STRUCTURE REPORT

ON

WIDENING VETERANS MEMORIAL BOULEVARD BRIDGES

CROSSING

SONIAT CANAL

Southeast Louisiana
Urban Flood Control
Jefferson Parish, Louisiana
DPW Project No. 92-008C1-DR

Prepared by
HARTMAN ENGINEERING, INC
Consulting Engineers
Kenner, Louisiana
April 1999

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I. GENERAL

A. Purpose. This report presents the results of the structural analysis of the existing bridges, a preliminary design of the widened bridges and a hydraulic analysis of the effects of the widened bridges on the Soniat Canal as improved for the Southeast Louisiana Urban Flood Control Project in Jefferson Parish (SELA). The report also presents the advantages and disadvantages of the alternatives and a comparison of the projected construction cost of a widened bridge with a flume beneath and culverts.

B. Project Description. Veterans Memorial Boulevard, a four–lane divided roadway, crosses the Soniat Canal in an east-west direction. The eastbound and westbound lanes cross the canal on separate bridges. Both bridges are three-span, simply supported, cast-in-place, reinforced concrete, slab-girder bridges with narrow sidewalks. Pedestrian traffic crosses the Soniat Canal on a paralleling, timber pedestrian bridge, immediately south of the eastbound bridge. The roadway bridges cross the canal at a 70-degree skew. The bridges are 126 feet long, abutment to abutment, with three 42-foot spans. A plan view of the existing bridges is shown on Plate I. Cast-in-place, reinforced concrete bents and abutments on precast concrete piles support the spans. The eastbound bridge was built around 1955 to 1957. The westbound bridge was built in 1962. The proposed project will widen these bridges to carry a six-lane divided roadway, sidewalks and a left turn lane. The pedestrian bridge will be removed. Four lanes of traffic, two eastbound and two westbound, will be maintained at all times during construction.

C. Canal Improvements at the Bridges. The Soniat Canal through the bridges will be improved to a 103-foot wide cast-in-place concrete flume, with four feet of granular backfill behind each wall. The flume will be constructed in a dewatered, cofferdamed excavation. The excavation plus cofferdam thickness is about 117 feet. The available width, normal to the channel, under the bridge is about 114 feet. Initially it was believed that the bridge would need to be lengthened to accommodate the flume. It is now planned to construct the cofferdam, for the flume under the bridges, through the approach slabs, against the outside of the abutments. This allows the flume to be constructed through the bridges with only some minor narrowing of the granular backfill. The bridges do not need to be lengthened.

D. Existing Information. Existing information used in this analysis is as follows:

1. 1962 as-built drawings for the westbound bridge by The Louisiana Department of Transportation and Development (DOTD). Drawings obtained from DOTD.
2. DOTD 1995 and 1997 bridge inspection reports for the westbound bridge. Furnished by the Jefferson Parish Department of Public Works.
3. The DOTD inspection file for the eastbound bridge. Furnished by DOTD.
4. Sketch of the plan view of the widened bridges by Buchart Horn, Inc. Sketch furnished by Brown, Cunningham and Gannuch (BCG), Program Managers, SELA.
5. Hartman Engineering, Inc. (HEI) hydraulic analysis and designed improvements to the Soniat Canal.
6. As-built drawings for the eastbound bridge cannot be found at neither DOTD nor the Parish.

E. Description of Improvements. The sketch of the plan view of the bridge widening is shown as Sketch 1. The sketch represents the requirements for bridges consistent with the roadway improvements currently under design to the east and west of the bridges. As shown, the westbound (north) bridge is widened by adding one traffic lane and a sidewalk to the north side of the bridge and the eastbound bridge (south) bridge is widened by adding a traffic lane and a sidewalk to the south side of the bridge and adding a left turn traffic lane to the north side of the bridge. The westbound bridge will go from a two-lane bridge to a three-lane bridge with a sidewalk on one side. It will have three 12-foot travel lanes, two 4-foot shoulders, New Jersey type, concrete barrier rails on the outsides of the travel lanes, and a sidewalk with railing. The widened westbound bridge is 51 feet and 8 inches wide. The eastbound bridge will go from a two-lane bridge to a four-lane bridge with a sidewalk on one side. The widened bridge will have three 12-foot travel lanes, a 12-foot wide lane to accommodate an extended left turn lane, two 4-foot shoulders, New Jersey type, concrete barrier on the outsides of the traffic lanes, and a sidewalk with railing. The widened eastbound bridge is 63 feet and 8 inches wide. The bridge widening includes construction of 350 feet of improved canal. This is the length of the no-work area left in the Soniat Canal, Reach 29 flume project, to allow for the bridge improvements.

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II. ALTERNATIVES

A. Alternatives Considered. The following alternatives for widening the bridges were studied for this report (hereinafter the alternatives will be identified by the paragraph numbering below, i.e., Alternate 1, Alternate 2, etc.):

1. Add lanes to both the existing eastbound and westbound bridges and construct a flume beneath.
2. Add lanes to the westbound bridge, replace the eastbound bridge and construct a flume beneath.
3. Construct a seven 16-foot by 16-foot barrel, cast-in-place, concrete culvert in the canal and construct the widened road over the culvert.
4. Construct a three-arch, precast, concrete culvert in the canal and construct the widened road over the culvert.

B. Description of Alternatives. As-built drawings for the westbound bridge were obtained from DOTD. No as-built drawings can be found for the eastbound bridge. Analysis of the westbound bridge, as depicted in the as-built drawings, shows that it has the structural capacity to carry current live loads. See Appendix A. The bridge widening will not have a significant effect on the flow in the improved canal. See Appendix B. In the absence of drawings for the eastbound span, one cannot verify the carrying capacity of this bridge. Therefore, one cannot make any representations on the actual adequacy or inadequacy of the eastbound bridge.

1. Given the foregoing, Alternate 1 is presented only for comparison with the other alternatives. It is not considered a valid alternative for construction of bridge widening. The following description describes how the bridge would be widened if the eastbound bridge were adequate. The widening would be accomplished by removing the curbs, sidewalks and concrete railings from the existing bridges. The new lanes and sidewalks would be constructed of precast, prestressed concrete voided slab units spanning between new cast-in-place concrete bents supported on precast, prestressed concrete piling. Because of the overall condition rating of the bridges shown in the bridge inspection reports, the additions would be constructed against the remaining existing bridges, but not connected. The joints on the existing bridge will be cleaned and rehabilitated. The

existing bridge bearing will be repaired or replaced. The widened bridge would be topped with an asphalt overlay to even the surface and compensate for any small differences between existing and new bridge. Two lanes, in each direction, will be kept open for traffic at all times. This requires a temporary one-lane bridge. The concrete flume would be constructed under the widened bridges. A section of the widened bridge are shown on Plate II and III.

2. Alternate 2 is similar to Alternate 1. It differs by removing the existing eastbound bridge, including superstructure, foundations, and approaches. The eastbound bridge is replaced with a new bridge. The new eastbound bridge consists of precast, prestressed concrete voided slab units, spanning between cast-in-place concrete caps founded on precast, prestressed concrete piling. The westbound bridge is widened as described in Alternate 1. A two-lane temporary bridge is required to maintain two lanes of traffic each way during construction. The concrete flume would be constructed under the new and widened bridges.
3. Alternate 3 is replacing the bridges and flume with a seven-barrel cast-in-place concrete culvert. Each barrel will be square, 16 feet wide and 16 feet high. The sequence of construction will allow detour roads to pass two lanes of traffic, each way, all the time.
4. Alternate 4 is replacing the bridges and flume with a three-barrel culvert with a cast-in-place concrete foundation slab and precast concrete walls and arched roof. The culvert will have two 32-foot by 16-foot barrels and a center 36-foot by 16-foot barrel. The sequence of construction will allow detour roads to pass two lanes of traffic, each way, all the time.

C. Evaluation of Alternatives.

1. Alternate 1, Widen Both Bridges — $3,700,000
   a. Advantages. One of the least costly alternatives.
   b. Disadvantages. No structural or geotechnical verification that the eastbound bridge is adequate for current loading as no drawings for the bridge can be found. The existing bridges have an overall DOTD rating of 4 out of 10 on DOTD inspection reports. The bridges are 44 to 37 years old.

2. Alternate 2, Replace Eastbound and Widen Westbound — $4,000,000
   a. Advantages. Replaces the old eastbound bridge.
   b. Disadvantages. The existing bridge has an overall DOTD rating of 4 out of 10 on DOTD inspection reports. The remaining bridge is 37 years old. No economic advantage to a less maintenance intensive culvert.

3. Alternate 3, Cast-in-Place Culvert $3,700,000
   a. Advantages. One of the least costly alternatives. The grade of the road can be adjusted to best suit the most beneficial vertical alignment for the improved roadway. Sequence of construction allows traffic to flow on the existing road until the north and south end sections are constructed. The four lanes can then be detoured over the completed work. This alternative removes the eastbound bridge.
   b. Disadvantages. Longer construction time than precast culverts.

