OLD CROSS CUT CANAL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 1 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 7/96

McDowell to Thomas CHECKED BY ____ DATE ____

Reinf. Steel (Savings)

Top Slab: original Length = 38-6 (#8 Bars)

(38-6) - (11'-0) = 27'-6

Lap = (2'-6) x 2 = 5-0

New Length = 32-6

Savings = (38-6) - (32-6) = 6'-0

Length = 4900'; No. of Bars = $\frac{4900 \times 12}{12 \text{ sp}}$ = 4900

Wt. of #8 Bars = 4900 x 6.0 x 2.67 lbs/ft = 78498 lbs

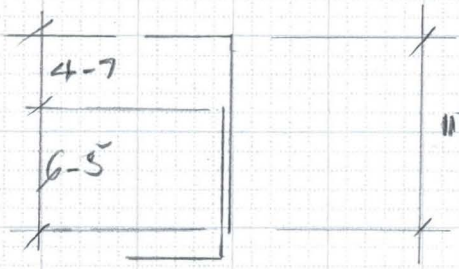
Bottom Slab:

#7 Bars Wt = 4900 x 6.0 x 2.044 lbs/ft = 60094

Walls

7-6 − 1-1 = 6-5

4-7 − 2-6 = 2-1 Lap



Savings length = 11 − (2-1) = 3'-11

No. of Bars = $\frac{4900 \times 12}{6}$ = 9800

Wt of #6 Bars = 9800 x 3.916 x 1.502 lbs/ft

= 57642 lbs

Both sides = 2 (57642) = 115284

253876 lbs

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grade Cut PAGE 2 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 7/96

McDowell To Thomas CHECKED BY ____ DATE ____

Reinf. Steel:

Top Slab: #8@12, L = 38'-6 lbs

No of Bars = 4900, wt = 4900 x 38.5 x 2.67 = 503,696

Truss Bars: #8@12, L = 39.3

wt = 4900 x 39.3 x 2.67 = 514,162

#5@12", L = 38.5

wt = 4900 x 38.5 x 1.043 = 196,762

Walls:

hh1 Bars: #6@6", No = 4900 x 12/6 = 9800

L = 16.5 wt = 9800 x 16.5 x 1.502

= 242873

hh2: 9800 x 13 x 1.502 = 191355

aa: #5@12" L = 12-2"

wt = 4900 x 12.17 x 1.043 = 62,197

496,425

Two walls = 2(496,425) = 992,850

Int. Wall:

bb2: [(4900 x 12.5) 1.043] 2 = 127,768

2 sides

bb1: (4900 x 6.58) 1.043 = 33,628

161,396 161,396

Bott. Slab:

#5-ee2: 4900 x 39. x 1.043 = 199,317

#7-dd2: 4900 x 39.75 x 2.044 = 398,120

#7-FF2: 4900 x 39.0 x 2.044 = 390,608

988,045 988,045

Temp. Steel:

No = 56 + 56 + 42 = 154 #4

No. of bars = 4900/30 => 154 @ 1'-6 = 246'

Tot. Length = (4900 + 246) = 5146'

wt = (154 x 5146) 0.668 = 529,379

3,886,290 lbs

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Gross Cut PAGE 3 OF ____

DETAIL 15'x10' Box COMPUTED KNH DATE 7/96

McDowell To Thomas CHECKED BY ____ DATE ____

Possible Steel:

a) # 8 @ 12", 38'-6" Long

Reducing by ~~8'-0~~ 6'-0 (3' Each Side)

(6 x 2.67 x 4900) 78498 lbs

b) # 7 @ 12" (6 x 2.044 x 4900) 60094

Bott. Steel → 138592

Top St. & walls → 253,876

Total Savings 392468 lbs

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Gravel Cut PAGE 4 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 7/96

