PLANNING REPORT

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FOR

PROPOSED 67TH AVENUE BRIDGE

OVER

ARIZONA CANAL DIVERSION CHANNEL

PREPARED FOR

MARICOPA COUNTY FLOOD CONTROL

3335 WEST DURANGO

PHOENIX, ARIZONA

PREPARED BY

E.M. PLUMMER CONSULTING ENGINEERS INC.

3666 NORTH MILLER ROAD SUITE 105

SCOTTSDALE, ARIZONA

1982

PLANNING REPORT

FOR

PROPOSED 67TH AVENUE BRIDGE

OVER

ARIZONA CANAL DIVERSION CHANNEL

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PROJECT DESCRIPTION

1.1 INTRODUCTION

The project consists of construction of roadway approaches, a bridge and a detour for 67th Avenue at the proposed Arizona Canal Diversion Channel.

1.2 LOCATION

The project is located in Glendale, south of the Greenway Road and north of the existing Arizona Canal, along 67th Avenue, (See Exhibit A). The approach roadway and bridge starts at 770 feet and 620 feet respectively south of the Greenway Road centerline.

1.3 AUTHORIZATION

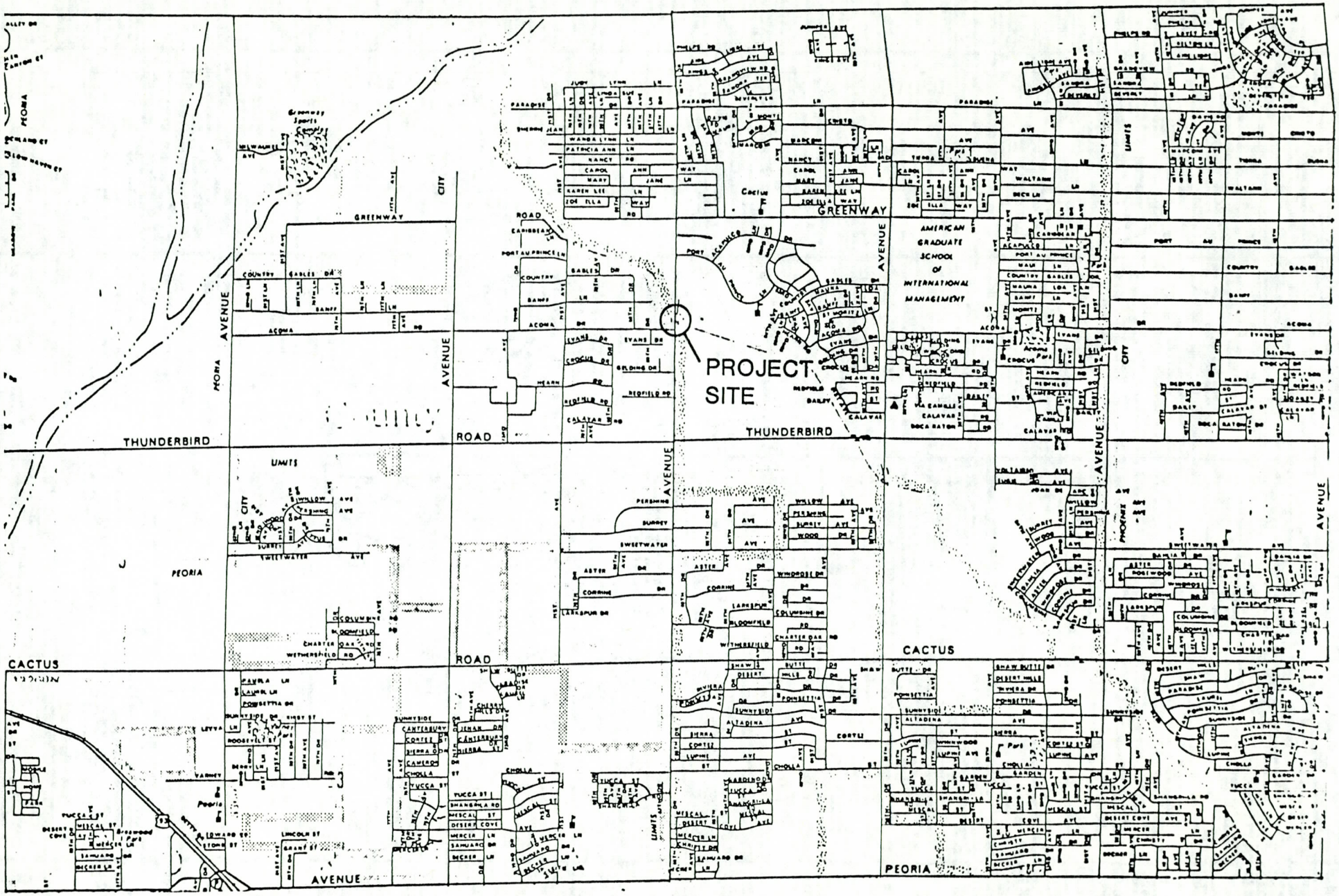
Board of Directors, Flood Control District of Maricopa County, June, 1982.

1.4 SPECIFICATIONS

Structural design will be in accordance with current AASHTO Specifications, as interpreted by the Flood Control District.

Horizontal and vertical alignments shall be in accordance with the 1973 AASHTO publication, "A POLICY ON DESIGN OF URBAN HIGHWAYS AND ARTERIAL STREETS", and supplemented by ADOT, 1979 Roadway Standards.

Construction specifications shall be in accordance with MAG Specifications, as supplemented by Maricopa County.


PROJECT SITE
AMERICAN GRADUATE SCHOOL OF INTERNATIONAL MANAGEMENT
GREENWAY
THUNDERBIRD
CACTUS
PEORIA
AVENUE
ROAD
CITY
LIMITS

EXIHIBIT "A"

1.5 PROJECT CRITERIA

The proposed bridge alignment will coincide with the existing 67th Avenue alignment.

The 67th Avenue approach roadways shall be improved to current City of Glendale standards for distances of approximately 150 feet north and south of the bridge structure.

The bridge will be 550 feet in length, provide a 68 foot wide curb to curb roadway width with two (2), five feet wide sidewalks separated from the roadway by physical barriers.

The piers and abutments shall be parallel with floor resulting in a skew of 38° for the bridge.

The bridge shall be centered on centerline of the proposed floodway and on the centerline of the existing roadway.

A minimum clearance of 20 feet from the channel invert to the soffit of the bridge girders shall be provided.

A temporary paved detour of traffic shall be provided for use during construction of the bridge.

1.6 TRAFFIC PARAMETERS

Since 67th Avenue is a major arterial roadway, major traffic volumes are projected. The following tabulation presents the traffic design parameters:

Average Daily Traffic

Current	7,000
Projected 20 years	18,000
Design Average	12,500
One Direction (50%)	6,250
Curb Lane (80%)	5,000
Truck Traffic	250

1.7 HYDRAULIC PARAMETERS

The flood diversion channel will be earth-lined and trapezoidal in section with six to one side slopes and a 220 feet wide bottom. The design flow rate is 29,000 cubic feet per second at a depth of approximately 17 feet and a velocity of approximately 5.5 feet per second. The channel invert elevation at the bridge is 1190.23 feet, (Corps. of Engineers datum).

1.8 BENEFICIAL EFFECTS

Proposed bridge will provide a properly aligned structure capable of serving the projected average daily traffic and loading requirements for a minimum period of 20 years, besides preventing traffic flow disruption during floor diversion through the channel.

The proposed structure will require only minimum maintenance expense for the foreseeable future.

1.9 STREET USE DURING CONSTRUCTION

A temporary paved detour will be provided for 67th Avenue at the project.

BRIDGE DESIGN OPTIONS

2.1 INTRODUCTION

To determine the most cost effective bridge alternative, meeting the requirements for profile grades, aesthetics and performance, probable nine different designs were investigated.

The variables used are:

a. Material
b. Span Length
c. Girder Types
d. Substructure

2.2 ALTERNATIVE OPTIONS

Preliminary structural analysis and designs were performed for nine different options. The resulting designs are shown on Exhibits.

The variations in spans considered are:

a. 8 Spans @ 68'9" (Option I)
b. 7 Spans @ 78'6" (Option II)
c. 6 Spans @ 91'8" (Option III)
d. 4 Spans @ 137'6" (Option IV)

Each variation in span was further explored for feasible variations in concrete and steel superstructures.

OPTION IA

Superstructure consists of 33" x 4'0" precast prestressed concrete box girders with 2" asphalt overlay. Each girder contains 20 - 1/2" ø, 7 wire prestressing strands. Substructure contains four - 4 feet diameter x 53 feet drilled shaft with cap beam at pier/abutment.

OPTION IB

Superstructure: Steel girder WF36 x 150 with 11" x 1¼" x 48'0" cover plate.

Substructure: 4'0" diameter x 55 feet drilled shaft.

OPTION IC

Superstructure: AASHTO-PCI Type III, precast prestressed girders at 7'6" o.c. with 30 - 1/2" ø 7 wire strand and 8" concrete deck.

Substructure: 4'0" diameter x 57 feet drilled shaft.

OPTION IIA

Superstructure: 39" x 4'0" precast prestressed concrete box girder with 22 - 1/2" ø 7 wire strands.

Substructure: 4'0" diameter x 60 feet drilled shaft.

OPTION IIB

Superstructure:AASHTO-PCI, Type IV, precast prestressed girders with 28 - 1/2" ø 7 wire strands and 8" concrete deck.

Substructure: 4'0" diameter x 58 feet drilled shaft.

OPTION IIC

Superstructure: Steel girders WF36 x 194 with 10-1/2" x 5/8" x 58'0" cover plate spaced 7'-6" o.c. and 8" concrete deck.

Substructure: 4'-0" diameter x 61 feet drilled shaft.

OPTION IIIA

Superstructure: AASHTO-PCI, Type IV, prestressed girders, spaced 7'6" o.c. with 8" concrete deck.

Substructure: 4'0" diameter x 63 feet drilled shaft.

OPTION IIIB

Superstructure: Steel girders WF36 x 245 with 15" x 1-1/4" x 61'0" cover plate, spaced 7'6" o.c. and 8" concrete deck.

Substructure: 4'0" diameter x 56 feet drilled shaft.

OPTION IVA

Superstructure: AASHTO-PCI, Type VI girders, spaced 7'6" o.c. with 55 - 1/2" ø 7 wire strand, (Pretensioned/Postensioned), and 8" concrete deck.

Substructure: 6'0" diameter x 69 feet frilled shaft.

2.3 RECOMMENDED OPTION

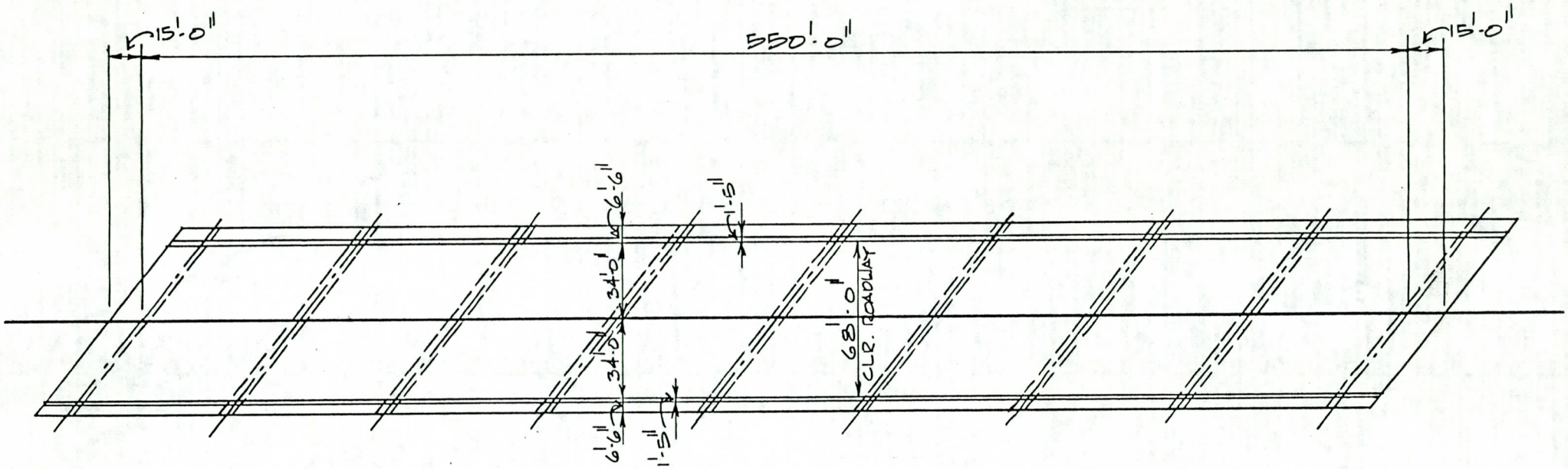
A comperative analysis was performed to determine the more economic options. Concrete structures were preferred to steel superstructures, to minimize annual average maintenance cost. The higher bearing strength of soil offsets the lightweight advantage of steel. Besides the proximity of a prestressing plant close to the project area, makes prestressing of concrete girders more economical compared to post-tensioning.

It appears from the comparison that the Option IIIA offers the most cost effective design.

It is recommended that Option IIIA may be extended to include alternatives for post-tensioning of girders and use of precast prestressed deck slabs.

OPTION IIIA - ESTIMATED QUANTITIES AND COSTS

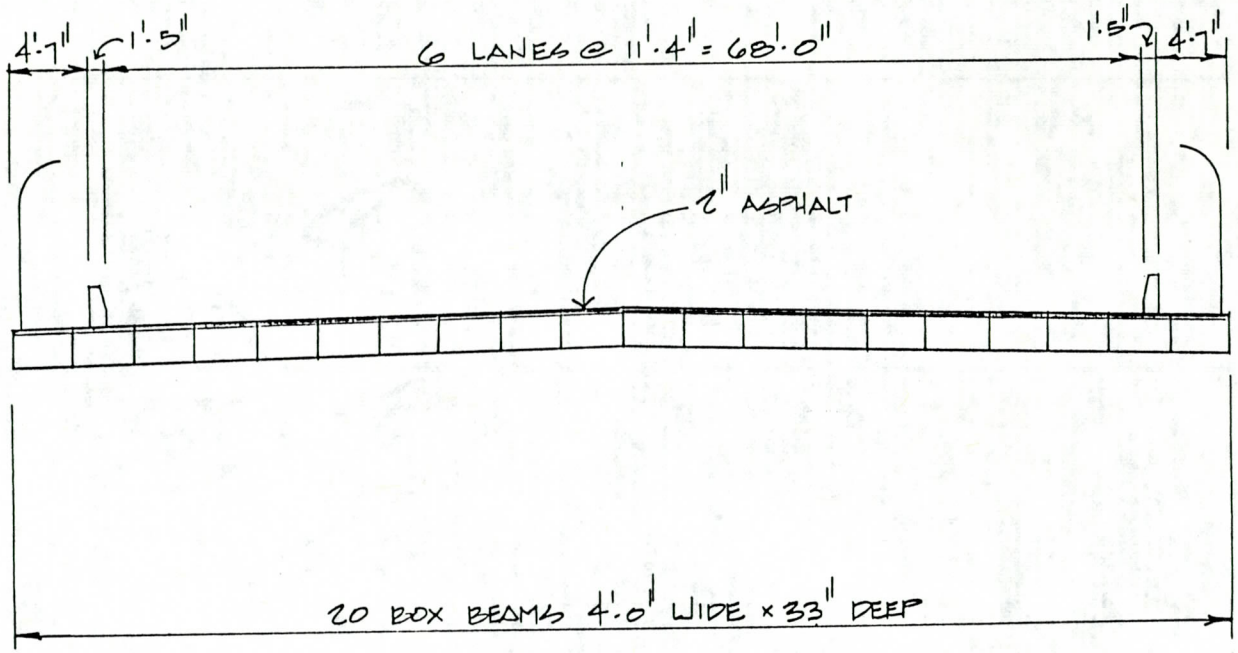
Item #	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
1.	Clearing & Grubbing	3.0	acre	1,000	$ 3,000
2.	Structural Excavation	1260	c.y.	12.0	15,150
3.	Special Backfill	1040	c.y.	17.00	17,680
4.	Drilling for Pier/Abut. Shafts	980	l.f.	25.00	24,500
5.	Structural Concrete	2742	c.y.	250.00	685,500
6.	Reinforcing Steel	689576	lbs.	0.50	344,790
7.	Prestressed Concrete Girders	6,000	l.f.	80.0	480,000
8.	Guardrail & Fencing	1,170	l.f.	25.00	29,250
9.	Asphalt (2")	4,382	s.y.	12.00	52,587
10.	Riprap	1,180	c.y.	30.00	35,400
11.	Aggregate Base @ App. Road	2,270	s.y.	3.25	7,377
12.	Paving Asphalt @ App. Road (2-1/2")	2,270	s.y.	15.00	34,000
		Sub Total, Bridge & App. Road			$1,729,240.00
				Mobilization	25,000.00
				O.H. and Profit	175,000.00
				TOTAL	$1,929,240.00



PLAN OF BRIDGE

EXIHIBIT "B"

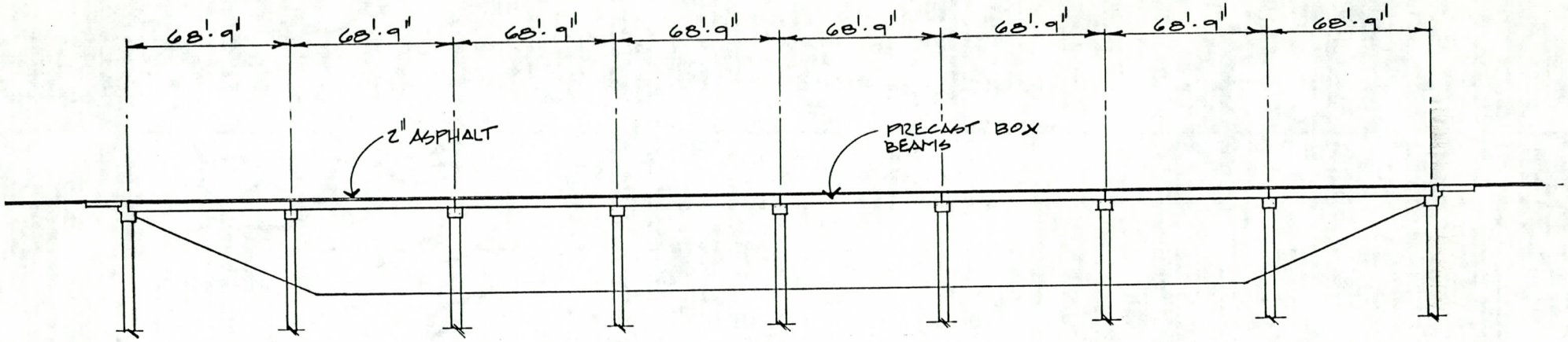
OPTION 1A



SECTION OF BRIDGE

EXIHIBIT "C"

OPTION 1A



SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

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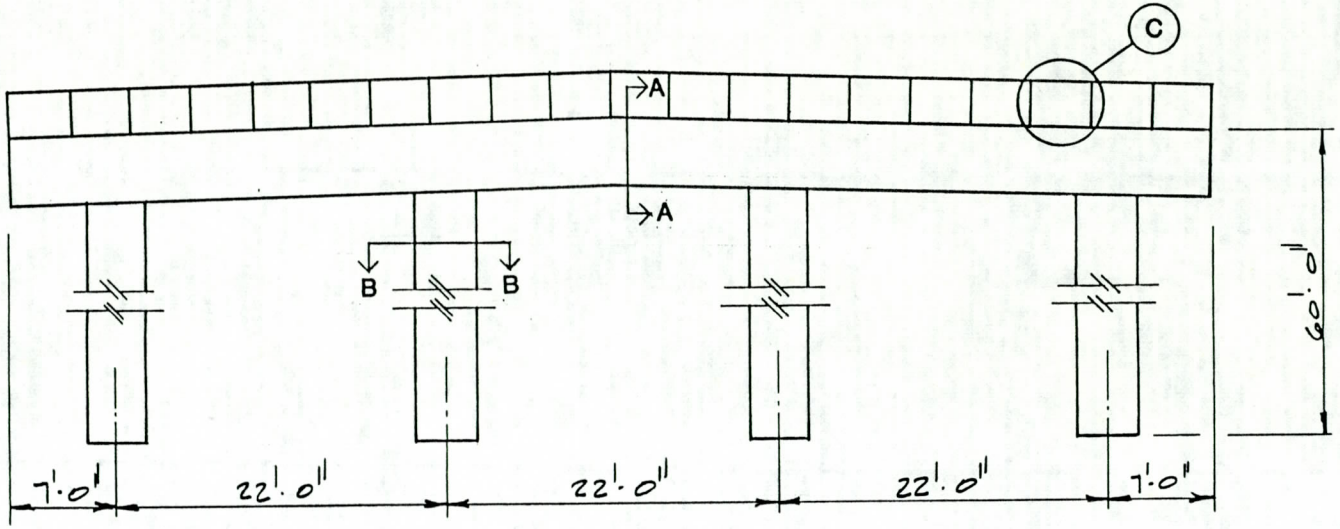

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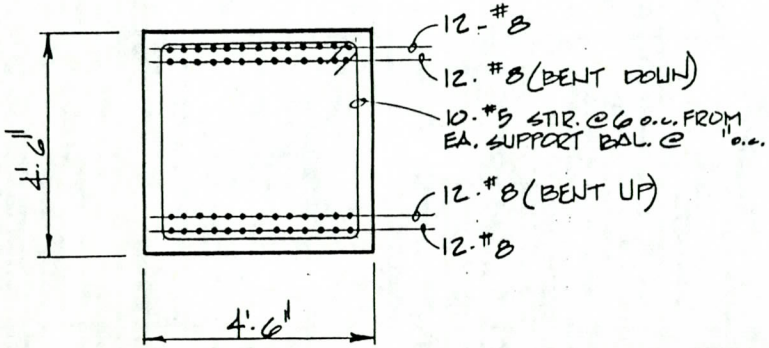

