WITH 30" FREE FALL, NO CUSHION.

THE BORING LOGS RECORDED ON THIS DRAWING ARE TAKEN FROM INFORMATION FURNISHED BY WESTERN TECHNOLOGIES, INC. DATED 7-08-82.

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE ON 59TH AVENUE
OVER
ARIZONA CANAL DIVERSION CHANNEL

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

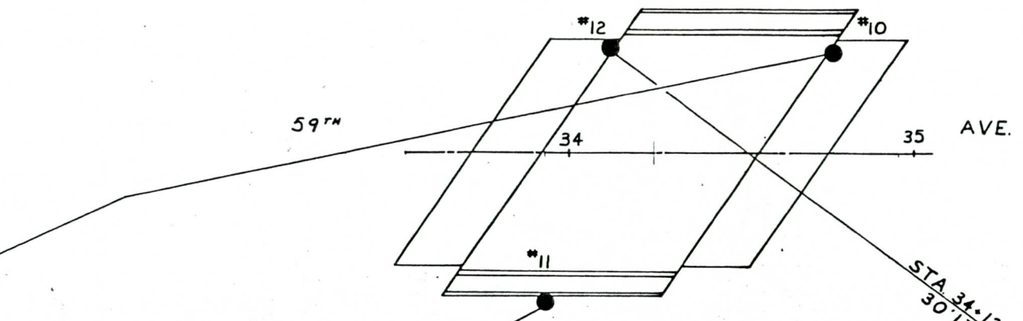
DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT

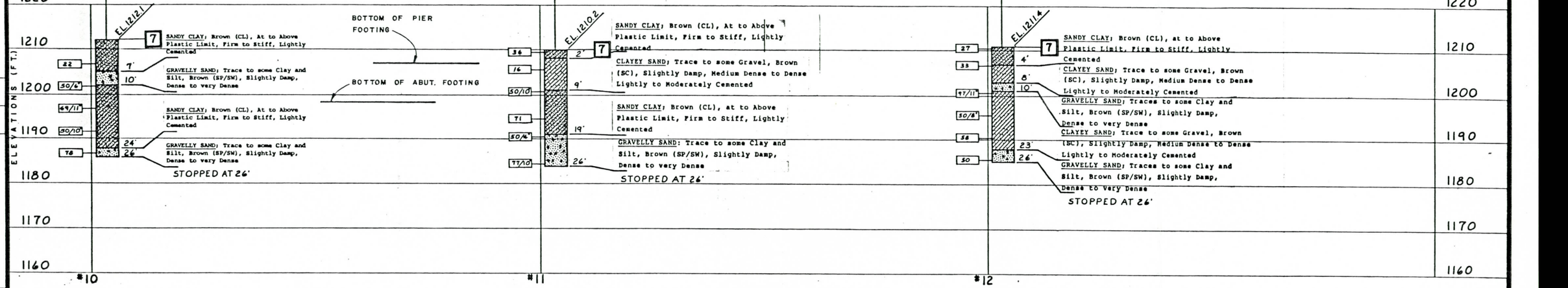
DATE 5-75 WEB
REVISIONS
REVISION—REDRAWN
DATE PDR
DATE PDR
DATE PDR

59TH AVE. - ARIZONA CANAL BRIDGE

FLOOD CONTROL DISTRICT - MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZONA				



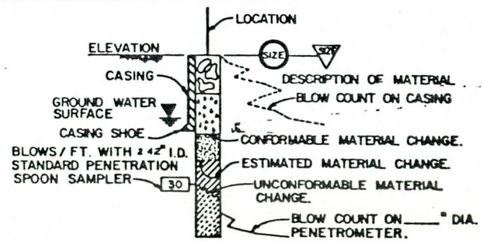


LEGEND OF SOIL SYMBOLS

- COBBLES OR BOULDERS
- GRAVEL
- SAND
- SILT
- CLAY
- VOLCANIC CINDERS, ASH OR TUFF
- LIME
- FILL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- NX CASING
- SIZE ___" DIA. PENETROMETER
- SIZE AUGER BORING (DRY)
- SIZE ___" DIA. BLUE DEMON ROTARY BORING (WET)
- AX CORE BORING (WET)
- SIZE ___" DIA. TRICONE ROTARY BORING (WET)
- TEST PIT



NOTES

INFORMATION CONTAINED ON THIS SHEET IS MADE AVAILABLE TO PROSPECTIVE BIDDERS FOR INFORMATION PURPOSES ONLY AND IS NOT TO BE CONSIDERED A PART OF THE CONTRACT PAPERS. CLASSIFICATION OF MATERIALS IS IN ACCORDANCE WITH AASHTO "MANUAL ON FOUNDATION INVESTIGATIONS." CLASSIFICATION OF EARTH MATERIALS IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS. THE ABSENCE OF A GROUND WATER INDICATION DOES NOT CONSTITUTE A REPRESENTATION THAT THE GROUND WATER WILL NOT BE PRESENT DURING CONSTRUCTION. GROUND WATER IS INDICATED HEREIN ONLY WHEN FOUND DURING THE FOUNDATION INVESTIGATION AND REPRESENTS THAT CONDITION ONLY ON THE DATE OF THE INVESTIGATION. INFORMATION IS DEVELOPED AS ACCURATELY AS POSSIBLE BY THE METHODS UTILIZED, HOWEVER, THE STATE ACCEPTS NO RESPONSIBILITY FOR ANY CONDITIONS ENCOUNTERED WHICH MAY BE AT VARIANCE FROM INFORMATION CONTAINED HEREIN. NX CASING AND THE 3" DIA. PENETROMETER ARE DRIVEN WITH 342 POUND HAMMER, WITH 30" FREE FALL, NO CUSHION. STANDARD PENETRATION SPOON SAMPLER AND THE 2" DIAMETER PENETROMETER ARE DRIVEN WITH 140 POUND HAMMER, WITH 30" FREE FALL, NO CUSHION.

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FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE ON 59TH AVENUE OVER RELOCATED ARIZONA CANAL

BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT

DIST 5-75 WEB REVISION—REDRAWN

59TH AVE BRIDGE OVER
ARIZONA CANAL DIVERSION CHANNEL

PHASE II (INITIAL DESIGN)

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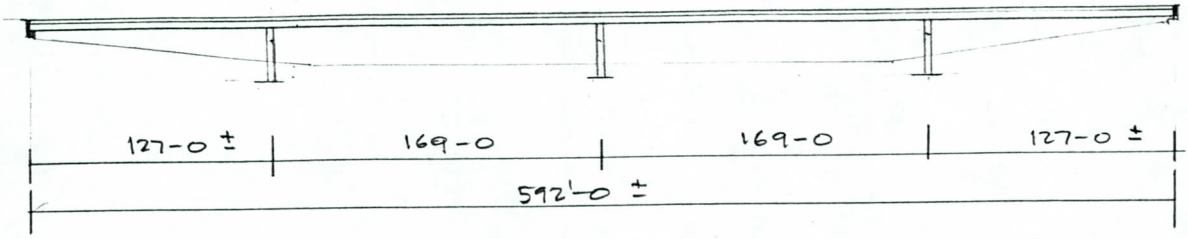
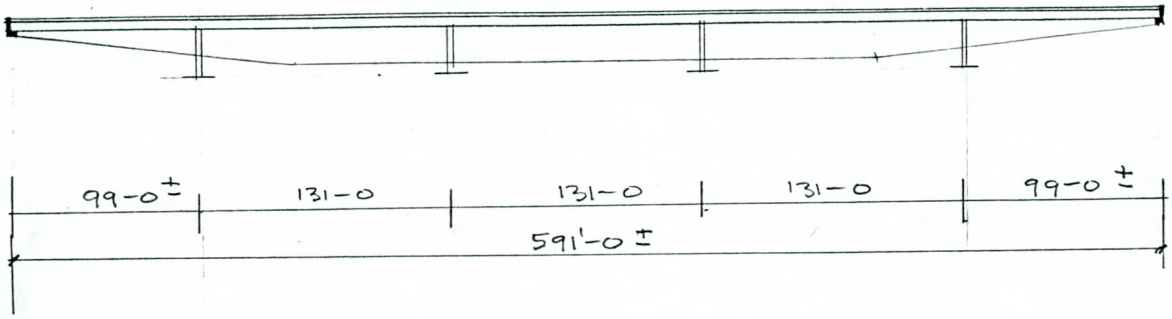
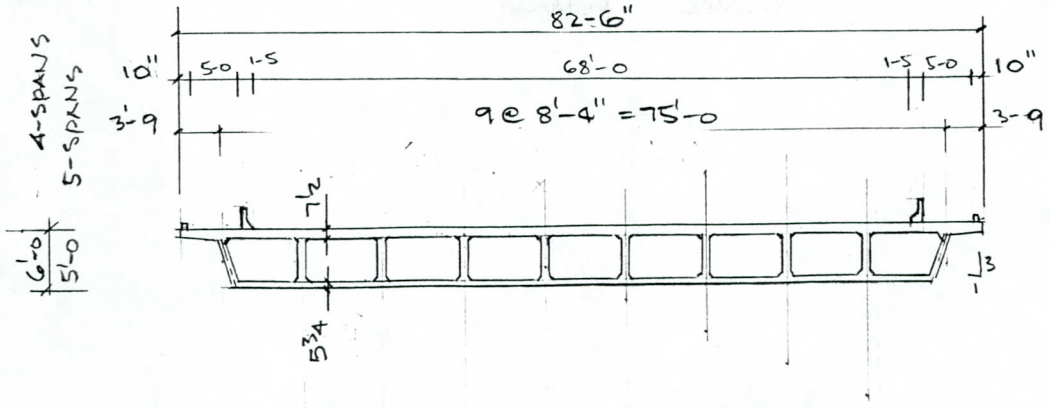
BENSON & GERDIN, INC. CONSULTING ENGINEERS PHONE (602) 264-0136	SHT. NO. 2 OF
	JOB NO. 2182B
59TH AVE	BY AG DATE 7-7-82
BOX GIRDER SCHEMES	CHKD. DATE
	REV.

SCALE 1" = 100'-0





59TH AVE



2% SLOPE

TYP. CROSS SECTION

SKEW ~ 42°

SLAB DESIGN MANUAL APP. 5-C-1

(a) 10 @ 7'-6":

EFF. SPAN (7'-6) - (1-0) = 6-6 = S

TOP SLAB T = 6'4 + ½ = 6¾" USE 7"

REINF. #5 @ 10" TOP
#5 @ 10" BOTT } TRANSV.
#5 @ 10"
9 #5 LONGIT. & #4 @ 18' IN T. OF SL.

BOTT. SLAB T = 5½"

REINF #4 @ 14" TOP
-"- BOTT

(b) 9 @ 8'-4":

EFF. SPAN: S = (8-4) - (1'-0) = 7'-4

Top. SLAB: T = 6⅝ + ½ = 7⅛ USE 7½"

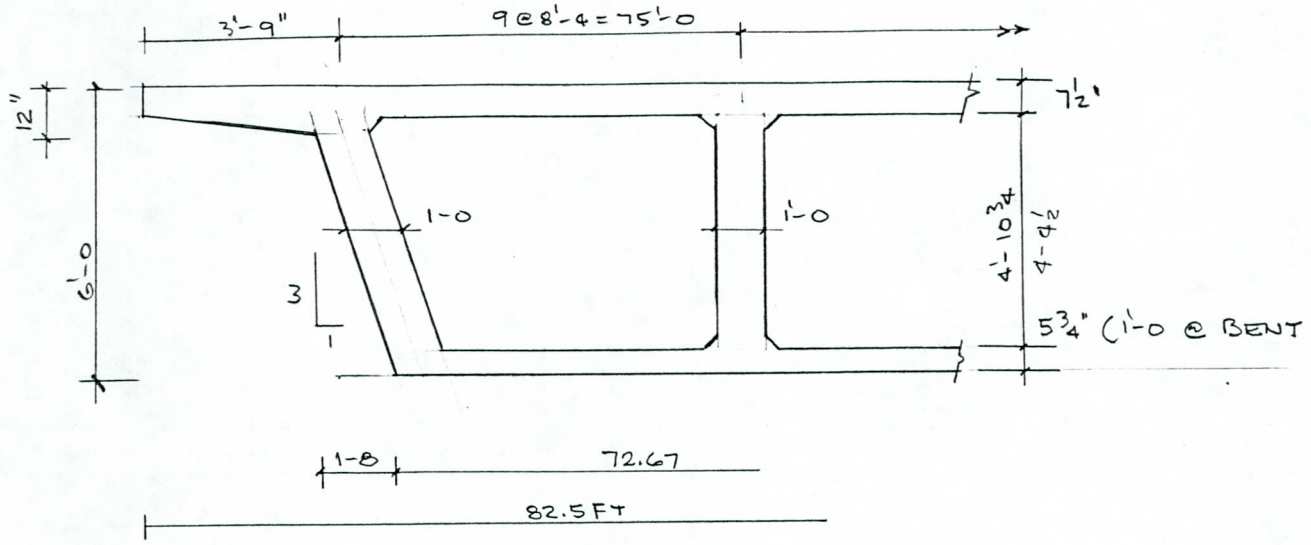
REINF.: #6 @ 13" TOP
#6 @ 16" BOTT
#6 @ 16" & 10 #5 LONGIT.

BOTT. SL. T_o = 5¾"

REINF. #4 @ 13" TOP
-"- BOTT

59TH AVE

DECK SECTION PROPERTIES:



SEC. PROPERTIES @ MID SPAN

	01 A FT²	d FT	02 Ad FT³	03 Ad² FT⁴	04 I_o FT⁴
T. SLAB 82.5(7.5/12)	51.56	5.69	293.4	1669	1.7
B. SLAB 72.67 (5.75)/12	34.82	.24	8.4	2	.7
WEBS 8(1.0)(4.90)	39.20	2.93	114.9	337	78.4
" 2(1.0)4.90)/.95	10.31	2.93	30.2	89	20.6
				−1469	→ 627.0
Σ	135.90		446.8		I = 728.4

$C_B = 3.29$

$C_T = 2.71$

STRESS COEFF.: $f_T = 1000 M C_T / 144 (I) = .0258 M$

$f_b = 1000 M C_B / 144 (I) = .0314 M$

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SHT. NO. 5 OF

JOB NO. 2182 B

BY AG DATE 7-6-82

CHKD. DATE

REV.

59TH AVE

SEC. PROP. @ BENT:

	A Δ	d	Ad	Ad^2	I_o
T. SL. 82.5(7.5)/12	51.56	5.69	293.4	1669	1.7
B. SL. 72.67 (1.0)	72.67	.50	36.3	18	6.0
WEB 8 (1) 4.375	35.00	3.19	111.7	356	55.8
WEB 2 (1) 4.375/.95	9.21	3.19	29.4	94	14.7
				-1316	821.8
Σ	168.44		470.8		I=900.0

$C_B = 2.79$

$C_T = 3.21$

STRESS COEFF.: $f_T = 1000 M c_T/144(I) = .0248 M$

$f_b = 1000 M c_B/144(I) = .0215 M$

DEAD LOAD:

W_1: 135.9 (.15) = 20.4 K/L

O'HG HAUNCH - 3.25(4.5/12)(.15) = .2

34 FILLETS 4X4: $\frac{1}{2}34(4)4/144(.15)$ = .3

WEB FLARES (2)9(1)$\frac{L}{16}\frac{1}{2}(4.9^{H})(.15)/160$ = .7

B. SL $(72.67-10.0)\frac{6.25}{12}(2)\frac{1}{2}(\frac{L}{16})(.15)/160$ = .5

22.1 K/L

W_2: BARRIERS 2(372 RAIL + 20) = 800

FENCE: (100 + 40)2 = 280

1.1

23.2 K/FT

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SHT. NO. 6 OF

JOB NO. 2182 B

BY AG DATE 7-13-82

CHKD. DATE

REV.

59TH AVE

FOOTINGS BOX GIRDERS

4- SPAN STRUCTURE

(a) 16" WALL PIER: $L^{MAX} = 169$ DECK WT. 23.2 K/L

W: 169 (23.2) = 3920

LL 1.05 (.75) (6) [(.64 (169) + 26)] = 634

IMP. .17 (634) = 108

4662 K

SKEW ~ 42° $\cos\alpha = .74$

UNIT LOAD TO FTG: ($L = 63 FT/\cos\alpha$)

$w = 4662 (\cos\alpha)/63$ = 54.8 K/L

CAP BM $7.33^{L} (9^{N}) (3.0^{B}) 4.4^{HT} (.15) \cos\alpha/75$ = ~~8.6~~ 1.3

16" WL. $22^{H} (.20)$ = 4.4

~~67.8 K/L~~

60.5

Sp. 10 K/LF 87'-0

USE FTG 7'-0 x 3'-0 x 64'/cosα LG.

$P_{ALL} = 70$ K/L

(b) 4- COL. PIERS

P = 4662 / 4 = 1170

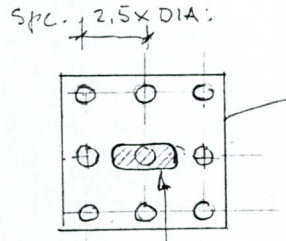
CAP BM ~~8.72~~ ^{B1} / 4 = ~~220~~ 33

COL. 3'x6'x 25^{H} (.15) = 65

1455 K

FTG 205

1860 K



FTG 15x15'x 6'-0 w/

8-(2'-0)Φ x 40'-0 DRILLED PIERS.

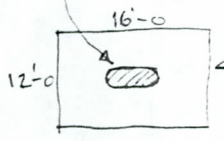
$P_A = 9(2.0)\ 106 = 1908$

COL. 3'x6'-0 ABOVE

ALTERNATE SPREAD FTG:

12'-0 x 16'-0 x 4'-0 THICK w/

20 #10 BARS EA. WAY



59TH AVE.