McDowell To Thomas CHECKED BY ____ DATE ____

a) Tot. Steel original = 3,886,290 lbs

lbs / Lft = 3,886,290 / 4900 = 793 lbs/Lft

b) Tot. Steel Revised = 3,632,414 (3,493,822)

lbs / Lft = 3,632,414 / 4900 = 741 (713) lbs/Lft

Reinf. St. / Lft

Top Slab: #8 @ 12", L = 32.5

wt = (32.5 x 2.67) = 86.8 Ncl

Truss bars, L = 39.32 x 2.67 = 104.9

#5 @ 12, 38.5 x 1.043 = 40.2 — 231.9

Bott. Slab: #7 @ 12, (32.5 x 2.044) = 66.4

Truss Bars (39.82 x 2.044) = 81.4

#5 @ 12, (39. x 1.043) = 40.7 — 188.5

Walls: hh1 5-6 / 7 (12.5 x 1.502) 2 = 37.6

#6 @ 6 — 2 Bars / Lft

hh2 7½-6 / 5-6 (13 x 1.502) 2 = 39.1

If #5 @ 12, (12.17 x 1.043) = 12.7

89.4 x 2 (2 walls) — 178.8

Int. wall #5 @ 12]1-6[12-2

(15.17 x 1.043) 2 = 31.6 — 31.6

Emy. Steel: Ncl = 56 + 56 + 42 = 154

154 #4 Bars = (154 x 0.668) 1.10 — 113.2

10% Laps

Very Close to 741 lbs/Lft of Item b) above. — 744 lbs

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 5 OF ____

DETAIL 18'x10' BOX COMPUTED KVH DATE 7/96

McDowell To Thomas. CHECKED BY ____ DATE ____

Concrete Qty

Top Slab: (1.25 x 38.83) 4900 = 237,834 cft

Walls: (1.0 x 10 x 4900) 2 = 98,000
(2 walls)

0.833 x 10 x 4900 = 40,817

Chamfers: [(½ x 0.5 x 0.5) 4900] 4 = 2450
(no 2)

Bott. Slab: (39.5 x 1.33) 4900 = 257,421

636,522 cft

= 23575 CY

a) Reinf. Steel / Cyd. = 3,886,290 / 23575

= 165 lbs / CY

392,468

b) Required Steel = (3,886,290) - (253,876)