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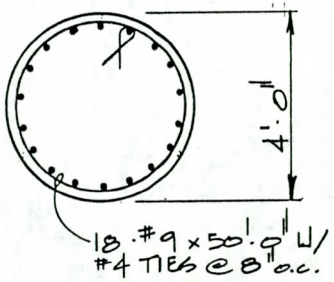

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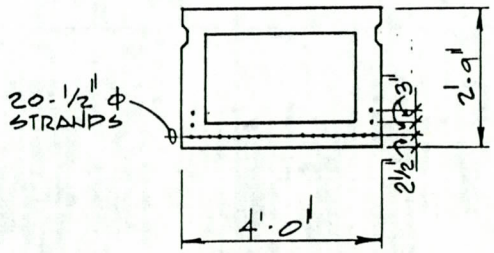

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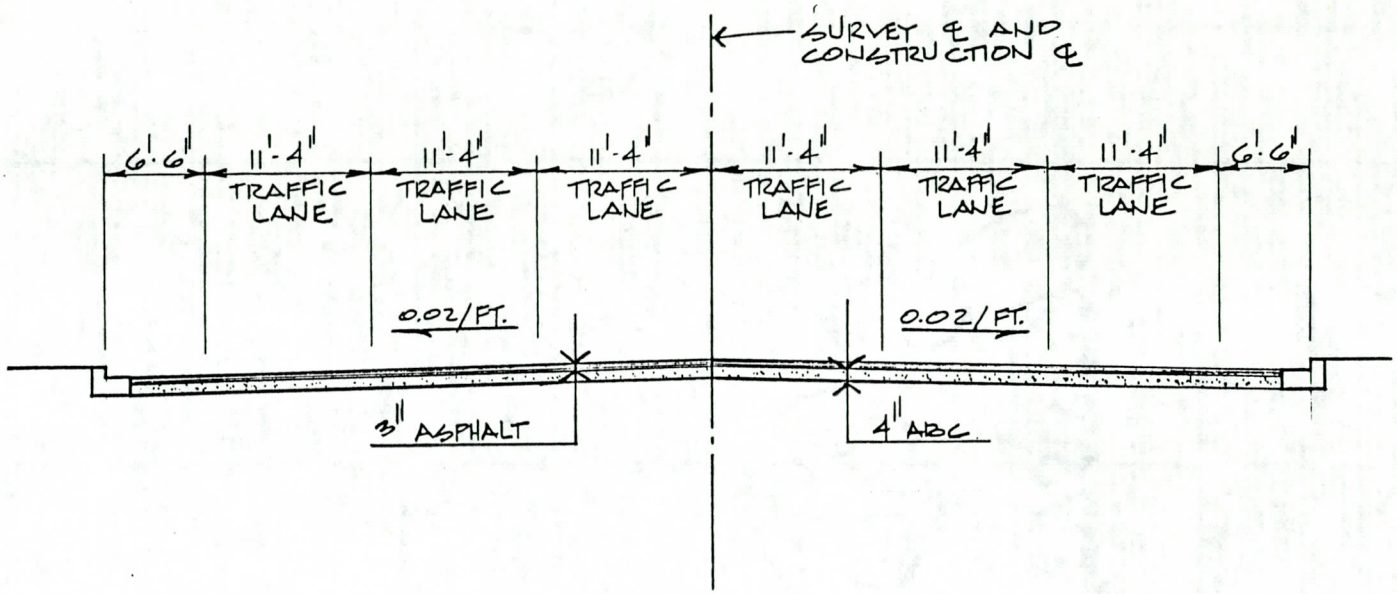

TYPICAL SECTION (ROADWAY APPROACHES)

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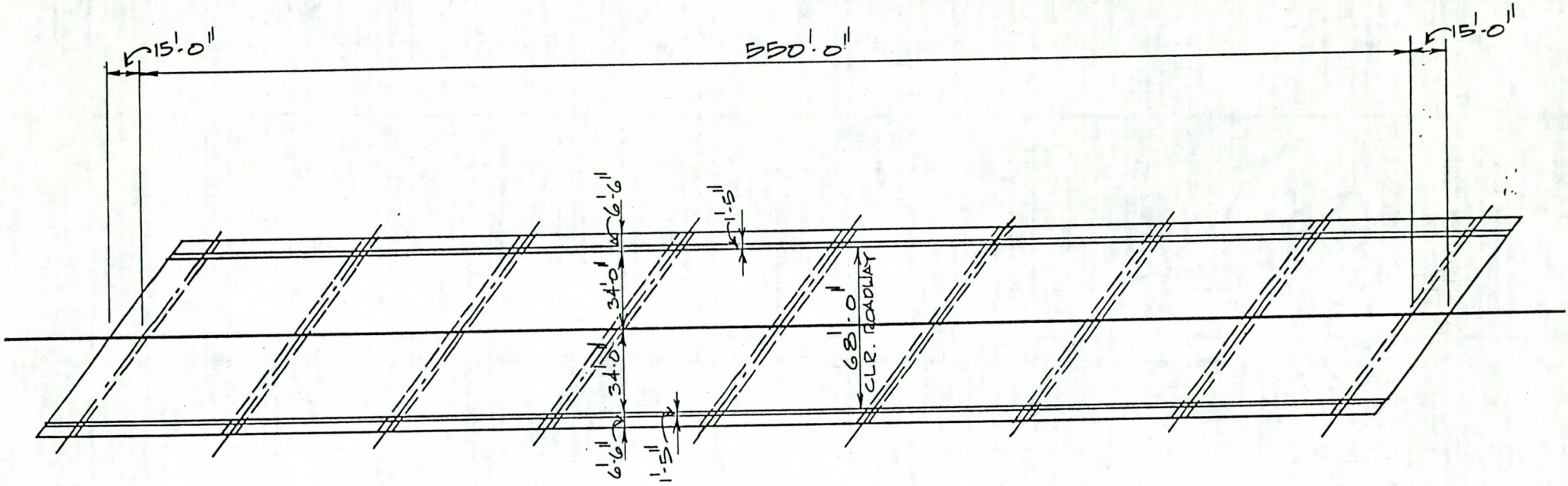
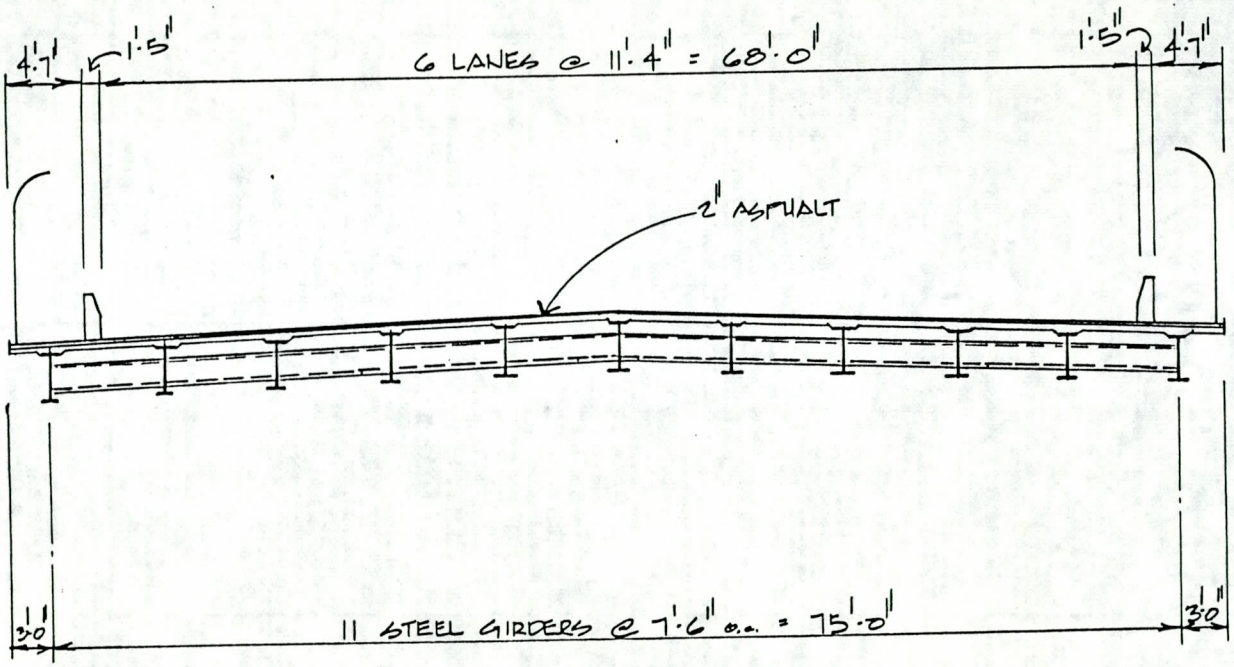


PLAN OF BRIDGE

EXIHIBIT "B"

OPTION 1B



SECTION OF BRIDGE

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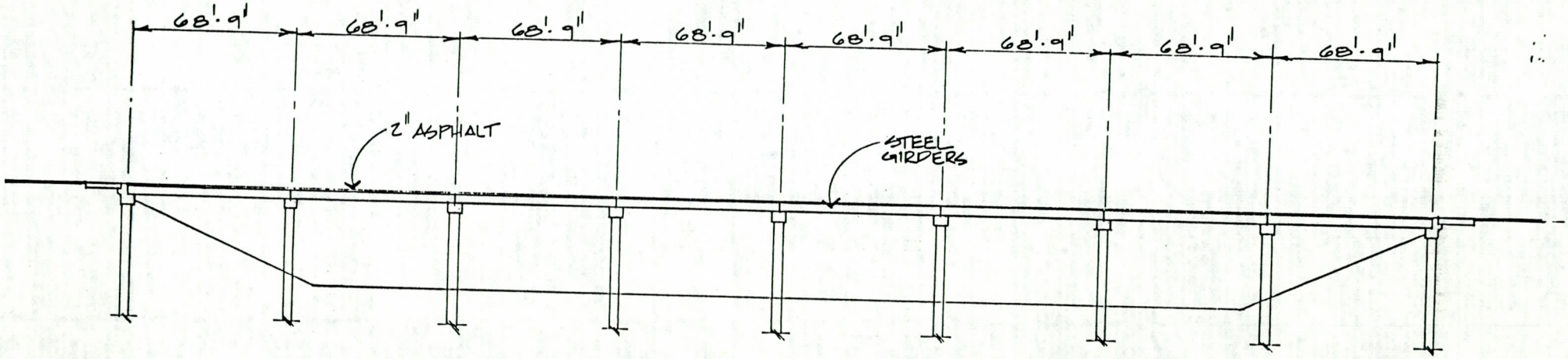

SECTION AT ℄ OF ROADWAY

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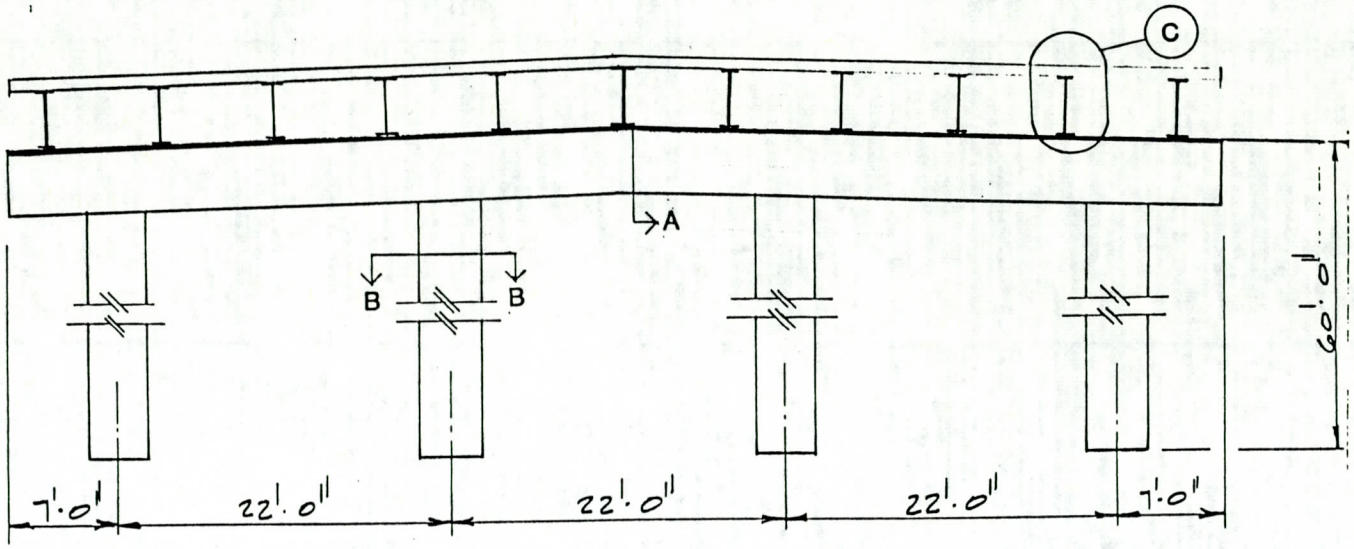

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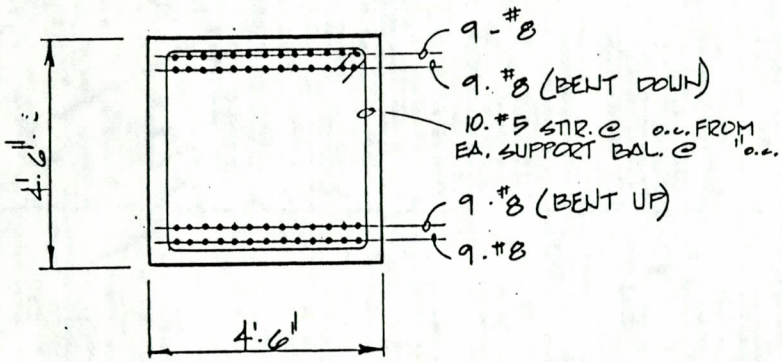

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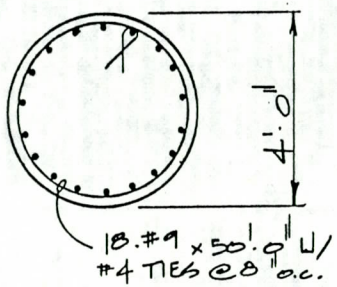

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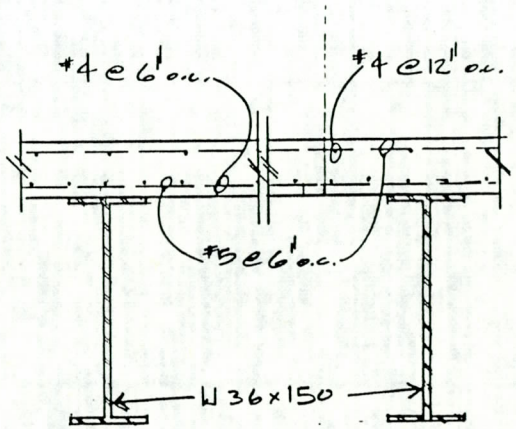

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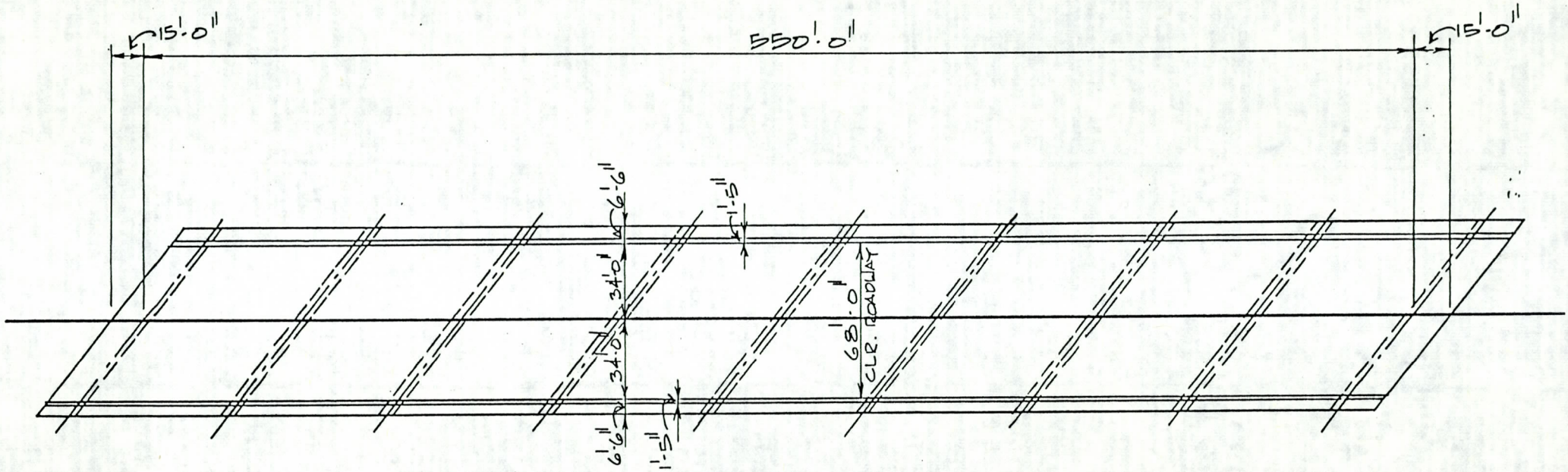
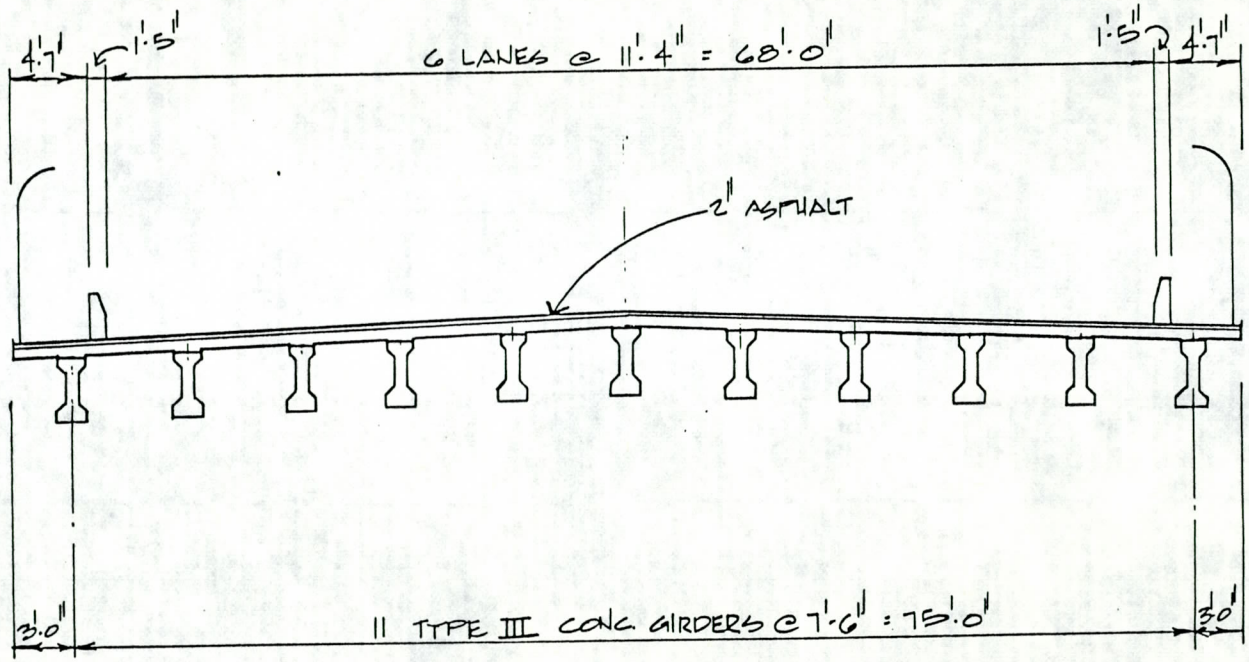


PLAN OF BRIDGE

EXIHIBIT "B"

OPTION 1C



SECTION OF BRIDGE

EXIHIBIT "C"

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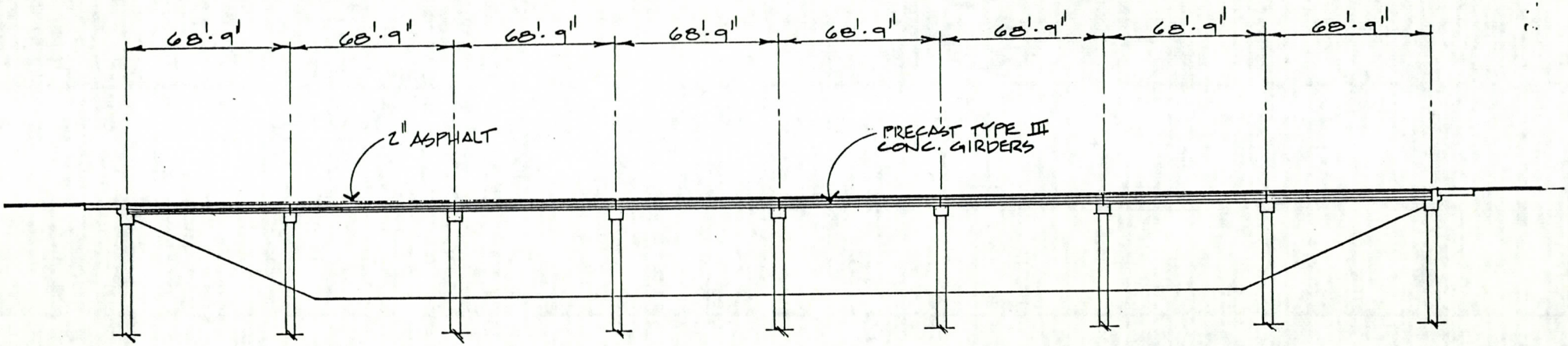

SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

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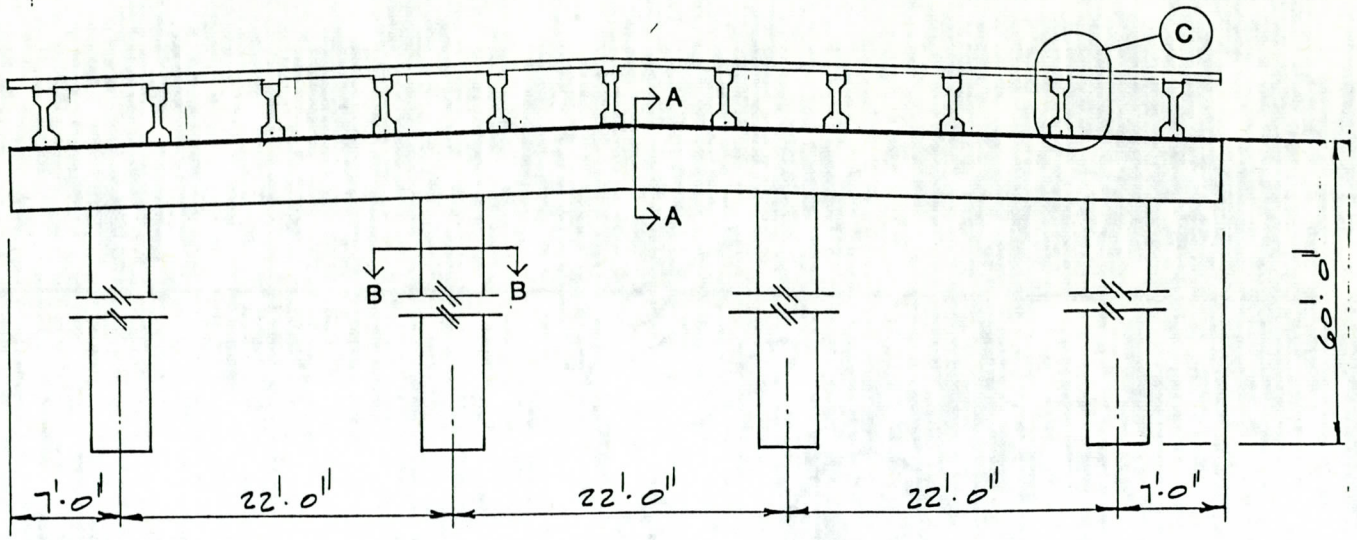

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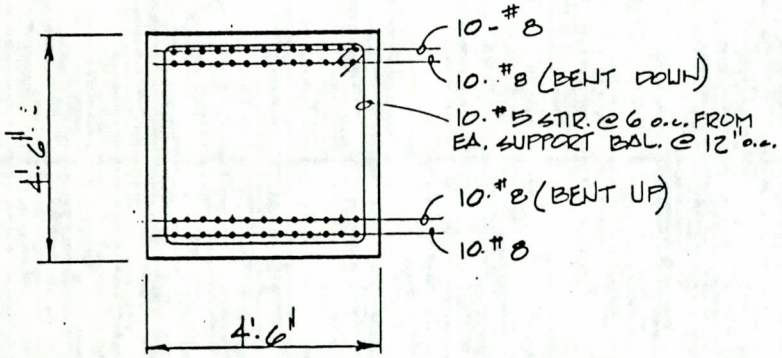

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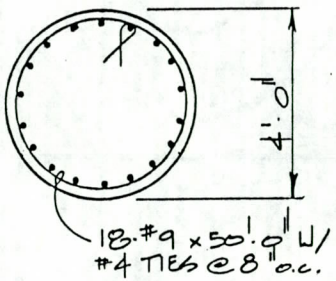

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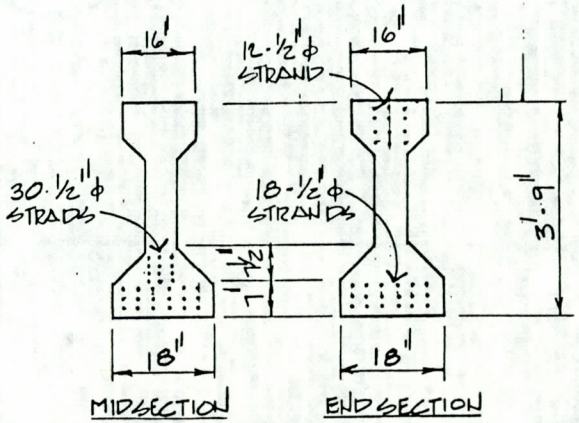

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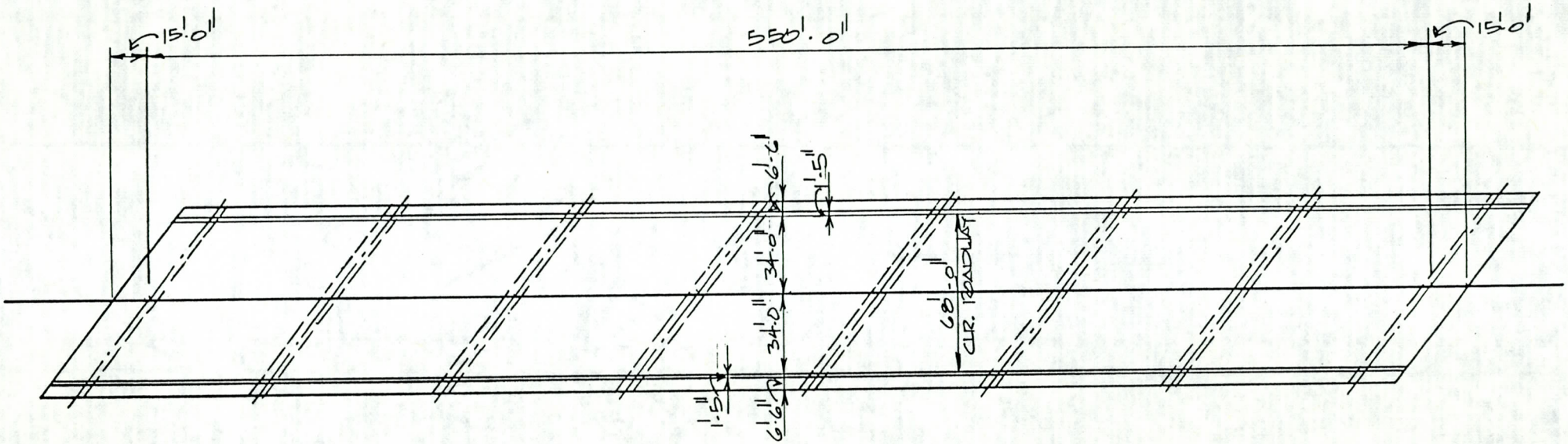
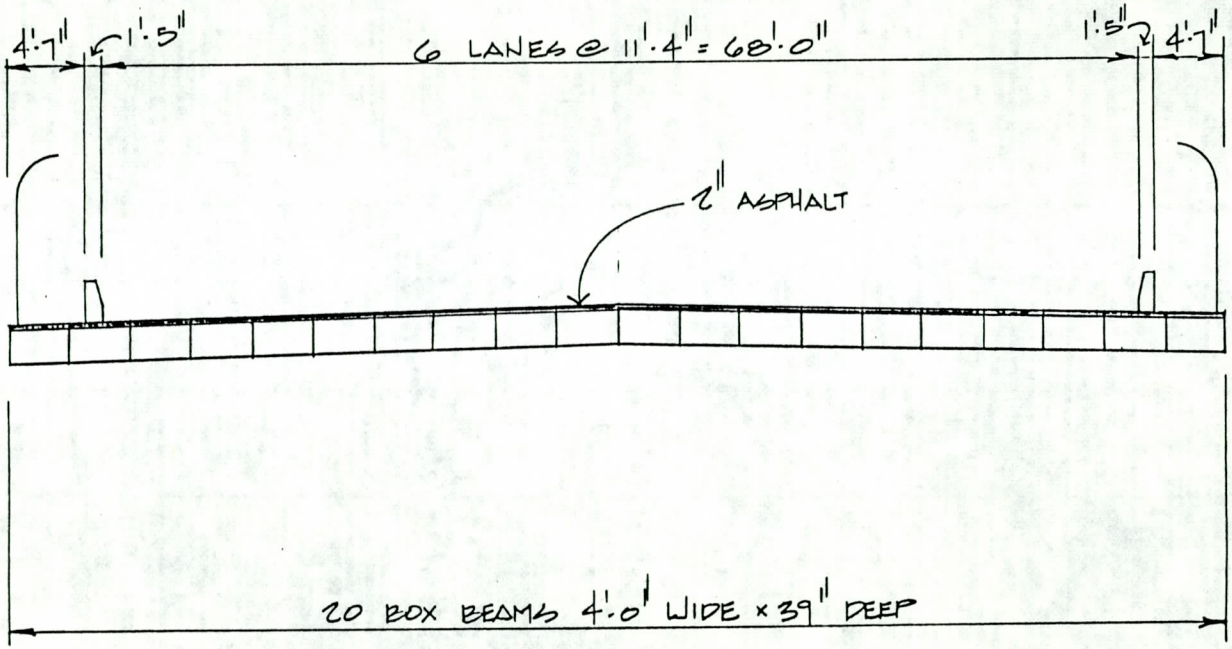


PLAN OF BRIDGE

EXIHIBIT "B"

OPTION 2A



SECTION OF BRIDGE

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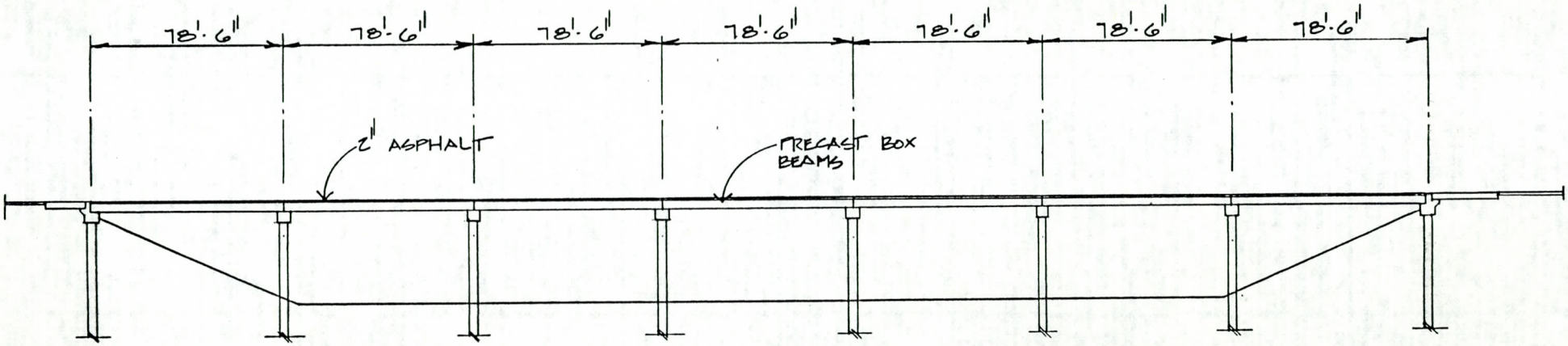

SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

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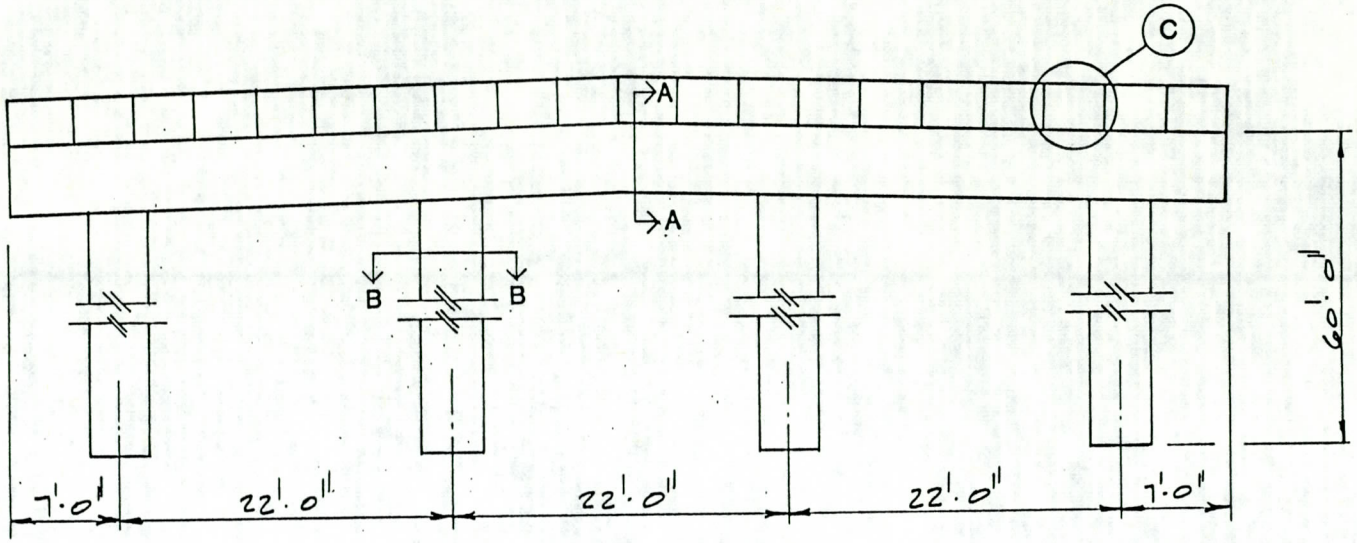

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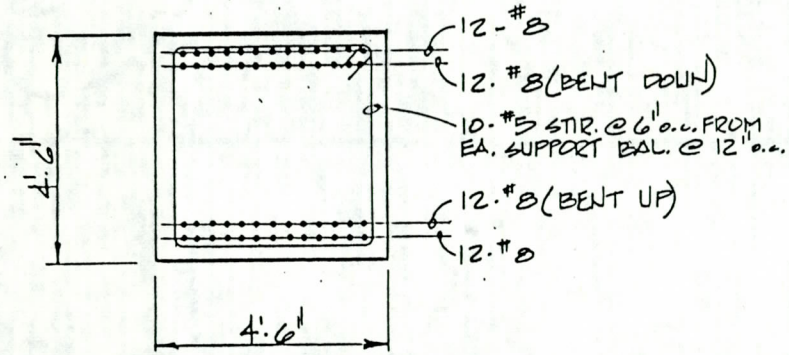

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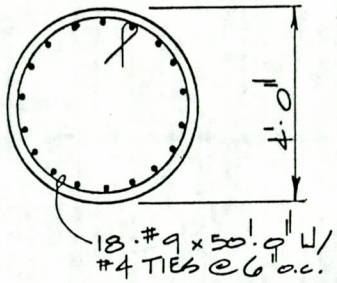

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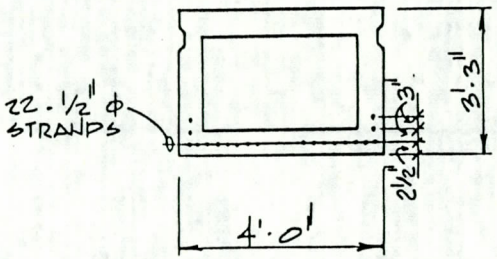

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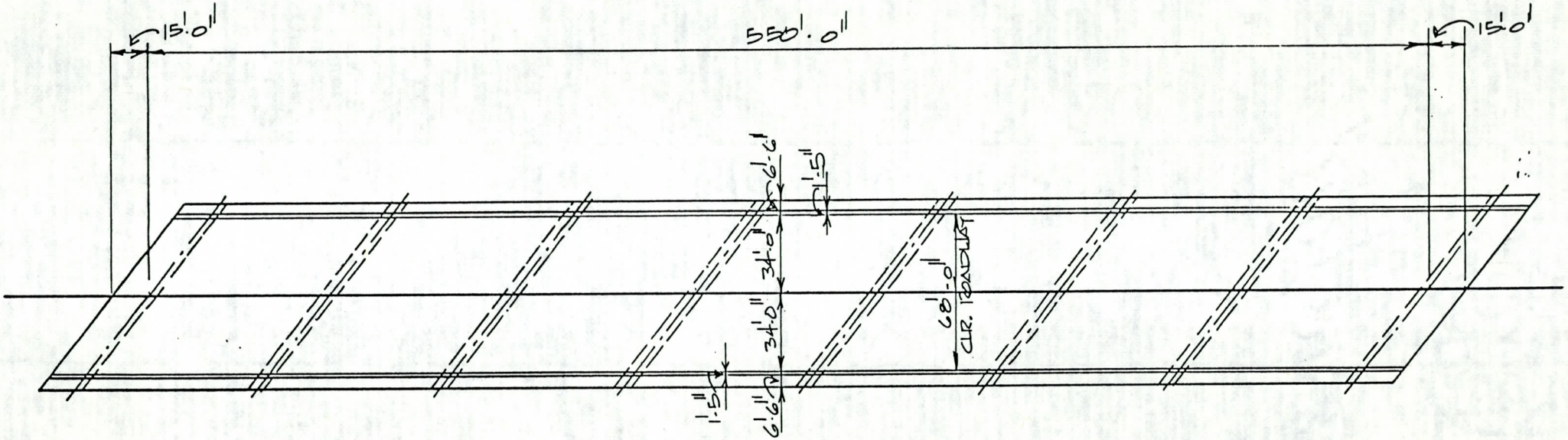
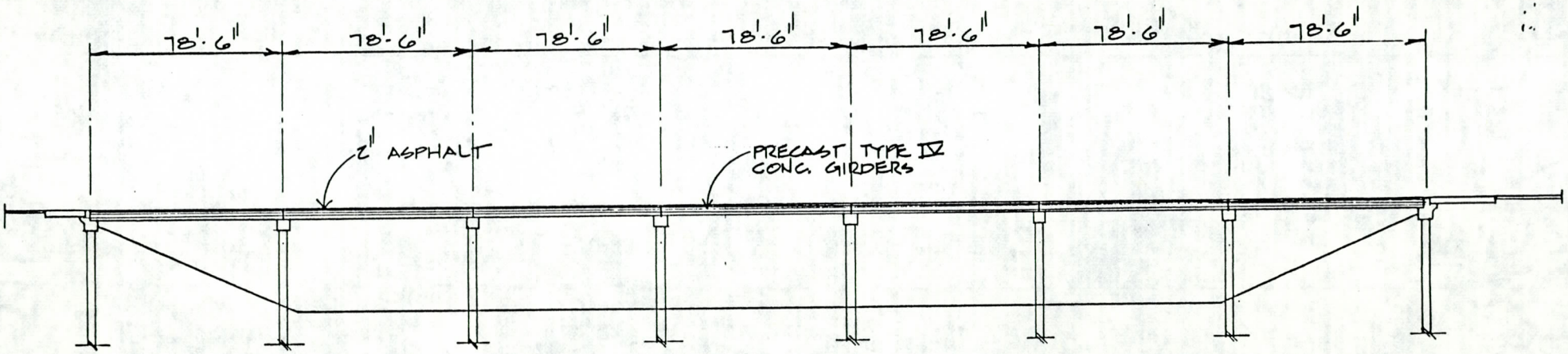


PLAN OF BRIDGE

EXIHIBIT "B"

OPTION 2B



SECTION AT ℄ OF ROADWAY

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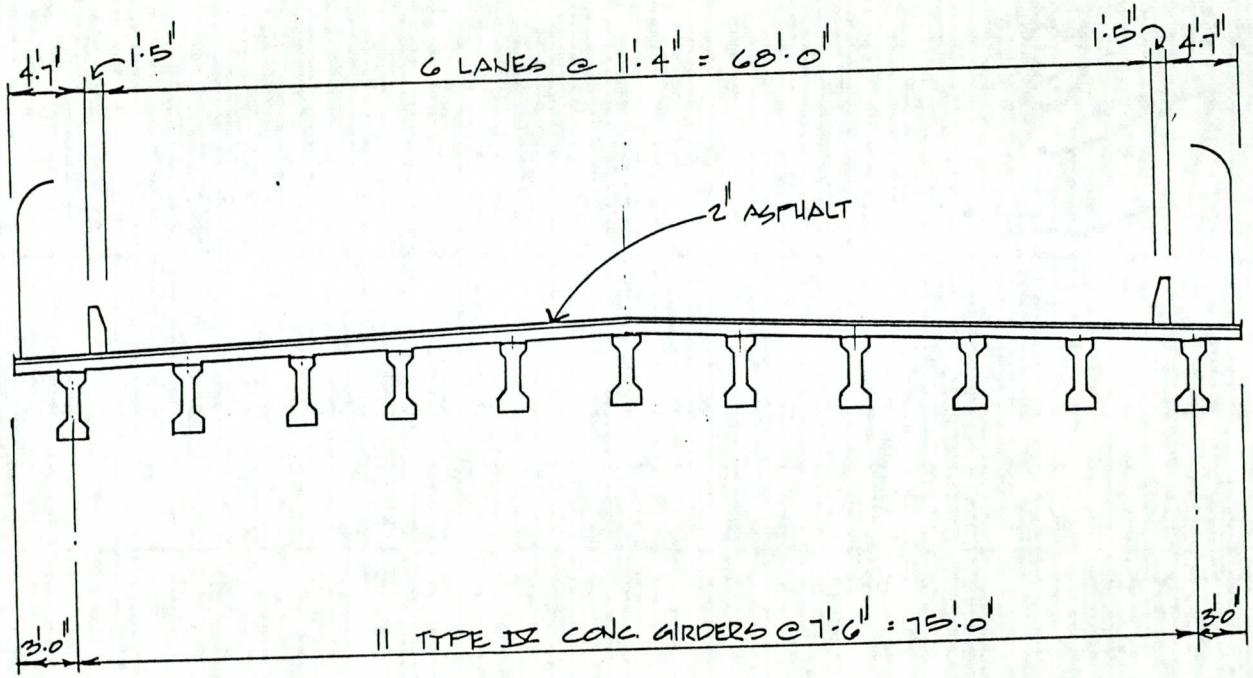
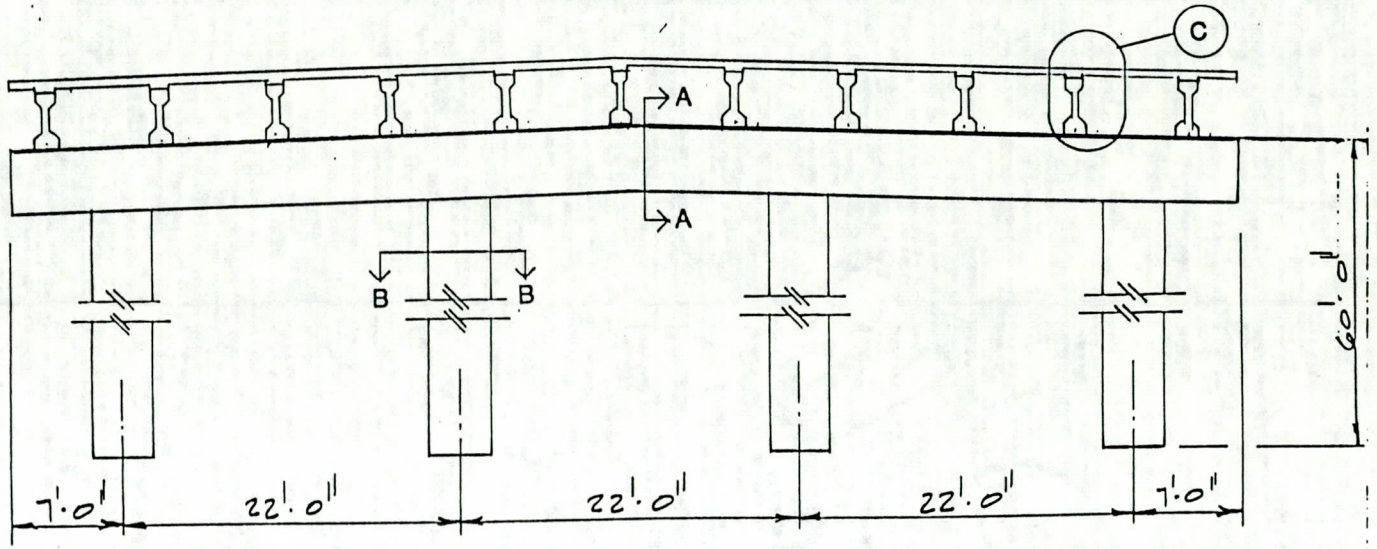