FOOTINGS BOX GIRDERS

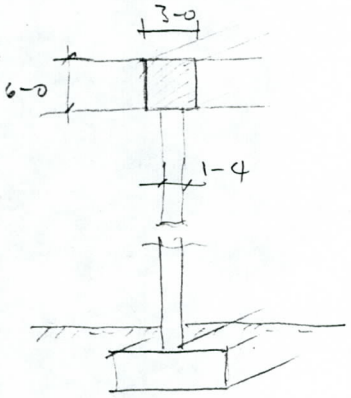
5 - SPAN COND.

$L_1 = L_5 = 99$ FT $L_2 = L_3 = L_4 = 131$ FT

(a) WALL PIER ; 16" THICK

W : 131 (23.2)

(LL+I) $1.20_{I}(1.05)(.75)_{RED}(6)[.64(131)+26] =$ 3039 + 623 = 3662 K



UNIT LOAD K/' $\cos\alpha = .74$ L = 63

W = 3662 $\cos\alpha$ /63 = 43.0

CAP BM + 16" WL. (SEE 4-SPAN) = 13.0

56.0 K/'

USE FTG 6'-0 x 3'-0 x 87'-0

P_{ALL} = 60 K/'

(b) 4-COL. PIERS

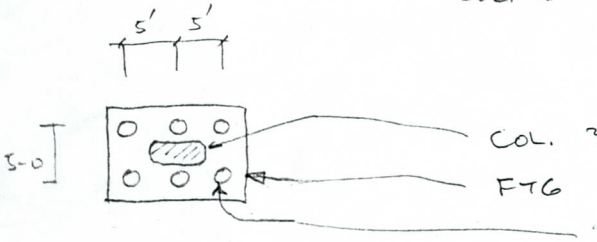
P = 3662/4

CAP BM 9.20

COL. 3 x 5 (25).15 220 X

~ 60

1200

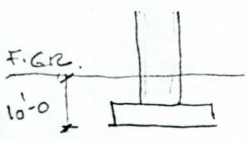


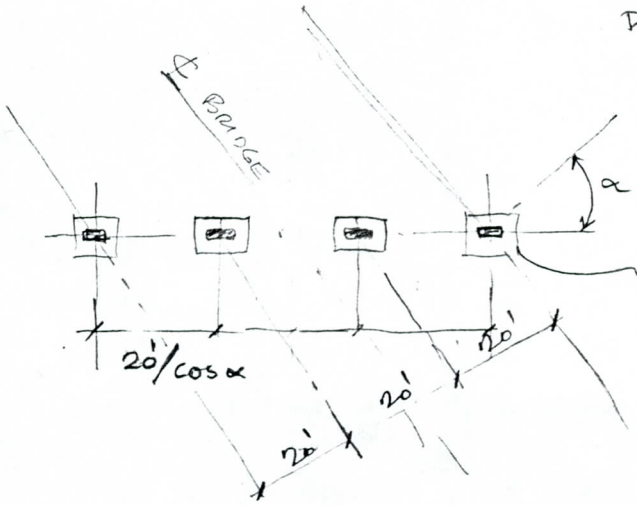
COL. 3'-0 x 5'-0

FTG 8'-0 x 13'-0 x 5'-0 THICK

6 - 2'-0 ϕ x 40'-0 DRILLED PIERS

P_{ALL} = 6(2)106 = 1272





59TH AVE

FOOTINGS BOX GIRDERS

ALT. SPREAD FOOTINGS.

$Sp = 10^k/\square' \quad @ \quad -10'-0$

4-SPAN CONDITION

SEISMIC FORCE:

$W = 1400^k$ /COL. $C = .06$ ZONE II $F = .8$

EQ. = $CFW = 67.2^k$ / COL. $h = 25$ FT

$M_{FTG} = EQ.(h/2) = 840^{k'}$

$\Sigma P = COL. + FTG = 1860^k$

$e = M/P = .45$ FT $/ \cos\alpha = .61$ FT

$A_{REQ'D} = \Sigma P/10 = 186\ \square'$

TRY $L = 16$ $e/L = .04$ $\gamma = 1.24$

$A_{REQ} = 1.24\,\Sigma P/10(1.33) < 186$

$B_{REQ'D} = 186/16 = 11.6$

USE FTG $12' \times 16' \times 4'-0$ THICK

$V^x_{ALL} = 12\overset{B}{(12)}\,d\,(.060)(12) = 103.7\,d$

$V = (5.5-d)\,12\,(10) = 660 - 120\,d$

$d_{REQ'D} = 660/223.7 = 2.95$ FT

$V^Y_{ALL} = 1(d)144(.06) = 8.64\,d$

$V = (4.5-d)\,1\,(10) = 45 - 10\,d$

$d^Y_{REQ'D} = 45/18.6 = 2.42$

PROJ. $x = 5.5$ $M_c = 10(5.5)^2/2\,(12) = 1815$

$A_s = M/1.76(40) = 25.8\ IN^2$

20 #10

$y = 4.5$ $M_c = 10(4.5)^2/2\,(16) = 1620$

$A_s = M/1.76(40) = 23.0$

ALT. SPREAD FOOTING
5 - SPAN CONDITION

SEISMIC :
$W = 1200/\text{col.}$ $C = .06$ $F = .8$
$EQ = CFW = 58^{K}/\text{col.}$
$M_{FTG} = EQ.(h/2) = 58 \times 12.5 = 720^{K'}$

$\Sigma P = \text{COL.} + FTG = 1200 + 100 = 1300$

$e = M/\Sigma P = .55/\cos\alpha = .75$

TRY $L = 14$ $e/L = .054$ $\gamma = 1.33$

$$A_{REQ'D} = \frac{\gamma(\Sigma P)}{10.0\,(1.33)_{SP}} = 130 \text{ SQ FT}$$

$B_{REQ'D} = A/14 = 9.3$

USE FTG $10'-0 \times 14'-0 \times 3'-6$

$V_x^{ALW} = {}^{B}_{10}(d)\,144\,({}^{V_A}_{.06}) = 86.4\,d$
$V = (5-d)\,{}^{B}_{10}\,({}^{SP}_{10}) = 500 - 100\,d$
$d^{x}_{REQ'D} = 500/186.4 = 2.7 \text{ FT}$

$V_y^{ALW} = 1(d)\,144\,(.06) = 8.64\,d$
$V = (3.5-d)\,1\,(10) = 35 - 10\,d$
$d^{Y}_{REQ'D} = 35/18.6 = 1.9 \text{ FT}$

PROJ: $x = 5.0$ $M_c = {}^{SP}_{10}\,({}^{B}_{10})(5)^2/2 = 1250$ $d = 3C$
$A_S = M/1.76\,d = 19.7$
16 # 10 LONGIT.

$Y = 3.5$ $M_c = 10(14)\,3.5^2/2 = 860^{K'}$ $d = 3C$
$A_s = M/1.76\,d = 13.5$
14 # 9 TRANSV.

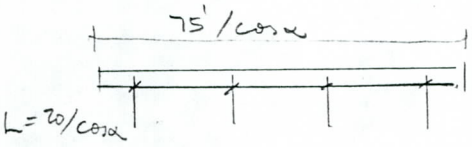
59TH AVE

CAP BM BOX GIRDERS

4-SPAN CONDITION:

L = 169 FT I = 50/(2(169)+125) = 1.08

W = Deck 3920
LL 63 + Imp. 51 (SEE FIGS) 685
~ 4610 K



SKEW ~ 42° α = .74

L = 20/cos = 27.0'
L' = 27 - 4 = 23'

W_{DL} = 3920 (cos α)/75 = 39 K/'
CAP: 7.33 (L) (9) (N) (5) (B) (4.4) (HT) .15 cos/75 = 3.0
42.0 K/'

W_{L+I} 742 (cos)/75 = 7.3 K/'

$M_{DL} = wL'^2/10$ = 2220
M_{LL} = 390

M_U = 1.4(2220) = 3110
1.7(390) = 660
3770 K'

V_{DL} = 13.5(42) = 567
V_{LL} = 13.5(7.3) = 100
667 K b = 60 d = 66

$V_{FACE} = 667 - \frac{210}{5}(42) = 457$ K

$v = V_F/bd$ = 115 PSI

$k_U = \frac{3770}{5(66)^2(3.6)} = .048$

$A_s = M_U/4.3(d)$ = 13.3 IN²

USE CAP BM 5'-0 × 6'-0 DEEP.

59TH AVE

CAP BM BOX GIRDERS

5- SPAN CONDITION

W : Deck 3030^k
LL 630^k } SEE FIG.

w : DL 3030 (cos α)/75 30.0^k/'
CAP BM 2.5 "
32.5^k/'

w_{LL+I} 630 (cos)/75 6.2^k/'

V_{TL} = 13.5 (32.5 + 6.2) = 522^k
(38.7)
w_{DL} d = 5(32.5) = 162
V@d = 360^k

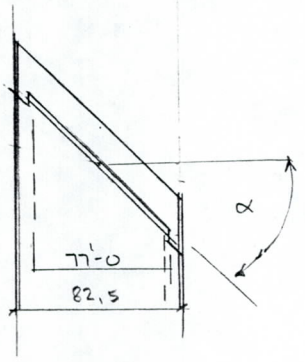
b = 48 d = 66

v = V/bd = 114 PSI

USE CAP BM 5'-0 x 5-0

59TH AVE

BOX GIRDER ABUT'T



4-SPAN CONDITION

L = 127 FT w_{DL} = 23.2 K/L

cosα = .74

V_A = .37 (L) w = 47'-0 w (SEE MOM DIST.)

W_{DL} = (47+1.5)(23.2) = 1125 K

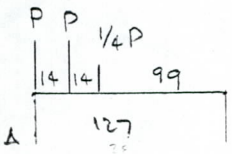
w_{DL} = W/ cosα/77 = 10.8 K/FT

DIAPH 3' THICK 1.3 -"-

ABUT. BM 3'-6(.15) = 2.7 -"-

APP. SLAB 6(.150) = .9 -"-

15.7 K/FT



24.75
1.3
264.75

γ = 8.33/7 = 1.19 S = 8'-4 I = .20

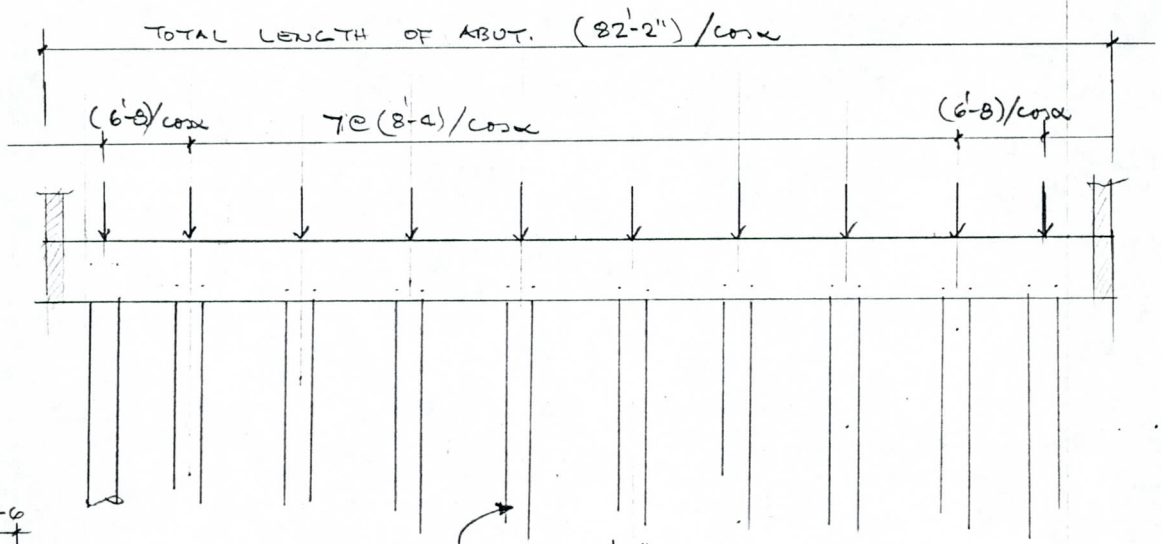
R_A = 264.75/127 P = 2.08 P

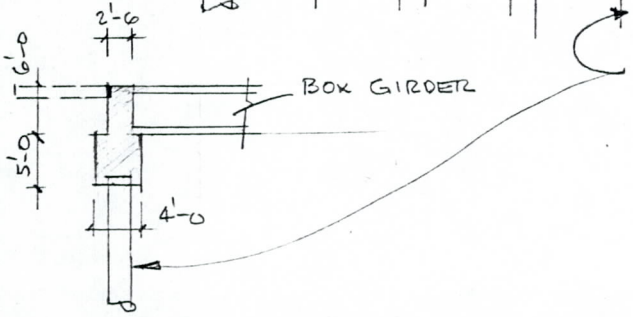
16(3 - 10/8.3 - 1.19) = 9.7 K

GIRD. REACTION:

R_{LL} = 39.6 γ (2.08) 16 + 9.7 = 49.3 K/GIRD

LL+I ≅ 60 K/GIRD





10-2'-6" Φ x 45'-0 DRILLED PIERS

P = 8.33/cosα (177/15.7) + 60 = 237 K/PIER

P_{ALL} = 2.5 (116) = 290 K

S. REP

BOX GIRDER ABUT.

5-SPAN CONDITION

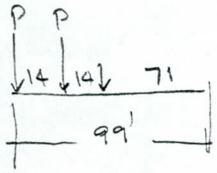
L = 99 FT .37L ≈ 37 FT

W_{DL} = (37+1.5) 23.2 = 893^k

w_{DL} = W conc/ft = 8.6^k

DIAP. + ABUT + APP. SL. = 4.9

13.5^k/ft



17.75
85
99
201

R = 201.75/99 P = 2.04 P γ = 1.19

16 (3 - 10/8.3 - 1.19) = 9.7^k

I = .223

R_{LL} = γ (2.04) 16 + 9.7 = 38.8 = 48.5

I = 10.8

59.3 ~ 60^k

DRILLED PIER:

P = $\frac{8.33}{\text{conc}}$ (13.5) + 60 = ~152 = 212

P_{all} = 2 (116) = 232^k

USE 10 - 2'-0 ϕ x 45'-0 DRILLED PIERS

BOX GIRDER (10 - WEBS)

DESIGN MOMENTS:

$W_{DL} = 23.2^{K}$ SHT.

LL - DISTRIBUTION

(a) PER GIRDER $y = S/7 = 8.33/7 = 1.19$

(b) ENTIRE STRUCT: $S = 8.33$ $N_w = 10$

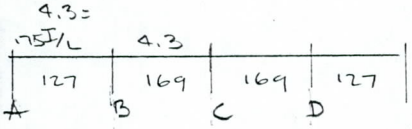
NO. OF LANES: $\frac{SN}{2(7)} = 5.95$ (6 LANES)

(c) IMPACT $50 \div (127 + 125) = .20$ (+) M_1

$50 + (148 + 125) = .183$ (−) M_B

$50 + (169 + 125) = .17$ (+) M_2 & (−) M_C

DEAD LOAD:

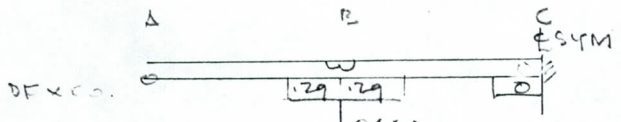


$I_B = 728$ FT^4 $I/L = 4.3$ TYP

$-I_{COL} = 6'\phi$ 63.6 FT^4 $h = 30$ $I/h = 2.1$ (3)

(3 COLS) $I/h = 3(2.1) = 6.3$

JT. B:	K	DF
= JT C	4.3	.29
	4.3	.29
	6.3	.42
	14.9	1.00



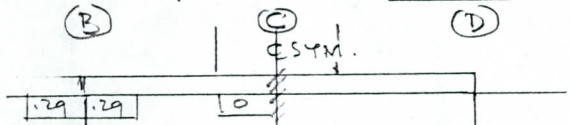
		−8444		
FEM DL	46774	−55218	55218	
	2448	2448	1224	
M_{BM}	49222	−52770	56442	
M_{COL}		3548	(3-COL'S)	

M/L $\frac{14732}{-388}$ $V_A = 1085$

$W_{LL} = \frac{6(1.17)}{I}(.64) = 4.5^{K}/_{L}$ (NO. OF LANES)

$P = \frac{6(18)}{I}1.17 = 12.6^{K}$

SUPPORT C: LIVE LOAD + I:



FEM:

$wL^2/12$	=	10 710
$PL\ .1481$	=	3154 RT
$PL\ .0763$	=	1625 LT

FEM	−	12335	13864	
	3577	3577	1788	
M_{BM}	3577	−8758	15652	LL+I
M_{CL}		5181	0	(3-COLS)

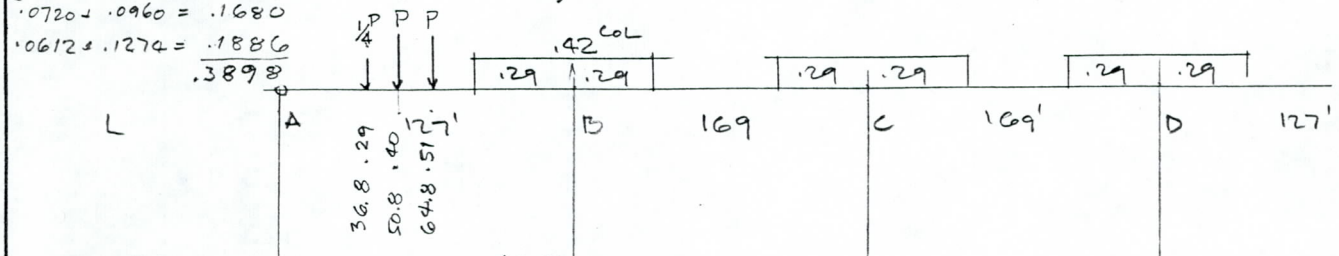
Box GIRDER

FEM COEFF m_R

$\frac{1}{4}$ (.0731 + .0597) = .0332
.0720 + .0960 = .1680
.0612 + .1274 = .1886
.3898