4. Alternate 4, Precast, Prestressed Concrete Culvert $3,700,000
   a. Advantages. One of the least costly alternatives. The grade of the road can be adjusted to best suit the most beneficial vertical alignments for the improved roadway. Shorter construction time than cast-in-place. Sequence of construction allows traffic to flow on the existing road until the north and south end sections are constructed. The four lanes can then be detoured over the completed work. This alternative removes the eastbound bridge.
   b. Disadvantages. Manufactured precast culverts are proprietary.

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III. CONCLUSIONS

A. Conclusions.

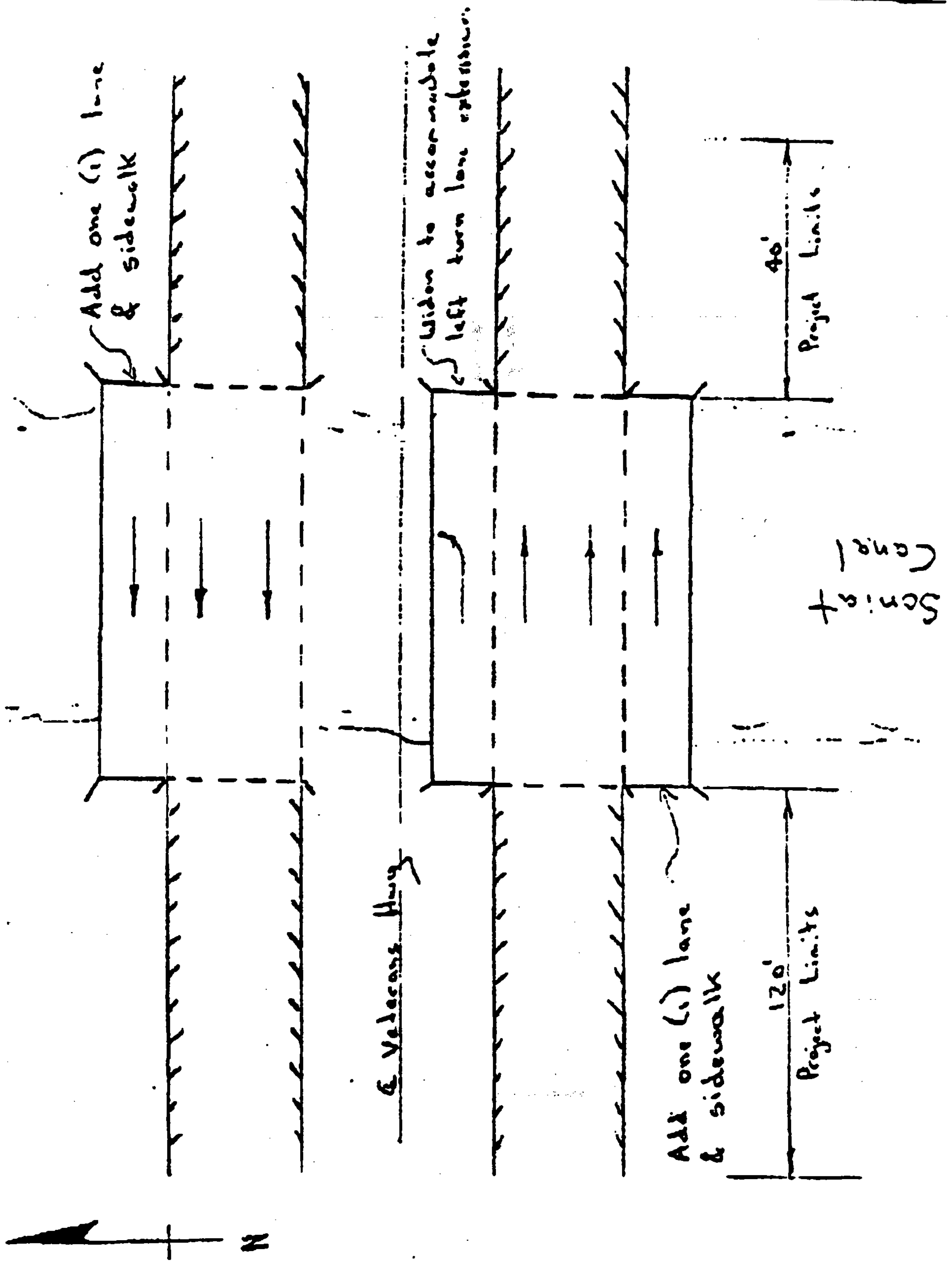
1. The eastbound bridge cannot be widened without review of the construction drawings. The drawings are not available.
2. The westbound bridge is structurally safe for current live loads.
3. The widening of the bridges, by the alternatives presented in this report, will not have a significant effect on the flow in the canal.
4. Culverts are the economical alternative to widening the bridges.

B. Recommendation. It is recommended that the bridges be removed and replaced with culverts in order to provide the required wider roadway at the Soniat Canal crossing. The plans and specifications will allow both cast-in-place and precast culverts.

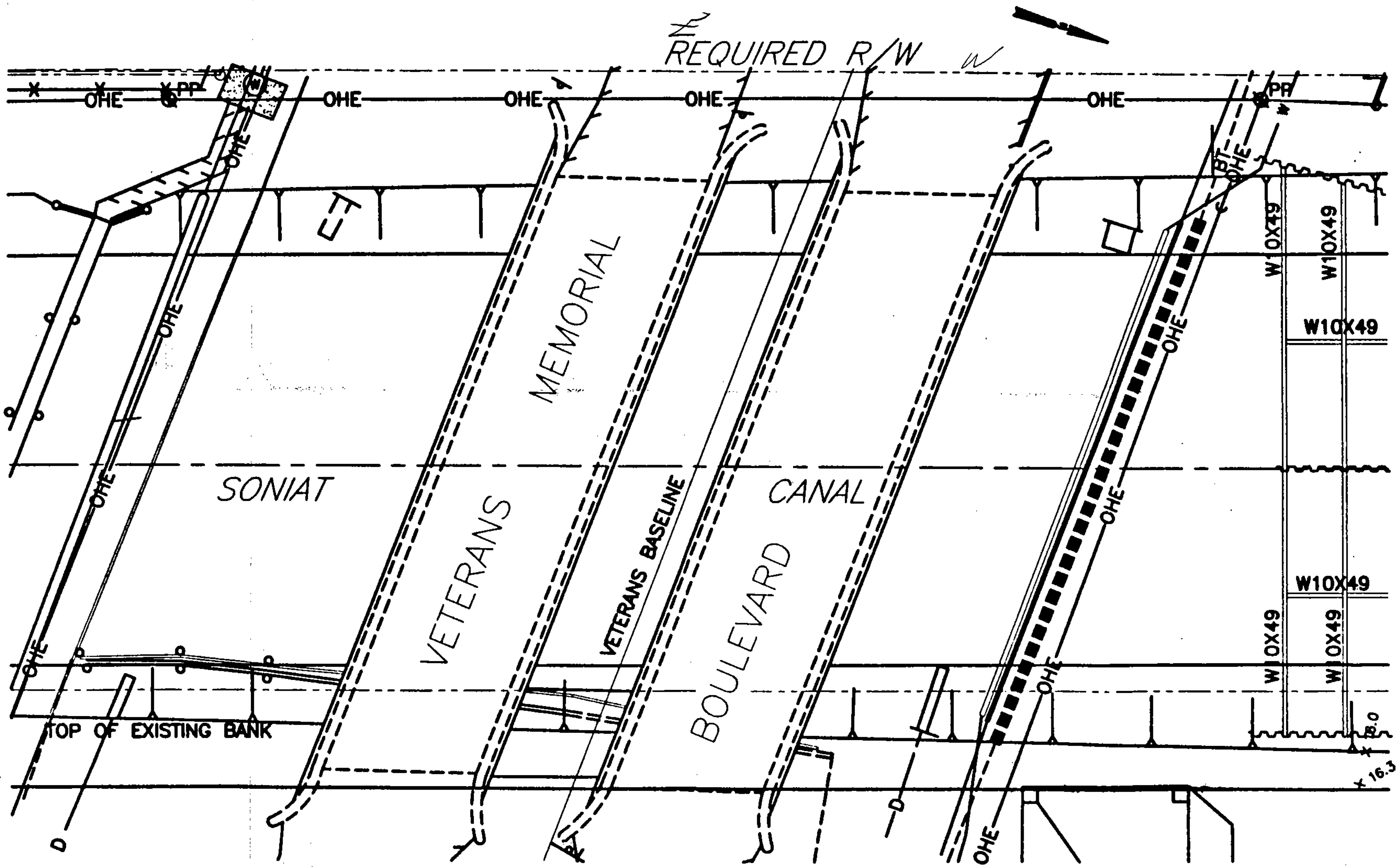
BY ______ DATE ?-5-98 SUBJECT Veterans Hwy Bridges @ Soniat Canal SHEET NO. ____ OF ____

CHKD. BY ______ DATE ______ JOB NO. [illegible]