SECTION OF BRIDGE

EXIHIBIT "C"

OPTION 2B



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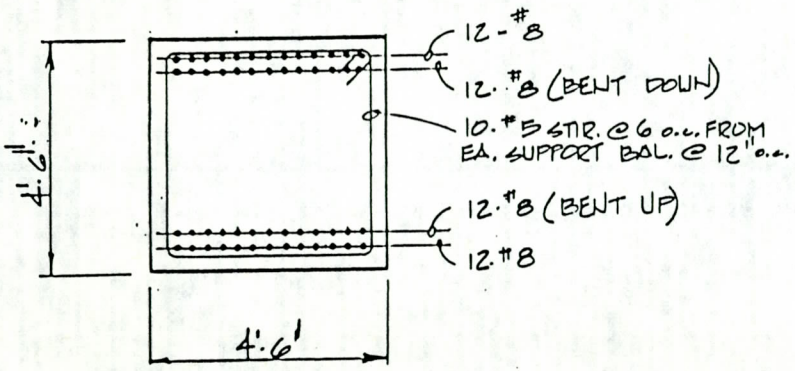
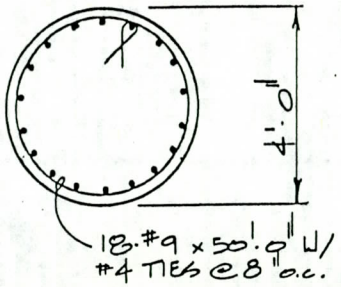


DETAIL A



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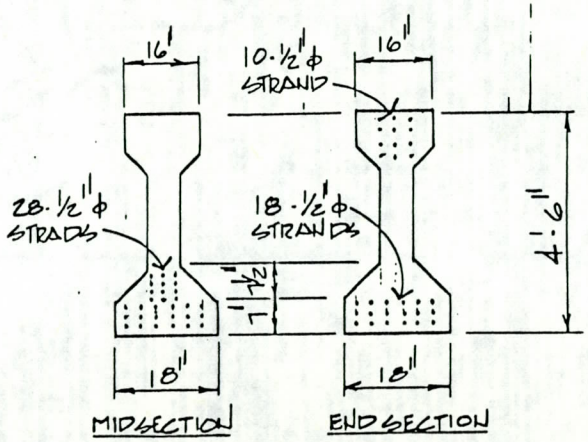

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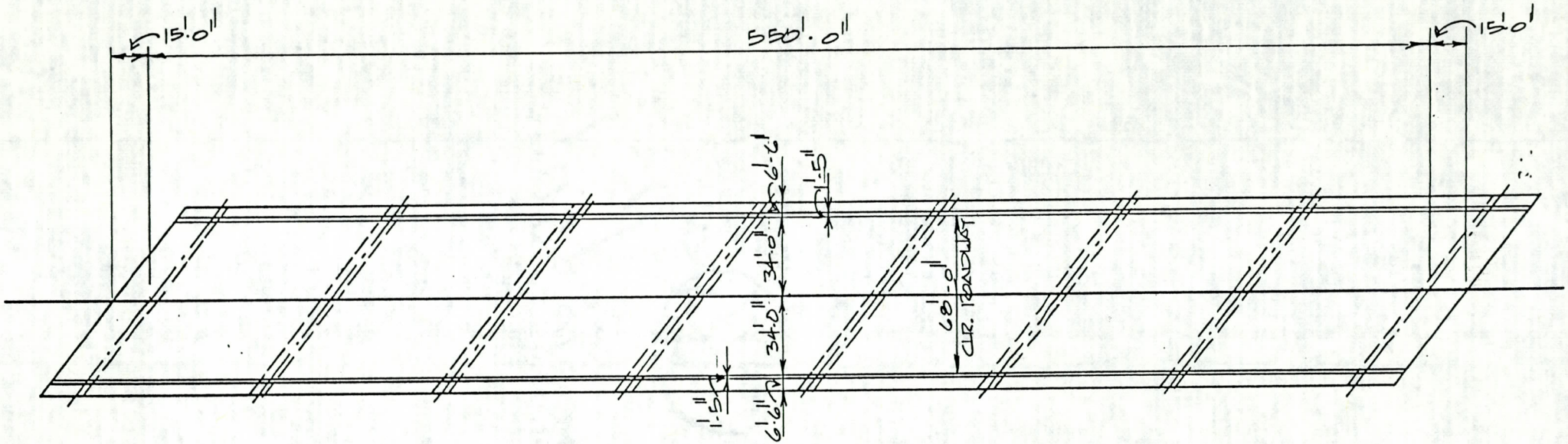
EXIHIBIT "E"

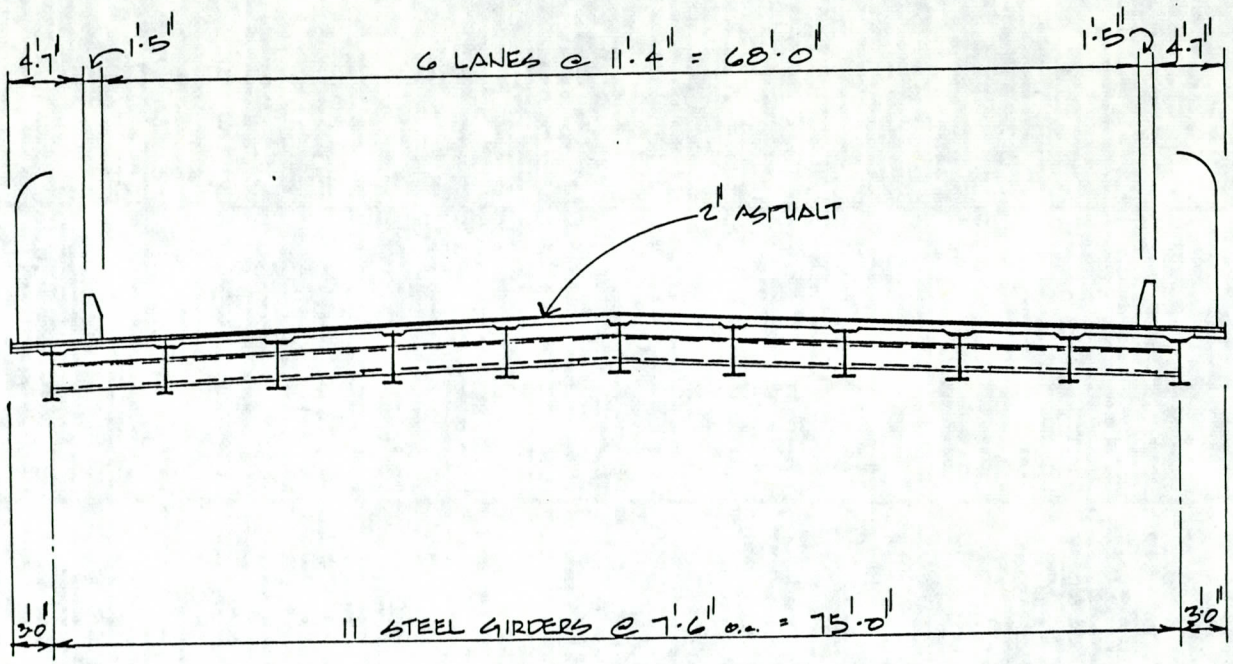
OPTION 2B



PLAN OF BRIDGE

EXIHIBIT "B"

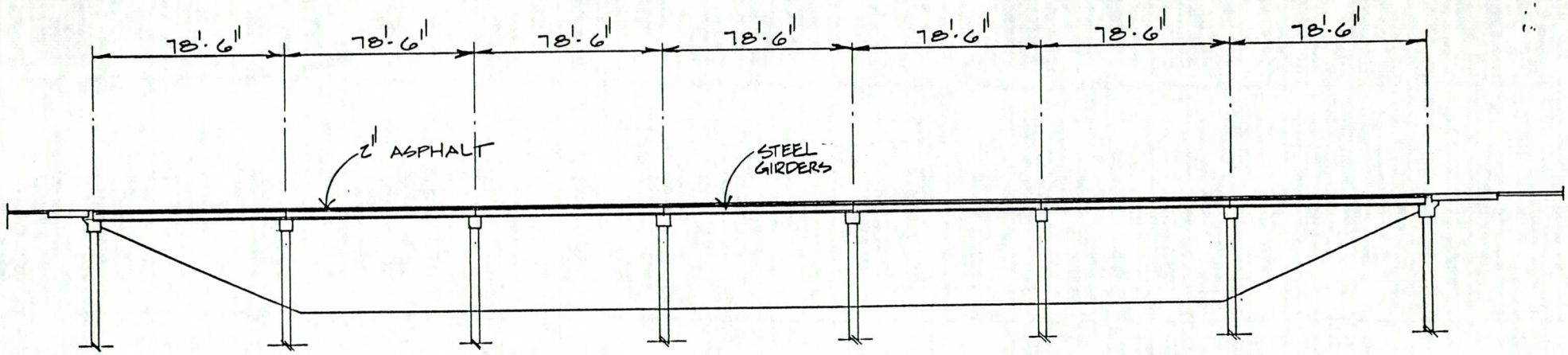
OPTION 2C



SECTION OF BRIDGE

EXIHIBIT "C"

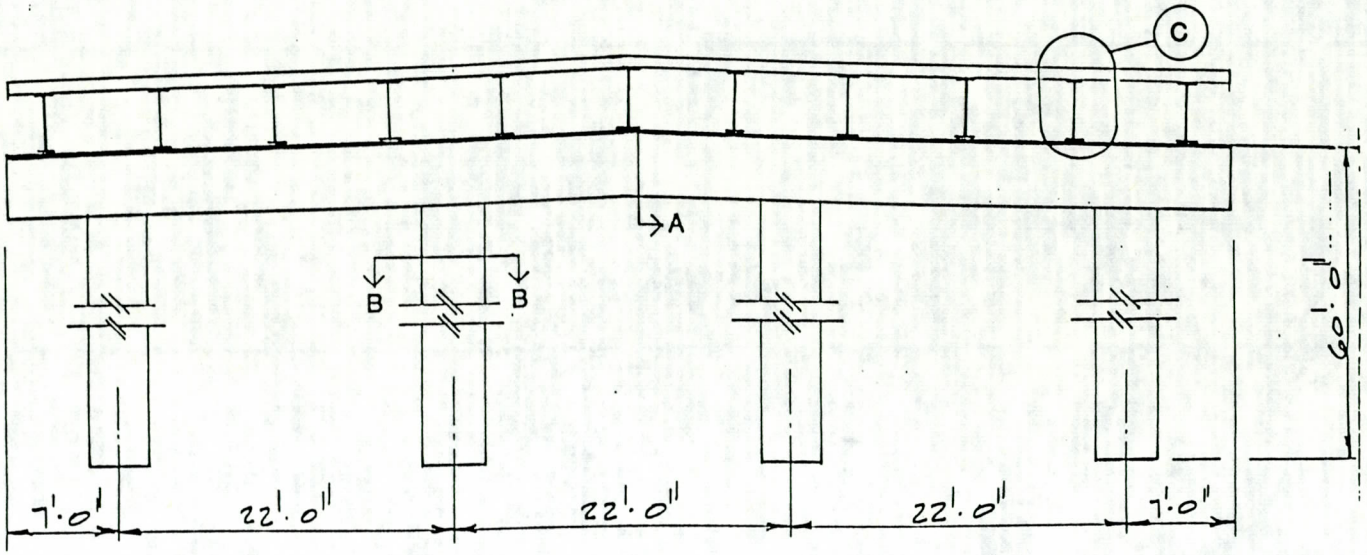
OPTION 2C



SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

OPTION 2C



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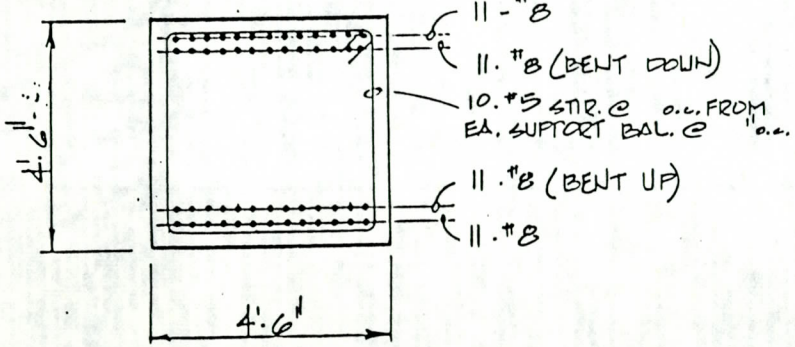
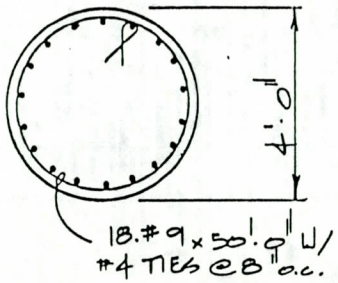


DETAIL A



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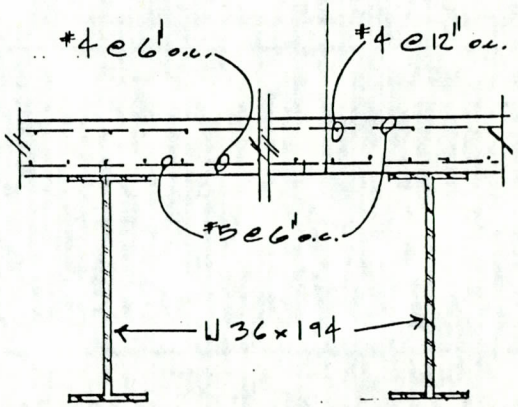
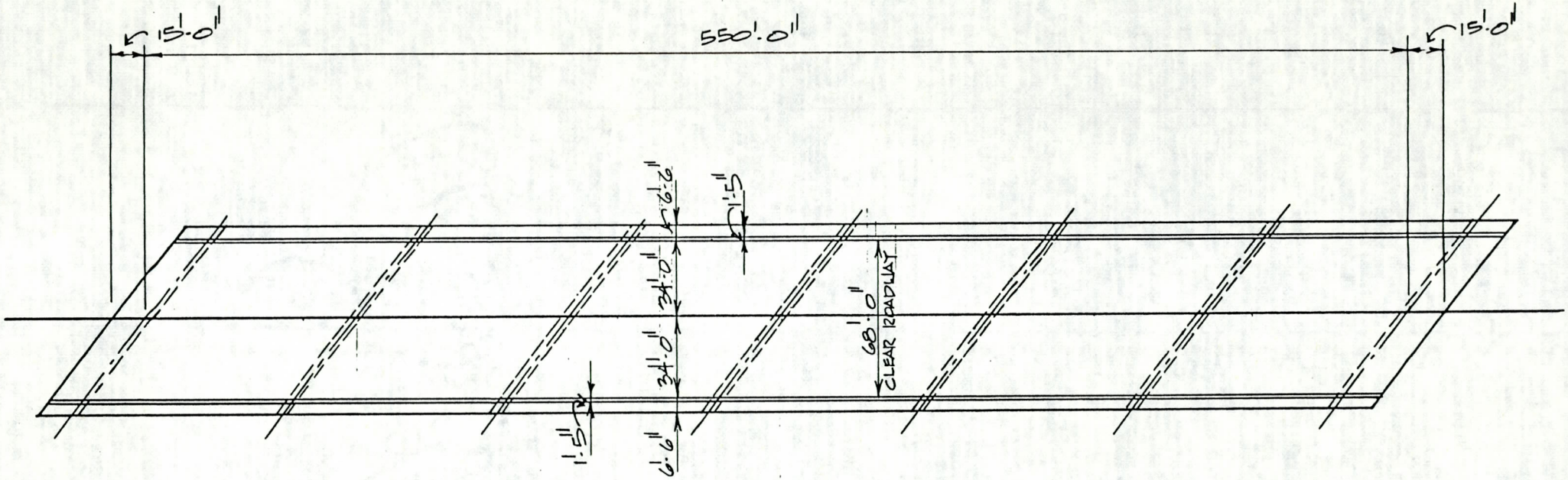


DETAIL C

EXIHIBIT "E"

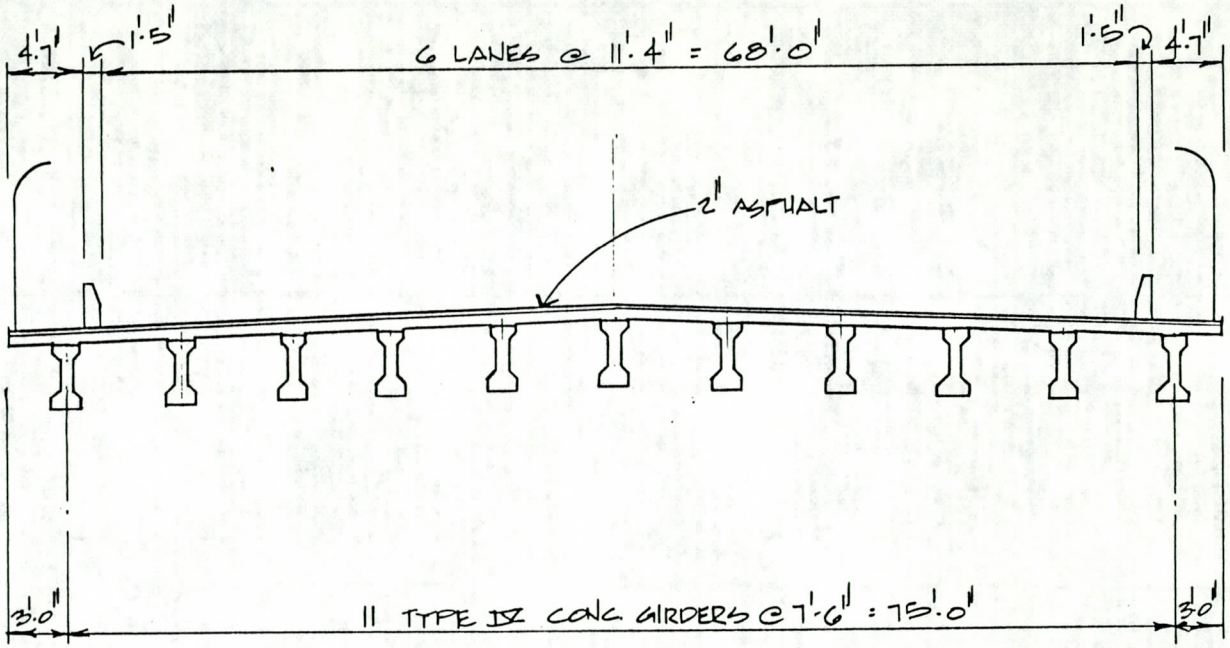
OPTION 2C



PLAN OF BRIDGE

EXIHIBIT "B"

OPTION 3A



SECTION OF BRIDGE

EXIHIBIT "C"

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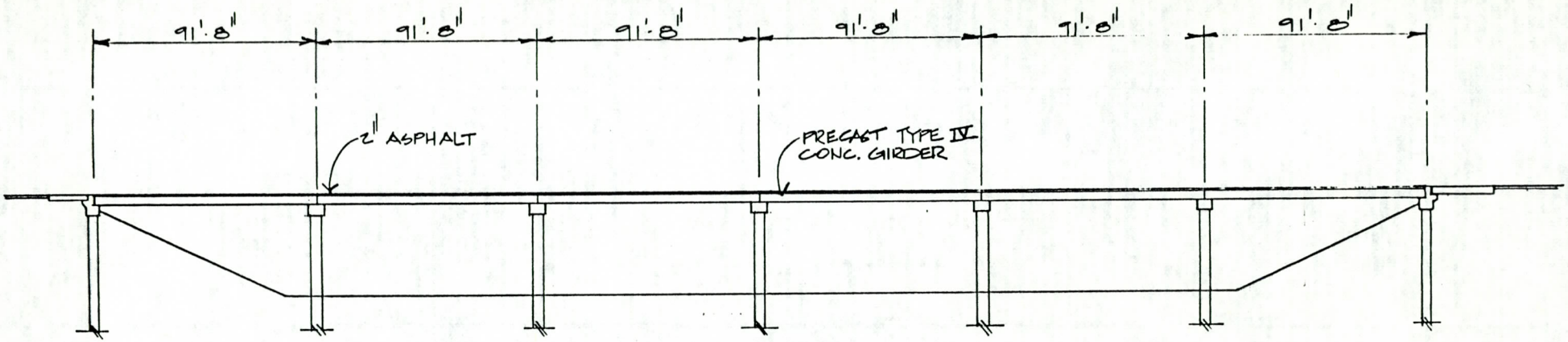

SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

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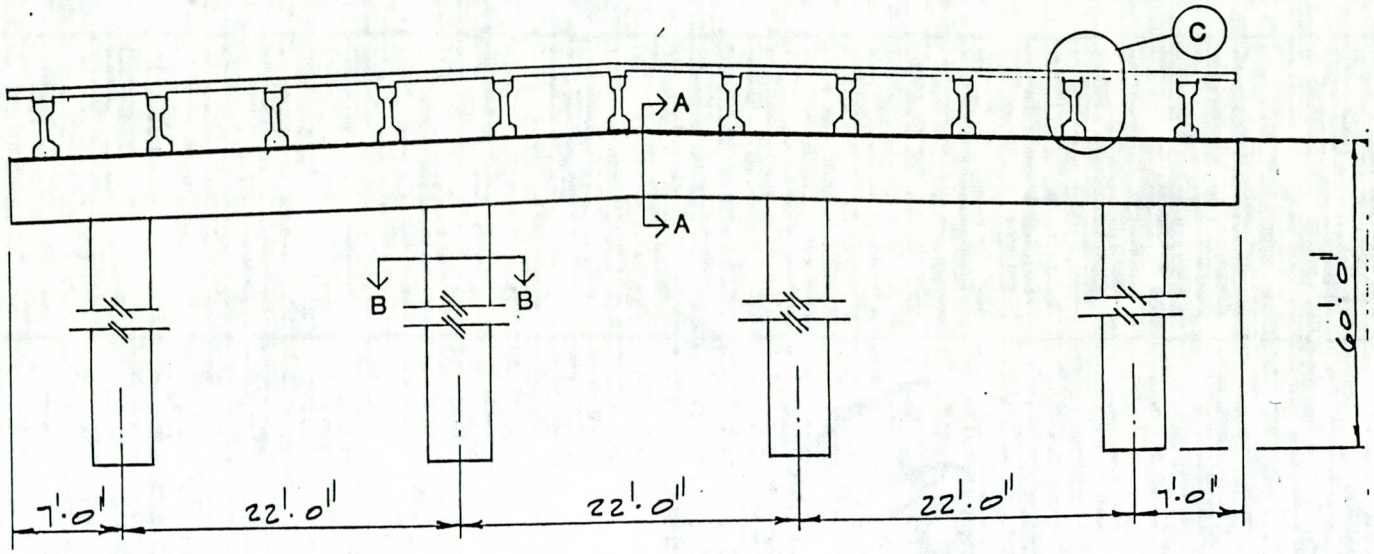
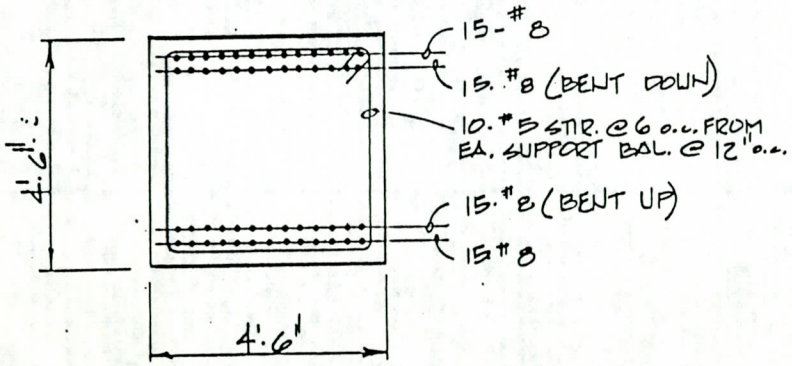


SECTION AT PIERS



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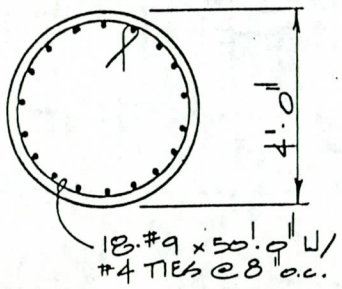

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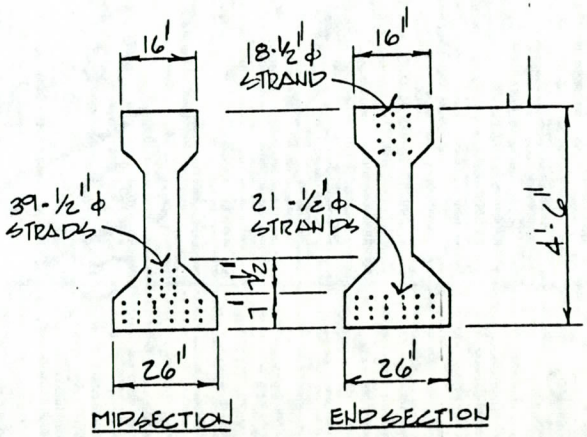
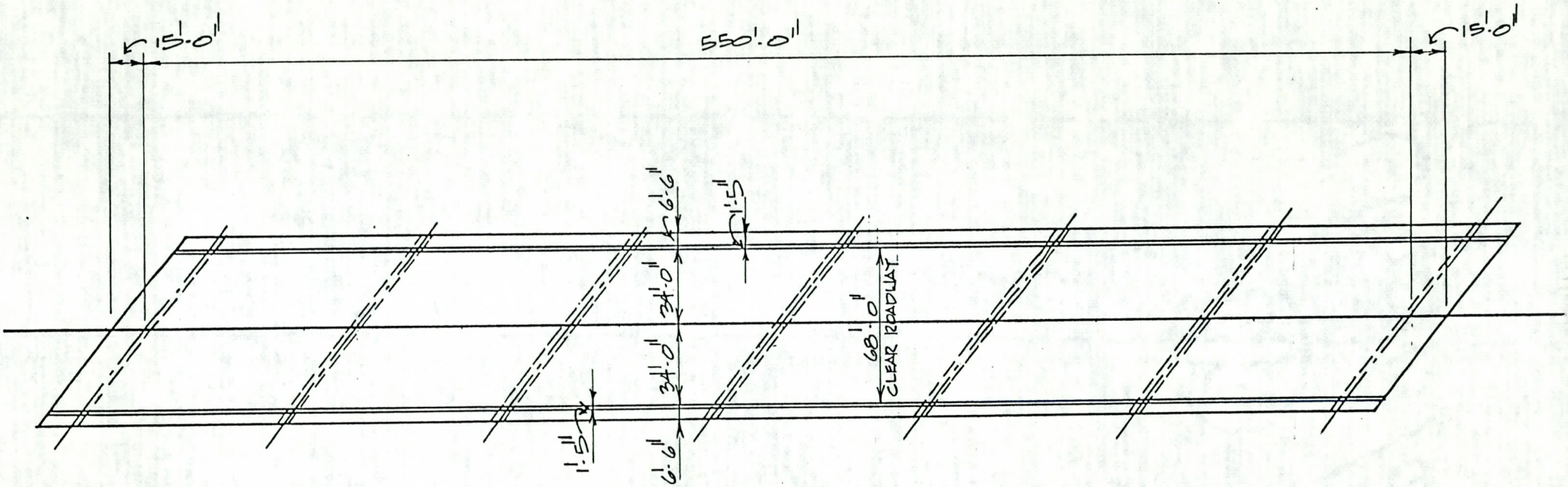


DETAIL C

EXIHIBIT "E"

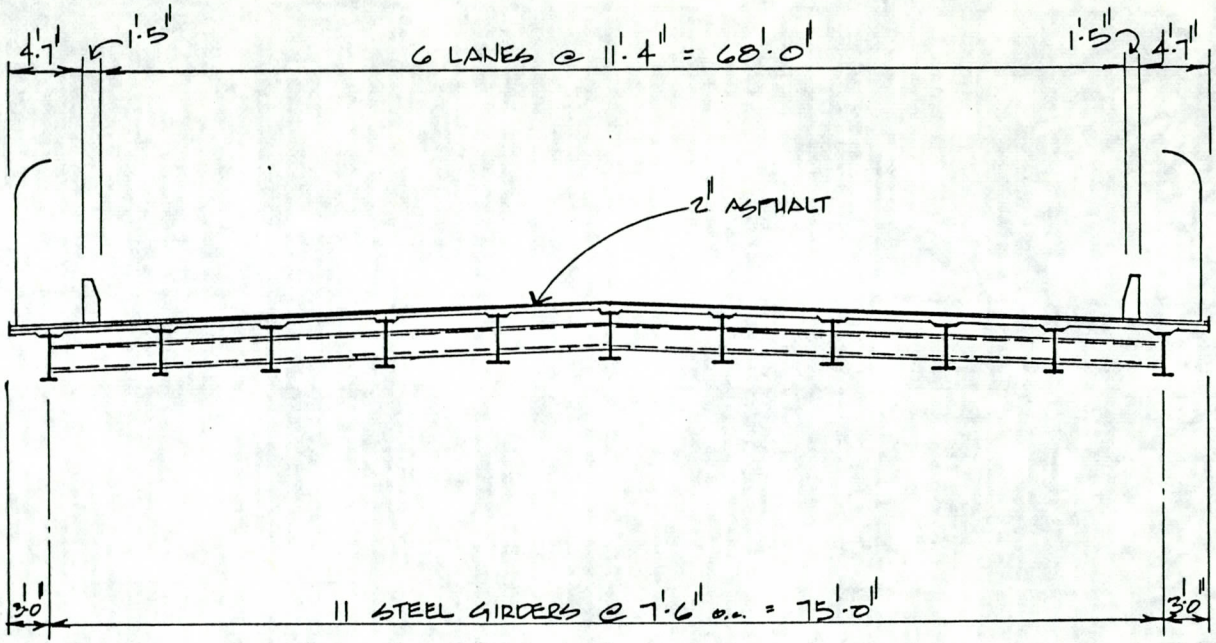
OPTION 3A



PLAN OF BRIDGE

EXIHIBIT "B"

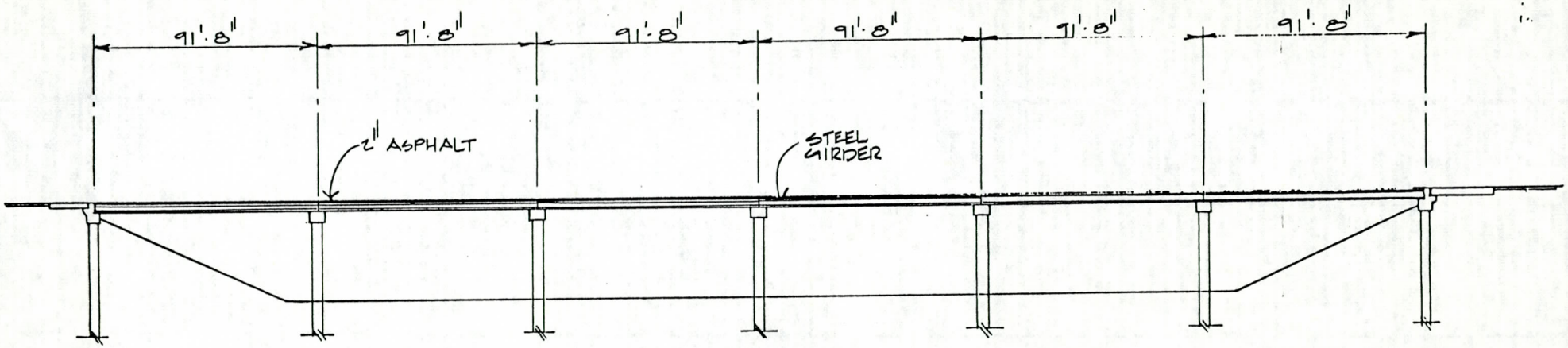
OPTION 3B



SECTION OF BRIDGE

EXIHIBIT "C"

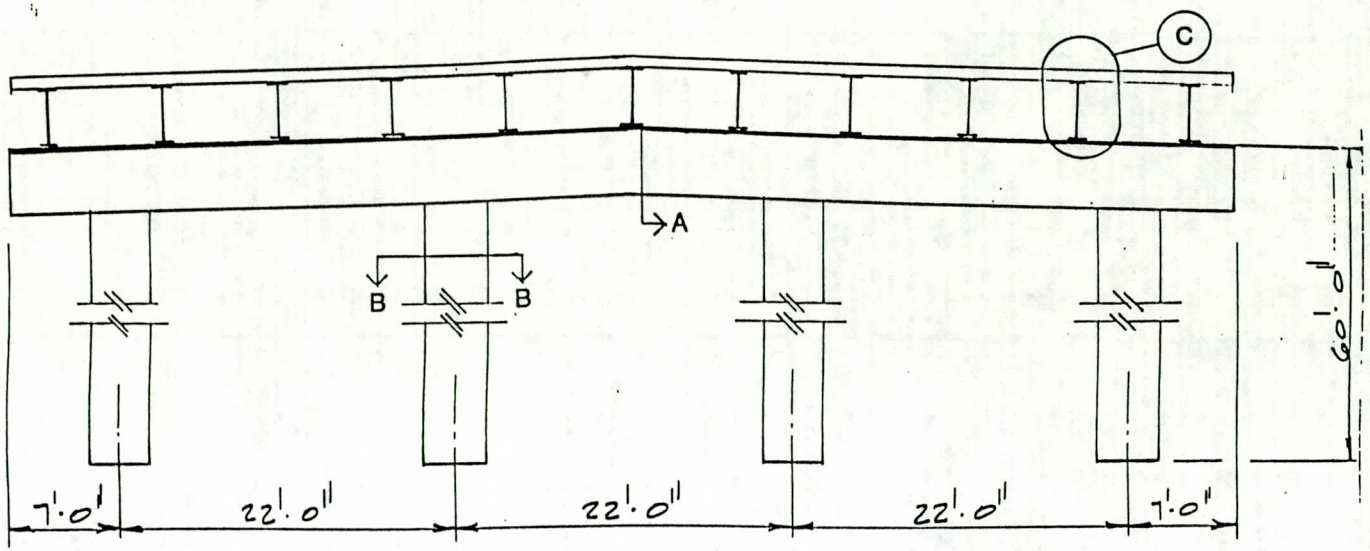
OPTION 3B



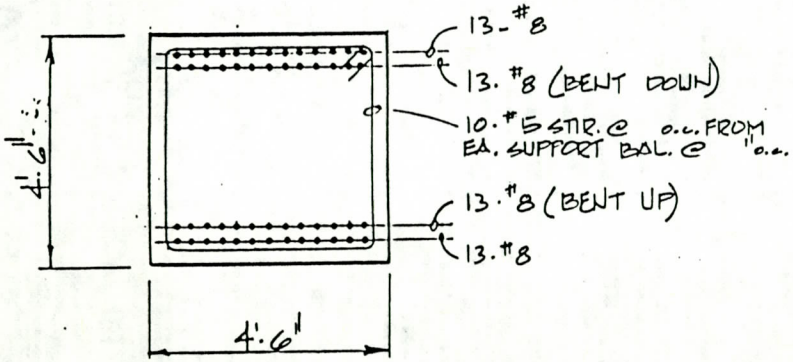
SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

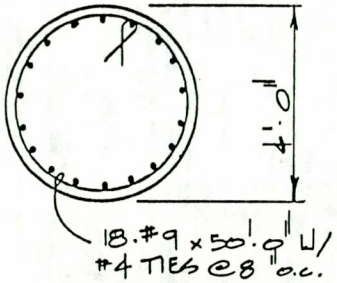
OPTION 3B



SECTION AT PIERS



DETAIL A



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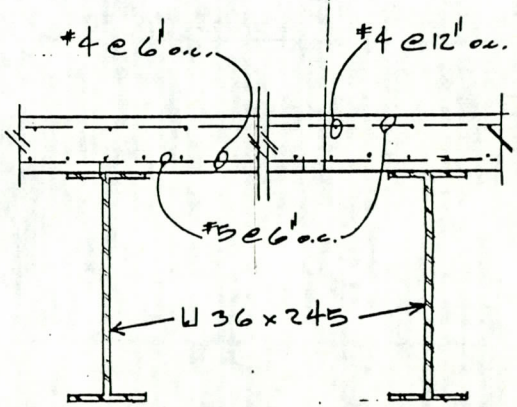
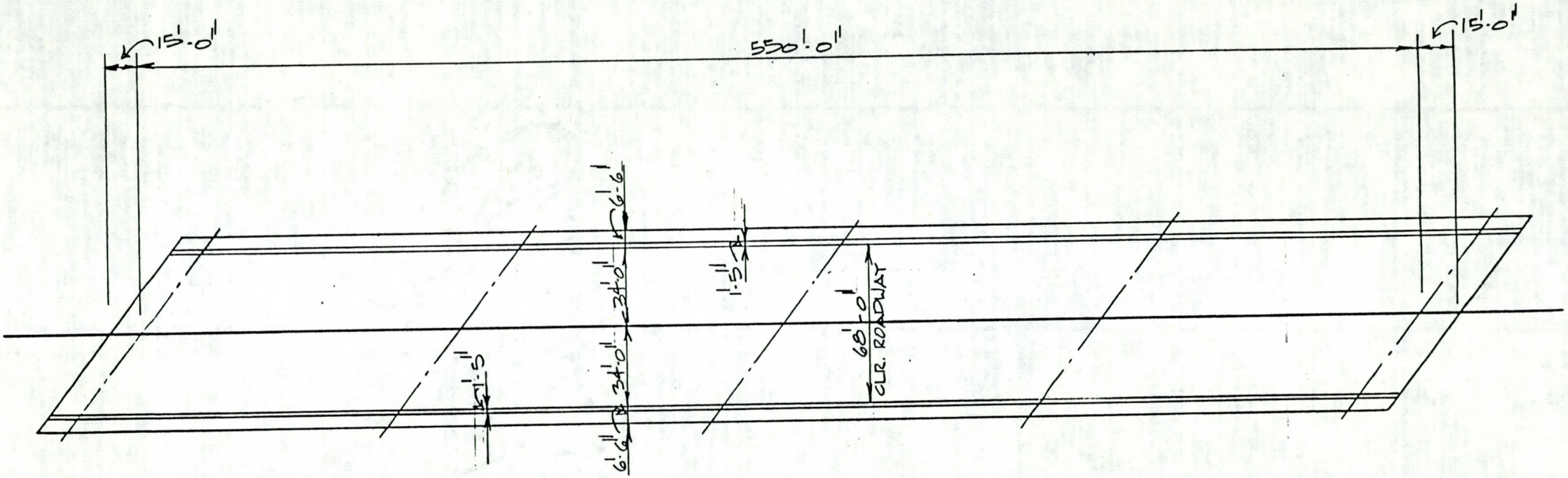


DETAIL C

EXIHIBIT "E"

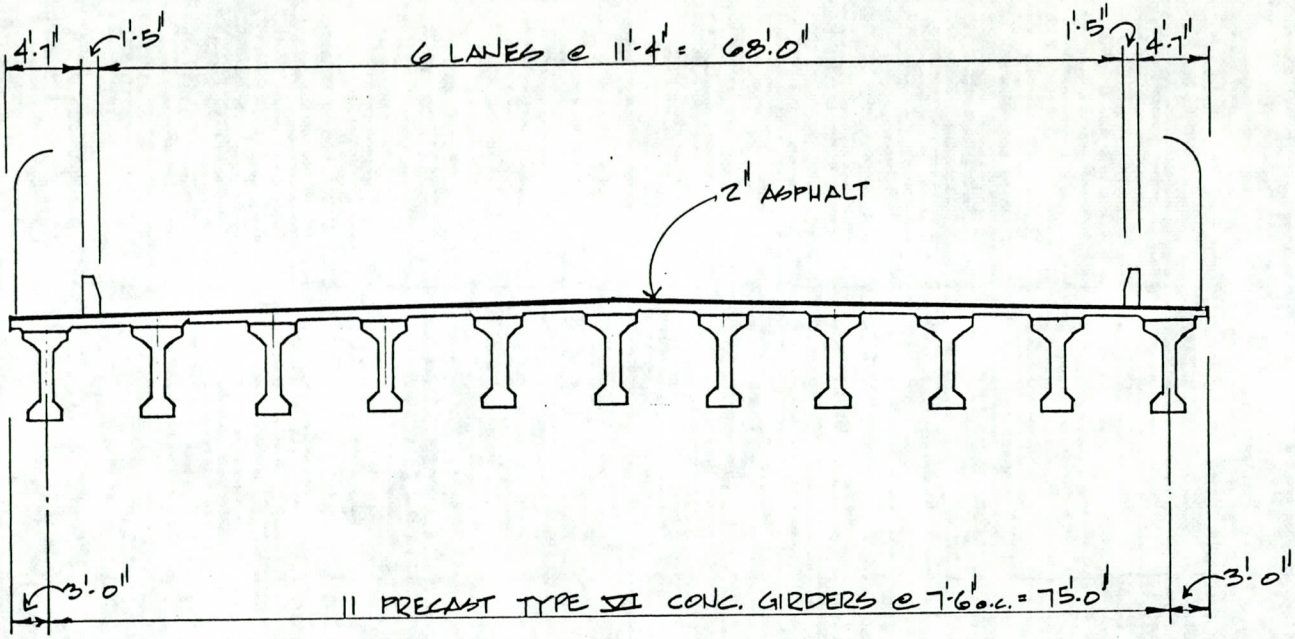
OPTION 3B



PLAN OF BRIDGE

EXIHIBIT "B"