DESIGN MOMENTS (CONT'D)

(LL + I.) SPAN 1 (END SPAN)



	A	B		C		D
FEM = PLm		49.5				
	0	-7.3	-7.3	1.1	1.1	
		-7.3	-6.2		-6.2	
M/P =		34.9	-13.5			
M/P (3-COLS)			21.4 (P) = 4922			

49
60
.18
.27

V_A = 1.27

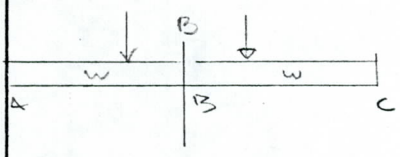
M/L − .27P

V_A 1.00P

(+) $M_{(LL+I)}$ = P(50.8) − $\frac{P}{a}$(14) = 47.3P = 10900 k'

No. of lanes
I = .20 P = 6(32)(1.20) = 230 k

SUPPORT B



w = 6(.64) 1.183 = 4.54
P = 6(18) 1.183 = 128 k

FEM B_{LT}: $WL^2/8$ = 9153
$PL(.1924)$ = 3127
} 12280

FEM B_{RT} = SHT. 13864 (1.183/1.17) = 14020
FEM C_{LT} = " 12335 (") = 12470

	A	B .29	B .29	C .29	C .29	D .29	D .29
FEM's		12280	-14020	12470			-9153
UNBAL'D			-1740	-"-			-"-
M'		561	561	-2127	-2127	1636	1636
		561	-1566	-1566	-491	-491	1636
(-) M_{BM}		13402	-15025	8777	-2618	1145	-5881
M (3-COLS)			1623		-6159		4736

BOX GIRDER

FRICTION LOSSES :

(a) ANGLE CHANGE α

SPAN 1: $AB = 2(3.29 - .92)/63.5 = .075$ (2.37)

$BC = 2(3.28)/50.8 = .129$

$CD = 2(4.10 - 3.28)/12.7 = .129$ (.82)

$\alpha_1 = \Sigma = .3329$

SPAN 2: $DE = 2(.82)/16.9 = .097$

$EF = 2(3.28)/67.6 = .097$

$FG = 2(.82)/16.9 = .097$

$\alpha_2 = \Sigma = .291$

(b) TENSION @ BENT 2: (SPAN 1)

$KL + \mu\alpha = .0002(127) + .25(.3329) = .1086$

$P_j = 1.115\ P_x$ $\quad P_x = 89.7\%$ OF P_j

TENS. @ BENT 2: (SPAN 2)

$KL + \mu\alpha = .0002(169) + .25(.291) = .10655$

$P_j = 1.112\ P_x$ $\quad P_x = 89.9\%$ OF P_j. } USE 90%

(c) TENSION @ BENT 2: SPAN 2 & 3

$P_j = 1.112\ P_x$ $\quad P_x = 89.9\%$ OF P_j.

LONG TERM LOSSES ASSUME 33 ksi $= \frac{33}{202} = .16\ P_j$

ANCHOR SET

(a) BASIS: $f'_s = 270$ ksi $\quad \Delta L = 5/8"$

$f_{jack} = 270(.75) = 202$ ksi

f_j @ BENT $= .899(202) = 181$ ksi

$d = 202 - 181 = 21$ ksi

(b) SPAN 1: $x = \sqrt{\frac{E(\Delta L)L}{12\,d}} = \left[\frac{29(10)^3(5/8)127}{12(21)}\right]^{\frac{1}{2}} = 95.6\text{ FT}$ $\quad .75L_1$

$\Delta f = \frac{2dx}{L} = \frac{2(21)(95.6)}{127} = 31.6 \sim 32$ ksi

$= \frac{31.6}{.75 f'_s} = .156\ P_j$

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59TH AVE

BOX GIRDER

PRELIM. POST-TENS. REQ'TS 4-SPAN

FIG 2.5 $L = 169$ FT $D/L = .0355$

ALLOW. TENS: $3\sqrt{f'_c}$ $\therefore$ USE $(75+8) = 83\%$

P/T REQ'D = $.83(4.3) = 3.57$ #/□' BRIDGE

$= 3.57(82.5) = 294.4$ #/FT BRIDGE

$= 294.4/.52 = 567$ STRANDS (TOTAL)

$= 567/10 = 57$ STRANDS / GIRDER

$P_j = 57(.75)270(.153) = 1766^K$/GIRDER

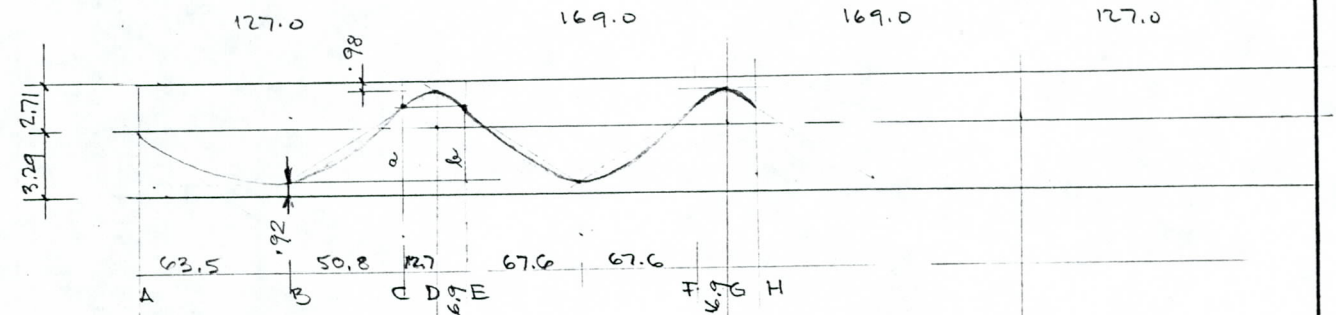
FIG 2.8 "D" $\cong$ 6"+

$e = \frac{6.0 - 1.90}{4.10} (50.8/63.5 = 3.28$

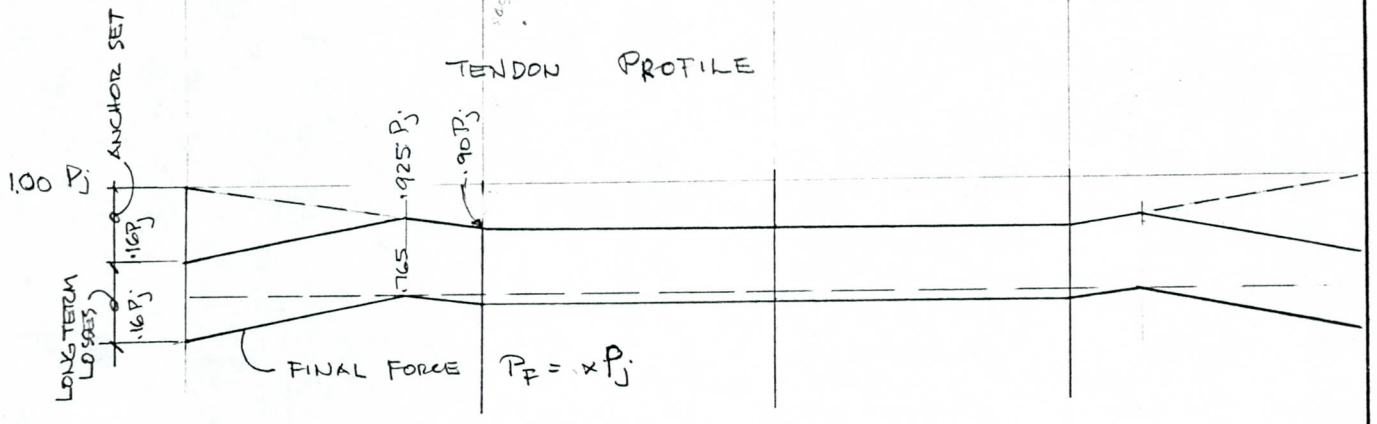
$L = 4.10\ 67.6/84.5 = 3.28$

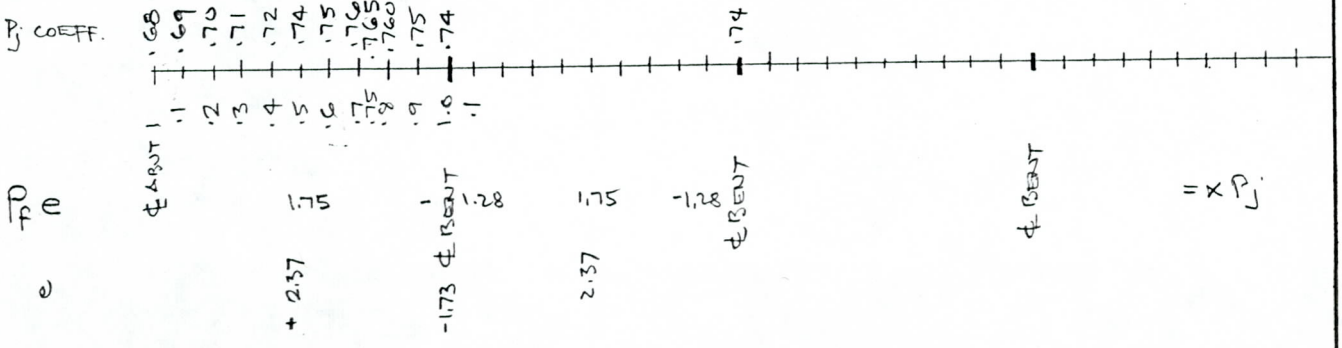
$X_{BOTH} = 6'' + 4\frac{3}{4} = 11''$

$X_{TOP} = 6'' + 5\frac{1}{2}'' = 11\frac{3}{4}''$



TENDON PROFILE





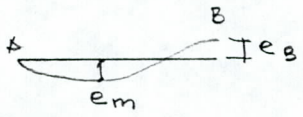
59TH AVE

BOX GIRDER

POST-TENS. FEMS 4-SPAN

END SPAN

$e_m = 2.37$ FT $e_B = -1.73$ FT



FEM: $M_A = \frac{P}{30}(16e_m - e_B) = +1.32P$

$M_B = \frac{P}{30}(16e_m - 19e_B) = +2.36P$

PINNED @ A:

$M_B = \frac{P}{30}(16e_m - 19e_B + \frac{16}{2}e_m - \frac{e_B}{2}) = \frac{P}{30}(24e_m + 19.5e_B)$

$= 2.36 + \frac{1}{2}(1.32) = 3.02P\ (.74) = 2.23P_j$

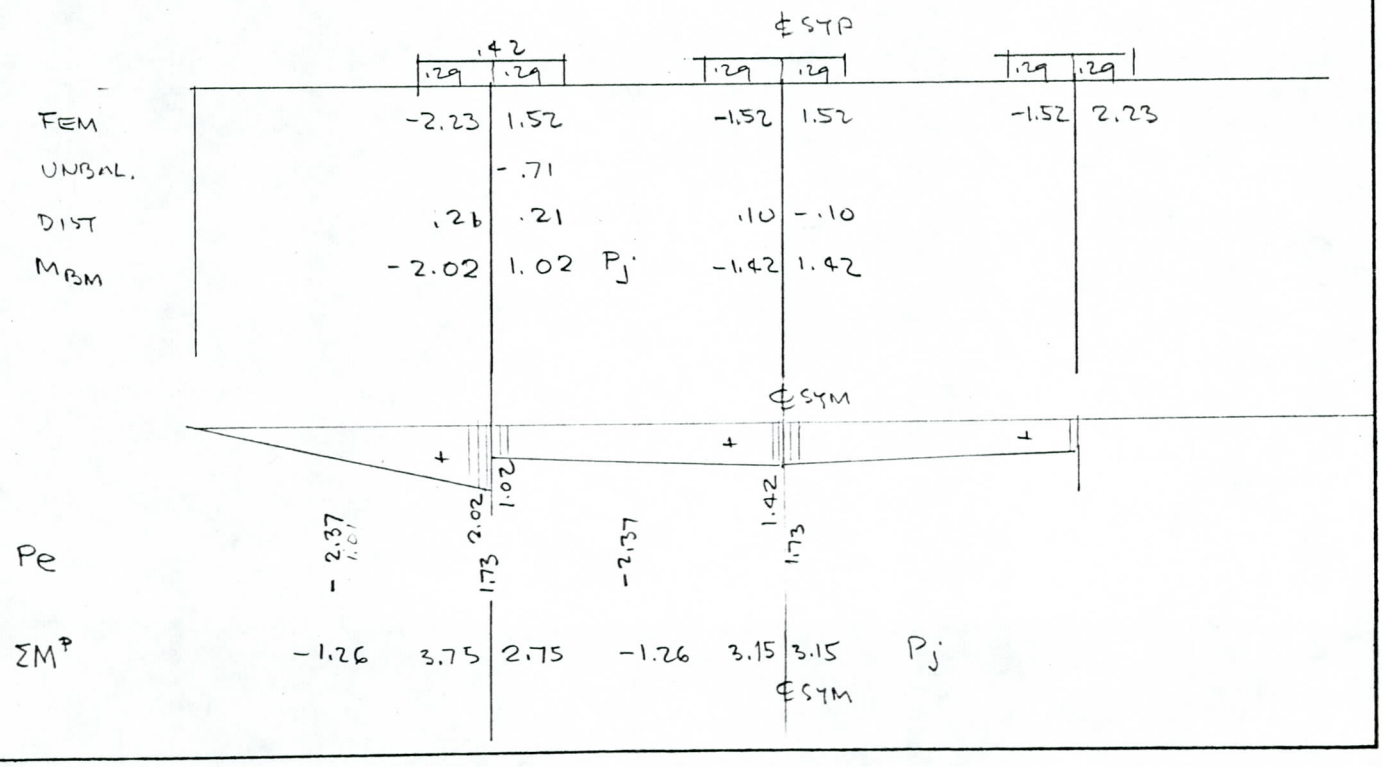
$e_A = e_B = -1.73$ $e_m = 2.37$

$M''_A = M''_B = \frac{P}{10}[e_A(2.25 - 10) + (11-6)e_m + (1+4.5)(.5)e_B]$

$= \frac{P}{10}(e_A[-7.75 + 2.75) + 5e_m])$

$= \frac{P}{10}[5(e_m - e_A)] = \frac{1}{2}P(2.37 + 1.73) = 2.05P$

$= .74(2.05P_j = 1.52P_j$



59TH AVE

BOR GIRDER:

$f'_c = 4500$ Psi 4-SPAN

$F_{T\,all} = 3\sqrt{f'_c} = 201$ Psi

$F_{C\,all} = .4(4500) = 1800$ Psi

$$f = \frac{P}{A} + \frac{Pec}{I}$$

BENT 2 TOP FIBER:

	LT	RT
M_{DL}	49 222	52 770
M_{L+I}	13 402	15 025
	62 624	67 795
$f_T = .0248M$ (TENSION)	1553	16 81 Psi

REQ'D POST TENS: $1681 - 201 = 1480$ Psi

$1553 - 201 = 1352$ Psi

$$\frac{1000(.74P_j)}{168.4(144)} + P_j\,3.75(.0248) = .1235P_j = 1352$$

$P_j = 10945^K$

$$\frac{1000(.74)P_j)}{168.4(144)} + P_j(2.75).0248) = .0987P_j = 1480$$

$P_j = 14992 / 10 = 1499^K$ / GIRDER ⇐ GOV.