3,493,822 = 3,632,414 lbs / 23575

= 154 lbs / CY

→ 148

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 7 OF ____

DETAIL 15' x 10' Box COMPUTED KVH DATE 7/96

McDowell To Thomas CHECKED BY ____ DATE ____

$M^{+ve} = 20.9$ k-ft

$d_{dy} = (15 - 1 - 0.5) = 13.5''$

$$A_s = \frac{20.9 \times 12}{24 \times 0.88 \times 13.5}$$

$$= 0.88$$

#8 @ 12 = 0.79

#5 @ 12 = $\frac{0.31}{1.10} > 0.88$

$M_{Neg} = 26.6$ k-ft

$d_{dy} = (15 - 2 - 0.5) = 12.5''$

$$A_s = \frac{26.6 \times 12}{24 \times 0.88 \times 12.5}$$

$$= 1.21$$

#8 @ 6" = 1.58 ∴ OK

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

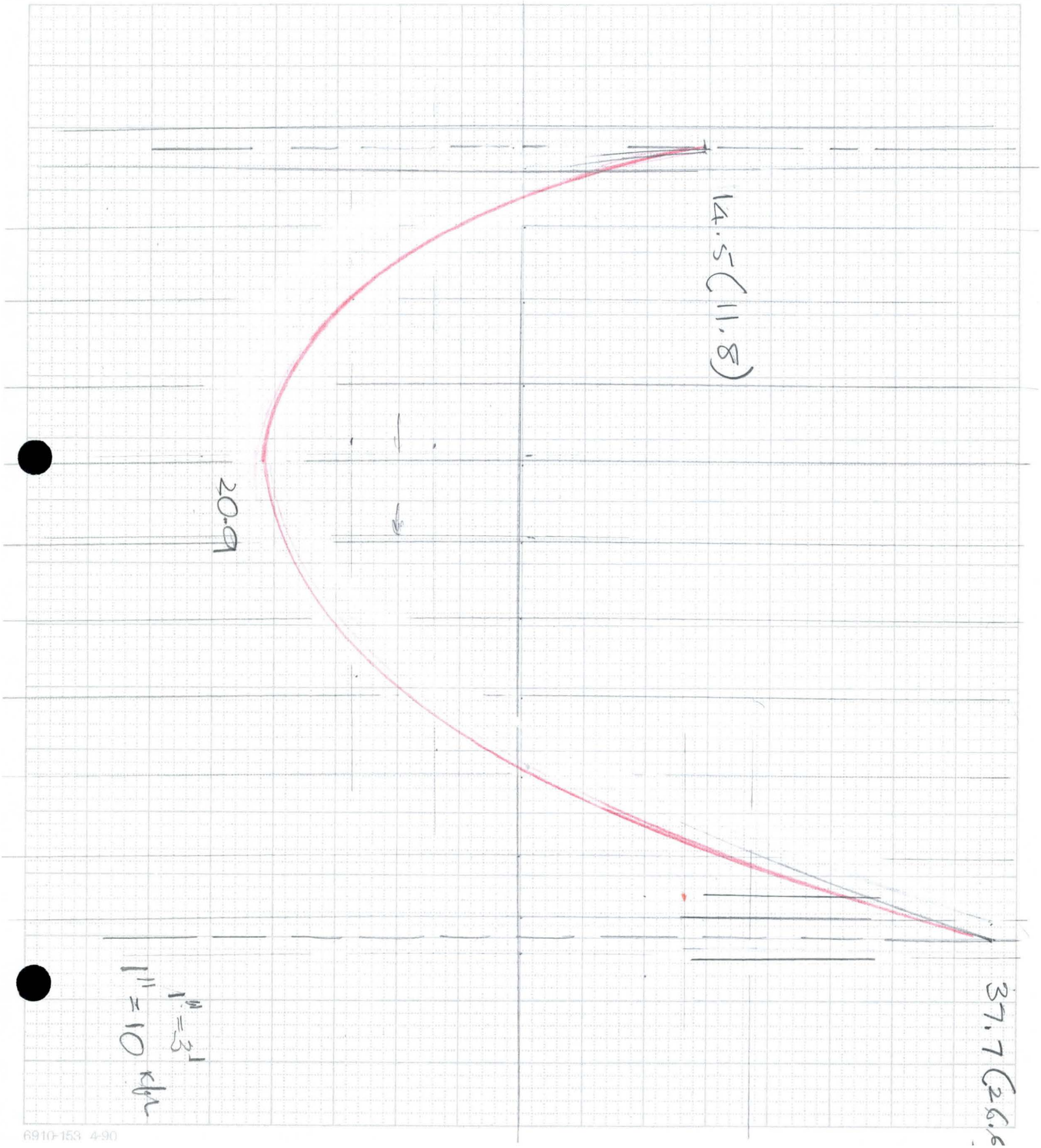
ITEM NO.	DESCRIPTION	UNIT	APPROX QTY.	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				ENGINEER'S ESTIMATE		AMES CONSTRUCTION*		PCL CIVIL CONSTRUCTORS, INC.*		MEADOW VALLEY	
105-1	Partnering	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
105-2	Protection of water and sewer lines	L.S.	1	$75,000.00	$75,000.00	$4,000.00	$4,000.00	$2,000.00	$2,000.00	$30,000.00	$30,000.00
107-1	NPDES/SWPPP Permits	L.S.	1	$20,000.00	$20,000.00	$5,000.00	$5,000.00	$2,000.00	$2,000.00	$17,000.00	$17,000.00
107-2	Preparation of Health and Safety Plan	L.S.	1	$5,000.00	$5,000.00	$3,000.00	$3,000.00	$2,000.00	$2,000.00	$1,000.00	$1,000.00
107-3	Public Information & Notification allowance	L.S.	1	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00
107-4	Project Signs allowance	L.S.	1	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00
107-5	Groundwater dewatering	L.S.	1	$200,000.00	$200,000.00	$40,000.00	$40,000.00	$134,942.00	$134,942.00	$300,000.00	$300,000.00
107-6	Ground Breaking and Dedication Ceremonies allowance	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
202	Mobilization	L.S.	1	$100,000.00	$100,000.00	$200,000.00	$200,000.00	$211,366.00	$211,366.00	$565,000.00	$565,000.00
206-1	Structure excavation	C.Y.	148,214	$6.00	$889,284.00	$2.00	$296,428.00	$3.00	$444,642.00	$4.00	$592,856.00
206-2	Structure backfill	C.Y.	29,438	$22.00	$647,636.00	$13.00	$382,694.00	$16.50	$485,727.00	$14.00	$412,132.00
206-3	Geocomposite drain	S.Y.	9,107	$10.00	$91,070.00	$2.00	$18,214.00	$4.00	$36,428.00	$5.00	$45,535.00
211	Fill construction	C.Y.	44,205	$8.00	$353,640.00	$1.25	$55,256.25	$2.00	$88,410.00	$1.00	$44,205.00