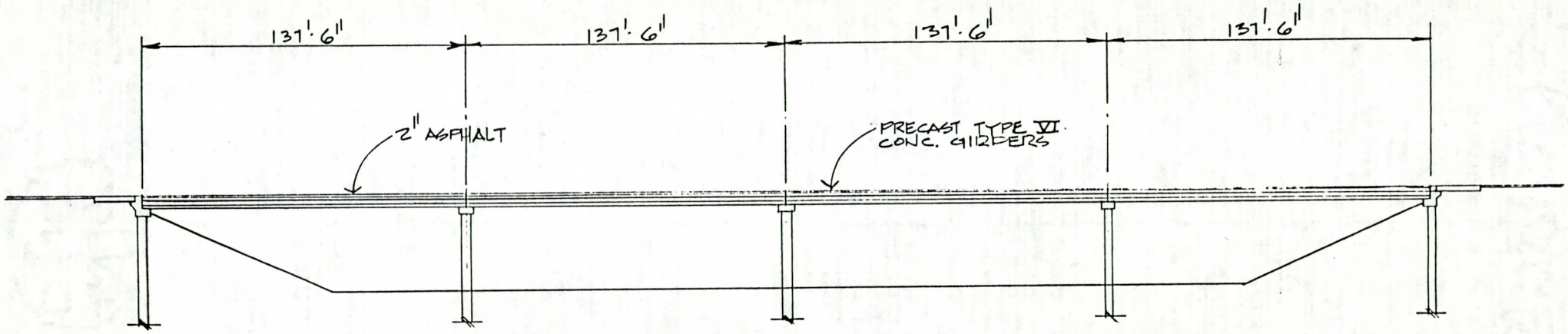
OPTION 4A



SECTION OF BRIDGE

EXIHIBIT "C"

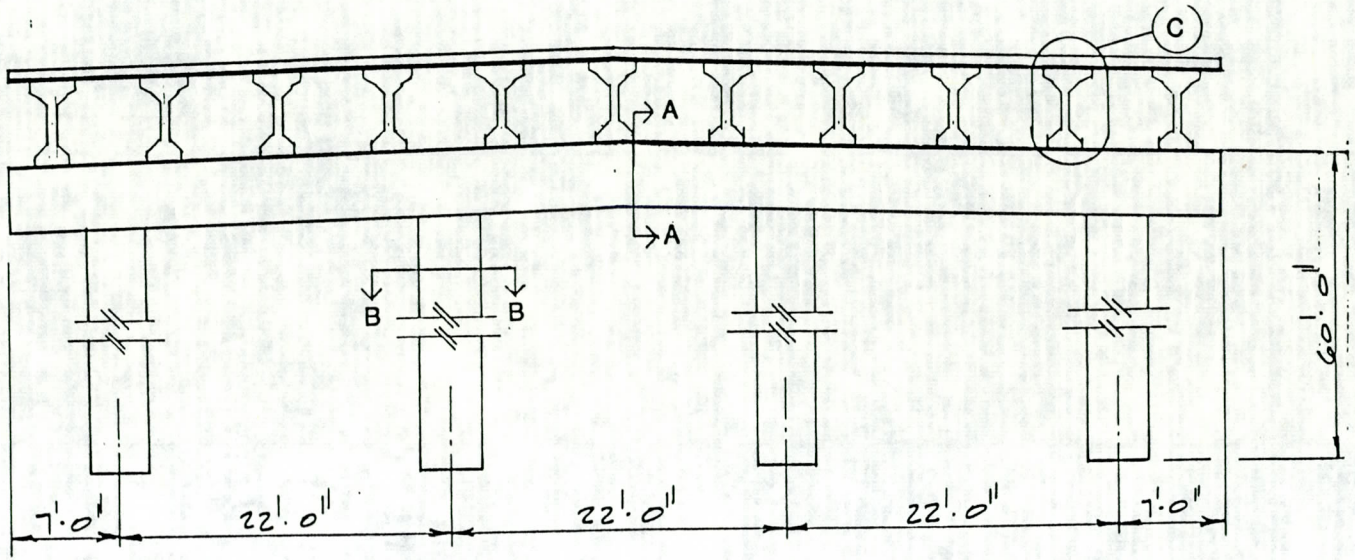
OPTION 4A



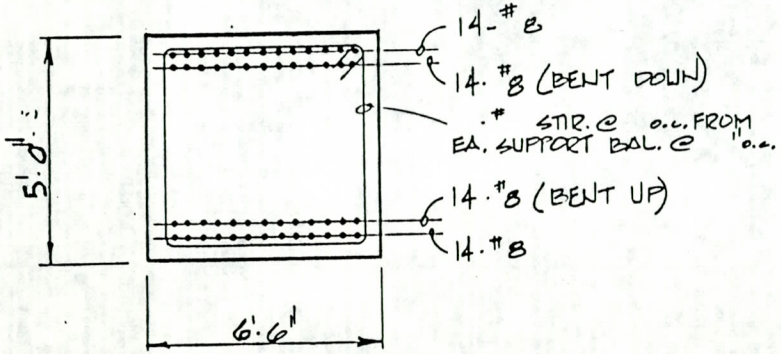
SECTION AT ℄ OF ROADWAY

EXIHIBIT "D"

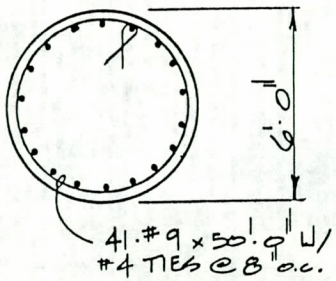
OPTION 4A



SECTION AT PIERS



DETAIL A



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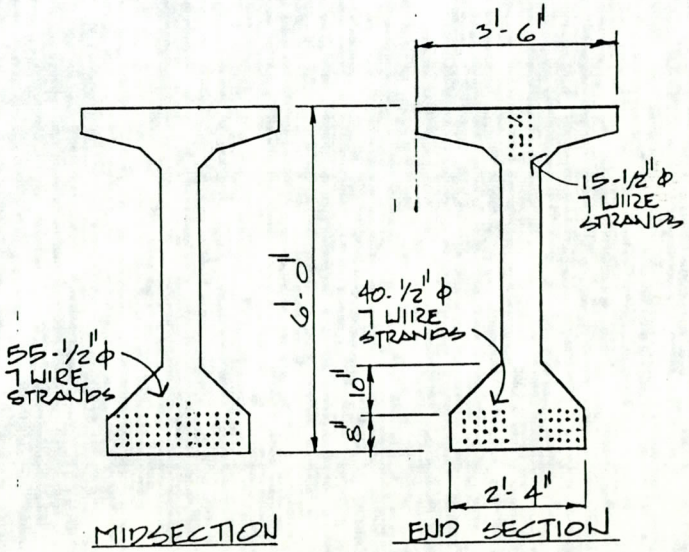


DETAIL C

EXIHIBIT "E"

OPTION 4A

ARIZONA CANAL DIVERSION CHANNEL BRIDGE

67th Avenue South of Greenway Road
Glendale, Arizona

Registered Professional Engineer
CERTIFICATE NO.
5979
TOM
THOMAS
8/30/
ARIZONA, U.S.A.

Prepared for

E.M. Plummer, Consulting Engineers
3666 Miller Road
Scottsdale, Arizona

THOMAS-HARTIG & ASSOCIATES, INC.
SOIL & FOUNDATION ENGINEERS

968-8778

SCOPE

The bridge is to span a diversion channel to be excavated parallel to and north of the Arizona Canal as shown on the accompanying site plan. It is understood that design concepts for the bridge structure and diversion channel are as follows:

Bridge Length	550 feet
Width of Bridge	68 feet
Number of Spans	6 at 91'-8"
Skew of Bridge	38°
Deck Elevation	Elev. 1215 feet
Channel Elevation	Elev. 1190 feet
Channel Bottom Width	220 feet
Channel Side Slopes	6.0 horizontal to 1.0 vertical
Channel Lining	Earth
Abutment Reactions	Dead Load = 1175 kips Live Load = 361 kips
Pier Reactions	Dead Load = 2060 kips Live Load = 565 kips

The 67th Avenue approach roadways are to be improved to current City of Glendale standards for distances of approximately 150 feet north and south of the bridge structure.

INVESTIGATION

Seven (7) test borings were drilled near abutment and pier locations as shown on the accompanying site plan. The borings were drilled with a rotary auger (CME-55) drill rig using 7 inch diameter, continuous hollow stem flight augers. Field penetration tests were made in the granular subsoils encountered for a guide to their relative in-situ density. Penetration resistance was measured by driving a 2.0 inch diameter standard split spoon sampler with a 40 inch free fall drop hammer weighing 140 pounds (ASTM: D1586). The more fine grained soils encountered were

sampled by driving a 2.42 inch I.D. ring sampler. Boring logs presenting the results of the test drilling are presented in "Part II, Field Results".

Representative soil samples obtained during the field investigation were subjected to the following laboratory analyses. The surface soils at the abutments and north and south of the bridge structure were also sampled and analyzed for evaluation relative to the approach roadways.

Test	Sample(s)	Purpose
Sieve Analyses and Plasticity Index	Bridge Site Subsoils (9) Approach Roadway Subgrade (5)	Laboratory classification and evaluation for approach roadway design
Direct Shear	Subsoils (7)	Pile capacity analyses
*Dry Density and Moisture Content	Driven Ring Sampler (40)	In-situ density and moisture determination

*Reported on boring logs.

The results of the testing are presented in "Part III, Laboratory Results".

SITE CONDITIONS

The proposed bridge alignment will coincide with the existing 67th Avenue alignment. The test borings were drilled on the roadway shoulders at the proposed abutment and pier locations.

As disclosed by the test borings, the subsoil stratification is somewhat variable. The surface soils are predominantly clays and overlie stratified granular and clayey subsoils. Specific subsoil data is presented on the boring logs, with the following tabulation presenting a generalization of the depths and thicknesses of the predominant strata.

0 - 9 feet±:	Sandy Clay; medium plasticity.
9 - 26 feet±:	Silty Sand becoming Sand and Gravel mixtures with some cobbles.
26 - 47 feet±:	Sand - Clay mixtures with some gravel and occasional cobbles.
47 - 70 feet±:	Sandy Silty Clay; medium to high plasticity.
70 - 75 feet±:	Sand and Gravel mixtures; some cobbles.

The subsoils throughout the depth of test drilling were generally described as damp, and no free ground water was encountered in the test borings.

FOUNDATION BEARING

It is understood that the Maricopa County Flood Control District requires piling for support of the structure. The subsoil conditions are quite suitable for circular drilled cast-in-place concrete piles, and for driven non-displacement piles. Displacement piles do not appear suitable due to the dense condition of the subsoils.

Due to the relatively heavy abutment and pier loads, and the relatively large load capacity of large diameter piles, circular drilled cast-in-place piles were analyzed for support of the structure. The following tabulation presents calculated pile capacities for selected diameters and depths of embedment below the depth of potential scour. Calculations for other sizes will be provided upon request.

Pile Diameter	*Pile Length	Allowable Pile Loading: Abutment Condition	Allowable Pile Loading: Pier Condition
3.0 ft.	20 ft.	110 kips	120 kips
3.0 ft.	30 ft.	200 kips	230 kips
3.0 ft.	40 ft.	320 kips	400 kips
4.0 ft.	20 ft.	180 kips	200 kips
4.0 ft.	30 ft.	310 kips	360 kips
4.0 ft.	40 ft.	480 kips	600 kips

- con't -

Pile Diameter	*Pile Length	Allowable Pile Loading: Abutment Condition	Pier Condition
5.0 ft.	20 ft.	270 kips	290 kips
5.0 ft.	30 ft.	440 kips	500 kips
5.0 ft.	40 ft.	670 kips	820 kips
6.0 ft.	20 ft.	370 kips	390 kips
6.0 ft.	30 ft.	610 kips	675 kips
6.0 ft.	40 ft.	890 kips	1040 kips

*Depth of embedment below the depth of potential scour.

The allowable pier loads are presented for dead plus design live loads except that a one-third increase is allowable for wind or seismic forces. No reduction in pier capacity for group action should be required where pier spacings exceed 3.0 diameters. Estimated pier settlements should not exceed 3/4 inches.

Although no free ground water was encountered at the time of test drilling, the analyses is based upon the assumption that partial saturation of the subsoils may develop during periods of heavy flow. Also, it was assumed that the pier excavating would be performed without the addition of water or slurry, although some sloughing and caving may be experienced when excavations penetrate the more granular subsoils. A heavy-duty drilling rig capable of developing high torque and down pressure will probably be required.

The lateral stability of rigid pile footings could be estimated by assuming the stiffness of the subsoils to increase lineally with depth beginning with zero (0) at the level of potential scour. A 28 pci horizontal modulus of subgrade reaction is recommended for estimating the horizontal load capacity per pile. No reduction due to group action should be necessary where pile spacings exceed 3.0 diameters.

STRUCTURE BACKFILLING

Backfill required against abutment walls and other retaining structures should be granular soils meeting the Arizona Highway Department Specifications for Select Backfill Materials. The backfill soils should be free of any silty or clayey fines so that the backfill will be free draining and not susceptible to increased loadings due to hydrostatic forces. Compaction should be accomplished to a minimum 95 percent of the AASHTO: T-180 maximum density. Retaining structures should be braced to resist equipment loadings during compaction of the backfill.

The following tabulation presents recommended soil pressures for estimation of lateral forces against retaining walls.

Equivalent "Active" Soil Pressure (Yielding structure)	30 psf/ft.
Equivalent "At-Rest" Soil Pressure (Rigid structure)	50 psf/ft.

APPROACH ROADWAYS

Since 67th Avenue is a major arterial, high traffic volumes are projected. The following tabulation presents the design parameters and indicated pavement sections for the approach roadways.

Average Daily Traffic:

Current	7,000
Projected 20 years (w/99th Ave. Loop)	18,000
Design Average	12,500
One Direction (50 percent)	6,250
Curb Lane (80 percent)	5,000
Truck Traffic (5%, 18K axle type)	250

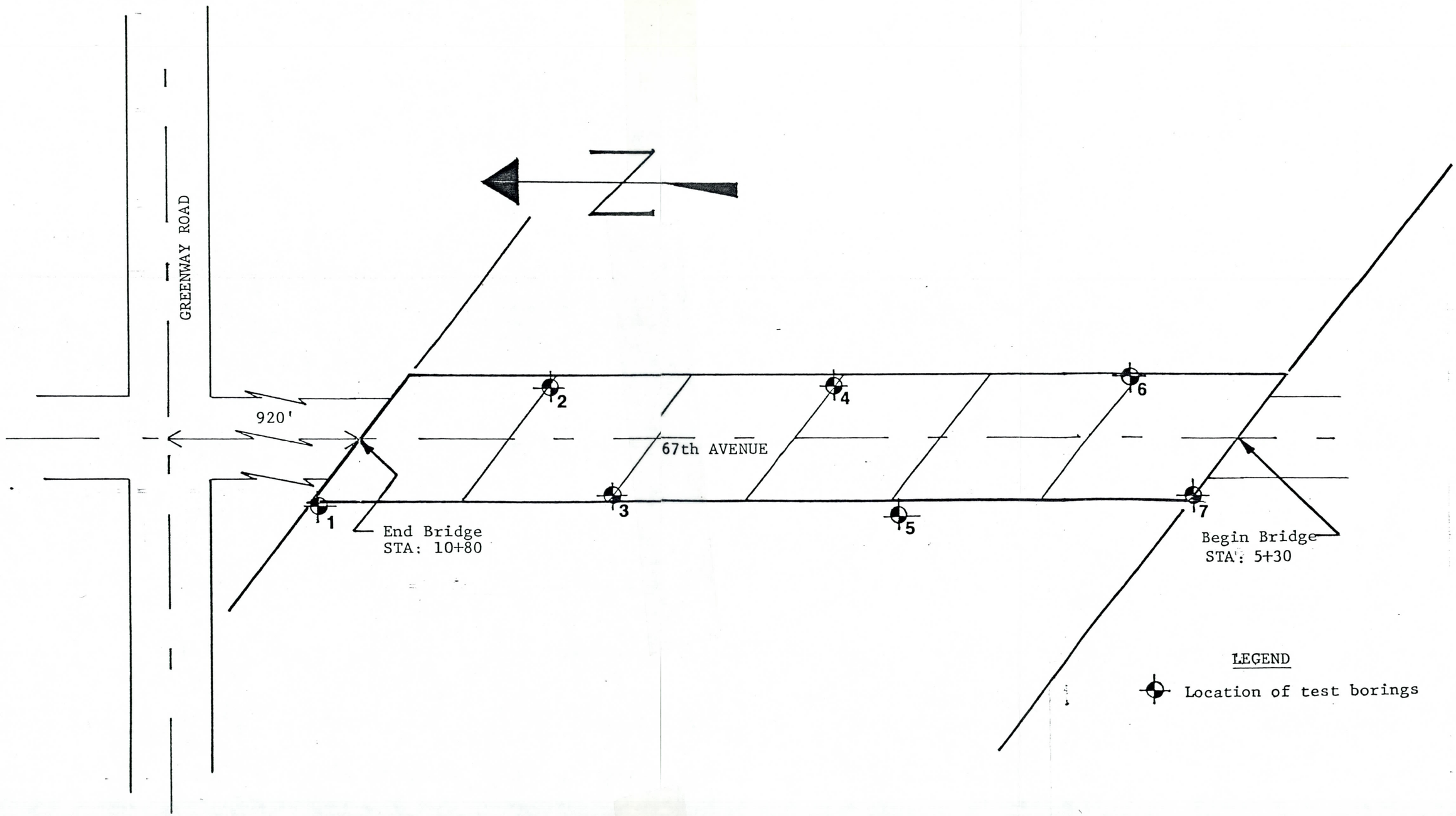
Subgrade/Pavement Daga:

R-Value----------15
Soil Support Value----------3.1
Structural Number----------4.3

Pavement Section:

	Computed	Alternate No: 1	Alternate No: 2
Asphaltic Concrete	4 inches	6 inches	10 inches
Aggregate Base Course	4 inches	6 inches	-
Select Subbase Course	21 inches	9 inches	-
Total Thickness	29 inches	21 inches	10 inches

The subgrade preparation, pavement materials and placement should be in accordance with the Maricopa Association of Governments Standard Specificatons with current City of Glendale supplements.



THOMAS-HARTIG & ASSOCIATES, INC.
PROJECT NO: 82-424

LEGEND

SOIL CLASSIFICATION ASTM: D2487

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	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 SILT-CLAYS 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	

log denotes visual approximation unless accompanied by mechanical analysis and Atterberg limits.

GRAIN SIZES

U.S. STANDARD SERIES SIEVE: 200, 50, 16, 4

CLEAR SQUARE SIEVE OPENINGS: ¾", 3", 6"

SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ⟶)

DRY — SLIGHTLY DAMP — DAMP — MOIST — VERY MOIST — WET (SATURATED)

(PL) (LL)

DEFINITIONS

Penetration Resistance — Blows per foot using 'A' rod and 140 lb. hammer with 30 inch free fall unless otherwise noted.

N Standard Penetration Resistance (ASTM:D1586), 2.0 inch O.D. split barrel sampler.

C Continuous Penetration Resistance, 2.0 inch O.D. Bull Nose.

R Penetration Resistance, 2.42 inch I.D. Ring Sampler

Sample Type

R - Ring T - Shelby Tube S - Standard Split Barrel B - Block
G - Grab C - Cutting V - Vertical Face Cut

CONSISTENCY			RELATIVE DENSITY	
CLAYS & SILTS	BLOWS/FOOT*	STRENGTH‡	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	0-¼	VERY LOOSE	0-4
SOFT	2-4	¼-½	LOOSE	4-10
FIRM	4-8	½-1	MEDIUM DENSE	10-30
STIFF	8-16	1-2	DENSE	30-50
VERY STIFF	16-32	2-4	VERY DENSE	OVER 50
HARD	OVER 32	OVER 4		

* Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-⅜ inch I.D.) split spoon (ASTM D-1588).

‡ Unconfined compressive strength in tons/sq. ft. Read from a pocket penetrometer.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 11+05, 40' left of
centerline

NO. 1 ELEV: 1215.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT C	PENETRATION RESISTANCE BLOWS/FT R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5		37	R	96.2	9.2																									
6																														
7					damp	Silty Sand; Some fine	SM		X	X		X				X		X									X			
8						gravely, brown.																								
9																														
10		17	R	*	*	STRATIFIED:	GC-		X			X				X		X	X								X	X		
1					damp	Sand and Gravel Mixtures;	GM																							
2						Some cobbles; some silt	SC-																							
3						and clay fines; grey-brown.	SM																							
4																														
5		50/7"	S			Some Lenses of:																								
6						Clean Sand and/or																								
7						Gravel (SP, GP)																								
8						Silty Sand (SM)																								
9						Clayey Sand (SC).																								
20		88	S																											
1																														
2																														
3																														
4																														
5		58/6"	S																											
6																														
7																														
8																														
9																														
30		60/6"	S																											
1																														
2																														
3																														
4																														
5		50/3"	S																											
6																														
7																														
8					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
9						Sandy Clay - Clayey Sand;	SC																							
40		100/9"	R	135.8	5.7	Some gravel.																								

*No sample recovery.