BUCHART HORN/BASCO ENGINEERS, ARCHITECTS AND PLANNERS



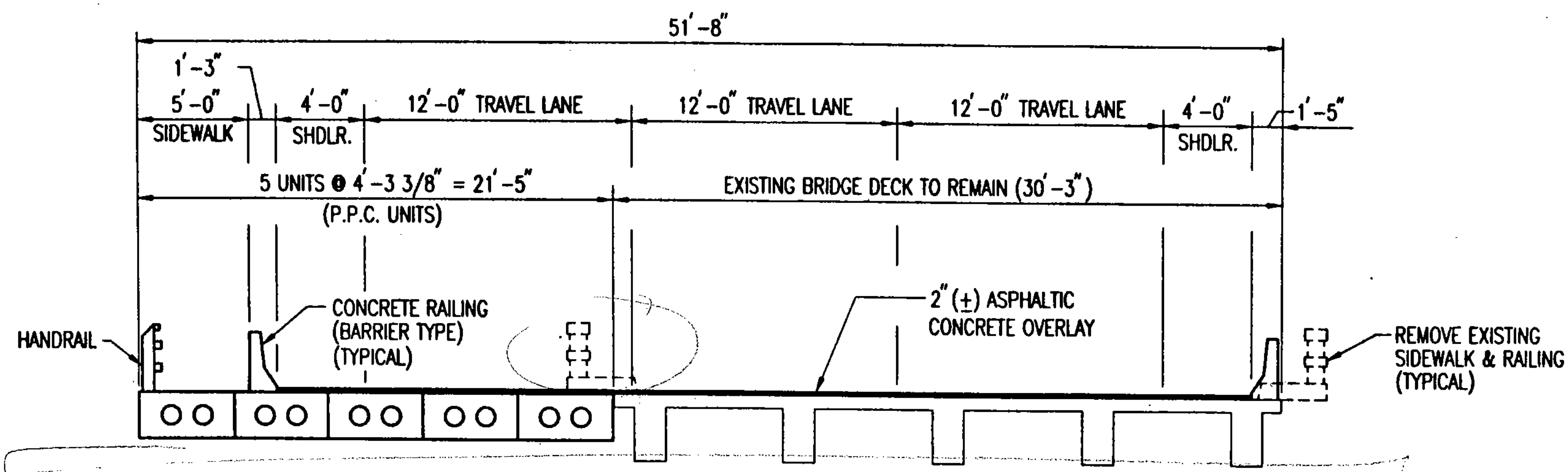
Sketch 1



EXISTING BRIDGES OVER SONIAT CANAL

PLATE I

Hartman Engineering, Inc.

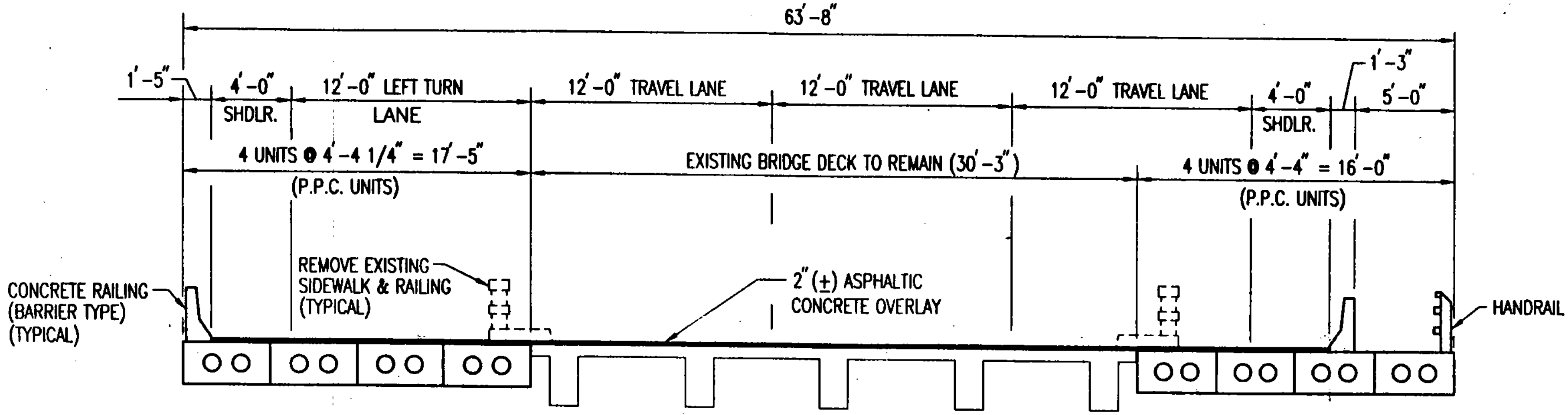


TYPICAL SECTION

WIDENING OF EXISTING WESTBOUND BRIDGE
VETERANS BLVD OVER SONIAT CANAL

PLATE II

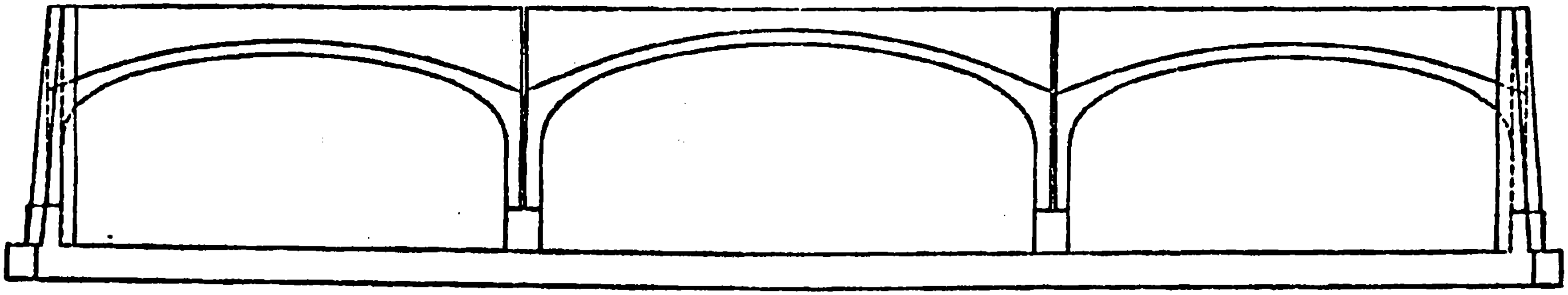
Hartman Engineering, Inc.



TYPICAL SECTION

WIDENING OF EXISTING EASTBOUND BRIDGE
VETERANS BLVD OVER SONIAT CANAL

PLATE III



TYPICAL SECTION
PRECAST CONCRETE CULVERT

Hartman Engineering, Inc.

Plate IV

STRUCTURE REPORT
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APPENDIX A

STRUCTURAL ANALYSIS EXISTING WESTBOUND BRIDGE

2

ANALYSIS OF EXISTING BRIDGES AT VETERANS MEMORIAL BOULEVARD OVER SONIAT CANAL

The purpose of this analysis is to determine if the existing bridges on Veterans Memorial Boulevard over the Soniat Canal are structurally capable of supporting the current live loads required by the Louisiana Department of Transportation and Development (DOTD). The current live loads are the AASHTO HS-20 Truck and the HST-18 Truck. Both are checked in this study.

A set of half-size "as-built" plans was obtained from the DOTD for use in this study. The plans are for the Westbound bridge (the north bridge); the Eastbound bridge (the south bridge) was already in place. Two inspection reports, dated March 31, 1995 and April 24, 1997 for both bridges was reviewed for the analysis.

The bridge slab was analyzed for moment using Load Factor Design (LFD) and Working Stress Design (WSD). The moment capacity of the slab is 9.71 ft-kips per linear foot of slab, using LFD method. The maximum factored moment was computed to be 8.52 ft-kips per foot, 87.7 percent of capacity. The WSD method showed a capacity of 5.16 ft-kips versus a maximum applied moment of 4.02 ft-kips per linear foot of slab, 77.9 percent of capacity. The slab is adequate for currently applied live loads.

The existing grider was analyzed for moment and shear capacity using LFD. The girder was checked as a T-beam, with the contributing slab acting as a compression flange. The factored moment and shear capacities are 1,145.35 ft-kips and 112.42 kips, respectively. The maximum factored applied moment and shear were found to be 1,016.9 ft-kips and 96.6 kips. The girders are adequate for currently applied live loads.

The maximum applied pile load was calculated. The maximum estimated load is 62.6 tons. It was noted on the "as-built" plans that the average pile load was 45 tons. The plans also showed plots of driving resistance versus depth of penetration for two piles. These indicated that resistances of 140 tons were encountered. Using a factor of safety of 2, a design load of 70 tons could be used. This compares favorably with a maximum estimated load of 62.6 tons. It is observed that the north bridge is supported by 24-inch x 24-inch square concrete piles and the south bridge is supported by 18-inch x 18-inch square concrete piles.

The westbound bridge superstructure has the structural capacity to support the current design live loads. The inspection reports showed that there was damage to the bents and abutments due to bearing loads. This can be repaired. There was no damage reported in the superstructure.