215	Earthwork for open channels (excavation)	C.Y.	10,419	$3.50	$36,466.50	$2.50	$26,047.50	$2.00	$20,838.00	$1.50	$15,628.50
222	Grasscrete construction	S.F.	22,457	$6.00	$134,742.00	$3.00	$67,371.00	$3.50	$78,599.50	$4.50	$101,056.50
301	Subgrade preparation under pavement	S.Y.	6,004	$2.00	$12,008.00	$0.35	$2,101.40	$0.60	$3,602.40	$1.50	$9,006.00
310-1	Aggregate base course	C.Y.	666	$12.00	$7,992.00	$15.00	$9,990.00	$19.00	$12,654.00	$22.00	$14,652.00
310-2	Gravel bedding	C.Y.	15,426	$25.00	$385,650.00	$10.00	$154,260.00	$15.00	$231,390.00	$12.00	$185,112.00
321	Asphalt concrete pavement C-3/4	TON	652	$32.00	$20,864.00	$30.00	$19,560.00	$31.00	$20,212.00	$29.00	$18,908.00
340-1	Concrete curb and gutter, MAG Det 220, Type A, H=9"	L.F.	4,492	$7.00	$31,444.00	$6.50	$29,198.00	$8.00	$35,936.00	$10.00	$44,920.00
340-2	6"x 6" Concrete edging	L.F.	9,990	$3.00	$29,970.00	$1.00	$9,990.00	$10.00	$99,900.00	$4.00	$39,960.00
340-3	Concrete header	L.F.	3,385	$3.50	$11,847.50	$1.50	$5,077.50	$15.00	$50,775.00	$6.00	$20,310.00
340-4	Concrete driveway, COP Det. P-1255	S.F.	180	$4.00	$720.00	$4.00	$720.00	$2.00	$360.00	$4.00	$720.00
345-1	Adjust box frame and cover	EA.	4	$250.00	$1,000.00	$100.00	$400.00	$330.00	$1,320.00	$300.00	$1,200.00
345-2	Adjust manhole frame and cover	EA.	10	$240.00	$2,400.00	$100.00	$1,000.00	$170.00	$1,700.00	$300.00	$3,000.00
350-1	Remove fence, handrail, guardrail, posts, and barricades	L.S.	1	$1,000.00	$1,000.00	$6,000.00	$6,000.00	$3,000.00	$3,000.00	$2,500.00	$2,500.00
350-2	Remove curb and gutter	L.S.	1	$50.00	$50.00	$1,000.00	$1,000.00	$520.00	$520.00	$6,000.00	$6,000.00
350-3	Remove pipe	L.S.	1	$4,400.00	$4,400.00	$2,000.00	$2,000.00	$7,200.00	$7,200.00	$5,000.00	$5,000.00
350-4	Remove spillways and channel lining	L.S.	1	$3,000.00	$3,000.00	$30,000.00	$30,000.00	$20,000.00	$20,000.00	$9,000.00	$9,000.00
350-5	Remove asphalt pavement	L.S.	1	$1,500.00	$1,500.00	$5,000.00	$5,000.00	$2,000.00	$2,000.00	$3,000.00	$3,000.00
350-6	Remove bike path pavement	L.S.	1	$3,200.00	$3,200.00	$2,000.00	$2,000.00	$5,200.00	$5,200.00	$5,000.00	$5,000.00
350-7	Remove pedestrian crossing and drop structure	L.S.	1	$20,000.00	$20,000.00	$10,000.00	$10,000.00	$19,000.00	$19,000.00	$11,000.00	$11,000.00
350-8	Remove gabions	L.S.	1	$1,200.00	$1,200.00	$3,000.00	$3,000.00	$2,000.00	$2,000.00	$1,500.00	$1,500.00