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Assoc. Engineers.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 1 ELEV: 1215.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5		100/11"	R	*	*	Some Lenses of:																								
6						Sand & Gravel Mixtures																								
7						(GM, GC, SM, SC).																								
8					damp	STRATIFIED:	CL-			X										X	X				X	X		X		
9						Sandy Silty Clay;	CH																							
50		100/6"	R	102.4	25.2																									
1						Some Lenses of:																								
2						Clayey Sand (SC)																								
3						Silty Sand (SM)																								
4						Gravelly Mixtures (GM,GC)																								
5		100/4"	R	113.0	25.0																									
6																														
7																														
8																														
9																														
60		100/8"	R	102.8	25.8																									
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
70																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 60 feet

Ground water encountered: None

*No sample recovery.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

East shoulder of 67th Avenue
Sta. 9+63, 34' right of
centerline

NO. 2 ELEV: 1217.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: JT DATE: 8-3-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7						Some lenses of Silty Sand																								
8						(SM) below 6 feet.																								
9					damp	STRATIFIED:	GC-		X			X				X		X	X								X	X		
10						Sand & Gravel Mixtures;	GM																							
1						Some cobbles, some silt	SC-																							
2						and clay fines; grey-brown.	SM																							
3																														
4						Some Lenses of:																								
5		23	S			Clean Sand and/or																								
6						Gravel (SP, GP)																								
7						Silty Sand (SM)																								
8						Clayey Sand (SC).																								
9																														
20																														
1																														
2																														
3																														
4					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
5		24	S			Sandy Clay - Clayey Sand;	SC																							
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30						Sand & Gravel Mixtures																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		50/11"	R	124.9	6.0																									
6																														
7																														
8																														
9																														
40																														

- con't -

NOTE: Test boring elevation interpolcated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 2 ELEV: 1217.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-3-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5		50/8"	R	114.6	5.0																									
6						Some Lenses of:																								
7						Sand & Gravel Mixtures																								
8						(GM, GC, SM, SC).																								
9																														
50																														
1					damp	STRATIFIED:	CL-			X										X	X				X	X		X		
2						Sandy Silty Clay;	CH																							
3																														
4						Some Lenses of:																								
5		100/8"	R	105.1	21.8	Clayey Sand (SC)																								
6						Silty Sand (SM)																								
7						Gravelly Mixtures (GM,GC)																								
8																														
9																														
60																														
1																														
2																														
3																														
4																														
5		50/7"	R	115.2	17.2																									
6																														
7					damp	STRATIFIED:	GM-		X			X				X	X	X	X									X		
8						Sand & Gravel Mixtures;	GC																							
9						Some cobbles, some																								
70						silt and clay fines,																								
1						grey-brown.																								
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Test Drilling Refused at: 72 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 9+22, 34' left of
centerline

NO. 3 ELEV: 1214.5 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8					damp	Silty Sand; Some fine	SM		X	X		X				X		X									X			
9						gravel; brown.																								
10					damp	STRATIFIED:	GC-		X			X				X		X	X								X	X		
1						Sand & Gravel Mixtures;	GM																							
2						Some cobbles; some silt	SC-																							
3						and clay fines; grey-brown.	SM																							
4																														
5						Some Lenses of:																								
6						Clean Sand and/or																								
7						Gravel (SP, GP)																								
8						Silty Sand (SM)																								
9						Clayey Sand (SC).																								
20																														
1																														
2																														
3																														
4					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
5						Sandy Clay - Clayey Sand;	SC																							
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30		50/9"	R	*	*	Sand & Gravel Mixtures;																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		59	S																											
6																														
7																														
8																														
9																														
40		35	S																											

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 3 ELEV: 1214.5 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5																														
6						Some Lenses of:																								
7						Sand & Gravel Mixtures																								
8						(GM, GC, SM, SC)																								
9					damp	STRATIFIED:	CL-			X										X	X				X	X		X		
50		50/8"	R	113.0	18.0	Sandy Silty Clay;	CH																							
1																														
2						Some Lenses of:																								
3						Clayey Sand (SC)																								
4						Silty Sand (SM)																								
5						Gravelly Mixtures (GM,GC)																								
6																														
7																														
8																														
9																														
60		50/8"	R	103.1	21.2																									
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
70																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 60 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

East shoulder of 67th Avenue
Sta. 7+80, 34' right of
centerline

NO. 4 ELEV: 1216.0 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-4-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	MED	POOR	GRAIN SHAPE ANGULAR	SUBANGULAR	ROUNDED	SUBROUNDED	RELATIVE DENSITY LOW	MED	HIGH	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	WEAK	MEDIUM	STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8						Some lenses of Silty Sand																								
9						(SM) below 7 feet.																								
10																														
1																														
2																														
3																														
4					damp	STRATIFIED:	GC-		X			X				X		X	X								X	X		
5						Sand & Gravel Mixtures;	GM																							
6						Some cobbles; some silt	SC-																							
7						and clay fines, grey-brown.	SM																							
8																														
9						Some Lenses of:																								
20						Clean Sand and/or																								
1						Gravel (SP, GP)																								
2						Silty Sand (SM)																								
3						Clayey Sand (SC).																								
4																														
5																														
6																														
7																														
8																														
9																														
30		50/6"	R	110.4	7.2																									
1																														
2					damp	STRATIFIED:	CL-			X		X				X			X	X				X	X			X		
3						Sandy Clay - Clayey Sand;	SC																							
4						Some gravel, occasional																								
5		50/8"	R	126.8	13.9	cobbles; brown.																								
6																														
7						Some Lenses of:																								
8						Sand & Gravel Mixtures																								
9						(GM, GC, SM, SC).																								
40		50/10"	R	120.2	3.5																									

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

- con't -

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 4 ELEV: 1216.0 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-4-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT C	PENETRATION RESISTANCE BLOWS/FT R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5		54	R	109.8	3.9																									
6						Some Lenses of:																								
7						Sand & Gravel Mixtures																								
8						(GM , GC, SM, SC).																								
9					damp	STRATIFIED:	CL-			X										X	X				X	X		X		
50		100/4"	R	102.6	23.7	Sandy Silty Clay;	CH																							
1																														
2						Some Lenses of:																								
3						Clayey Sand (SC)																								
4						Silty Sand (SM)																								
5		100/8"	R	104.8	21.7	Gravelly Mixtures (GM,GC)																								
6																														
7																														
8																														
9																														
60		50/6"	R	108.7	22.8																									
1																														
2																														
3																														
4																														
5		50/6"	R	120.1	17.9																									
6																														
7					damp	STRATIFIED:	GC-		X			X				X	X	X	X									X		
8						Sand & Gravel Mixtures;	GM																							
9						Some cobbles, some																								
70		50/6"	R	112.8	5.2	silty and clay fines,																								
1						grey-brown.																								
2																														
3																														
4																														
5		50/9"	R	137.9	8.7																									
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 75 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 7+38, 46' left of
centerline

NO. 5 ELEV: 1215.1 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
1																														
2					damp	Silty Sand; Some fine	SM		X	X		X				X		X								X				
3						gravel, brown.																								
4																														
5																														
6																														
7																														
8					damp	STRATIFIED:	GC-		X			X				X		X	X							X		X		
9						Sand & Gravel Mixtures;	GM																							
20						Some cobbles, some silt	SC-																							
1						and clay fines; grey-brown.	SM																							
2																														
3						Some Lenses of:																								
4						Clean Sand and/or																								
5						Gravel (SP, GP)																								
6						Silty Sand (SM)																								
7						Clayey Sand (SC)																								
8					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
9						Sand Clay - Clayey Sand;	SC																							
30		50/11"	R	107.4	21.2	Some gravel, occasional																								
1						cobbles; brown.																								
2																														
3						Some Lenses of:																								
4						Sand & Gravel Mixtures																								
5						(GM, GC, SM, SC).																								
6																														
7																														
8																														
9																														
40		50/6"	R	122.9	2.6																									

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 5 ELEV: 1215.1 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-29-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT C	PENETRATION RESISTANCE BLOWS/FT R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3					damp	Some gravel, occasional	CL-			X										X	X				X	X		X		
4						cobbles; brown.	CH																							
5						Some Lenses of:																								
6						Sand & Gravel Mixtures																								
7						(GM, GC, SM, SC).																								
8						STRATIFIED:																								
9						Sandy Silty Clay;																								
50		100/8"	R	114.8	16.9																									
1						Some Lenses of:																								
2						Clayey Sand (SC)																								
3						Silty Sand (SM)																								
4						Gravelly Mixtures (GM,GC).																								
5																														
6																														
7																														
8																														
9																														
60		100/9"	R	92.0	32.6																									
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
70																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 60 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

East shoulder of 67th Avenue
Sta. 5+96, 39' right of
centerline

NO. 6 ELEV: 1216.6 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-3-82

DEPTH FT.	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sandy Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9						Some lenses of Silty Sand																								
10						(SM) below 8 feet.																								
1																														
2																														
3					damp	STRATIFIED:	GC-	X			X				X			X	X							X	X		
4						Sand & Gravel Mixtures;	GM																							
5		67	S			Some cobbles; some silt	SC-																							
6						and clay fines; grey-brown.	SM																							
7																														
8						Some Lenses of:																								
9						Clean Sand and/or																								
20						Gravel (SP, GP)																								
1						Silty Sand (SM)																								
2						Clayey Sand (SC)																								
3																														
4					damp	STRATIFIED:	CL-			X	X				X			X	X					X	X		X		
5		50/11"	R	99.1	25.4	Sandy Clay - Clayey Sand;	SC																							
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30						Sand & Gravel Mixtures																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		50/9"	R	124.3	6.1																									
6																														
7																														
8																														
9																														
40																														

- con't -

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

Project No.

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 6 ELEV: 1216.6 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 8-3-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	R	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	MED	POOR	GRAIN SHAPE ANGULAR	SUBANGULAR	ROUNDED	SUBROUNDED	RELATIVE DENSITY LOW	MED	HIGH	PLASTICITY NONE	LOW	MEDIUM	HIGH	CONSISTENCY SOFT	FIRM	STIFF	VERY STIFF	HARD	CEMENTATION NONE	WEAK	MEDIUM	STRONG
41					damp	STRATIFIED:	CL-			X	X					X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles; brown.																								
5		100/10"	R	132.0	2.5																									
6						Some Lenses of:																								
7						Sand & Gravel Mixtures;																								
8						(GM, GC, SM, SC).																								
9																														
50					damp	STRATIFIED:	CL-			X										X	X				X	X		X		
1						Sandy Silty Clay;	CH																							
2																														
3						Some Lenses of:																								
4						Clayey Sand (SC)																								
5		100/4"	R	108.9	21.6	Silty Sand (SM)																								
6						Gravelly Mixtures (GM,GC).																								
7																														
8																														
9																														
60																														
1																														
2																														
3																														
4																														
5		100/9"	R	120.2	17.1																									
6																														
7																														
8																														
9					damp	STRATIFIED:	GC-		X			X				X	X	X	X									X		
70						Sand & Gravel Mixtures;	GM																							
1						Some cobbles, some silt																								
2						and clay fines; grey-brown.																								
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Test Drilling Refused at: 73 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

West shoulder of 67th Avenue
Sta. 5+54, 34' left of
centerline

NO. 7 ELEV: 1214.7 ft.± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-30-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT C	PENETRATION RESISTANCE BLOWS/FT R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
1					damp	Sand Clay; Brown.	CL			X		X								X				X	X		X	X		
2																														
3																														
4																														
5		25	R	107.3	16.3																									
6																														
7																														
8																														
9					damp	Silty Sand; Some fine	SM		X	X		X				X		X									X			
10		19	R	126.2	2.6	gravel, brown.																								
1																														
2																														
3					damp	STRATIFIED:	GC-		X			X				X		X	X								X	X		
4						Sand & Gravel Mixtures;	SC																							
5		50	S			Some cobbles, some silt	GM-																							
6						and clay fines; grey-brown.	SM																							
7																														
8						Some Lenses of:																								
9						Clean Sand and/or																								
20		50/4"	S			Gravel (SP, GP)																								
1						Silty Sand (SM)																								
2						Clayey Sand (SC).																								
3																														
4					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
5		75	S			Sandy Clay - Clayey Sand;	SC																							
6						Some gravel, occasional																								
7						cobbles; brown.																								
8																														
9						Some Lenses of:																								
30		100/9"	R	121.2	16.3	Sand & Gravel Mixtures																								
1						(GM, GC, SM, SC).																								
2																														
3																														
4																														
5		50/11"	R	115.5	3.8																									
6																														
7																														
8																														
9																														
40		50/9"	R	128.7	2.6																									

NOTE: Test boring elevation interpolated from topographic data received from Dashney Associates, Engineers

- con't -

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

SOIL BORING LOG

con't
NO. 7 ELEV: 1214.7 ft. ± SIZE OF HOLE 7 in. FIELD ENGR: J.T. DATE: 7-30-82

DEPTH FT	PENETRATION RESISTANCE BLOWS/FT. C	PENETRATION RESISTANCE BLOWS/FT. R&N	SAMPLE TYPE	DRY DENSITY PCF	MOISTURE CONTENT	DESCRIPTION	SOIL CLASSIFICATION	GRADATION WELL	GRADATION MED	GRADATION POOR	GRAIN SHAPE ANGULAR	GRAIN SHAPE SUBANGULAR	GRAIN SHAPE ROUNDED	GRAIN SHAPE SUBROUNDED	RELATIVE DENSITY LOW	RELATIVE DENSITY MED	RELATIVE DENSITY HIGH	PLASTICITY NONE	PLASTICITY LOW	PLASTICITY MEDIUM	PLASTICITY HIGH	CONSISTENCY SOFT	CONSISTENCY FIRM	CONSISTENCY STIFF	CONSISTENCY VERY STIFF	CONSISTENCY HARD	CEMENTATION NONE	CEMENTATION WEAK	CEMENTATION MEDIUM	CEMENTATION STRONG
41					damp	STRATIFIED:	CL-			X		X				X			X	X					X	X		X		
2						Sandy Clay - Clayey Sand;	SC																							
3						Some gravel, occasional																								
4						cobbles, brown.																								
5		56	R	1279	3.9	Some Lenses of:																								
6						Sand & Gravel Mixtures																								
7						(GM, GC, SM, SC)																								
8					damp	STRATIFIED:	CL-			X										X	X				X	X		X		
9						Sandy Silty Clay;	CH																							
50		50/10"	R	1127	17.5																									
1						Some Lenses of:																								
2						Clayey Sand (SC)																								
3						Silty Sand (SM)																								
4						Gravelly Mixtures (GM,GC).																								
5		50/7"	R	1118	16.2																									
6																														
7																														
8																														
9																														
60		100/9"	R	1228	4.2																									
1																														
2																														
3																														
4																														
5		89	R	1258	4.8																									
6																														
7																														
8					damp	STRATIFIED:	GC-		X			X				X	X	X	X									X		
9						Sand & Gravel Mixtures;	GM																							
70		75	S			Some cobbles; some silt																								
1						and clay fines; grey-brown.																								
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
80																														

Stopped test drilling at: 70 feet

Ground water encountered: None

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test Borings - See Site Plan

Type Auger Cuttings and Drive Samples

Material Subsoil

Sampled By Thompson

TESTED: Gradation and Plasticity Index

RESULTS:

Sample	LL	PI	Sieve Size - 200	100	50	30	16	Accum. % Passing 8	4	3/4"	1"	2"	3"	(1) Class
1; 0'-6'	41	21	71	80	86	90	94	97	100					CL
1; 6'-9'	26	5	36	53	66	71	73	75	76	83	89	100		SC-SM
1; 9'-13'	33	15	27	35	42	46	51	61	69	97	100			SC
1; 13'-37'	38	21	22	26	29	31	36	52	71	98	100			SC
*1; 49'-59'	56	25	79	85	88	90	91	92	94	100				CH
7; 0'-8'	46	28	70	76	80	85	90	94	97	100				CL
7; 8'-12'	19	3	25	30	38	52	65	75	83	100				SM
*7; 24'	42	12	56	72	82	88	92	94	98	100				CL
*7; 49'&59'	24	3	18	24	34	48	64	81	93	100				SM

*Composite of drive samples.

(1) Unified Soil Classification

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source: Test boring 1; 39'-40'

Type: Driven ring sample

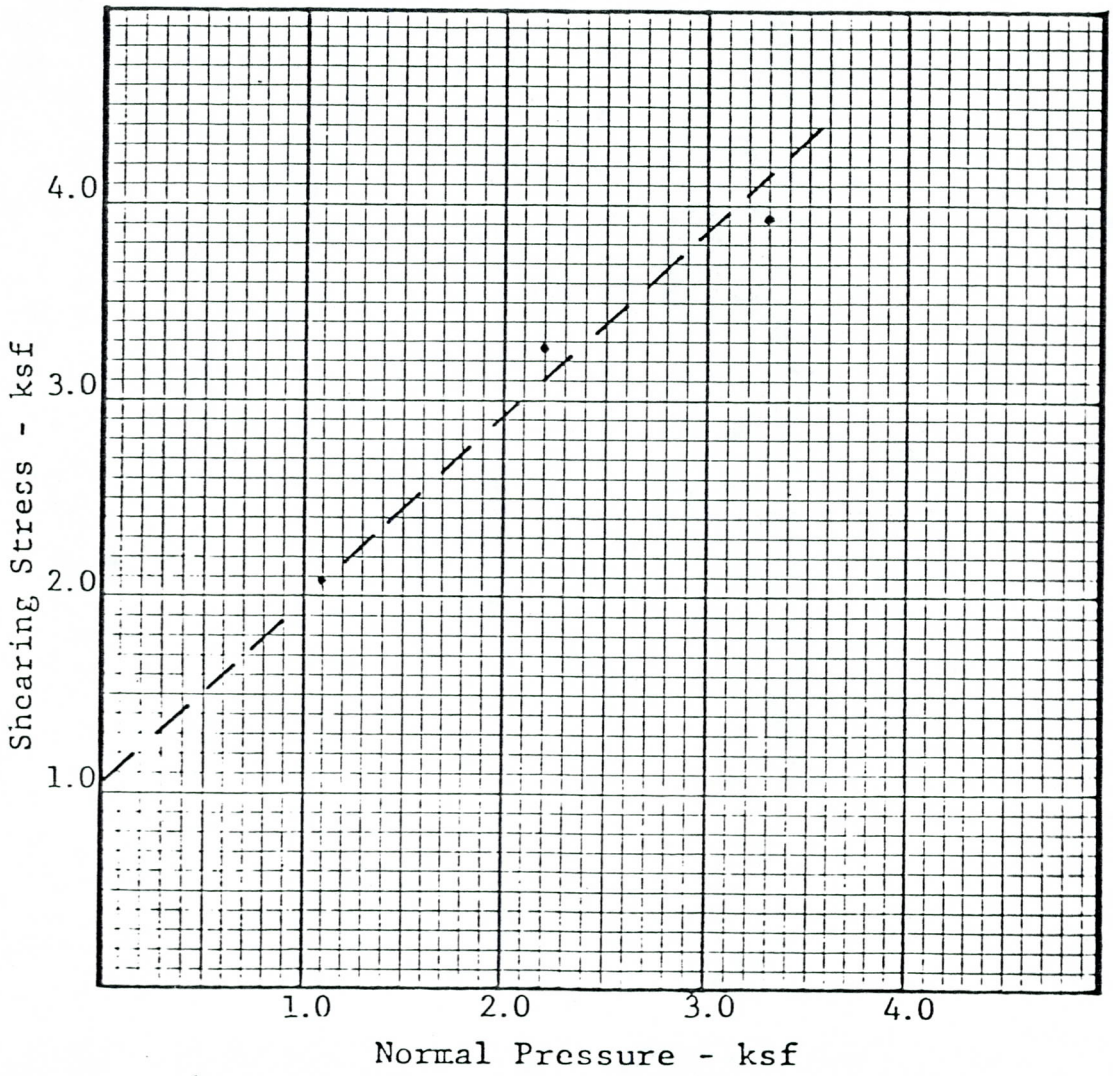
Material: Subsoil; 135.8 pcf dry density; 5.7% field moisture

Sampled By: Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 43° Cohesion (c) = 1.05 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 34'-35'

Type Driven ring sample

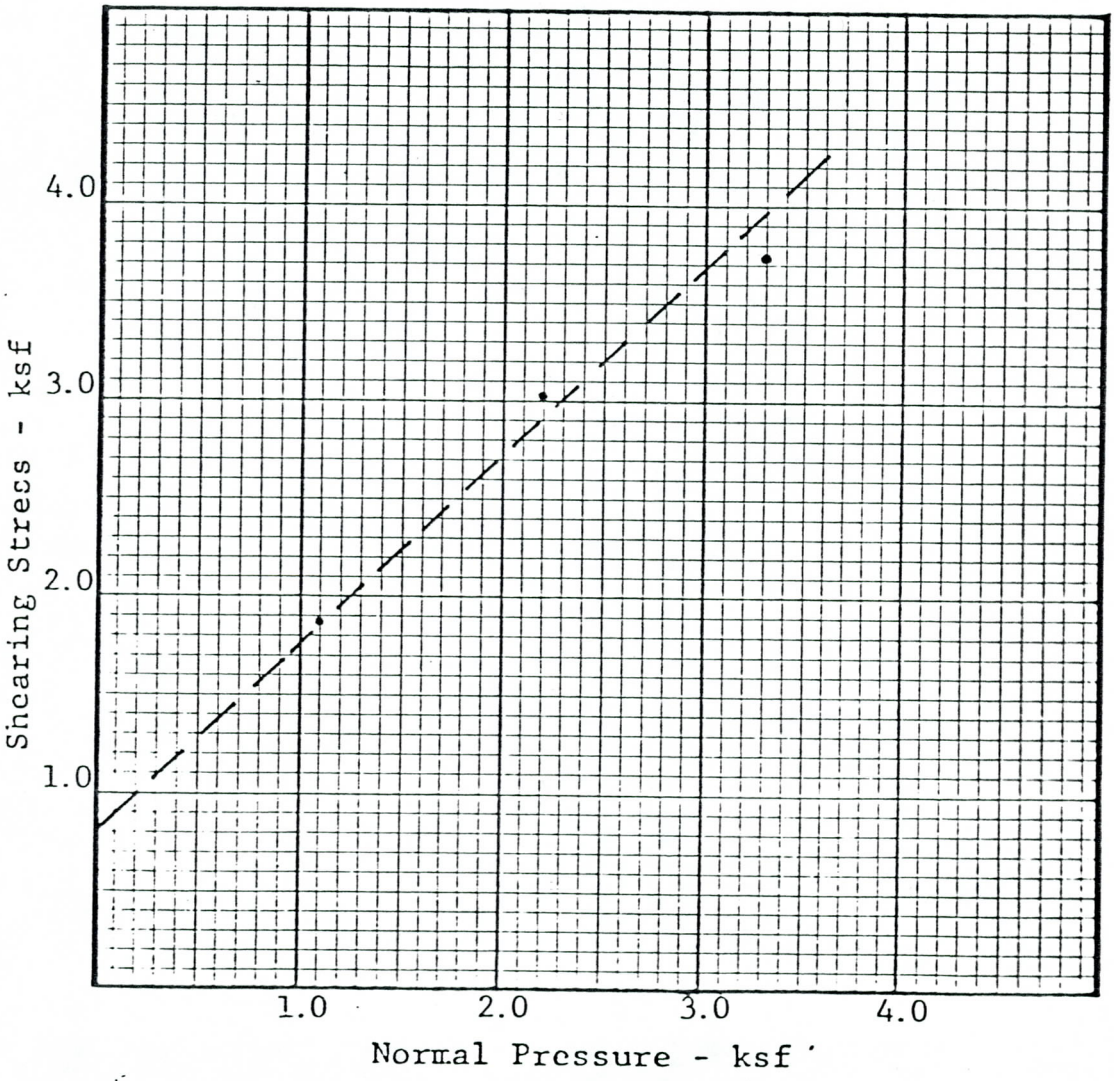
Material Subsoil; 126.8 pcf dry density; 13.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 44° Cohesion (c) = 0.80 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 44'-45'