ASSUMED 1766

SPAN 2: BOTT. FIBER

(+) $M_{DL} = (1085)^2/2(23.2)$ = 25 371

(+) $M_{LL} = 230(50.8 - 3.5)$ = 10 879

36 250

$f_b = .0314M$ TENS. 1138 Psi

$1138 - 201 = 937$

$$\frac{1000(.74)P_j}{135.9(144)} + P_j\,1.26(.0314) = 937 = 12110^K$$

$P_j = 12110 / 10 = 1211^K$ / GIRDER

CHECK POST-TENS. 4-SPAN

SUPPORT C TOP FIBER

M_{DL}	56 442
M_{LL+I}	15 652
ΣM	72 094

$f_T = .0248 M$ TENS = 1790 PSI

REQ'D 1790 − 200 = 1590

$$\frac{1000 \ .74 P_J}{168.4(144)} + P_J \, 3.15(.0248) = 1590 = .109 P_J$$

$P_J = 14\,636 / 10 = 1464^K$ / GIRDER

PREL. POST-T. REQ'TS 5-SPAN

L = 131 FT D = 5'-0 D/L = .038

P/T REQ'S .83(3.1) = 2.57 #/01

= 2.57(82.5) = 213 #/FT BRIDGE

= 213/.152 = 408 STRANDS

= 408/10 = 41 STRANDS / GIRDER

$P_J = 41(.75)270(.153) = 1270^K$ / GIRDER

FIG 2.8 D = 5"

$X_{BOT} = 5 + 4\frac{3}{4} = 10"$

$X_{TOP} = 5 + 5\frac{1}{2} = 10\frac{1}{2}"$

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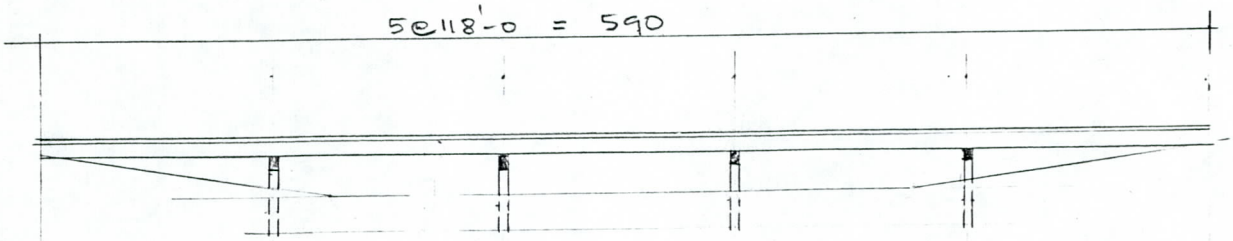
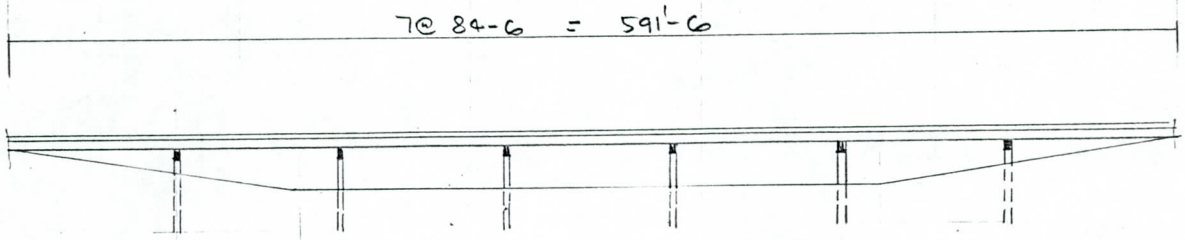
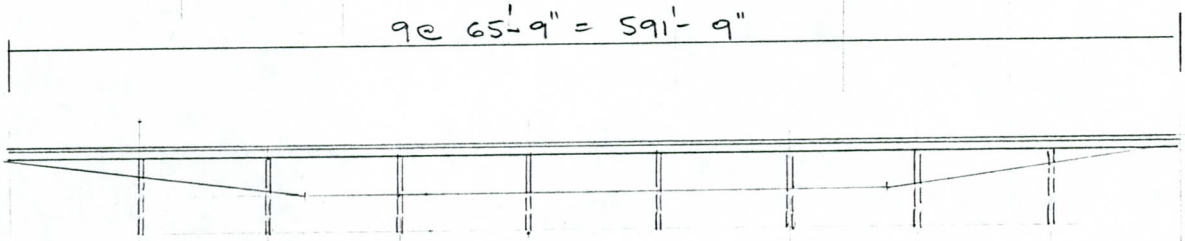
PI- GIRDERS	REV.



TYPE VI GIRDERS



TYPE IV GIRDERS



TYPE III GIRDERS

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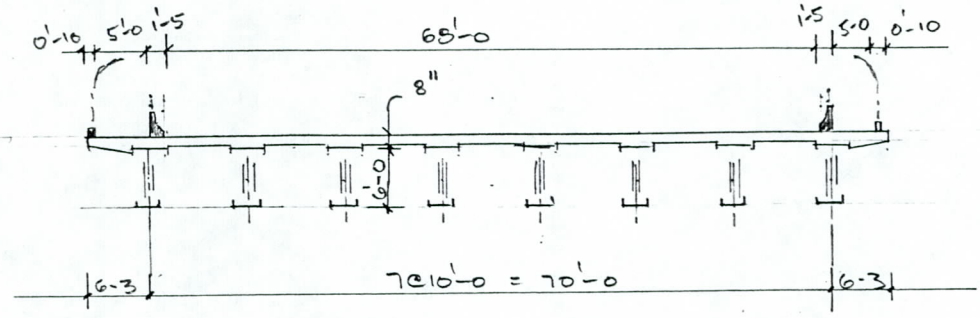
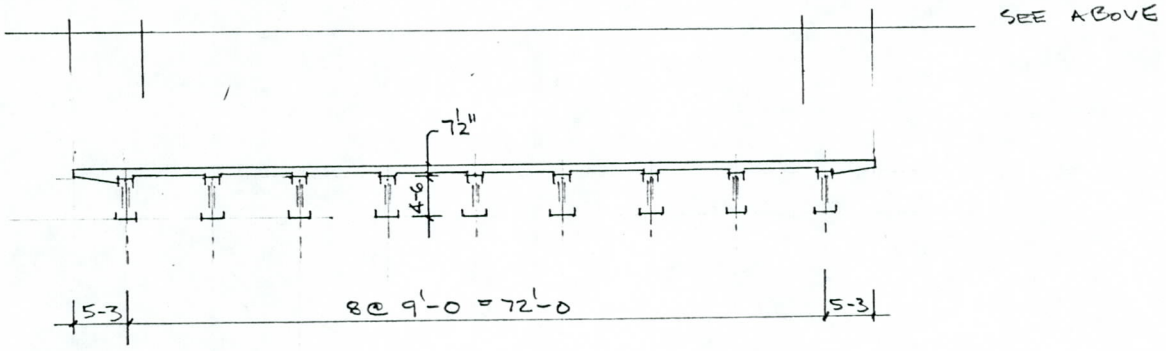
P - I - GIRDERS	REV.

TYPE VI GIRDERS



PIER SPACING: 5 @ 118 ± FT = 590'-0 ±

TYPE IV GIRDERS



PIER SPACING: 7 @ 84'-6" ± = 591'-6" ±

TYP III - GIRDERS

(1) GIRDER SPACING 9 @ 8'-0 = 72'-0

(2) O'HANG 5'-3" EA. SIDE

(3) SLAB THICKNESS 7"

(4) PIER SPACING 9 @ 65'-9" ± = 591'-9" ±

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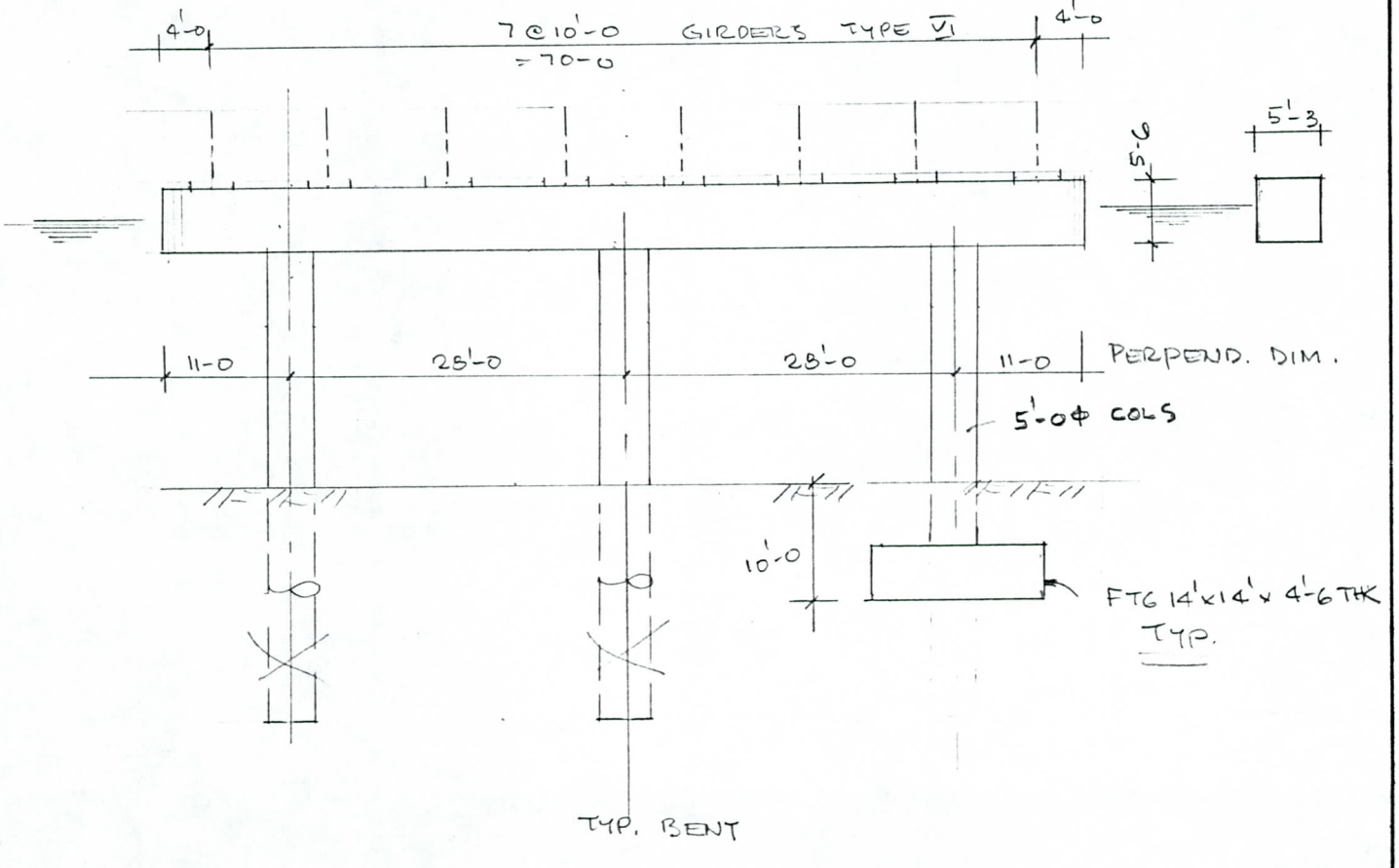
TYPE VI GIRDERS :

(a) EXTER :

8" SLAB : (6.25 + 5.0) .100	=	1.13
1" BUILD-UP 3.5 ($\frac{1}{12}$) .15	=	.04
HAUNCH : 4.5 ($\frac{4}{12}$) $\frac{1}{2}$ .15	=	.11
GIRDER 1085 (150/144)	=	1.13
INT. DIAPH : 2 ($\frac{1}{2}$) 5400* / 118	=	.05
CURB 100 + FENCE 40 + BARRIE^{L} 370 + RAIL 20	=	.53
	W_{DL} =	≈ 3.00 K/FT

(b) INTER :

8" SL. 10 (.10) + 1" BULD-up .04	1.04
GIRD. 1.13 + INT. DIAPH .09	1.22
W_{DL} =	2.26 K/FT



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PI-GIRDERS

TYPE III

EXTER:

7"SL.	.81
	.02
	.13
	.58
	.03
	.53
	2.10

INTER.:

7"SL. + B-UP.	.72
.58+.07	.65
	1.37

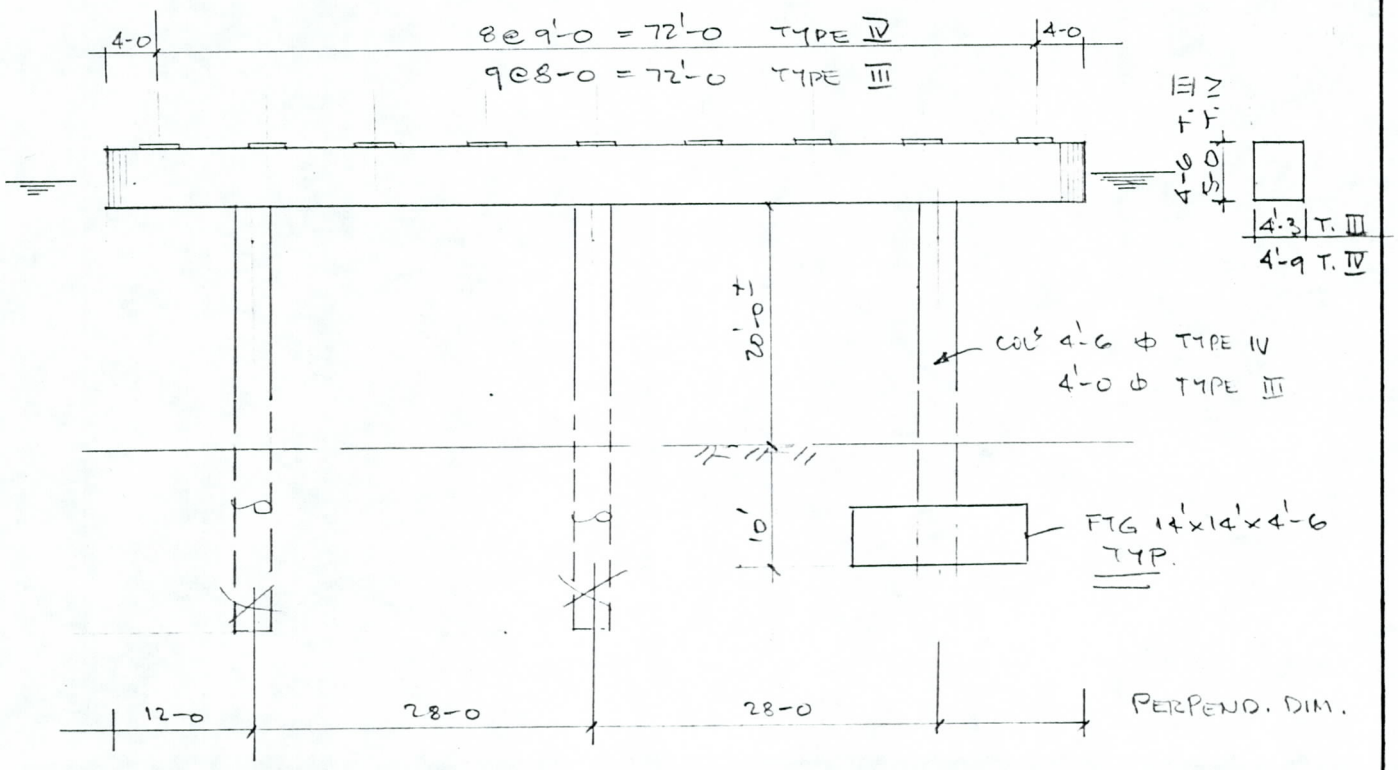
TYPE IV

(a) EXTER:

$7\frac{1}{2}$" SL. $(5.25+4.5)\frac{7.5}{12}(.15)$	.91
BUILD-UP 1.7 (12.5)	.02
HAUNCH $4.5\frac{4.5}{12}\frac{1}{2}(.15)$	.13
GIRDER 789 (150/144)	.82
INT. DIAPH SEE JN 2087 $2(\frac{1}{2})3.3/84.5$	.04
CURB etc SEE TYPE VI	.53
	2.45 k/l

(b) INTER.:

$7\frac{1}{2}$" SL. $9(\frac{7.5}{12})(.15)$ .84 + BULD-UP .02	.86
GIR. .824 INT. DIAPH .08	.90
	1.76 k/l



TYP. BENT TYPE III & IV

59TH AVE

TYPE VI BENTS

DEAD LOAD REACTIONS (L = 118 FT)

P_1^{DL} (CURB & RL.)

(3.0 − .53)(118) = 291.5

.53 (1.132)(") = 70.8

PAD 3(3.5).075 ≈ .7

363.0 K

P_2^{DL} 2.26(118) + PAD 1.3 = 268.0 K

P_{LL}:

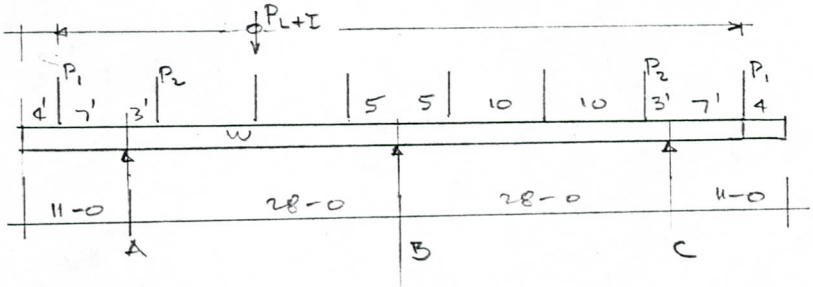
$\gamma = 10/5.5 = 1.82$ S = 10'-0 I = .139

$16\left(3 - \frac{10}{10} - \gamma/2\right) = 17.4^K$

$\frac{1}{2}\gamma\left[116 + \frac{3}{5}(3.9)\right] + 17.4 = 125.1^K$

Imp.: .139(125.1) = 17.3

≈ 143.0 K



W: CAP BM: 5.25 (5.5) .15 = 4.33 K/'

DIAPH. 5.3 (1.0) (.15 = .77

5.10 K/'

CANT.

$M_C = wL^2/2$ 2850 { 309 / $(\cos\alpha)^2$ = 564 ; 2541 / $\cos\alpha$ = 3434 } 3998

$P_1^{DL}(7.0)$ = 1351

P_{LL+I} (7) ≈ 1000 K

$V = \frac{11(w)}{\cos\alpha} + P_1 + P_{L+I}$; 56.1 / .76 ; 363 ; 143 ; DL 439 + 143 = TL 582 K

@ FACE L_c = 9.0 FT

$M_C = wL^2/2 + P_1(5) + (LL+I)5$; 207 ; DL 1815 ; 715 = 2737

2022

$\frac{}{\cos^2} = 378 + 2453 + 966 = 3797$

2831

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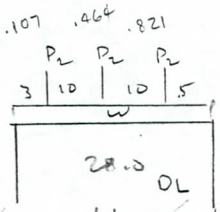
TYPE VI BENT	REV.