350-9	Remove rip rap	L.S.	1	$1,400.00	$1,400.00	$1,000.00	$1,000.00	$2,000.00	$2,000.00	$1,500.00	$1,500.00
350-10	Remove chain link fence	L.S.	1	$300.00	$300.00	$1,000.00	$1,000.00	$175.00	$175.00	$2,000.00	$2,000.00
350-11	Miscellaneous removals	L.S.	1	$1,000.00	$1,000.00	$5,000.00	$5,000.00	$1,700.00	$1,700.00	$72,000.00	$72,000.00
350-12	Remove trees	EA.	20	$350.00	$7,000.00	$150.00	$3,000.00	$240.00	$4,800.00	$250.00	$5,000.00
401-1	Traffic control	L.S.	1	$30,000.00	$30,000.00	$15,000.00	$15,000.00	$50,000.00	$50,000.00	$55,000.00	$55,000.00
401-2	Off-duty uniformed officer	M.H.	600	$21.00	$12,600.00	$34.00	$20,400.00	$20.00	$12,000.00	$20.00	$12,000.00
415-1	Guardrail, ADOT Std. Dwg. No. C-10.04	L.F.	50	$25.00	$1,250.00	$25.00	$1,250.00	$15.00	$750.00	$32.00	$1,600.00
415-2	Dwg. No. C-10.15	EA.	1	$1,300.00	$1,300.00	$1,500.00	$1,500.00	$2,000.00	$2,000.00	$1,600.00	$1,600.00
430-1	Seeded turf	ACRE	7.27	$2,100.00	$15,267.00	$850.00	$6,179.50	$2,500.00	$18,175.00	$8,000.00	$58,160.00
430-2	Sodded turf	S.Y.	16,856	$4.00	$67,424.00	$1.75	$29,498.00	$1.40	$23,598.40	$4.50	$75,852.00
432	Gravel mulch	S.Y.	2,839	$3.00	$8,517.00	$2.00	$5,678.00	$2.00	$5,678.00	$2.20	$6,245.80
440-1	Irrigation system	L.S.	1	$100,000.00	$100,000.00	$75,000.00	$75,000.00	$117,650.00	$117,650.00	$120,000.00	$120,000.00
440-2	4" PVC sleeves	L.F.	470	$2.00	$940.00	$8.00	$3,760.00	$10.00	$4,700.00	$16.00	$7,520.00
440-3	6" PVC sleeves	L.F.	544	$4.00	$2,176.00	$10.00	$5,440.00	$15.00	$8,160.00	$19.00	$10,336.00
505-1	Double 18'x 10' concrete box culvert	L.F.	4,900	$1,100.00	$5,390,000.00	$900.00	$4,410,000.00	$795.00	$3,895,500.00	$825.00	$4,042,500.00
505-2	Concrete open channel	L.F.	100	$655.00	$65,500.00	$710.00	$71,000.00	$1,200.00	$120,000.00	$875.00	$87,500.00
505-3	Concrete encasement for 8" water line, MAG Det. 402	L.F.	44	$40.00	$1,760.00	$90.00	$3,960.00	$44.00	$1,936.00	$20.00	$880.00
505-4	Retaining wall (ADOT B-18.10 & B-18.20)	L.F.	805	$85.00	$68,425.00	$100.00	$80,500.00	$200.00	$161,000.00	$100.00	$80,500.00
505-5	Retaining wall (STA. 17+75 to STA. 18+95)	L.F.	120	$90.00	$10,800.00	$90.00	$10,800.00	$190.00	$22,800.00	$110.00	$13,200.00
505-6	Concrete apron	S.F.	3,587	$3.00	$10,761.00	$4.00	$14,348.00	$4.00	$14,348.00	$3.50	$12,554.50