Type Driven ring sample

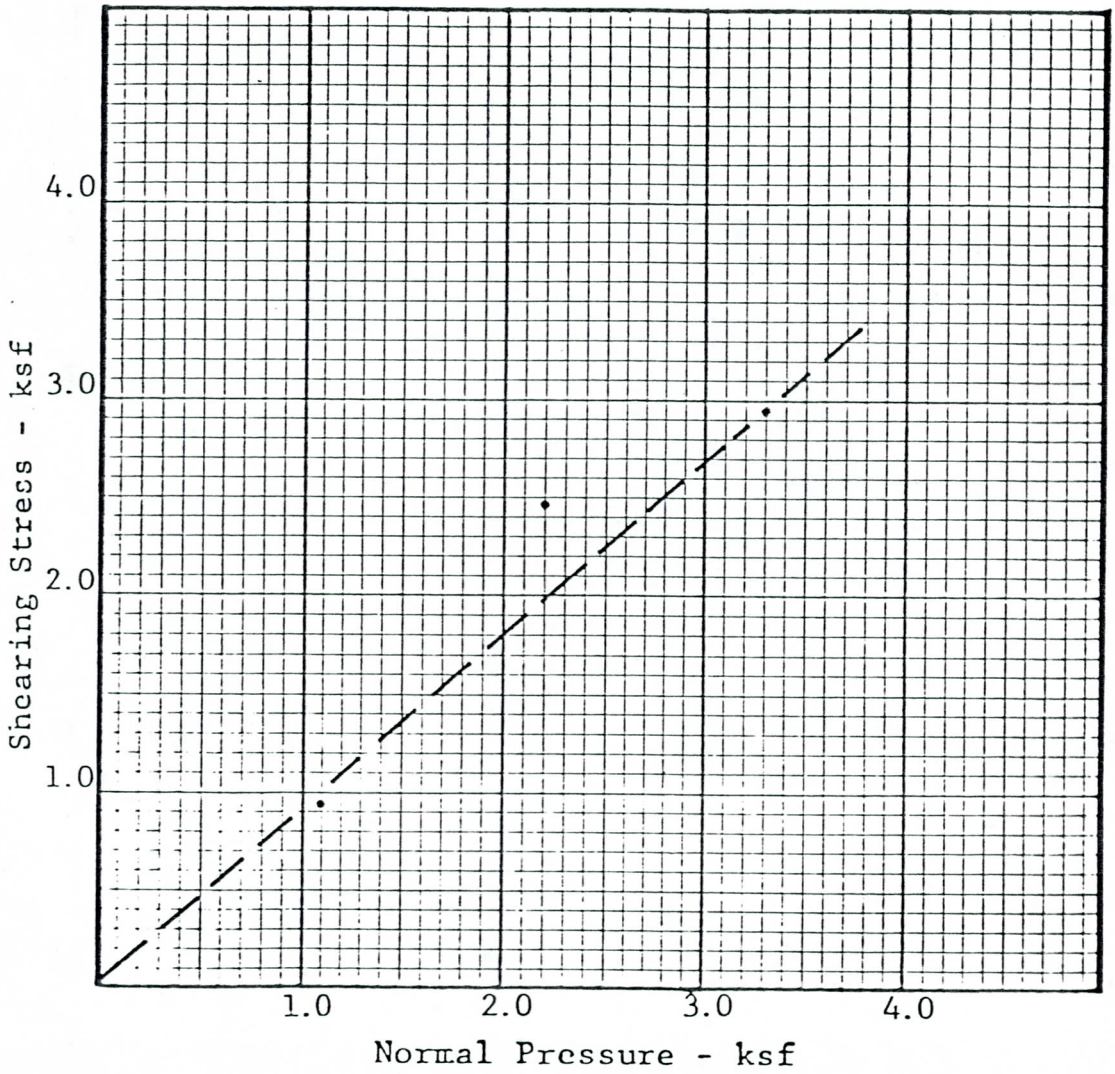
Material Subsoil; 109.8 pcf dry density; 3.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 42° Cohesion (c) = Nil



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source: Test boring 4; 54'-55'

Type: Driven ring sample

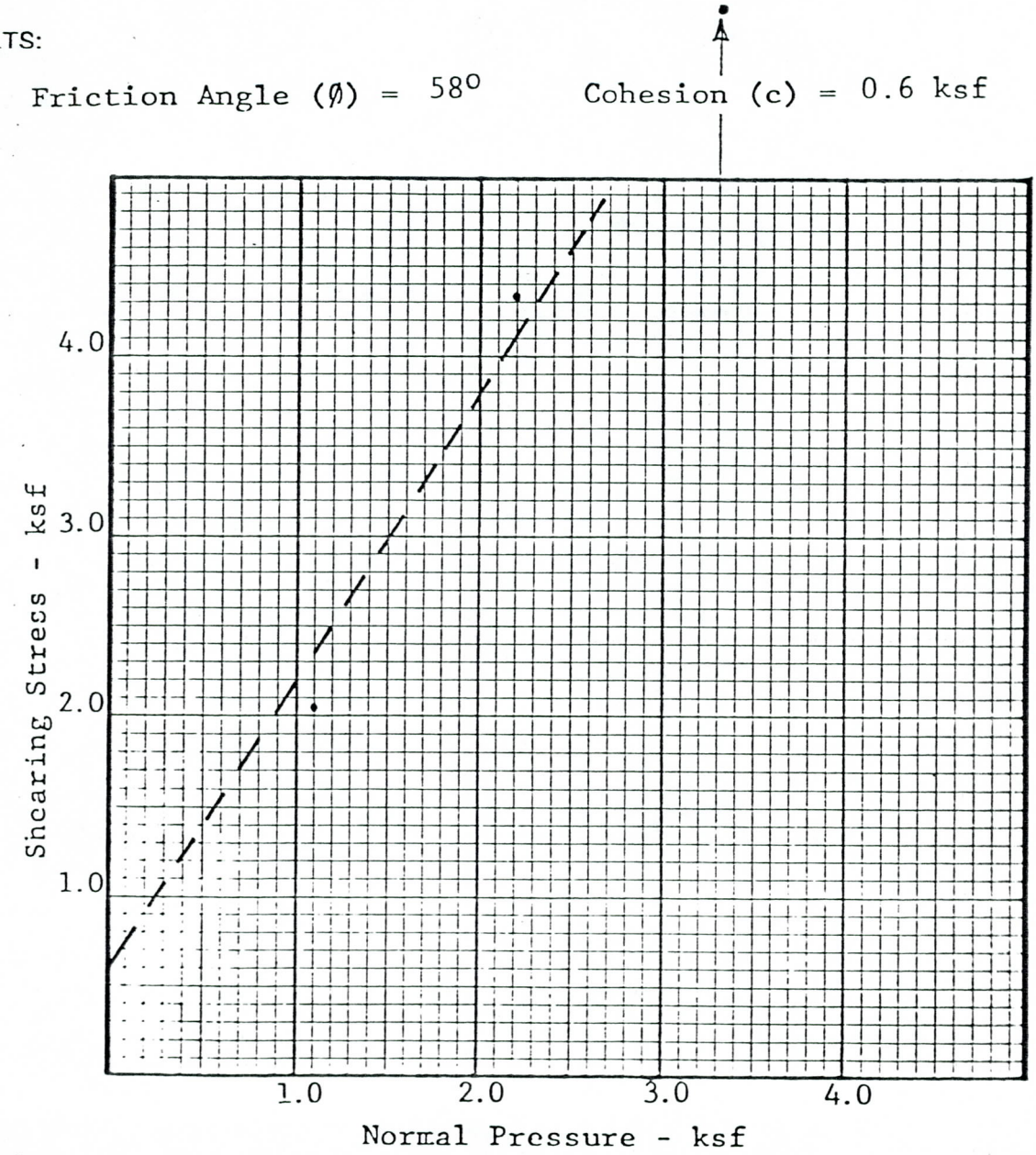
Material: Subsoil; 104.8 pcf dry density; 21.7% field moisture

Sampled By: Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 58° Cohesion (c) = 0.6 ksf



NOTE: Normal pressure 3.3 ksf, shearing stress 5.95 kfs.

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 4; 64'-65'

Type Driven ring sample

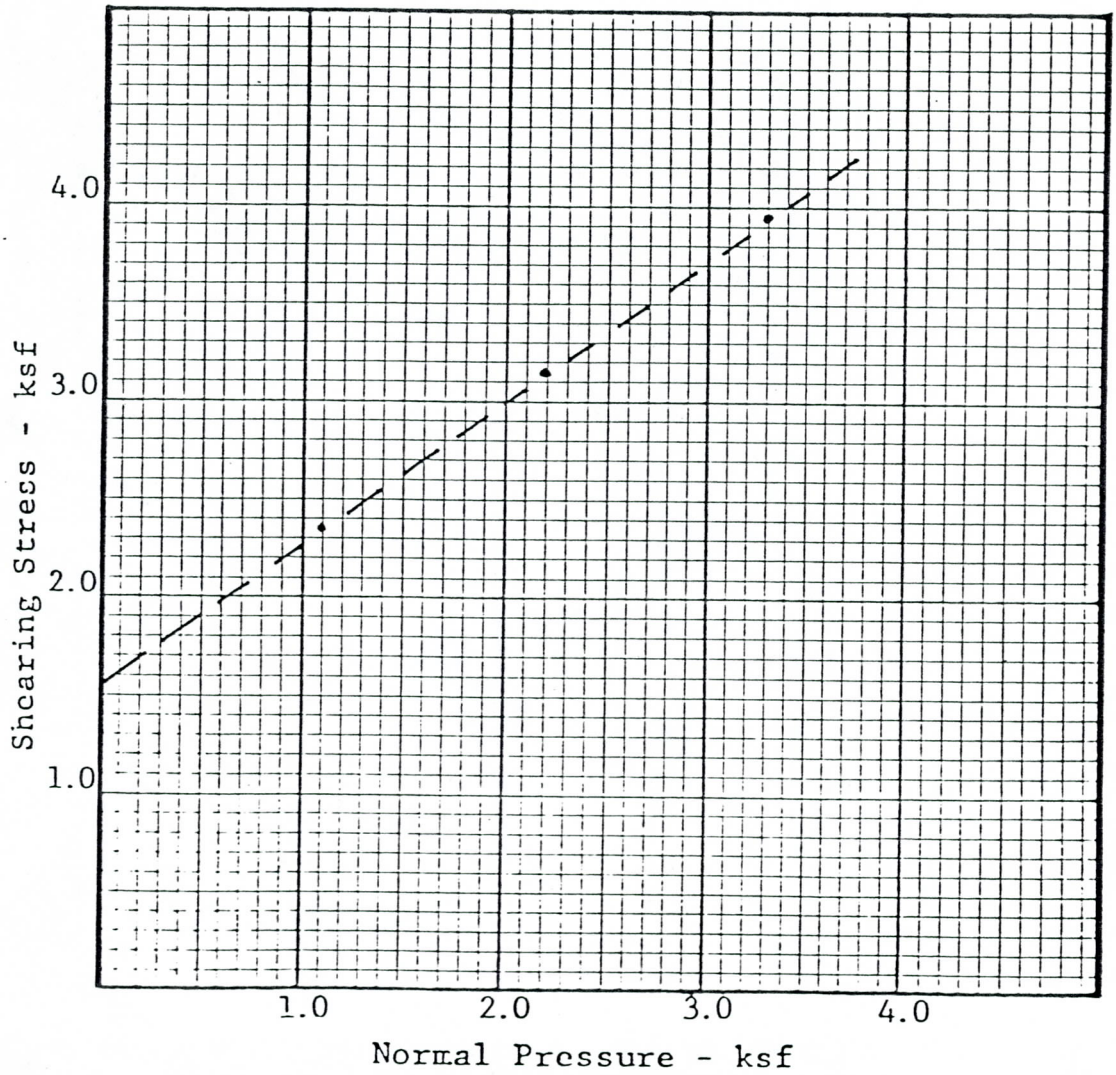
Material Subsoil; 120.1 pcf dry density; 17.9% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition.

RESULTS:

Friction Angle (Ø) = 36° Cohesion (c) = 1.55 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source Test boring 7; 29'-30'

Type Driven ring sample

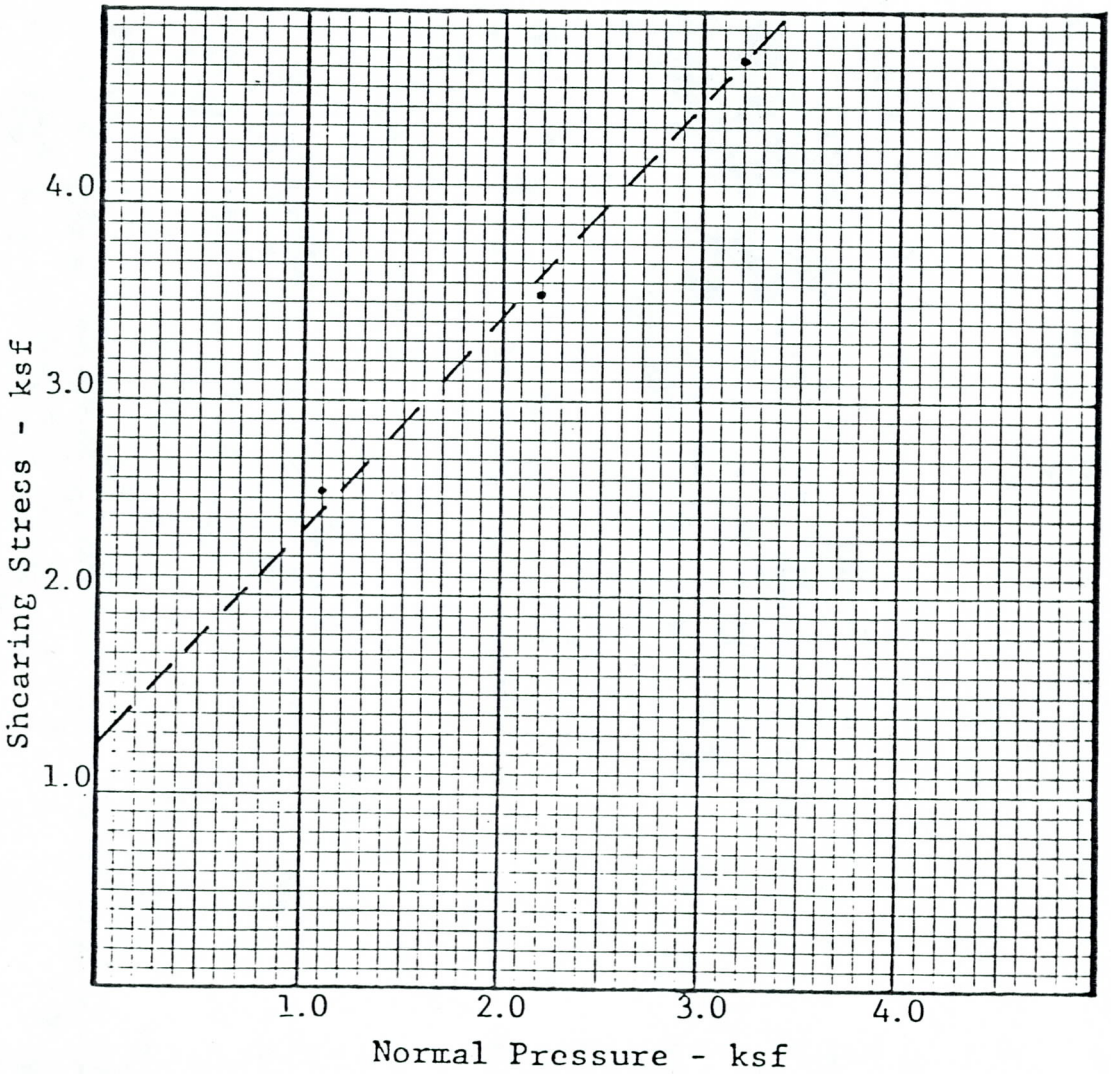
Material Subsoil; 121.2 pcf dry density; 16.3% field moisture

Sampled By Thompson

TESTED: Direct Shear; samples tested in a soaked condition

RESULTS:

Friction Angle (Ø) = 47° Cohesion (c) = 1.25 ksf



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8/16/82

Source: Test boring 7; 44'-45'

Type: Driven ring sample

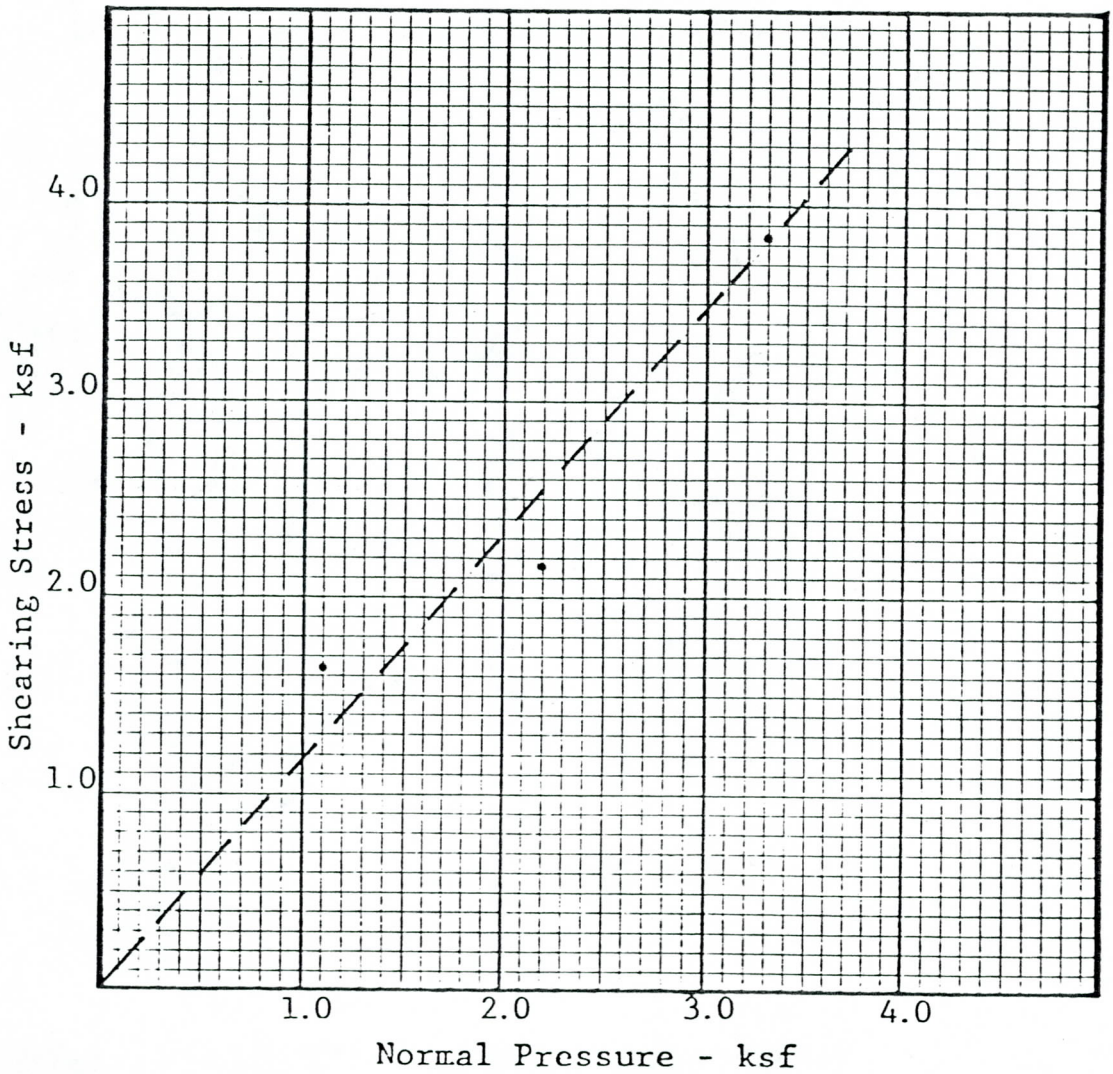
Material: Subsoil; 127.9 pcf dry density; 3.9% field moisture

Sampled By: Thompson

TESTED: Direct Shear; samples tested in a soaked condition

RESULTS:

Friction Angle (Ø) = 50° Cohesion (c) = Nil



Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.

REPORT ON LABORATORY TESTS

SAMPLE: Date 8-24-82

Source 67th Avenue Approach Roadways to Bridge

Type Bulk

Material Pavement Subgrade

Sampled By TH/White

TESTED: Gradation, Plasticity Index and R-Value

RESULTS:

Sample/Location	Percent Passing No. 200 Sieve	Plasticity Index	R Value
#1; Sta. 0+00, 40'left of ceterline	68	20	-
#2; Sta. 5+54, 34'left of centerline	70	28	15
#3; Sta. 11+50, 40'left of centerline	71	21	-
#4; Sta. 14+50, 90'left of centerline	49	11	-
#5; Sta. 18+00, 90'left of centerline	61	13	-

Project No. 82-424

THOMAS-HARTIG & ASSOCIATES, INC.