DL 96.5 71.4 430.7 — DL wL/2 71.4 / 96.5 P2 373.7

L+I 502.1 230 445.1 199 — 527.2 470.2

FEM	LT DL	LT LL	RT DL	RT LL	m L	m R
wL/12	333 / 608		333 / 608			
$P_2 L_m$	1853 / 2504		1838 / 2484		.247	.245
$P_{L+I} L_m$	2186	989	2171	981	"	"
	3112	1336	3092	1326		

GIRDER $I_G = 5.25(5.5)^3/12 = 72.8$ FT^4

COL. 5'Ø $I_C = \pi D^4/64 = 30.7$ "

EFF. COL. LENGTH $L_C \sim 30$ FT $L_G = 28.0$

$k_C = I/L =$ 1.0 .28

$k_G =$ 2.6 .72 ; 3.6 1.00

1.0 .16 ; 2.6 .42 ; 2.6 .42 ; 6.2

		.36	.21	.21	.36	
FEM DL	2850	-2186	2171	-2171	2186	-2850
UNBAL'D		664		0	-664	
		-239	0	0	239	
		-239	-239	239	239	
(-) M_G	2850	-2664	1933	-1933	2664	-2850
$\Delta M/L$		26.1	-26.1	-26.1	26.1	
M_{COL}		-186		0		186
FEM (L+I)	1000	-989	981	-981	989	-1000
(a) CANTIL. ONLY :						
M	1000	-720	0	0	720	-1000
M_{COL}		-280				280
(b) SPANS ONLY		+356 } +712			-712	
		+356	+356	-356		
$M_G =$		-277	1337	-1337	277	
M_{COL}		277		0		-277
M/L		-37.9	37.9	37.9	-37.9	

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BY AG DATE 7-8-82

CHKD. DATE

REV.

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TYPE VI BENT

COL. REACTIONS:

	M_{COL}	DL	LL+I	LLI M/L
A:		439		
CANT. ONLY	-280	419 527	143	+26
S.SP. ONLY	+277	502	230	-38
$\Delta M/L$		26 992		
M_{COL}			-186	

P_{MAX}: DL 997 + L+I 373 = 1320 K

1370 K

B:

	DL	LL+I
S.SP: 2(470/445) / 2(199) =	940 890	398
$\Delta M/L$ - 2(26) =	- 52	
CANT ONLY 2(26)		-52
SPANS. ONLY 2(38)		76
Σ	838	

P_{MAX} = DL 940 838 + L+I 474 = 1312 K 1414 K

CAP BM:

M_{ULT} FACE = 1.4(2831 2022) = 2830 3963

1.7(966 715) = 1220 1642

M_U = 4050 K' 5605 K'

b = 5'-0 d = 60" f'_c = 4.0 f_y = 60

$K_U = \frac{M_U}{5.0} \div [d^2 3.6] = .063$ .086 $\alpha = 4.3$ 4.2

A_s = 22.24 15.7 IN^2 ~ 15 10 #11

$V_{CANT.}$ = 582 562 - 25 5(5.1) = 557 537

$v = V/bd$ = 189 154 psi o.k.

$V_{INT.} = 527 + 230 - (7(5.1) + 268) < V_{CANTIL}$

59TH AVE

TYPE VI BENT

SEISMIC LONGIT:

$W_{@\,COL}$ = 940^K C = .08 (BELL ROAD) F = 1.0 CANTIL

EQ. = CFW = 75.2^K

h = 25 FT M_{COL} = 1880 K'

TRY 5'-0 ϕ COL.:

e = M/P = 2.0 FT = 24"

P_U = 1.3(.75) 940 = 940

M_U = 1.3(1880) = 2444 K' e = 31.2 IN

CHECK 5'-0 ϕ COL:

F'_c = 4.0 ϕ = .70 d_o = 60 - (3+1+1.5) = 64.5

	e	24"	30"	32"	40"	45"	50"	55"	60
p = 2.22 %	A_S								
28 # 11	43.68	3285	2562	2360	1731	1455	1243	1078	948^K

USE 5'-0 ϕ COL.

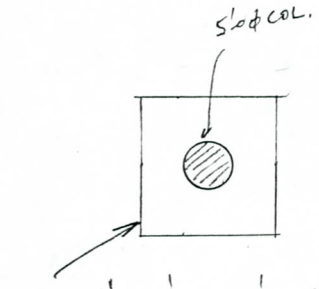
FTG P_{TL} = 1414 + COL. 76 = 1490^K

sp = 10.0 $A_{R'D}$ = 149 □' SKY 14x14

ΣP_{DL} = 940 + 70 (COL) + FTG 140 = 1150^K

M = 75.2(35) = 2632 e = 2.29 e/L = .164 γ = 1.96

$A_{R'D}$ = 1.96(ΣP)/10 (1.33) = 169 < 14'x14' = 196



C_m = (7.0 - 2.0) = 5.0 FT

M = 10 (sp) (C)^2/2 (14) = 1750 K' d = 48

A_S = M/1.76(d) = 20.7 18 # 10 EWAY

V_o = 1490 - π (9)^2/4 (10) (sp) (62.6) = 854^K

V_{AU} = .100 (π) 9 (4) 144 = 1629^K > V_o o.k

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SHT. NO. 29 OF
JOB NO. 2182 B
BY AG DATE 7-8-82
CHKD. DATE
REV.

59TH AVE

TYPE IV BENT

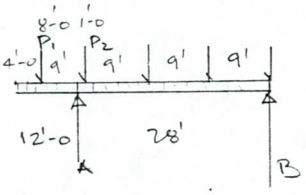
L = 84.5 FT

P_1^{DL} (2.45 − .53) (84.5) = 162 K
.53 (1,132) − " − = 51
213 K

P_2^{DL} 1.76 (84.5) = 149 K

P_{LL} γ = 9/5.5 = 1.64 S = 9'-0
16 (3 − 10/9 − γ/2) = 17 K 4.0 K AISC PG. 1
I = 50/(169 + 125) = .17

½γ [92) + 17 = 93 K
I = .17 (93) = 17
110 K



$w = {}^{BM}4(5)(.15) + {}^{\#}4.5(1).15 = {}^{3.0}{}^{.6}$ = 3.6 K/'

COL. A:	DL	LL+I
P: 26 (w)/2 + P1: 213	340	110
P2 (54)/28	287	212
	627	322

TL 949

COL. B:			
P: 28 (w)/2 + P2	285	110
P2 30/28 [2]	319	236
	604	346

TL 950

V_{CANT}: 12w/cos∝ + 110 = 382
@ d = 4.5 (3.6) = − 16
366

b = 48
d = 56

v = V/bd = 136 PSI o.k.

M FACE L_c = 1.5
M = w (10.5)²/2/cos² = 198 362
P_1 (8 − 1.5) = 13.85 / 1583 (1.4) = 2216 2446
1747
P_w (6.5) = 715 (1.7) = 1216

M_U = 3432 3662
a = 4 3.2
K_U = .075
A_S = 14.25 10 #11 o.k.
15.6

59TH AVE

TYPE IV BENTS

TYPE IV GIRDERS

(a) COL:

EQ = CFW : C = .08 F = 1.0

COL. A : P_{DL} = 627 + COL. 63 = 690^k

EQ = 55.2^k

M = EQ (26) = 1440$^{k'}$

M_U = 1.3 (1440) = 1872$^{k'}$

$P_U = \frac{4}{3}\left(\frac{3}{4}\right) P_{DL}$ = 690

e = M_U / P_U = 2.7 FT (12) = 33"

4'-6" ϕ f'_c = 4000 ϕ = .70 d_o = 54-6 = 48"

A_g = 2290 in^2

$P_E M$	p	BARS		36"	40"	45"	50"	55"
.218	1.33%	24#10	30.48	1148	960	785		
.255	1.55%	28#10	35.56			898	759	654

USE 4'-6 ϕ w/ 28#10 VERTS

(b) FTG:

P_{TL} = 950 + COL. 60 = 1010^k

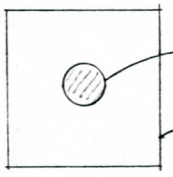
sp = 10 A_{REQ} = 101 SAY 14' x 14"

P_{DL} = 600 + COL. 60 + FTG 132 90 = 792^k

M_{OT} = 55.2 (35) = 1932$^{k'}$

e = M/P = 2.4 FT / 14 = .174 γ = 2.05

A_{REQ} = γ (792) / 13.3 = 1220 in^2 < (14)^2 = 196



USE FTG OF TYPE VI

59TH AVE

TYPE III BENTS

$L = 65.75$ FT

P_1^{DL} : $(2.1^{1.57} - .53)(65.75) = 104$

$.53(1.132)$ -"- $= 40$

PAD 1

145^K

$P_2^{DL} = 1.37(65.75) = 90^K$

P_{LL} : $\gamma = 8/5.5 = 1.45$ $S = 8$ FT > 6 $I = .196$

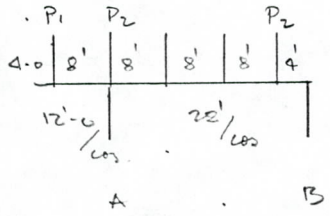
$16\left(3 - \frac{10}{8} - \gamma\right) = 4.8^K$ AISC PG. 1

(LL) : $\frac{1}{2}(\gamma)(76.9 + .8) + 4.8 = 61.3$

$I = .196$ (LL) 12.0

$LL + I = 73.3^K$

CAP BM TYPE IV $3.6^K/_1$



$\cos\alpha = .74$

COL. A:

P: $26\,w/\cos + P_1$ (127, 145) $+ P_2\ 64/28$

	DL	LL+I
	272	73
	206	168
	478	241
TL	719^K	

COL. B:

P: $28\,w/\cos$ (136) $+ P_2(2)\frac{48}{28}$ (309) $= 445^K$ 251

TL 696^K

$V_{cent} = 12\,w/\cos\alpha$ (59) $+ 145 + 73 = 277^K$

$-d: -4(3.6)$ -14

263 $b = 51$ $d = 9.8$

$v = \frac{V}{bd} = 107$

59TH AVE

TYPE III BENTS

COL : A

EQ = CFW = .08(525) = 42^k

P_{DL} = 478 + COL. 47 = 525

h = 26 TO T. FTG.

M_U = 1.3 (EQ) h = 1420

$P_U = \frac{4}{5}\frac{3}{4}(P_{DL})$ = 525

e = 2.7'(12) = 33"

COL. 4'-0 ϕ f'_c = 4000 ϕ = .70 d_o = 48-6 = 42"

1809.5

P_{ALL}^{ULT}

P_t m	p	BARS	As \ e"	30"	35"	40"	45"	50"	55"
.247	1.4%	20#10	25.4	986	767	(618)	513		
	1.68%	24#10	30.48				(604)	516	

M^U = 604(45)/12 = 2265

M^U = 618(40)/12 = 2060

FTG :

P_{TL} = 720 + COL. 47 = 767^k sp = 3.9^k/ft.

sp = 10 AR'D = 78 DI SAY 10x10

P_{DL} = 445 + COL. 45 = 490^k + 130^{FTG} = 620

$M_{OT} = 42^{EQ}(35)$ = 1470 ft-k

e = M/p = 2.37 (6) = 14.2 Try L = 14'-0

e/L = .169

14 SQ x 4'-6 w/ 18#10 E.W.

4'-0 ϕ FTG

V_o = 770 − $\frac{\pi(8)^2}{4}(3.9)$ = 574 (196)

V_{ALL} = .100 π 8 (4) 144 = 1447^k

C_M = 7.0 − 1.7 = 5.3 FT

$M = [^{sp}10(C)^2/2 \; \frac{5}{14}(14)$ = 1966 d = 42

f_s = M/1.76 = 23.2 18#10 o.k.

59TH AVE

PJ - GIRDERS ABUT.

TYPE VI L = 118

P_1^{DL} : $3.0\left(\frac{(118)}{2} + 1.5\right)$ + PAD 1.0 $\overset{182}{=}$ 183^K

P_2 $2.26\left(\frac{(118)}{2} + 1.5\right)$ + PAD 1.0 $\overset{137}{=}$ 138

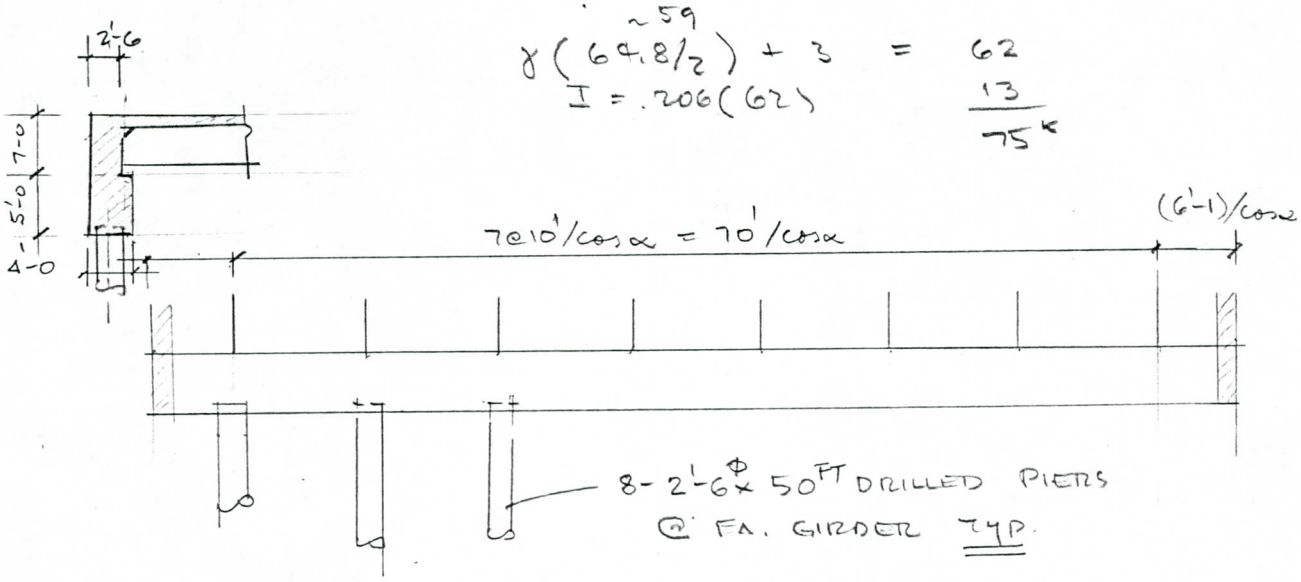
P_{LL} : $\gamma = 1.82$ $I = .206$

$16\left(3 - \frac{10}{10} - \gamma\right) = 3.0$

$\gamma\left(\frac{69.8}{2}\right) + 3 \overset{\sim 59}{=} 62$

$I = .206(62)$ 13

75^K



WT. OF ABUT

W = 14(3) .15 = 6.3^K/' } 7.2^K

APP. SL .9

DRILLED PIER:

$P = \frac{10}{\cos\alpha}\left(\overset{97}{7.2}\right) + 183 + 75 = 355^K$/PIER

$P_2 =$ 97 + 138 + 75 = 310^K/PIER

. 8 - 2'-6" Φ x 50 FT

$P_{ALL} = 2.5(147) = 368^K$/PIER

59TH AVE

PI- GIRDERS ABUT.

TYPE IV L= 84.5 FT

P_1^{DL} : $2.45 \left(\frac{84.5}{2}\right)^{104} + PAD\ 1.0 = 105^K$

P_2 : $1.76 \left(\ \ \right)^{75}$ -11- $= 76$

P_{LL} $\gamma = 1.64$ $S = 9.0'$

$16\left(3 - \frac{10}{9} - \gamma\right) = 4^K$

$I = \frac{50}{(L+125)} = .239$

$P = \gamma\left(62.1/2\right)^{51} + 4.0 = 55^K$

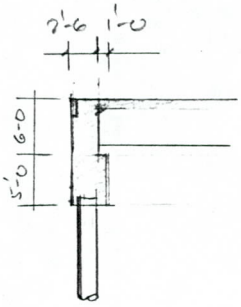
I: $\frac{13}{68^K}$

$W^{ABUT} = 7.2^K/_1$ SEE TYPE 4

DRILLED PIER:

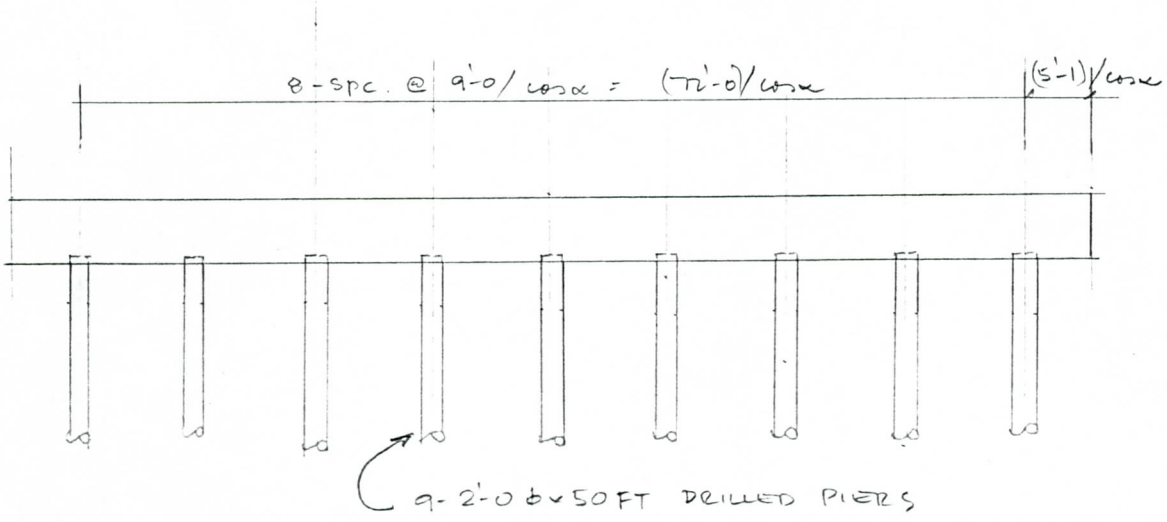
$P_1 = \frac{9}{\cos\alpha}\left(7.2\right)^{8K} + 105 + 68 = 261^K$ / PIER