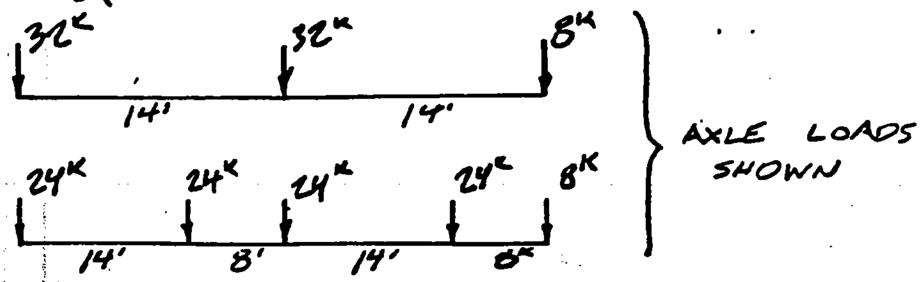
The calculations were done assuming a 3000 psi concrete ultimate compressive strength (f'c) and a 40,000 psi reinforcing steel yield strength (fy).

EXISTING BRIDGE @ VETS. BLVD OVER SONIAT CANAL

LIVE LOADS TO CHECK:

HS-20

HST-18



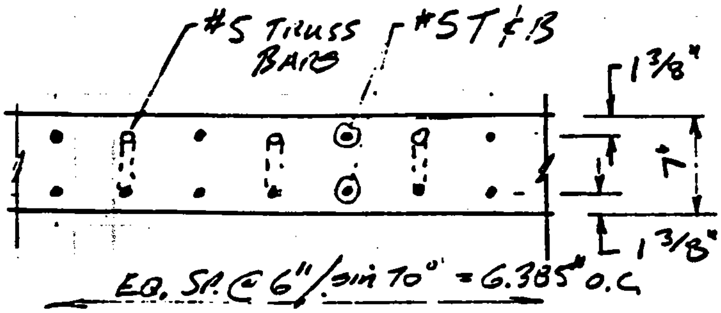
SPAN LENGTH:

℄ JT. − ℄ JT = 42.00'
(−) 2 × BRG. OFFSET = 1.25' (2 × 7½")
SPAN LENGTH = 40.75'

IMPACT: $I = \frac{50}{L+125} \le 0.30$

$= \frac{50}{40.75' + 125} = 0.30$

SLAB CHECK



(4)

$A_s/\text{BAR} = 0.31^{\square''}/\sin 70° = 0.330^{\square''}/\text{BAR}$, $A_s/\text{FT} = 0.330\left(\frac{12}{6.385}\right) = 0.62^{\square''}/\text{FT}$

$d = 7" - 1.375" = 5.625"$

$b = 12"$

$\rho = \frac{0.62}{12 \times 5.625} = 0.00919$

FOR $f'_c = 3$ ksi & $f_y = 40$ ksi: $n = \frac{29{,}000{,}000}{57{,}000(\sqrt{f'_c})} = 9.29 \sim 9.3$

$k = \sqrt{2\rho n + (\rho n)^2} - \rho n$; $\rho n = (0.00919)(9.3) = 0.08542$

$k = 0.337$

$j = 1 - \frac{k}{3} = 0.888$

ALLOWABLE WORKING STRESS

$f_s = 20$ ksi (per AASHTO 8.15.2.2)

$f_c = 0.4 f'_c = 1.2$ ksi (8.15.2.1)

$M = A_s f_s j d$

$= (0.62^{\square''})(20)(0.888)(5.625'')$

$= 61.94^{''\text{-K}}/_1 = 5.16^{'\text{-K}}/_1$ ← GOVERNS

OR $M = \frac{f_c}{2} k j b d^2$

$= \frac{1.2}{2}(0.337)(0.888)(12)(5.625)^2$

$= 68.17^{''\text{-K}}/_1 = 5.68^{'\text{K}}/_1$

DEAD LOAD OF SLAB $= \frac{7}{12}(0.15\text{ ksf}) = 0.0875$ ksf

S = CLEAR SPAN BTW. GIRDERS = (6'-9") − (1'-5") = 5'-4" = 5.333'

$M_{DL} = \frac{1}{12}(0.0875\,^{K}/_{ft})(5.333')^2 = 0.207^{'K}/_1$

∴ LL + I MOMENT CAPACITY = 5.16 − 0.21 = $4.95^{'K}/_1$

$M_{L+I} = (1.3)(0.8)\left(\frac{5.333 + 2}{32}\right)(16^{k}) = 3.81^{'K}/_1 < 4.95^{'K}/_1$

∴ SLAB IS OK. BY WORKING STRESS

CONCSRS.XLS

SLAB BY ULTIMATE STRENGTH (LFD)

	A	B	C	D
1	ANALYSIS OF SINGLY REINFORCED CONCRETE SECTIONS			
2				
3	This worksheet computes the allowable flexural capacity of a singly-reinforced			
4	concrete section in accordance with the ACI 318-89 Specification.			
5				
6				
7	INPUT PARAMETERS			
8	Concrete compressive strength	3	ksi	
9	Yield strength of reinforcing steel	40	ksi	
10	Beam width, b	12	in	
11	Effective depth, d	5.625	in	
12	Area of reinforcing steel	0.62	sq. in.	
13				
14	RESULTS OF COMPUTATIONS			
15	beta1	0.85		
16	Steel ratio	0.00918519		
17	Balanced steel ratio	0.03712057		
18	Minimum steel ratio	0.005		
19	Maximum steel ratio	0.02784043		
20				
21	Depth to rectangular stress block	0.81045752	in.	
22				
23	Nominal moment (Mn)	10.7875272	ft-kips	
24	Design moment (Mu)	9.70877451	ft-kips	

$$M_u = 1.3\left[M_D + \frac{5}{3}(M_{L+I})\right]$$

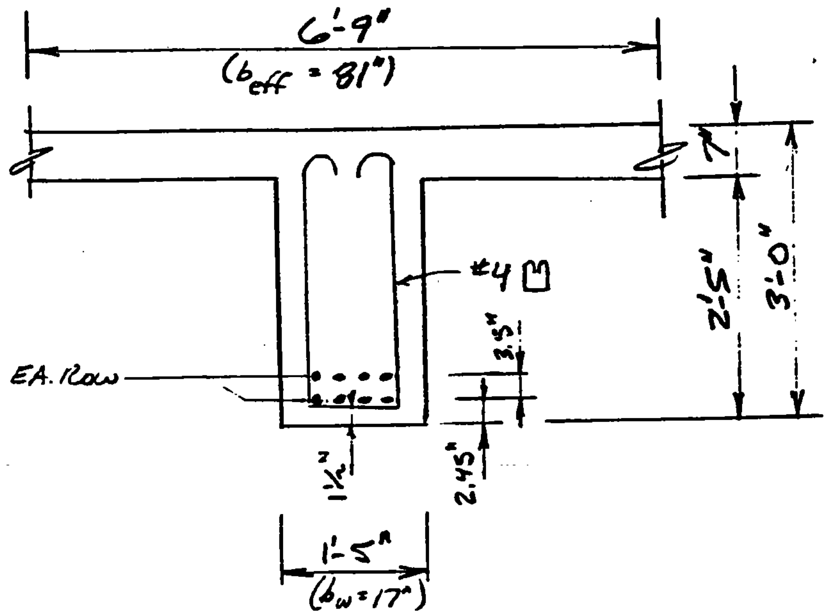
$$= 1.3\left[0.207 + \frac{5}{3}(3.81)\right] = 3.52^{k}/_{1} < 9.71^{k}/_{1}$$

OK. BY STRENGTH ANALYSIS

2

GIRDERS:

INTERIOR



DEAD LOAD = (6.75')(0.0875 K/SF) + (2.4167')(1.4167')(0.15 K/CF) = 1.467 K/LF

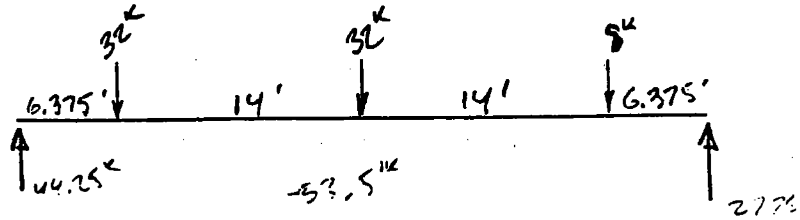
M_{DL} = 1/8 (1.467 K/') (40.75')² = 304.5 ᴵᴷ (W/o DIAPH)

DIAPHRAGM WT = (0.333')(1.9167')((6.75' − 1.4167') / sin 70°)(0.15 K/CF) = 1.36 K

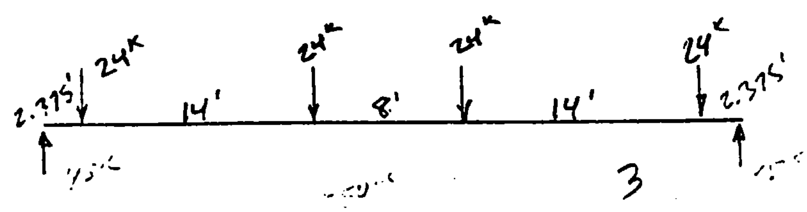
M_{DIAPH} = (1.36 K)(40.75') / 4 = 13.9 ᴵᴷ

LIVE LOAD:

A. HS20 (1 LANE)



B. HST-18 (1 LANE)



5/14

ANALYSIS OF BEAMS

Beam type: Simply supported
Moment of inertia 1
Modulus of elasticity 1

LOADING CASE 1 - HS20

LEFT REACTION = 44.2454 RIGHT REACTION = 27.7546
LEFT END SLOPE = -5813.682 RIGHT END SLOPE = 5211.381

DISTANCE	SHEAR FORCE	MOMENT	DEFLECTION
0.00	44.25	0.00	0.00000E+00
2.04	44.25	90.15	-1.17830E+04
4.07	44.25	180.30	-2.31918E+04
6.11	44.25	270.45	-3.38520E+04
8.15	12.25	303.80	-4.34193E+04
10.19	12.25	328.75	-5.17256E+04
12.23	12.25	353.70	-5.86670E+04
14.26	12.25	378.65	-6.41401E+04
16.30	12.25	403.60	-6.80413E+04
18.34	12.25	428.55	-7.02670E+04
20.38	-19.75	453.50 ← M_{MAX}	-7.07136E+04
22.41	-19.75	413.25	-6.93226E+04
24.45	-19.75	373.00	-6.62160E+04
26.49	-19.75	332.75	-6.15610E+04
28.53	-19.75	292.50	-5.55246E+04
30.56	-19.75	252.25	-4.82739E+04
32.60	-19.75	212.00	-3.99761E+04
34.64	-27.75	169.65	-3.07981E+04
36.67	-27.75	113.10	-2.09234E+04
38.71	-27.75	56.55	-1.05791E+04
40.75	-27.75	0.00	-1.98798E-02

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Beam type: Simply supported
Moment of inertia 1
Modulus of elasticity 1

LOADING CASE 1 - HST18

LEFT REACTION = 48
LEFT END SLOPE = -5883.375

RIGHT REACTION = 48
RIGHT END SLOPE = 5883.375

DISTANCE	SHEAR FORCE	MOMENT	DEFLECTION
0.00	48.00	0.00	0.00000E+00
2.04	48.00	97.80	-1.19197E+04
4.07	24.00	154.80	-2.34531E+04
6.11	24.00	203.70	-3.43439E+04
8.15	24.00	252.60	-4.43892E+04
10.19	24.00	301.50	-5.33857E+04
12.23	24.00	350.40	-6.11307E+04
14.26	24.00	399.30	-6.74210E+04
16.30	24.00	448.20	-7.20536E+04
18.34	-0.00	450.00	-7.48558E+04
20.38	-0.00	450.00	-7.57898E+04
22.41	-0.00	450.00	-7.48558E+04
24.45	-24.00	448.20	-7.20536E+04
26.49	-24.00	399.30	-6.74209E+04
28.53	-24.00	350.40	-6.11307E+04
30.56	-24.00	301.50	-5.33857E+04
32.60	-24.00	252.60	-4.43891E+04
34.64	-24.00	203.70	-3.43439E+04
36.67	-24.00	154.80	-2.34531E+04
38.71	-48.00	97.80	-1.19197E+04
40.75	-48.00	0.00	-2.24433E-02

ANALYSIS OF BEAMS

Beam type: Simply supported
Moment of inertia 1
Modulus of elasticity 1

LOADING CASE 2 - HST18

LEFT REACTION = 53.59509
LEFT END SLOPE = -5654.282
RIGHT REACTION = 42.40491
RIGHT END SLOPE = 5841.718

DISTANCE	SHEAR FORCE	MOMENT	DEFLECTION
0.00	29.60	0.00	0.00000E+00
20.38	5.60	450.00	-7.45207E+04
40.75	-42.40	0.00	0.00000E+00

ANALYSIS OF BEAMS

Beam type: Simply supported
Moment of inertia 1
Modulus of elasticity 1

LOADING CASE 1 - HS20

LEFT REACTION = 55.5092 - V_{max} RIGHT REACTION = 16.4908
LEFT END SLOPE = -3933.399 RIGHT END SLOPE = 3486.602

DISTANCE	SHEAR FORCE	MOMENT	DEFLECTION
0.00	23.51	0.00	0.00000E+00
20.38	-8.49	275.00	-4.83827E+04
40.75	-16.49	0.00	0.00000E+00

DEAD LOAD SHEAR

$$V_{MAX} = \frac{(1.467^{k}/_{l})(40.75')}{2} + \frac{1.36^{k}}{2} = 30.6^{k}$$

LIVE LOAD DISTRIBUTION TO GIRDERS (AASHTO TABLE 3.23.1)

$D = \frac{S}{5.5}$; LL DISTRIBUTION : $M = \frac{6.75'}{2 \times 5.5}(453.5^{'k}) = 278.3^{'k}$

$S = 6.75'$

$V = (\,\text{do}\,)(55.5^{k}) = 34.1^{k}$

TOTAL MOMENT ⇒ $M_D = 304.5^{'k} + 13.9^{'k} = 318.4^{'k}$

$M_{L+I} = 278.3^{k}$

$\Sigma M = 596.7^{k}$

TOTAL SHEAR ⇒ $V_D = 30.6^{k}$

$V_{L+I} = 34.1^{k}$

$\Sigma V = 64.7^{k}$

$$M_u = 1.3\left[318.4^{'k} + \frac{5}{3}(278.3)^{'k}\right] = 1,016.9^{'k}$$

$$V_u = 1.3\left[30.6^{k} + \frac{5}{3}(34.1^{k})\right] = 96.6^{k}$$

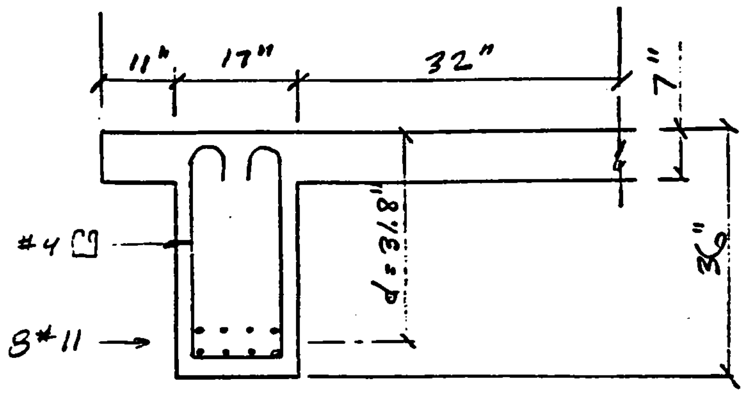
3/25/?? 10/14

	A	B	C	D
1	ANALYSIS OF SINGLY REINFORCED CONCRETE SECTIONS			
2				
3	This worksheet computes the ultimate flexural capacity of a singly-reinforced			
4	concrete section in accordance with the ACI 318-89 Specification.			
5				
6				
7	INPUT PARAMETERS			
8	Concrete compressive strength, f'c	3.00	ksi	
9	Yield strength of reinforcing steel, fy	40.00	ksi	
10	Beam width, bw	17.00	in	
11	Slab width, beff	81.00	in	
12	Effective depth, d	31.80	in	
13	Area of reinforcing steel, As	12.48	sq. in.	
14				
15	RESULTS OF MOMENT COMPUTATIONS			
16	beta1	0.85		
17	Steel ratio	0.0048451		
18	Balanced steel ratio	0.03712057		
19	Minimum steel ratio	0.005		
20	Maximum steel ratio	0.02784043		
21				
22	Depth to rectangular stress block	2.42	in.	
23				
24	Nominal moment (Mn)	1272.61	ft-kips	
25	Design moment (Mu)	1145.35	ft-kips	
26				
27	RESULTS OF SHEAR COMPUTATIONS			
28	Nominal concrete shear (Vnc)	59.22	kips	
29	Design concrete shear (Vuc)	50.34	kips	
30	Stirrup spacing, s	6.00	in	
31	Stirrup steel area, Av	0.40	sq in	
32	Nominal shear taken by stirrups (Vns)	84.80	kips	
33	Design steel shear (Vus)	72.08	kips	
34	Total shear capacity (Vu)	122.42	kips	

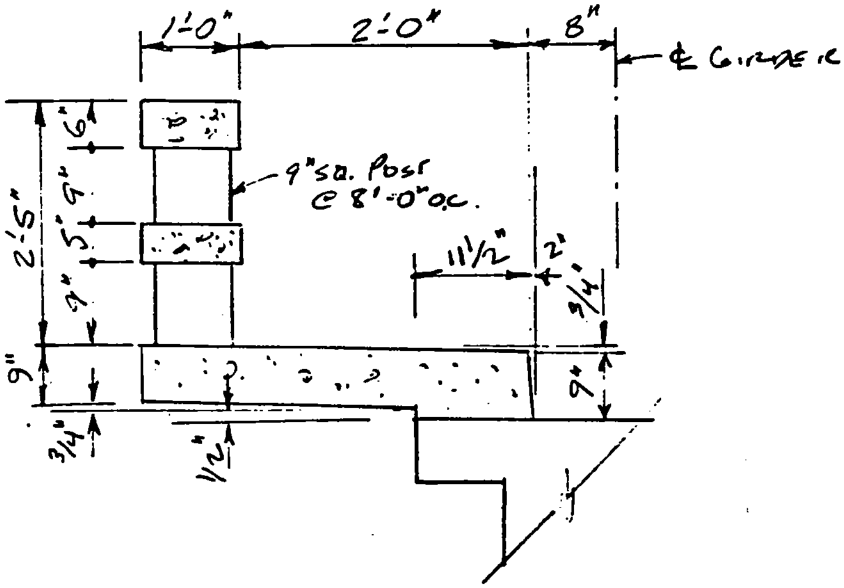
$M_u = 1{,}016.9^{'K} < 1{,}145.35^{'K}$ O.K.