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grand Canal PAGE 6 OF ____

DETAIL 18'x 10' Box COMPUTED KVH DATE 7/96

McDowell to Thomas CHECKED BY ____ DATE ____



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 9 OF ____

DETAIL 18'x16' Box COMPUTED KVH DATE 7/96

McDowell To Thomas CHECKED BY ____ DATE ____

Savings using #5 @ 12"

Top Slab

Savings Length of #8 Bars = 8'-0

[(8 x 2.67) 4900] 2 = 209328

Both Sides

Addition #5 @ 12" x 12'-0

[12 x 1.043 4900] 2 = 122656 lbs

Net Sav. = 86672 lbs 86672

Bott. Slab

Savings Length of #7 Bars = 8'-0

[(8 x 2.044) 4900] 2 = 160250

Addition #5 Bars = 122656

Net Savings = 37594 37594

Total Sav. By using #5 Bars in the middle 124,266

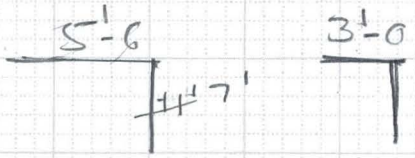
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT O/A Cross Cut PAGE 10 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 7/96

McDowell To Thomas CHECKED BY ____ DATE ____

Reducing Corner Bars #6 @ 6"



Reducing 5'-6 to 3'-0 for half of Bars

Sav. Length = 2-6"

#6 @ 12" [(2.5) 4900 x 1.502] 4 = 73598 lbs

4 Corners

Sav. By using #5 @ 12 in the middle Page. 9 = 124266

Total Savings = 197864 lbs

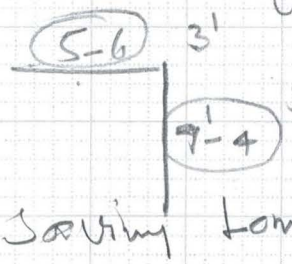
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT _____ PAGE ____ OF ____

DETAIL _____ COMPUTED _____ DATE ____

_____ CHECKED BY _____ DATE ____

Reducing Horz. Leg from 5'-6 to 3'-0 & Vertical leg from 7'-4 to 3'-0



Saving Length = (2'-6)+(4'-4) = 6'-8 3

6@12", $\frac{4700 \times 12}{12} = 4700$ lbs

Wt = [(4900) 6.83 x 1.502] 4 = 201,070 lbs
4 Corners

Additional Savings by using two types of Corner Bars

Total Saving Previous 392,468

593,538 lbs

Mr.William Kantor, P.E.
Address

RE: Old cross Cut Canal, McDowell Rd. to Thomas Rd.

Dear Mr.Kantor:

The following changes will be made as per our discussion of July 26, 1996 for the Phase II of Old Cross Cut Canal, from McDowell to Thomas road.

Top slab reinforcing FF1 #8@12" will be shortened by 3'-6" at each end and lapped with HH1 #6@6". Bottom slab reinforcing FF2 #7@12" will also be shortened by 3'-6" at each end and lapped with HH2 #6@6".

Vertical leg of reinforcing HH1 #6@6" will be shortened by 4'-0" and lapped with HH2 #6@6", both exterior walls.

Also we looked into the bending moment envelope and shortened the truss bars DD1 #8@12" and DD2 #7@12" by 3'-6" at each end. Structural integrity of the box will remain the same and still be in compliance with the AASHTO requirement, Sect. 8.24.2.1 of one-fourth the positive reinforcement in the continuous members shall extend into the support, which will be satisfied by #5@12" running for the full length.

Please feel free to call me if you have any questions and return the signed letter as soon as possible. Self addressed stamped envelope is enclosed for your convenience.

Sincerely,

Kumar V.Hanumaiah, P.E.