$P_2 = 88 + 76 + 68 = 232$ -11-



9- 2'-0 ϕ x 50 FT

$P_{ALL} = 2(147) = 294^K$ / PIER



TYPE III L = 65.75

P_1^{DL} : $2.10\left(\frac{69.3}{33}\right)$ + PARAPET .7 → 70ᵏ

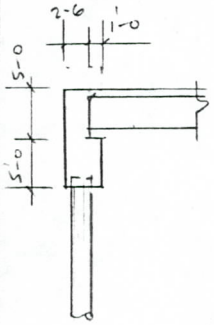
P_2 : $1.37\left(\frac{45.3}{33}\right)$ + -"- → 46ᵏ

P_{LL} $\gamma = 1.45$ $S = 8'$

$16\left(3 - \frac{10}{8} - \gamma\right) = 4.8 \sim 5^k$ $I = .263$

$P_{LL} = \gamma\left(\frac{59.3}{2}\right)(43) + 5 = 48$

$I = \sim \frac{13}{61^k}$



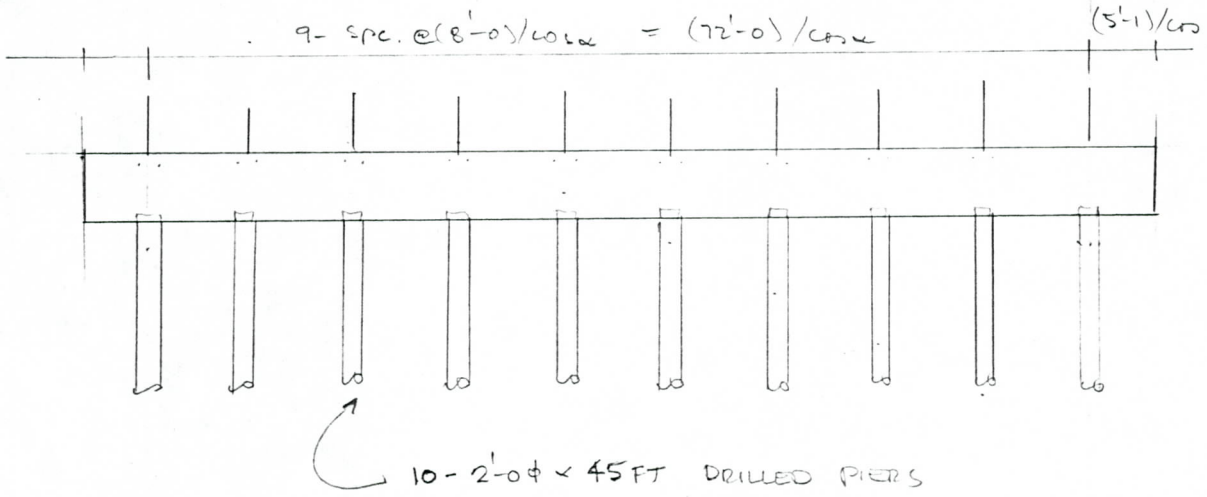
w^{ABUT} $\left(6(2.5) + 5(3.5)\right).15 = 4.9$ $\cos\alpha = .74$

DRILLED PIERS

$P_1 = (5.1 + 4)(w)/\cos^{61} + 70 + 61 = 192^k$/PIER

$P_2 = 8(w)/\cos^{53} + 46 + 61 = 160^k$/PIER

2'-0 Φ × 45 FT $P_{allow} = 2(116) = 232^k$



10 - 2'-0 Φ × 45 FT DRILLED PIERS

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street – Phoenix, Arizona 85009 – Tel (602) 262-1501

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

DES.	DR	CK	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			

PLAN
SURVEYED
PLOTTED
QUANTITIES CHECKED
BENCH MARK NO.

PROFILE
SURVEYED
PLOTTED
CURVES CHECKED
B.M.'S NOTED
STRUCTURE NOTATIONS CHKD

"SWEETWATER AVENUE"

12'W

UGE

Sta. 28+00 to 32+00 Lt.
Exist 400 L.F. Conc. Curb, Gutter & Sidewalk
Remove
Constr. 400 L.F. New Conc. Curb & Gutter
M.A.G. Det. 220, Type A
Const. 2000 S.F. New. Conc. Sidewalk
M.A.G. Det. 230

Exist. R/W

48" IRR.

65'
38'
34'
32.58'
24'
40'
Varies
30'
13'
27'
2'
5'
6'

59 TH.

Conc. Pvmt. Under
Exist. Pvmt.

3"G

28
29
30
31
AVENUE

Sta. 26+13.77
1/4 Cor.
Fd. B.C. in H.H.

MATCH SHT.

STA. 32+00

Sta. 28+00
Cut Exist. Pvmt.
Begin New A.C. Pvmt.

Sta. 30+00 to 32+00 Rt.
200 L.F. Guard Rail
A.D.O.T. Std.

1218
1216
1214
1212
1210

LEVEL
EXIST'G GRADE
+0.18%
28+00 B.V.C. P 10.54
29+00 P.I.V.C. EL. 1072 (CORR. +0.45)
30+00 E.V.C. P 12.70
+1.976%
Fin. Constr. & Grade
P16.65
200' V.C.

PHASE I

PRELIMINARY

26
27
28
29
30
31
32

PLATE 1-SINGLE PLAN AND PROFILE (FULL SHT.

FLOOD CONTROL DISTRICT OF MARICOPA CO.					
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501					
BENSON & GERDIN CONSULTING ENGINEERS PHOENIX, ARIZONA					
DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			

PLAN — SURVEYED, PLOTTED, ALIGNMENT CHECKED, RT. OF WAY CHECKED, DATE, BOOK, NO.

PROFILE — SURVEYED, PLOTTED, GRADES CHECKED, R.I.'s NOTED, STRUCTURE HOLES PLOTTED, DATE, BOOK, NO.

Sta. 32+00 to 33+54
Exist. 154 L.F. Curb, Gutter & Sidewalk
Remove
Construct New Conc. Curb, Gutter, Sidewalk & Driveway
M.A.G. Det. 220 Type A, 230

Sta. 34+55.8 to 36+10
Exist. Conc. Headwall & Conc. Lined Ditch
Remove
Construct New 42" Irr. Pipe & Ditch by S.R.V.W.U.A.

Sta. 35+50 to 36+00 Lt.
Construct 50 L.F. Conc. Barrier Transition

42" Irr. by S.R.V.W.U.A.

MATCH SHT.

STA. 32+00

STA. 38+00

Exist. R/W

Exist. R/W

Sta. 32+00 to 33+12.5 Rt.
112.5 L.F. Guard Rail
A.D.O.T. Std.

59TH. AVENUE

Conc. Pvmt. Under Exist. Pvmt.

Sta. 33+80 to 38+00
Exist. Conc. Pvmt.
Remove

Sta 34+87 to 35+37 Rt.
Construct 50 L.F. Conc. Barrier Transition

Top of Bank

℄ Approx. H.W. Line

Toe of Slope

℄ Channel

+.90 ℄ D/W

+.09 ℄ D/W

+.57 ℄ D/W

42" IRR.

65' 38' 34' 32.58' 15' Varies 30' 24' 65' 6' 40' 4"G 12"W

33 34 35 36 37

200' V.C.

Temp. 200' V.C. PHASE I

Temp. 200' V.C. PHASE I

P16.65

33+00 P.V.C. P1862

34+00 P.I.V.C. EL. 1260 (CORR.-0.44)

35+00 P.V.C. P20.80

36+00 P.I.V.C. Temp. Appr. El. 21.00 (Corr. -0.63)

30+00 P.I.V.C. Temp. Appr. El. 15.09 (Corr. +0.95)

+1.976%

+0.20%

-2.55%

Fin. Constr. ℄ Grade

Fin. Constr. Grade Temp. Approach

PHASE I

PHASE II

EXISTING GRADE

Approx. Top of Exist. Conc. Pvmt.

1220 1218 1216 1214 1212 1210

32 33 34 35 36 37 38

PRELIMINARY

PLATE 1-SINGLE PLAN AND PROFILE FULL SCALE

FLOOD CONTROL DISTRICT OF MARICOPA CO.					
3335 W. Durango Street – Phoenix, Arizona 85009 – Tel (602) 262-1501					
BENSON & GERDIN CONSULTING ENGINEERS PHOENIX, ARIZONA					
DES	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			

PLAN — SURVEYED, PLOTTED, GRADES CHECKED, R/W OR EASEMENT CHECKED, STRUCTURE NOT A PART OF CONTRACT — DATE, BY, NOTE BOOK, PG

PROFILE — SURVEYED, PLOTTED, GRADES CHECKED, R/W OR EASEMENT CHECKED, STRUCTURE NOT A PART OF CONTRACT — DATE, BY, NOTE BOOK, PG

℄ Channel

MATCH SHT.

STA. 38+00

Sta. 38+00 to 40+98
Exist. Conc. Pvmt.
Remove

Toe of Slope

Construct New Conc.
Spillway Outlet
A.D.O.T. 4.02

24"IRR

48"

Approx. H.W. Line

Top of Bank

18"

12"W

4"G

39 59TH 40 41 42 43 AVENUE

Sta. 41+92 to 42+42 Lt.
Construct 50 L.F. Conc.
Barrier Transition

Sta. 42+42 to 44+00 Lt.
Construct New Conc. Curb, Gutter, Sidewalk, & Driveway
M.A.G. Det. 220 Type A, 230

New 18"x275'
Storm Drain

2' 5' 7.5' ± D/W

Exist R/W

16'

33' 22' 18' 34' 32.58' 45' 26'

Exist. R/W

Sta. 41+30 to 41+80 Rt.
Construct 50 LF. Conc.
Barrier Transition

Sta. 41+80 to 43+40 Rt.
Taper Edge of New Pvmt.
From 34' Rt. to 26' Rt. of
Constr. ℄

MATCH SHT.

STA. 44+00

200' V.C. 200' V.C.

1222 1220 1218 1216 1214

+0.20%

39+00 GR. BK. P 21.60

-0.20%

41+00 B.V.C. P 21.20

42+00 P.I.V.C. EL. 21.00 (CORR-030)

43+00 P.R.V.C. P 19.60

Fin. Constr. ℄ Grade

-1.40%

44+00 P.I.V.C. EL. 18.20 (CORR+046)

EXIST. N. GR.

Temp. 200' V.C.
PHASE I

+1.20%

Approx. Top of Exist. Conc. Pvmt.

PHASE II

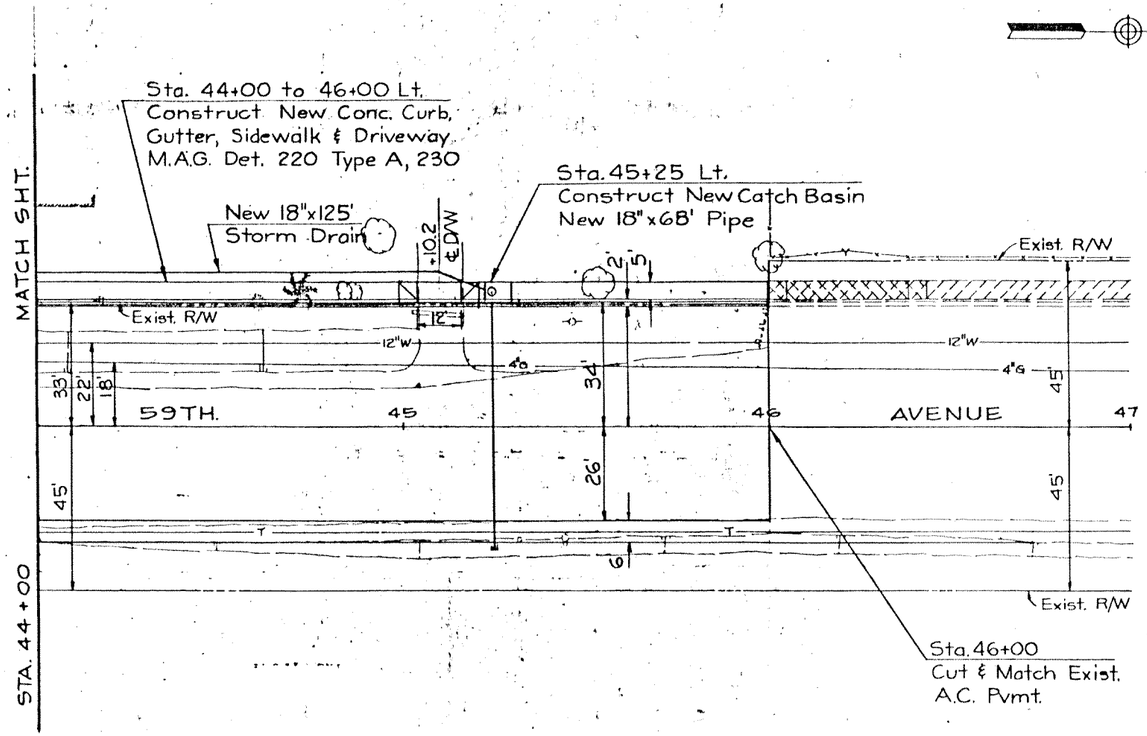
PRELIMINARY

38 39 40 41 42 43 44

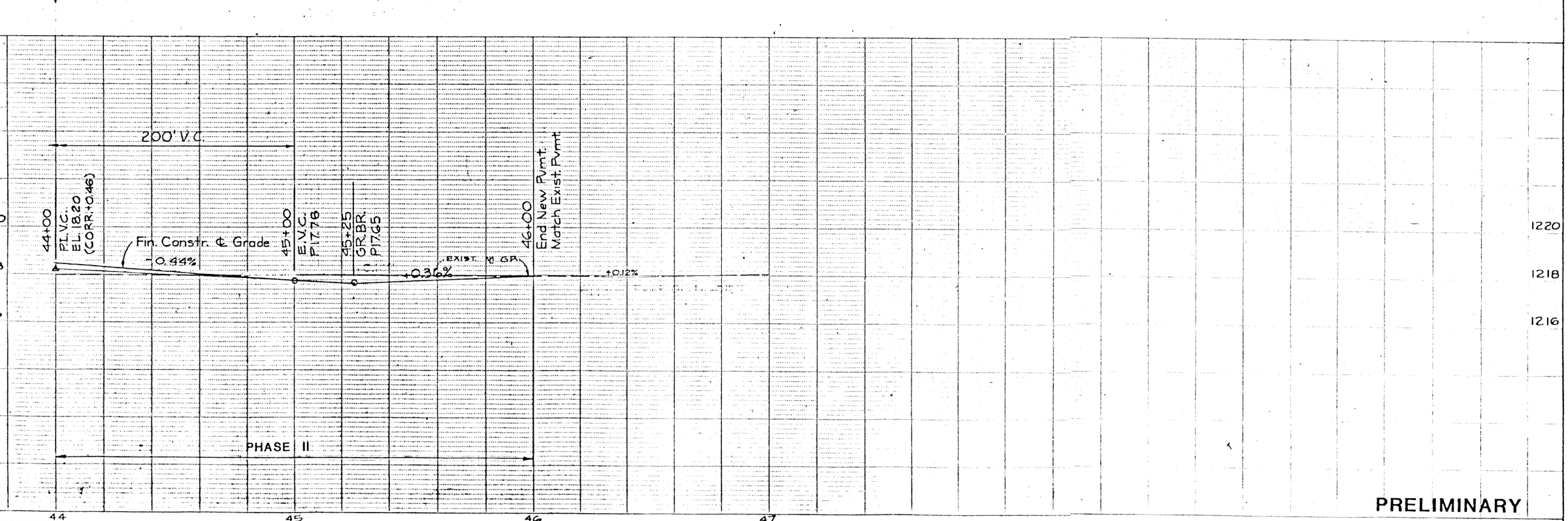
FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street – Phoenix, Arizona 85009 – Tel (602) 262-1501
BENSON & GERDIN
CONSULTING ENGINEERS PHOENIX, ARIZONA

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			

PLAN — SURVEYED / PLOTTED / ALIGNMENT CHECKED / BY / NOTE BOOK / NO. / DATE / BY / MAP CHECKED



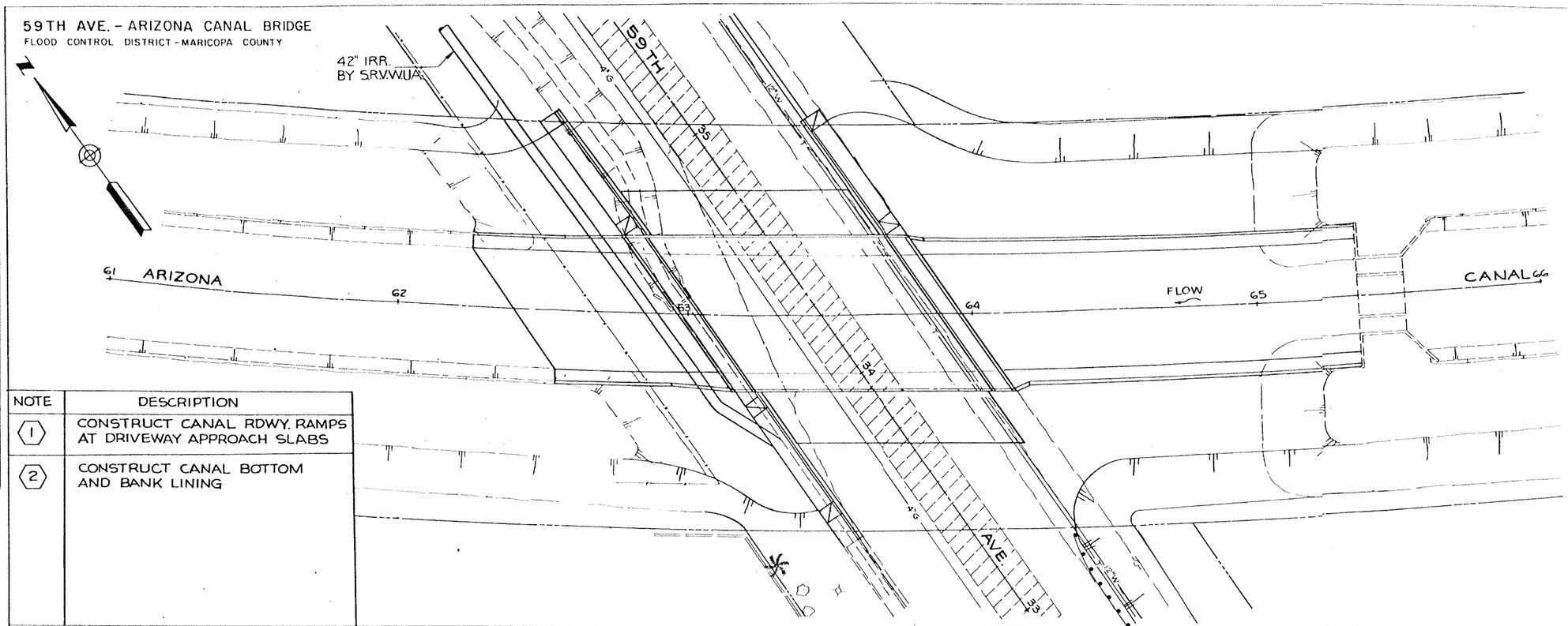
PROFILE — SURVEYED / PLOTTED / GRADES CHECKED / BY / NOTE BOOK / NO. / DATE / BY / STRUCTURE NOTES CHKD.