$V_u = 96.6^{K} < 122.42^{K}$ O.K.

EXTERIOR GIRDER



DEAD LOAD:



HANDRAIL : $\frac{(6"+5")}{12"/'}(1')(0.15^k/_{cf})$ = $0.138^k/_{LF}$

POSTS : $\frac{(9")(9")}{144^{s.i}/_{sf}}(0.15^k/_{cf})/8$ = $0.011^k/_{FT}$

SIDEWALK : $(0.75')(3')(0.15^k/_{cf})$ = $0.337^k/_{FT}$

$+(\frac{0.5"}{12"/'})(\frac{11.5"}{12"/'})(0.15^k/_{cf})$ = $0.006^k/_{FT}$

$0.492^k/'$

GIRDER : $(2.4167')(1.4167')(0.15^k/')$ = $0.514^k/'$

SLAB : $\left(\frac{11"+17"+32"}{144^{s.i}/_{sf}}\right)(0.15^k/_{cf})$ = $0.062^k/'$

0.576^k

DEAD LOAD (CONT):

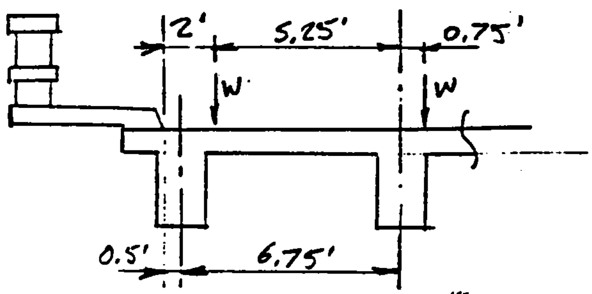
DIAPHRAGM WT $= 1.36^{K}/2 = 0.78^{K}$ @ MIDSPAN

$$M_D = \frac{0.492^{K}/' + 0.576^{K}/'}{8}(40.75')^2 + \frac{(0.78^{K})(40.75')}{4}$$

$$= 229.6^{'K}$$

$$V_D = \frac{1.068^{K}}{2}(40.75) + \frac{0.78^{K}}{2} = 22.15^{K}$$

LIVE LOAD:



$$D.F. = \frac{5.25'}{6.75'}(W) = 0.778\,W$$

W = WHEEL LOAD

$$M_{L+I} = 0.778\left(\frac{453.5^{K}}{2}\right) = 176.4^{'K}$$

$$M_D = \underline{229.6^{'K}}$$

$$406.0^{'K}$$

$$V_{L+I} = 55.5^{K}\left(\frac{0.778}{2}\right) = 21.59^{K}$$

FACTORED: $M_u = 1.3\left[229.6^{'K} + \frac{5}{3}(176.4^{'K})\right] = 680.7^{'K}$

$V_u = 1.3\left[22.15^{K} + \frac{5}{3}(21.59^{K})\right] = 64.78^{K}$

3/24/97
13/14

ANALYSIS OF SINGLY REINFORCED CONCRETE SECTIONS

This worksheet computes the ultimate flexural capacity of a singly-reinforced concrete section in accordance with the ACI 318-89 Specification.

INPUT PARAMETERS		
Concrete compressive strength, f'c	3.00	ksi
Yield strength of reinforcing steel, fy	40.00	ksi
Beam width, bw	17.00	in
Slab width, beff	60.00	in
Effective depth, d	31.80	in
Area of reinforcing steel, As	12.48	sq. in.
RESULTS OF MOMENT COMPUTATIONS		
beta1	0.85	
Steel ratio	0.00654088	
Balanced steel ratio	0.03712057	
Minimum steel ratio	0.005	
Maximum steel ratio	0.02784043	
Depth to rectangular stress block	3.26	in.
Nominal moment (Mn)	1255.01	ft-kips
Design moment (Mu)	**1129.51**	**ft-kips**
RESULTS OF SHEAR COMPUTATIONS		
Nominal concrete shear (Vnc)	59.22	kips
Design concrete shear (Vuc)	50.34	kips
Stirrup spacing, s	6.00	in
Stirrup steel area, Av	0.40	sq in
Nominal shear taken by stirrups (Vns)	84.80	kips
Design steel shear (Vus)	72.08	kips
Total shear capacity (Vu)	**122.42**	**kips**

$M_u = 680.7^{'k} < 1,129.5^{'k}$ O.K.

$V_u = 64.78^{k} < 122.42^{k}$ O.K.

3

REACTION @ PILE TOPS (NOTE: PILES ARE LOCATED DIRECTLY BENEATH ℄ GIRDERS)

A.) INTERIOR BENT

PILE CAP WT. = $(3.5')(2.75'\pm)(7.1667')(0.15^{k}/_{CF}) = 10.35^{k}$

GIRDER REACTION =

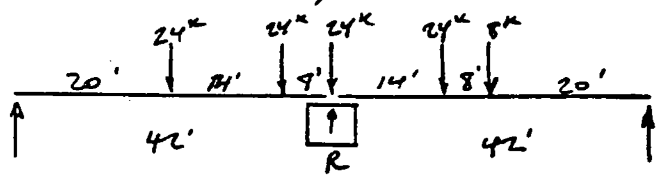
$(42')(1.467^{k}/_{LF}) = 61.61^{k}$

MIDSPAN DIAPHRAGM = $2\left(\frac{1.36^{k}}{2}\right) = 1.36^{k}$

END DIAPHRAGMS = $2(1.36^{k}) = 2.72^{k}$

DL = 65.69^{k}

LIVE LOAD (BY OBSERVATION, HST-18 PRODUCES MAXIMUM LOAD)



$R = \left(\frac{20'+34'+28'}{42'}\right)(24^{k}) + 24^{k} + \left(\frac{20'}{42'}\right)(8^{k}) = 74.67^{k}/_{LANE}$

(L + I) PILE REACTION $= (1.3)\left(\frac{6.75}{2\times 5.5}\right)(74.67^{k}) = 59.57^{k}$

TOTAL REACTION $= 125.26^{k}$

$= 62.63^{T}$

A NOTE APPEARS ON SHT. NO. 106 OF THE AS-BUILT PLANS STATES THAT THE "AVERAGE PILE LOAD = 45.0 TONS," CONSIDERABLY LESS THAN THE 62.6 TONS COMPUTED ABOVE. HOWEVER, TWO PLOTS SHOWING DRIVING RESISTANCE VS. DEPTH OF PENETRATION INDICATED THAT DRIVING RESISTANCES OF AT LEAST 140 TONS WERE ACHIEVED. USING THIS AS AN ULTIMATE LOAD WITH A FACTOR OF SAFETY OF 2, A DESIGN PILE LOAD OF 70 TONS COULD BE USED. ∴ PILES ARE OK.

STRUCTURE REPORT
ON
WIDENING VETERANS MEMORIAL
BOULEVARD BRIDGES
CROSSING
SONIAT CANAL

APPENDIX B

HYDRAULIC ANALYSIS
WIDENED BRIDGES

5

HYDRAULIC ANALYSIS OF THE PROPOSED VETERANS BOULEVARD BRIDGES AT THE SONIAT CANAL IN METAIRIE, LOUISIANA

The Soniat Canal between the West Napoleon Canal and Canal #3 is designed as a concrete U-frame section having a width of 103 feet. This analysis considers the widening of the two Veterans Boulevard bridges across the Soniat Canal, centered at Canal Stations 183+27 and 184+17. Figure 1 is a schematic of the analyzed canal reach showing the locations of the cross sections and the proposed bridges.

The plan provides for the design U-frame section to continue under the widened bridges, with the only impediments to smooth flow being two rows of square 24-inch supporting piles, aligned with the channel in the same configuration as the existing bridges. Each proposed bridge would be 57 feet wide normal to the direction of flow to accommodate three traffic lanes and a sidewalk.

The HEC-RAS computer model was used to calculate the water surface profiles through and beyond the bridges for the 10-Year Design Storm condition of 5000 cubic feet per second, beginning at a water surface elevation of 15.85 feet Cairo Datum 83 feet downstream of the westbound bridge. The attachments show the calculated profile.

The graphical and tabular summaries of the water surface profiles indicate that widening the bridge will not impose a significant head loss in the Soniat Canal. The calculated total increases in the water surface elevation between the downstream and upstream approach sections of 0.06 and 0.07 foot, respectively, were less than the corresponding rise in the design invert elevation of 0.08 foot.