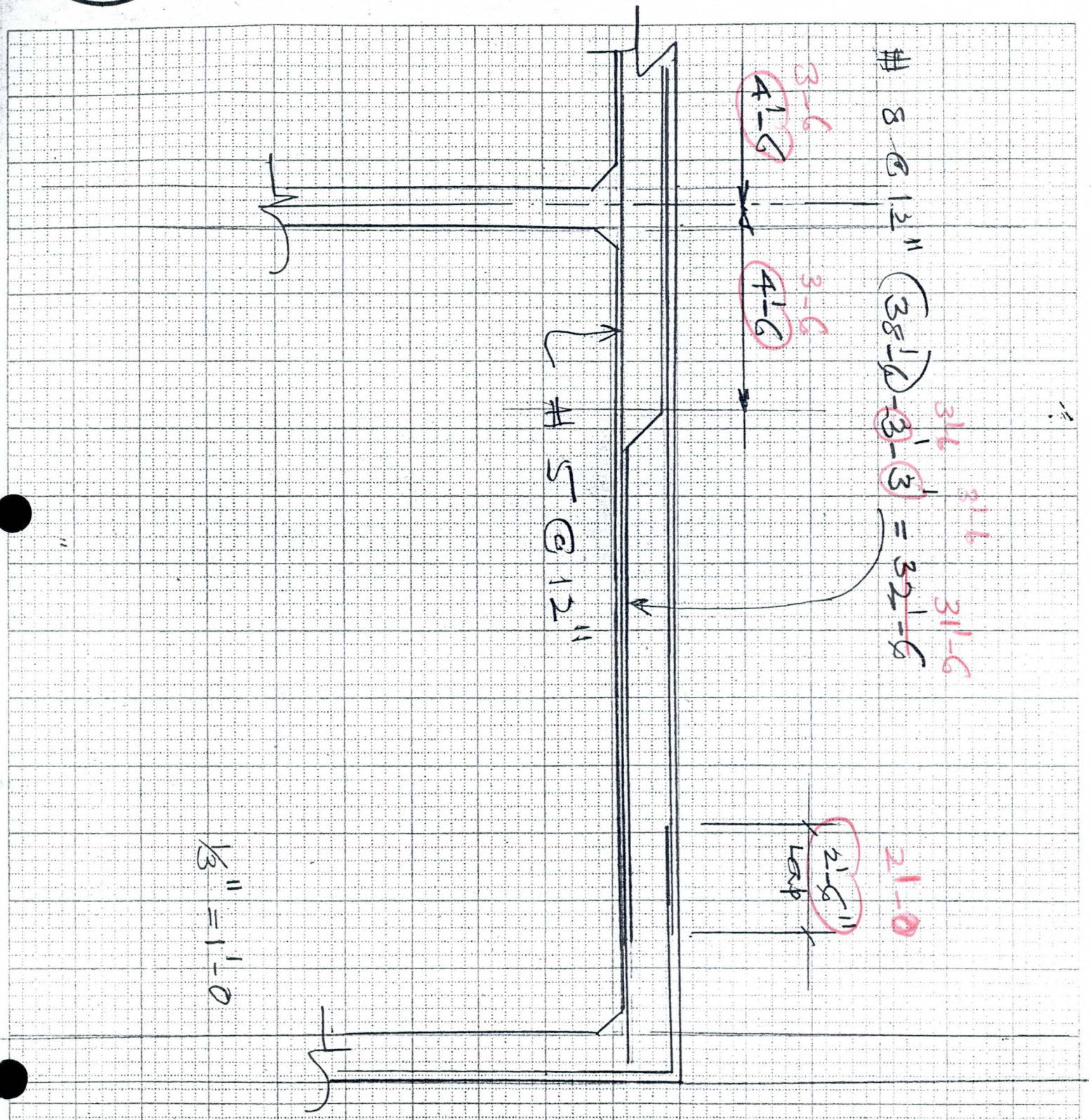
William Kantor, P.E.
Project Engineer

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Crossed Cut PAGE 8 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 2/96