PRELIMINARY

59TH AVE. - ARIZONA CANAL BRIDGE

FLOOD CONTROL DISTRICT - MARICOPA COUNTY



NOTE	DESCRIPTION
1	CONSTRUCT CANAL RDWY. RAMPS AT DRIVEWAY APPROACH SLABS
2	CONSTRUCT CANAL BOTTOM AND BANK LINING

PLAN — SURVEYED, PLOTTED, GRADES CHECKED, ALIGNMENT CHECKED, STRUCTURE NOTATIONS CHKD. — BY, DATE, NOTE BOOK, NO.

PROFILE — SURVEYED, PLOTTED, GRADES CHECKED, ALIGNMENT CHECKED, STRUCTURE NOTATIONS CHKD. — BY, DATE, NOTE BOOK, NO.

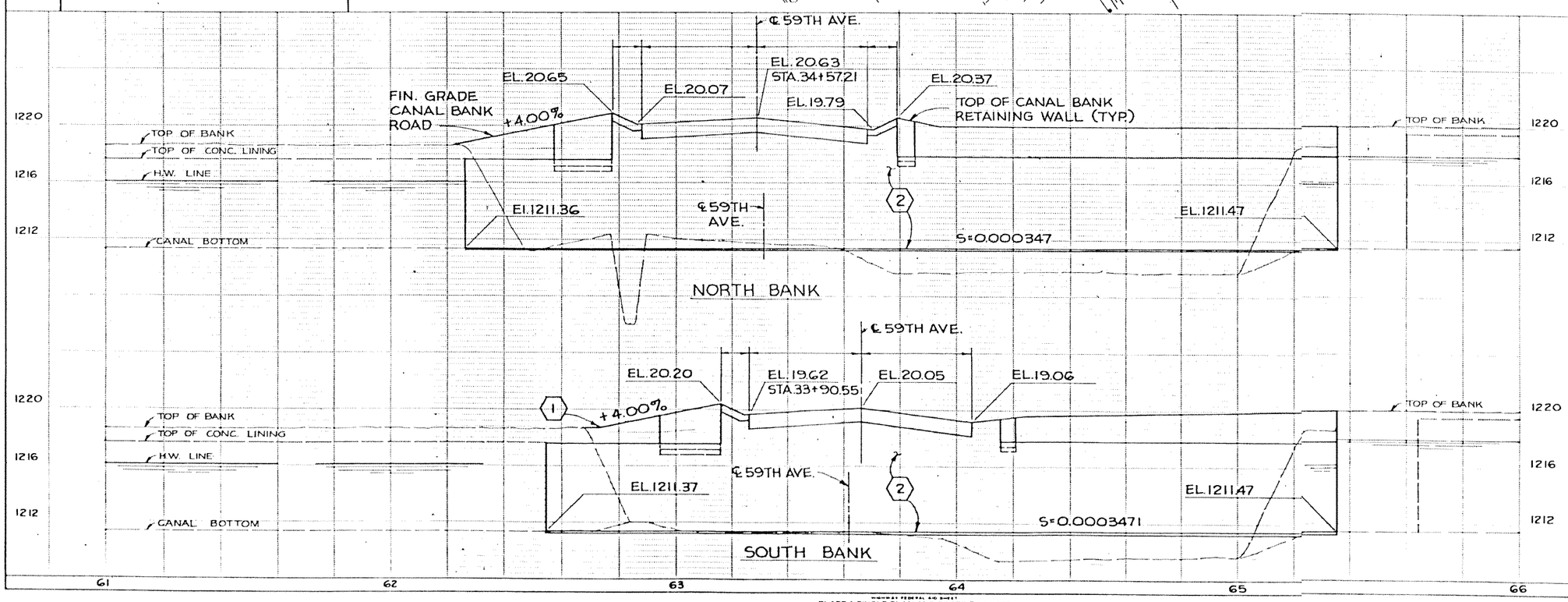


PLATE 1 SINGLE PLAN AND PROFILE FULL DOT

FLOOD CONTROL DISTRICT OF MARICOPA CO.

3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BENSON & GERDIN
CONSULTING ENGINEERS — PHOENIX, ARIZONA

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			

GENERAL BRIDGE SPECIFICATIONS

THE TERM "ENGINEER" AS USED IN THESE SPECIFICATIONS SHALL MEAN THE ASSISTANT GENERAL MANAGER-WATER OR HIS DULY AUTHORIZED REPRESENTATIVE.

1. ALL WORK IS TO BE IN CONFORMANCE WITH S.R.V.W.U.A. LICENSE ISSUED FOR THIS PROJECT. IF THE PLANS AND SPECIFICATIONS PREPARED BY THE LICENSEE DIFFER FROM THESE SPECIFICATIONS, THESE SPECIFICATIONS SHALL TAKE PRECEDENCE.

2. S.R.V.W.U.A. LICENSE TO BE VALID FOR TIME PERIOD AS NOTED IN THE LICENSE. THIS LICENSE IS FOR THE EXPRESS PURPOSE OF AUTHORIZING THE CONSTRUCTION, OPERATION AND MAINTENANCE OF STREET OR HIGHWAY IMPROVEMENTS WITHIN THE CANAL RIGHT OF WAY. USE OF THE CANAL RIGHT OF WAY BY THE PUBLIC WILL NOT BE PERMITTED WITHOUT FORMAL DEDICATION BY A SEPARATE EASEMENT REQUESTED BY THE LICENSEE AND GRANTED BY THE SALT RIVER PROJECT.

3. ELEVATIONS OF PROPOSED BRIDGE FLOOR AND UNDERSIDE OF BRIDGE DECK TO BE VERIFIED BY THE ENGINEER PRIOR TO PLACING CONCRETE.

4. NO CONCRETE WILL BE PLACED WITHOUT PRIOR APPROVAL OF THE ENGINEER.

5. REALIGNMENT OF CANAL BANK FROM EXISTING BANK TO TIE-IN TO WING WALL OF BRIDGE NOT TO EXEED A 4 TO 1 TAPER.

6. EXACT ALIGNMENT AND LENGTH OF RETAINING WALLS OR WING WALLS, IF REQUIRED, WILL BE ESTABLISHED IN THE FIELD BY THE ENGINEER PRIOR TO SETTING FORMS. IF CANAL BANK IS DISTURBED DURING INSTALLATION OF RETAINING WALL FOOTINGS, BANK TO BE RESHAPED AND COMPACTED, OR LINED, AS DIRECTED BY THE ENGINEER.

7. THREE INCH THICK HAND PLACED CONCRETE OR 1 1/2" THICK PNEUMATICALLY APPLIED LINING (MINIMUM 3000 P.S.I. 28 DAY STRENGTH) ON CANAL BANKS UNDER BRIDGE TO BE TIED TO UNDERSIDE OF BRIDGE OR ABUTMENT AND TO EXTEND 3' BEYOND END OF BRIDGE, WHICHEVER IS GREATER, AND PLACED OVER 6" x 6" x 1.4 x w 1.4 (10 GAGE) GAGE WELDED WIRE FABRIC, AND KEYED IN WITH A 12" DEEP CUTOFF LIP FOR FULL PERIMETER OF LINING (OR TIED TO EXISTING LINING).

8. CANAL BOTTOM UNDER BRIDGE TO BE NONREINFORCED SHOTCRETE OR POURED CONCRETE (MINIMUM 2000 P.S.I. 28 DAY STRENGTH) UNLESS OTHERWISE SPECIFIED, EXTENDING 3' BEYOND END OF BRIDGE, WHICHEVER IS GREATER, AND TO BE A MINIMUM OF 4" THICK KEYED IN WITH A 12" DEEP CUTOFF LIP FOR FULL PERIMETER (OR TIED TO EXISTING LINING). IF EXISTING BOTTOM LINING DOES NOT MEET THIS REQUIREMENT, IT SHALL BE REMOVED AND REPLACED AS SPECIFIED HEREIN.

9. ALL CONCRETE, PLASTER OR HEADWALLS TO BE SPRAYED WITH A WHITE PIGMENTED CURING COMPOUND, IMMEDIATELY AFTER FINISHING OR FORM REMOVAL.

10. ANY ABANDONED STRUCTURES FOUND WITHIN THE ZONE OF CONSTRUCTION TO BE COMPLETELY REMOVED TO THE ENGINEER'S SATISFACTION.

11. ANY MATERIAL PLACED IN CANAL OR OTHER ASSOCIATION FACILITIES TO BE COMPLETELY REMOVED TO THE ENGINEER'S SATISFACTION.

12. APPROACH RAMP FROM NEW BRIDGE APPROACH APRON TO CANAL ROAD TO HAVE A MAXIMUM SLOPE OF 4% PARALLEL TO THE CANAL. THE APPROACH RAMP OR CANAL ROAD IS TO BE GRADED WITH A MAXIMUM 2% SLOPE FROM THE CANAL BANK TO THE EDGE OF THE CANAL ROAD TO FACILITATE DRAINAGE AWAY FROM THE CANAL. APPROACH RAMP MATERIAL TO BE OF REASONABLY WELL GRADED, SCREENED GRAVEL OR BROKEN ROCK WITH A GOOD DISTRIBUTION OF ALL SIZES OF MATERIAL BETWEEN THE 1 INCH AND THE #200 SIEVE SIZE AND TO BE THOROUGHLY MIXED WITH A MINIMUM OF 20% TO A MAXIMUM OF 40% FINES (MATERIAL THAT WILL PASS THE #200 SIEVE). MATERIAL TO BE MOISTENED AS DIRECTED BY THE ENGINEER AND COMPACTED TO A MINIMUM OF 90% PROCTOR DENSITY.

13. ALL BACKFILL TO BE CAREFULLY PLACED IN 8" UNCOMPACTED LIFTS AND COMPACTED TO A MINIMUM OF 90% PROCTOR DENSITY.

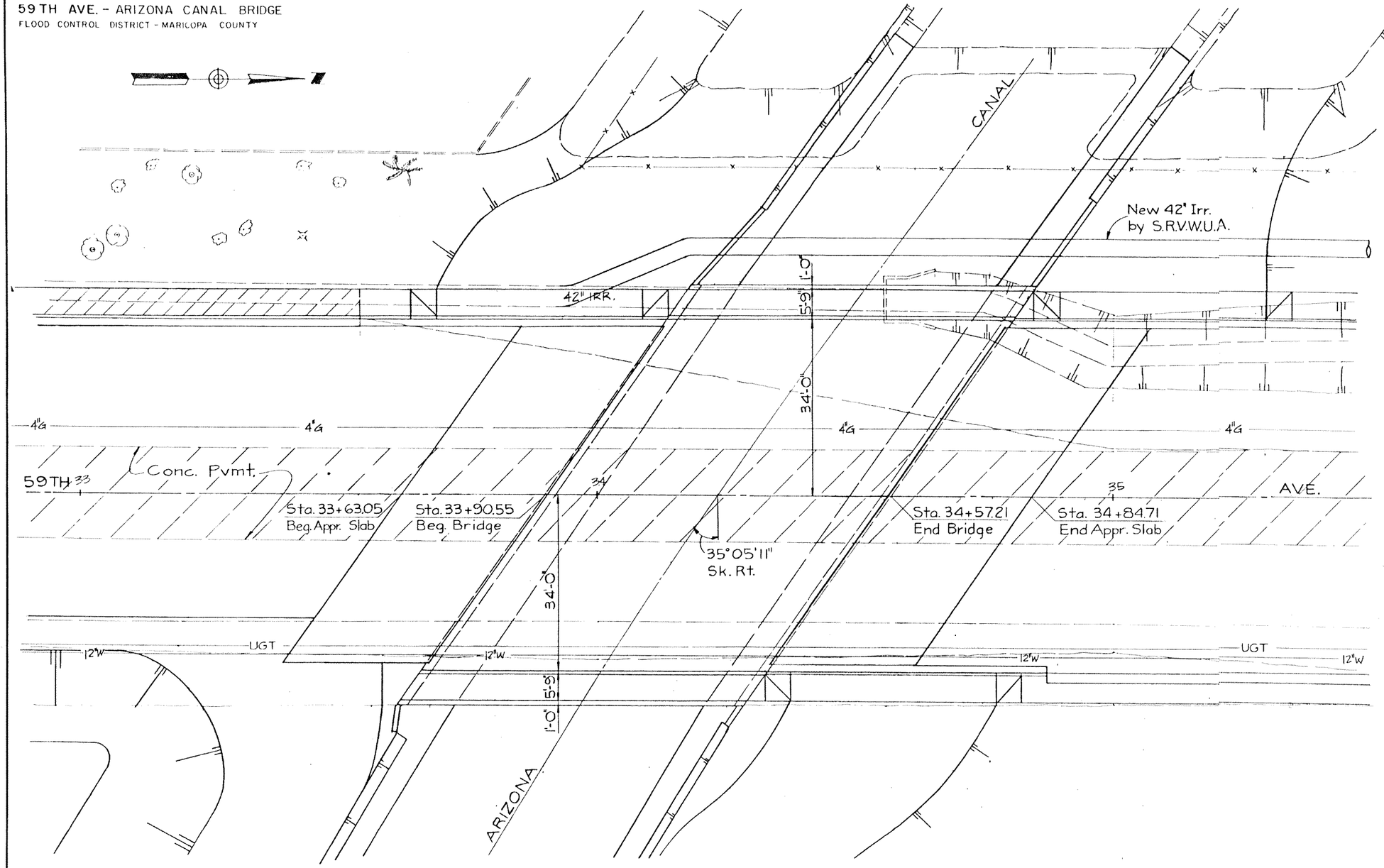
14. ALL DAMAGE TO ASSOCIATION'S FACILITIES TO BE REPAIRED BY THE LICENSEE OR HIS CONTRACTOR TO THE ENGINEER'S SATISFACTION. IF EMERGENCY REPAIR WORK IS NECESSARY OR LICENSEE FAILS TO COMPLETE ALL WORK COVERED BY THIS LICENSE IN A REASONABLE TIME AS DETERMINED BY THE ENGINEER, THIS WORK WILL BE PERFORMED BY THE ASSOCIATION AND LICENSEE AGREES TO PAY FULL COST OF SAID WORK.

15. WORK TO BE DONE ONLY AFTER SECURING A CONSTRUCTION CLEARANCE FROM THE TRANSMISSION WATERMASTER AT 273-5461.

PRELIMINARY

59TH AVE. - ARIZONA CANAL BRIDGE
FLOOD CONTROL DISTRICT - MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				



STA. 34+
LOCATION PLAN
New 2 Span R.C. Continuous Slab Bridge - 68' Clear Rdwy.
35° 05' 11" Sk. Rt.
Scale: 1" = 10'

Description	Struct. Excav. C.Y. *	Spec. Backfill C.Y. *	Class A Conc. C.Y.	Class A A Conc. C.Y.	Reinforcing Steel Lbs.	Cast In Place Piling No.	Cast In Place Piling L.F.
Abutment #1							
Abutment #2							
Pier							
Deck Slab							
Approach Slab							
Retaining Walls							
Totals							

* None Pay Item

GENERAL NOTES

Construction:
Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction, 1979 Edition, revised to date with Maricopa County High Department Supplement, and Standard Specifications, Arizona Department of Transportation, 1971 Edition, revised to date.

Design:
A.A.S.H.T.O. Standard Specifications for Highway Bridges, 1977 Edition, revised to date.

Loading Class: HS20-44

Allowable Stress:
Concrete:
Class AA - f'c = 4000 psi - Deck Slab (fc = 1400 psi); n=8
Class A - f'c = 3000 psi - all other Concrete; n=9
Reinforcing Steel:
Grade 40 - fs = 20000 psi
Grade 60 - fs = 24000 psi
Structural Steel:
fs = 20000 psi

Reinforcing Steel shall be intermediate grade and shall conform to A.S.T.M. A-615
Bar sizes #7 and smaller shall be grade 40
Bar sizes #8 and larger shall be grade 60

Structural Steel shall conform to A.S.T.M. A-36.

All welding shall conform to the requirements of the American Welding Society - Structural Welding Code D1.1-75, revised to date.

Paint and Painting shall conform to Standard Specifications. Contact surfaces shall not be painted
Shop Paint - one coat #1A or #1B, #8 or #9, and #10
Field paint - none required

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

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

Chamfer all exposed corners of concrete 3/4" unless otherwise noted.