To: Carl Anderson (Project Engineering)

From: Clyde Barre' (Hydraulic Design)

Subject: Design Data in Reaches 28 & 29 for Hartman Engineering

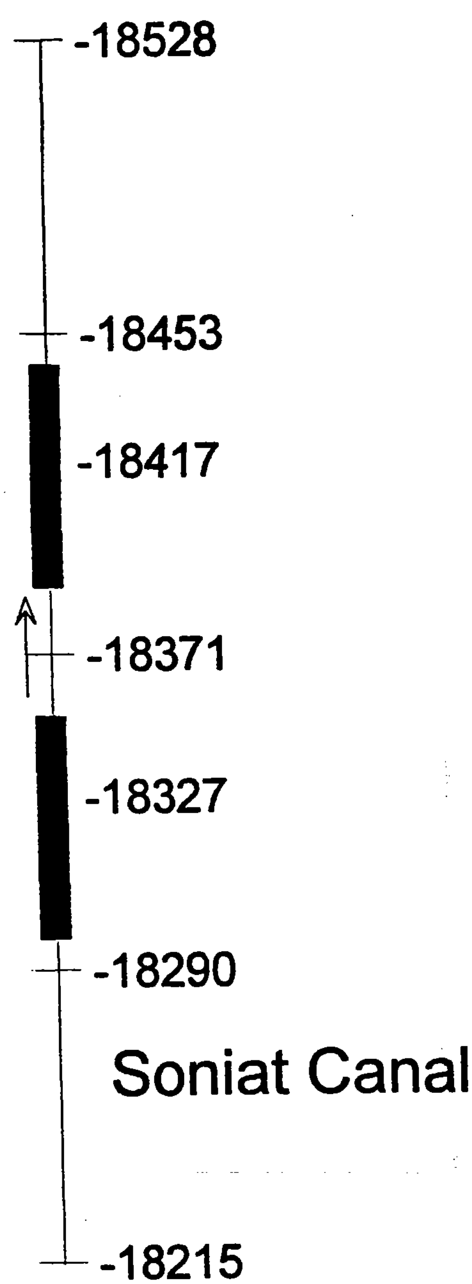
	Water Surface Elevation (Ft. - Cairo Datum)			Peak Discharge (cfs)		
	10 Year	50 Year	100 Year	10 Year	50 Year	100 Year
Canal No. 3	15.6	16.4	16.6	5000	5450	5600
W. Napoleon	16.0	16.9	17.1	4800	5310	5500
W. Metairie	16.2	17.5	18.0	4800	5310	5500

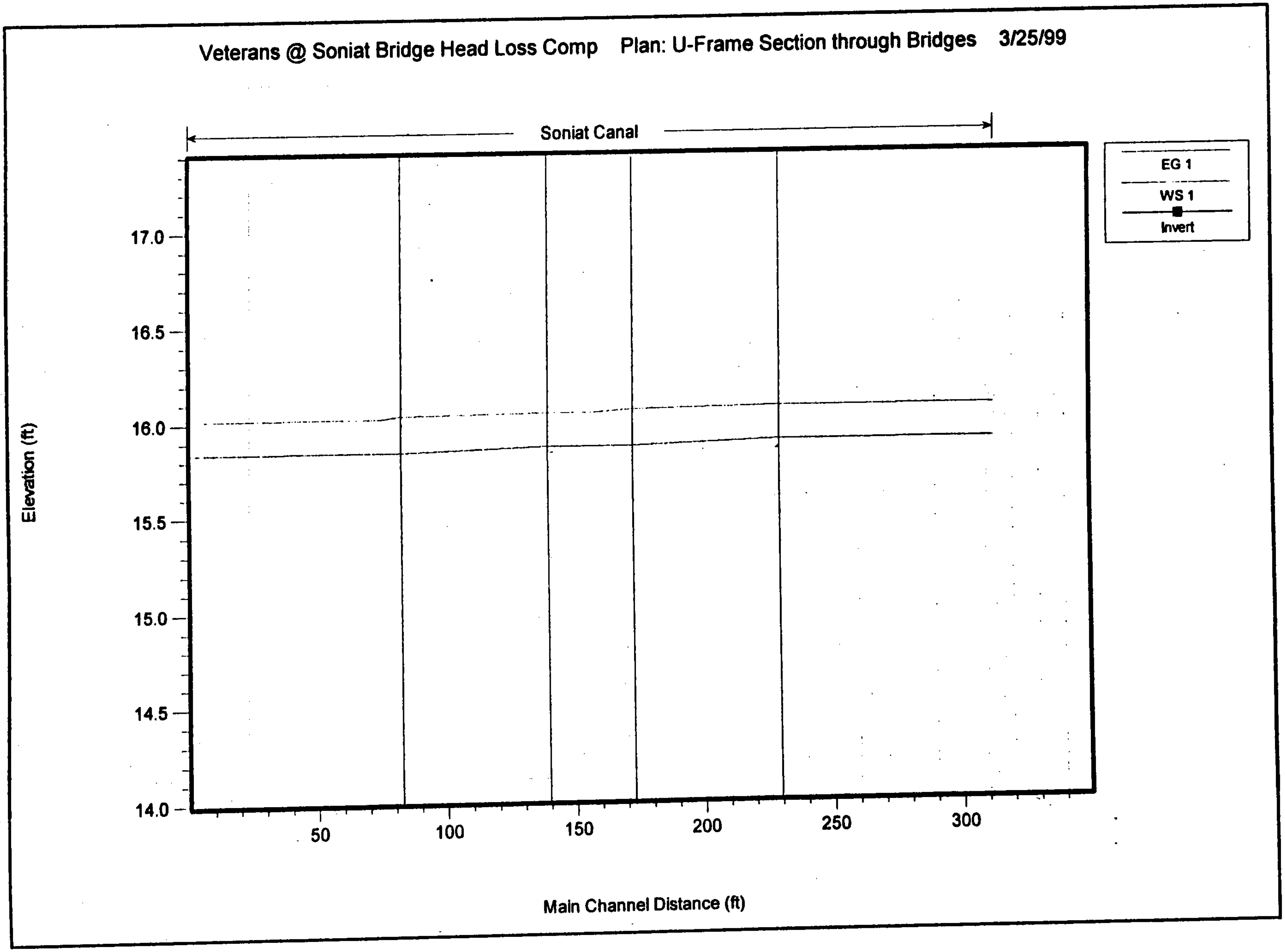
	T.O.B. (Ft. – Cairo Datum)	B.W. (Ft.)	Beginning Inv. (Ft. – Cairo Datum)	Slope (ft/ft)
Reach 28	17.0	96	3.2 @ W. Met	0.00008
Reach 29	16.5	108	2.9 @ W. Nap	0.00008

2.5 @ Canal #3

TOTAL P.02

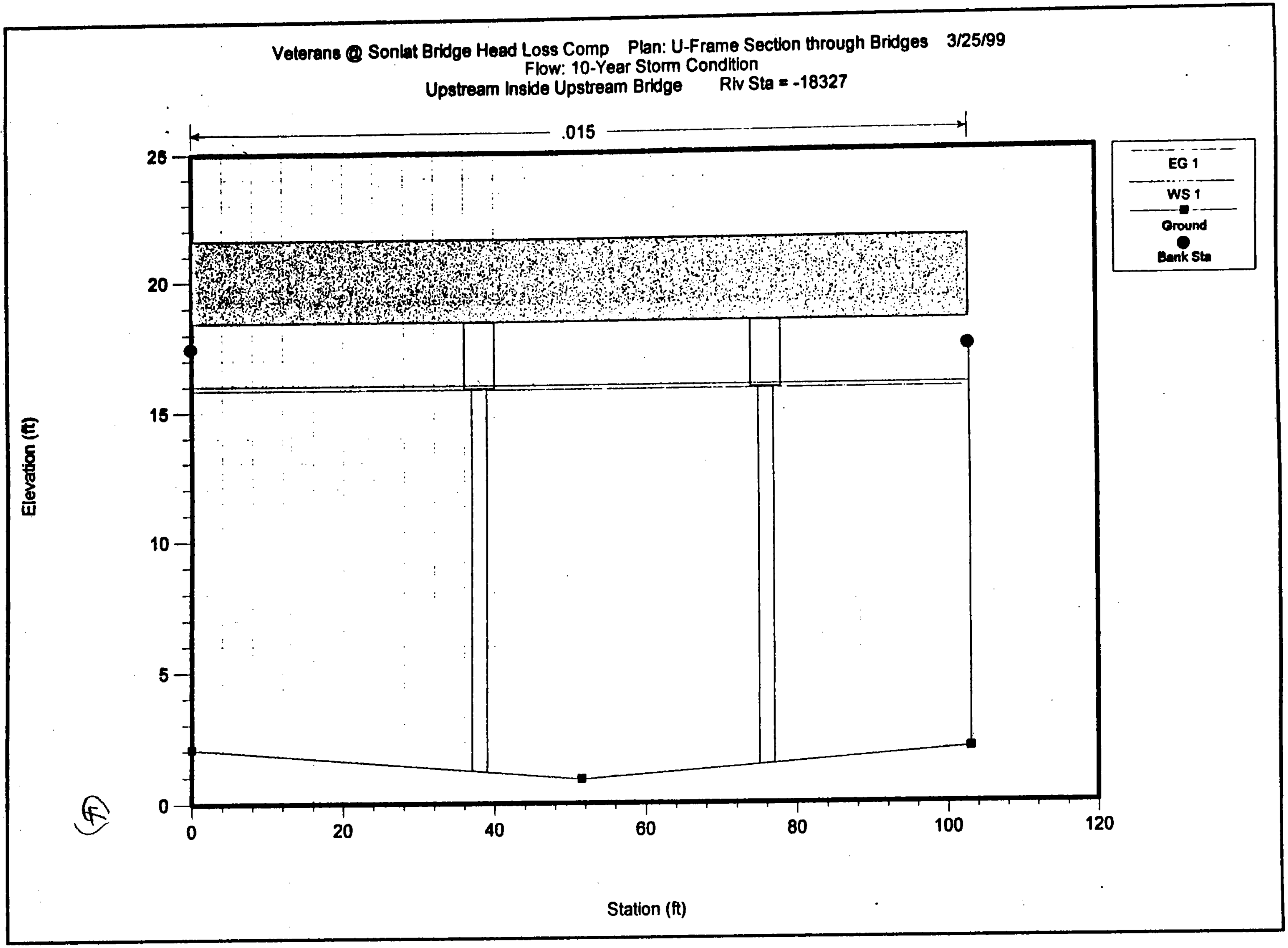
1


-18528
-18453
-18417
-18371
-18327
-18290
Soniat Canal
-18215



Veterans @ Soniat Bridge Head Loss Comp   Plan: U-Frame Section through Bridges   3/25/99
Soniat Canal
EG 1
WS 1
Invert
17.0
16.5
16.0
15.5
15.0
14.5
14.0
Elevation (ft)
50
100
150
200
250
300
Main Channel Distance (ft)

3


Veterans @ Sonlat Bridge Head Loss Comp   Plan: U-Frame Section through Bridges   3/25/99
Flow: 10-Year Storm Condition
Upstream Inside Upstream Bridge   Riv Sta = -18327
.015
EG 1
WS 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
5
10
15
20
25
0
20
40
60
80
100
120

STRUCTURE REPORT
ON
WIDENING VETERANS MEMORIAL BOULEVARD BRIDGES CROSSING SONIAT CANAL

APPENDIX C

OPINION OF PROBABLE CONSTRUCTION COST

Hartman Engineering, Inc.
Consulting Engineers
Kenner, Louisiana

VETERANS MEMORIAL BLVD. BRIDGES OVER SONIAT CANAL OPINION OF PROBABLE CONSTRUCTION COST

April 23, 1999

PROJECT : PRECAST CONCRETE CULVERTS

Feature: Channels and Canals

Item No.	Item	Quanity	Unit	Unit Price	Total Price
1	Mob and Demob	1	LS	120,000.00	$120,000
2	Demolition	1	LS	13,800.00	13,800.00
3	Excavation	12,633	Cu.Yd	6.00	75,798.00
4	Clearing and Grubing	1	LS	15,000.00	15,000.00
5	Cofferdam	38,500	Sq.Ft.	12.00	462,000.00
6	Dewatering	1	Job	300,000.00	300,000.00
7	Detours	3,200	Sq.Yd.	20.00	64,000.00
8	Culvert Foundation Slab Concrete	3,228	Cu.Yd	200.00	645,600.00
9	Precast Concrete Culvert	1	job	891,000.00	891,000.00
10	Flume Transition Concrete	960	Cu.Yd	220.00	211,200.00
11	Granular Backfill	1,600	Cu.Yd	40.00	64,000.00
12	Backfill	5,051	Cu.Yd	8.00	40,408.00
13	Final Roadway	4,000	Sq.Yd	50.00	200,000.00
					S
	Total				$3,102,806.00
	20%+/- Contingency				597,194.00
	TOTAL PROJECTED CONSTRUCTION COST				**$3,700,000**

Hartman Engineering, Inc.
Consulting Engineers
Kenner, Louisiana

VETERANS MEMORIAL BLVD. BRIDGES OVER SONIAT CANAL
OPINION OF PROBABLE CONSTRUCTION COST

April 23, 1999

PROJECT : SEVEN 16'x16' CULVERTS

Feature: Channels and Canals

Item No.	Item	Quanity	Unit	Unit Price	Total Price
1	Mob and Demob	1	LS	120,000.00	120,000.00
2	Demolition	1	LS	13,800.00	13,800.00
3	Excavation	12,633	Cu.Yd	6.00	75,798.00
4	Clearing and Grubing	1	LS	15,000.00	15,000.00
5	Cofferdam	38,500	Sq.Ft.	12.00	462,000.00
6	Dewatering	1	Job	300,000.00	300,000.00
7	Detours	3,200	Sq.Yd	20.00	64,000.00
8	Culvert Concrete	7,128	Cu.Yd	220.00	1,568,160.00
9	Flume Transition Concrete	960	Cu.Yd	220.00	211,200.00
10	Backfill	6,651	Cu.Yd	8.00	53,208.00
11	Final Roadway	4,000	Sq.Yd	50.00	200,000.00
	Total				$3,083,166.00
	20%+/- Contingency				616,834.00
	TOTAL PROJECTED CONSTRUCTION COST				**$3,700,000**

Hartman Engineering, Inc.
Consulting Engineers
Kenner, Louisiana

VETERANS MEMORIAL BLVD. BRIDGES OVER SONIAT CANAL OPINION OF PROBABLE CONSTRUCTION COST

April 23, 1999

PROJECT: WIDEN WESTBOUND BRIDGE AND REPLACE EASTBOUND BRIDGE

Feature: Channels and Canals

Item No.	Item	Quantity	Unit	Unit Price	Total Price
1	Mob and Demob	1	LS	100,000.00	$100,000.00
2	Precast Concrete Span	10,300	Sq.Ft.	45.00	463,500.00
3	Excavation	12,107	Cu.Yd	12.00	145,284.00
4	Clearing and Grubbing	1	LS	15,000.00	15,000.00
5	Cofferdam	38,500	Sq.Ft.	12.00	462,000.00
6	Dewatering	1	Job	300,000.00	300,000.00
7	Detours	3,200	Sq.Yd.	20.00	64,000.00
8	Concrete in Flume	4,202	Cu.Yd	220.00	924,440.00
9	Granular Backfill and Filter	5,002	Cu.Yd	40.00	200,080.00
10	24"Sq. Concrete Piling	5,100	L.Ft.	44.00	224,400.00
11	Permanent Roadway	1,495	Sq.Yd.	50.00	74,750.00
12	Approach Slabs	130	Sq.Yd.	50.00	6,500.00
13	Barriers	290	L.Ft.	60.00	17,400.00
14	Asphalt Wearing Course to Even the Bridge Surface	1,400	Sq.Yd	30.00	42,000.00
15	Temporary Two-Lane detour Bridge	9	Span	25,000.00	225,000.00
16	Rehibilitate Existing Bridge Joints	112	L.Ft.	120.00	13,440.00
17	Repair Bridge Bearings	30		1,400.00	3 42,000.00
	Total				$3,319,794.00
	20+/-Contingency				680,206
	TOTAL PROJECTED CONSTRUCTION COST				**$4,000,000**

Hartman Engineering, Inc.
Consulting Engineers
Kenner, Louisiana

VETERANS MEMORIAL BLVD. BRIDGES
OVER SONIAT CANAL
OPINION OF PROBABLE CONSTRUCTION COST

April 23, 1999

PROJECT : WIDEN WESTBOUND AND EASTBOUND BRIDGES

Feature: Channels and Canals

Item No.	Item	Quantity	Unit	Unit Price	Total Price
1	Mob and Demob	1	LS	100,000.00	$100,000.00
2	Precast Concrete Span	6400	Cu.Yd	45.00	288,000.00
3	Excavation	12107	Cu.Yd	12.00	145,284.00
4	Clearing and Grubbing	1	LS	15,000.00	15,000.00
5	Cofferdam	38500	Sq.Ft.	12.00	462,000.00
6	Dewatering	1	Job	300,000.00	300,000.00
7	Detours	3200	Sq.Yd.	20.00	64,000.00
8	Concrete in Flume	4202	Cu.Yd	220.00	924,440.00
9	Granular Backfill and Filter	5002	Cu.Yd	40.00	200,080.00
10	24"Sq. Concrete Piling	3,400	L.Ft.	44.00	149,600.00
11	Permanent Roadway	1,495	Sq.Yd.	50.00	74,750.00
12	Approach Slabs	130	Sq.Yd.	50.00	6,500.00
13	Barriers	290	L.Ft.	60.00	17,400.00
14	Asphalt Wearing Course to Even the Bridge Surface	1,400	Sq.Yd.	30.00	42,000.00
15	Temporary Single-Lane Detour Bridge	9	Spans	17,000.00	153,000.00
16	Rehabilitate Joints in existing Bridges	224	L.Ft.	120.00	26,880.00
17	Repair Existing Bridge Bearings	60	Ea.	1,400.00	84,000.00
	Total				2 $3,052,934.00
	20%+/- Contingency				$647,066.00
	TOTAL PROJECTED CONSTRUCTION COST				**$3,700,000**