All reinforcing steel shall be 2" clear unless otherwise noted.

Dimensions shall not be scaled from drawing

Caution: Entering of caisson drill holes for cleaning or inspection purposes shall be done only when a suitable casing or shield has been installed in drill hole for protection of personnel. The contractor shall comply with all provisions and regulations of O.S.H.A.

PRELIMINARY

LOCATION PLAN

FLOOD CONTROL DISTRICT OF MARICOPA CO.
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE ON 59TH AVENUE
OVER
RELOCATED ARIZONA CANAL

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

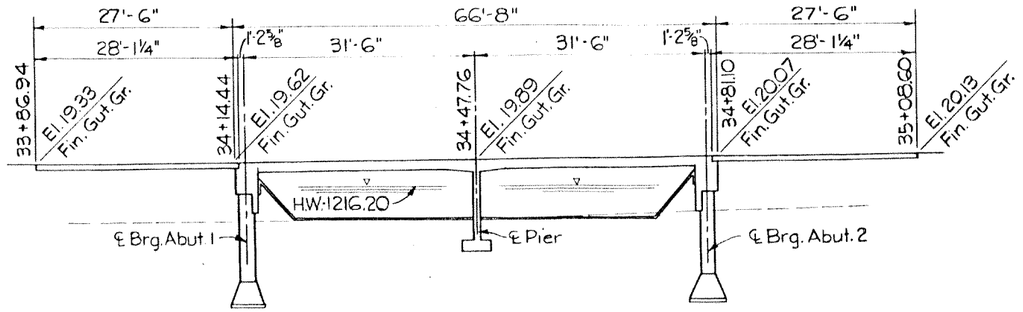
DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT

SURVEY NOS. / PLANNED PLANS / LOCATION / DATE

59 TH AVE - ARIZONA CANAL BRIDGE

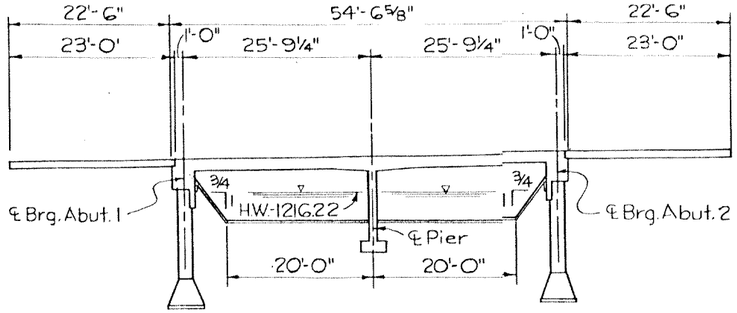
FLOOD CONTROL DISTRICT - MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				



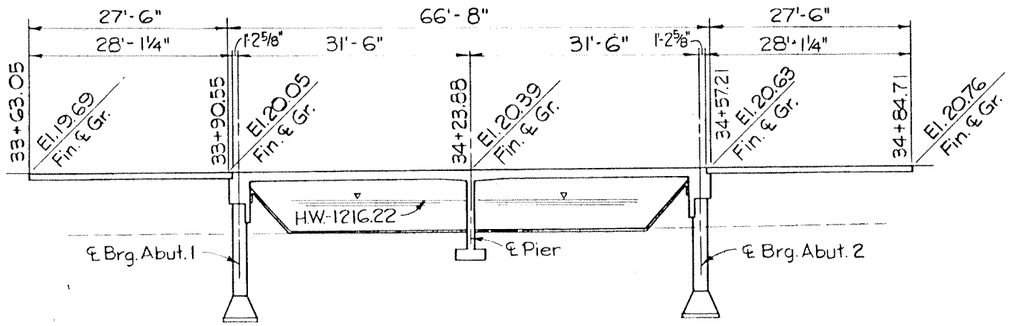
SECTION @ LEFT GUTTER

Scale: 1" = 10'



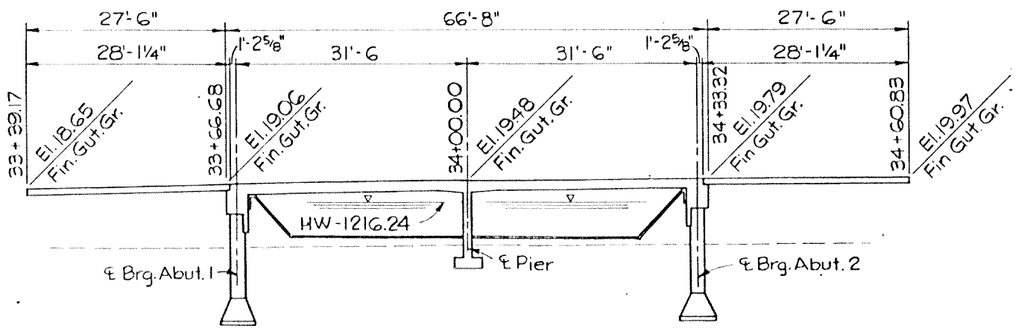
TYPICAL SECTION @ ℄ CANAL LOOKING DOWNSTREAM

Scale: 1" = 10'



SECTION @ CONSTRUCTION ℄

Scale: 1" = 10'



SECTION @ RIGHT GUTTER

Scale: 1" = 10'

CANAL SECTIONS & RETAINING WALL DETAILS

FLOOD CONTROL DISTRICT OF MARICOPA CO.

3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE ON 59TH AVENUE OVER RELOCATED ARIZONA CANAL

BENSON & GERDIN

CONSULTING ENGINEERS PHOENIX, ARIZONA

DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT

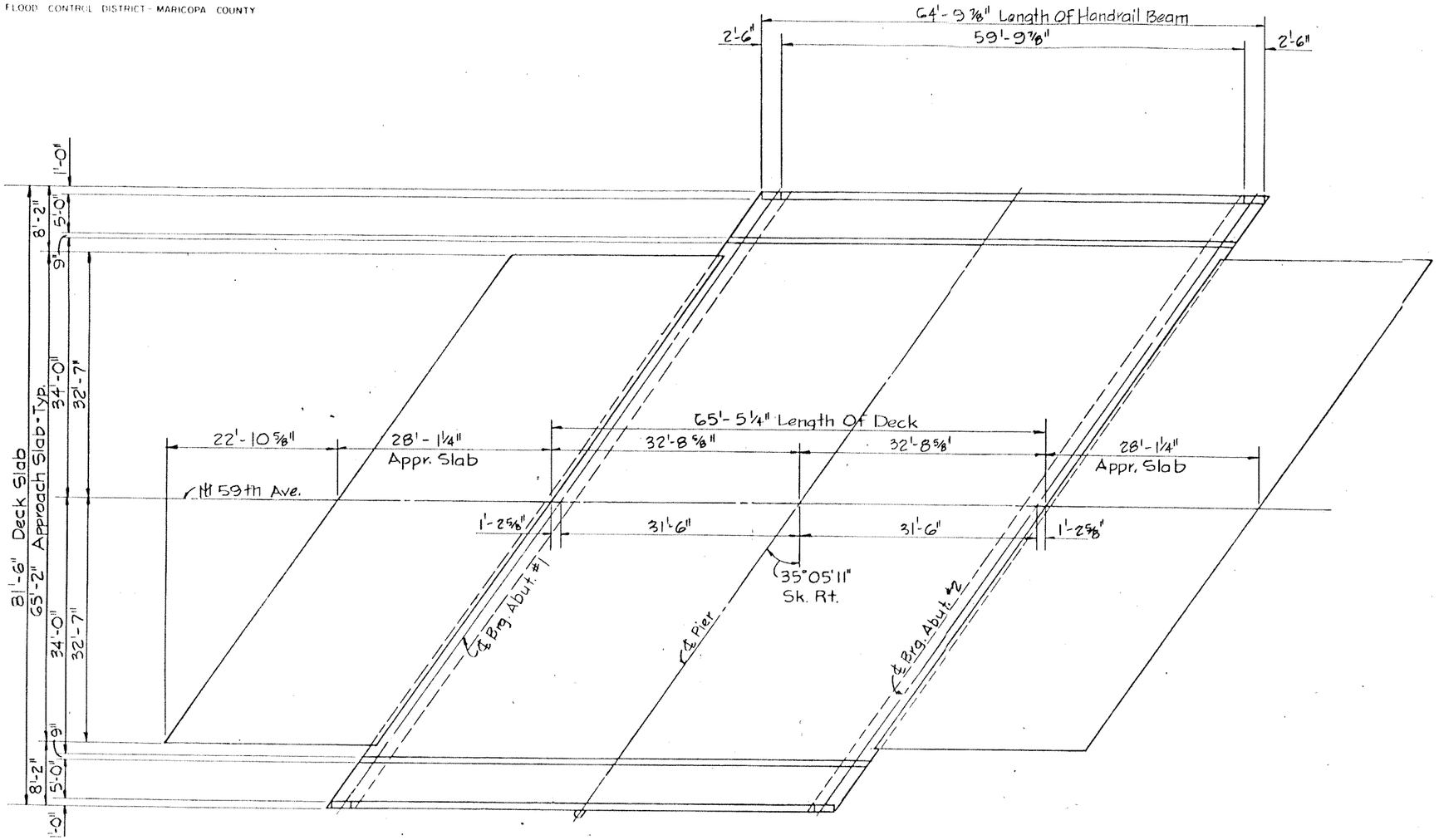
PRELIMINARY

NOS. | BY | REVISIONS | DATE

59 TH AVE. - ARIZONA CANAL BRIDGE

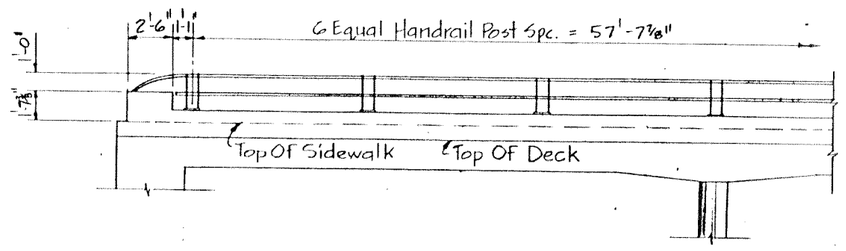
FLOOD CONTROL DISTRICT - MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				



DECK PLAN

Scale: 1/8" = 1'-0"



PART ELEVATION

Scale: 1/4" = 1'-0".

PRELIMINARY

DECK PLAN

FLOOD CONTROL DISTRICT OF MARICOPA CO.

3335 W. Durango Street - Phoenix, Arizona 85009 - Tel. (602) 262-1501

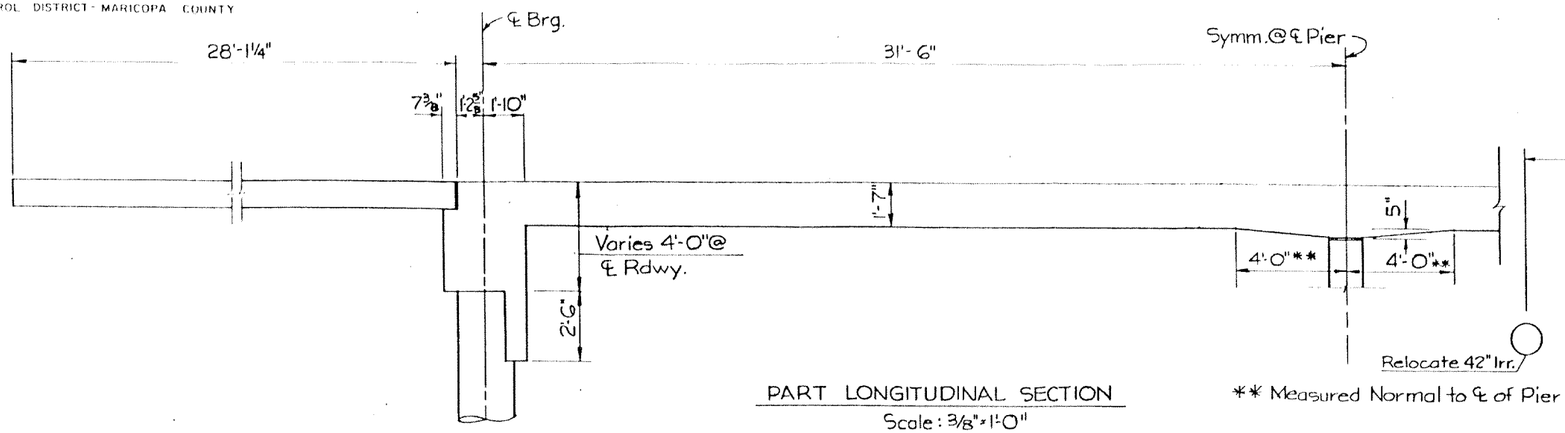
BRIDGE ON 59TH AVENUE
OVER
RELOCATED ARIZONA CANAL

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			

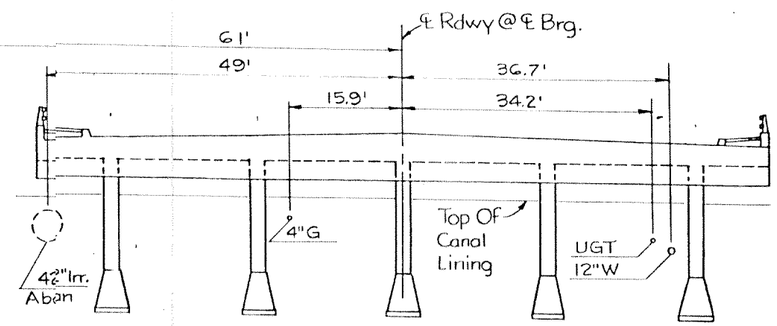
59TH AVE - ARIZONA CANAL BRIDGE
FLOOD CONTROL DISTRICT - MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

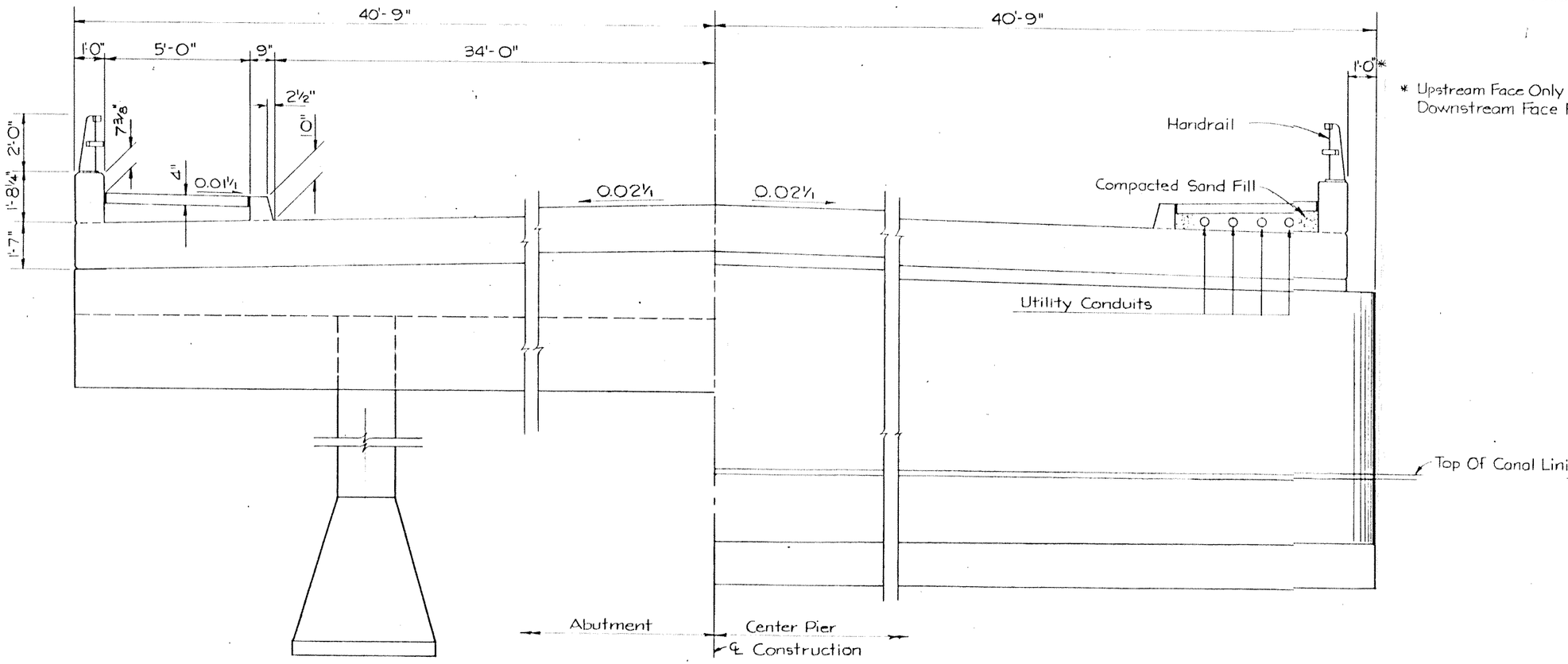


PART LONGITUDINAL SECTION
Scale: ⅜"=1'-0"

** Measured Normal to ℄ of Pier



ELEVATION ABUTMENT 2
Looking North
Abutment 1 Similar
Scale: 1"=10'



* Upstream Face Only
Downstream Face Flush With Deck

TYPICAL CROSS-SECTION
Scale: ½"=1'-0"

PRELIMINARY

TYPICAL SECTIONS

FLOOD CONTROL DISTRICT OF MARICOPA CO
3335 W. Durango Street - Phoenix, Arizona 85009 - Tel (602) 262-1501

BRIDGE ON 59TH AVENUE
OVER
RELOCATED ARIZONA CANAL

BENSON & GERDIN
CONSULTING ENGINEERS
PHOENIX, ARIZONA

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS PLOT
QTY.	DATE	DATE			