McDowell To Thomas CHECKED BY ____ DATE ____

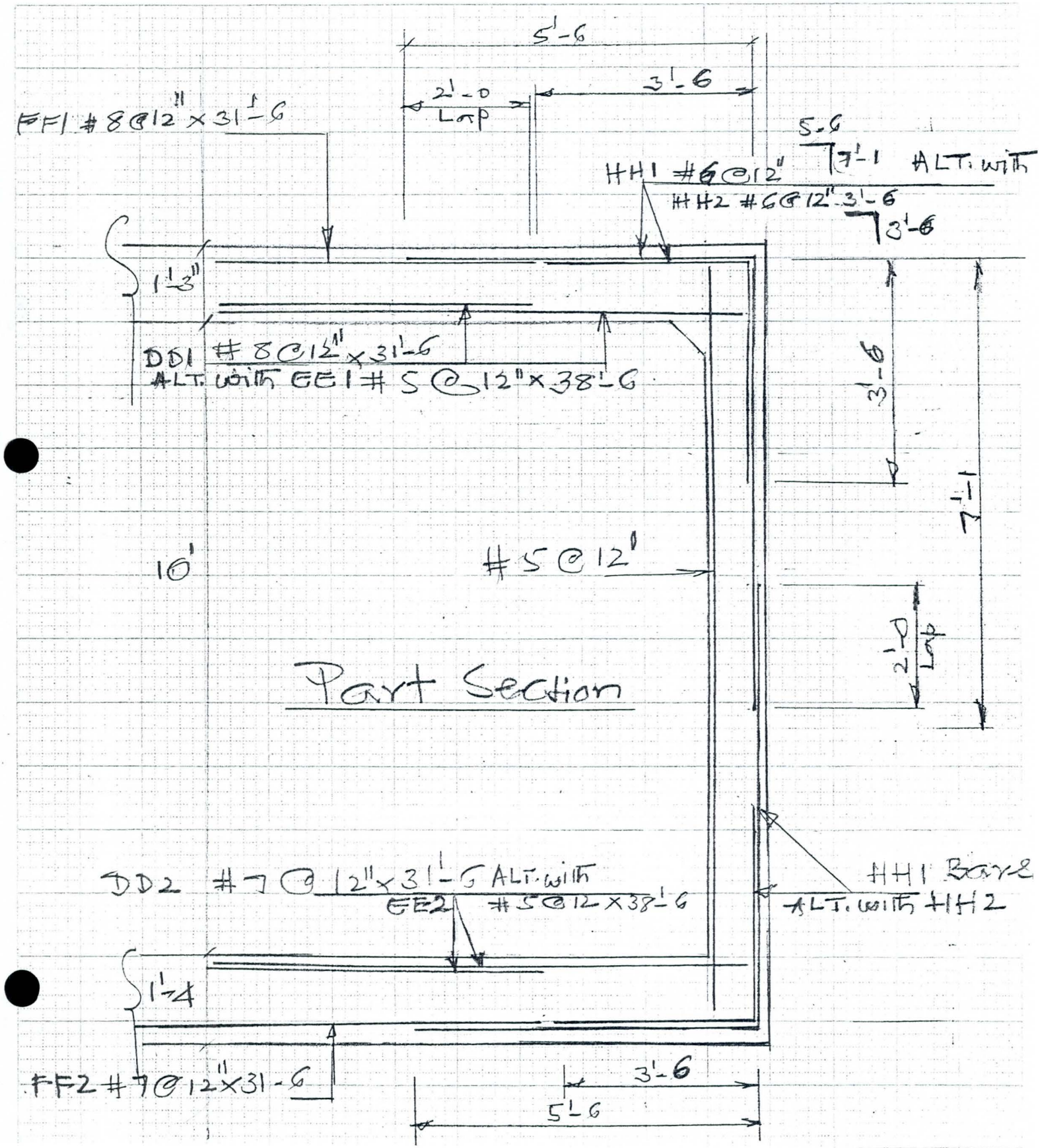


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 1 OF

DETAIL 5'x10' Box COMPUTED KNH DATE 8/96

McDowell To Thomas CHECKED BY DATE

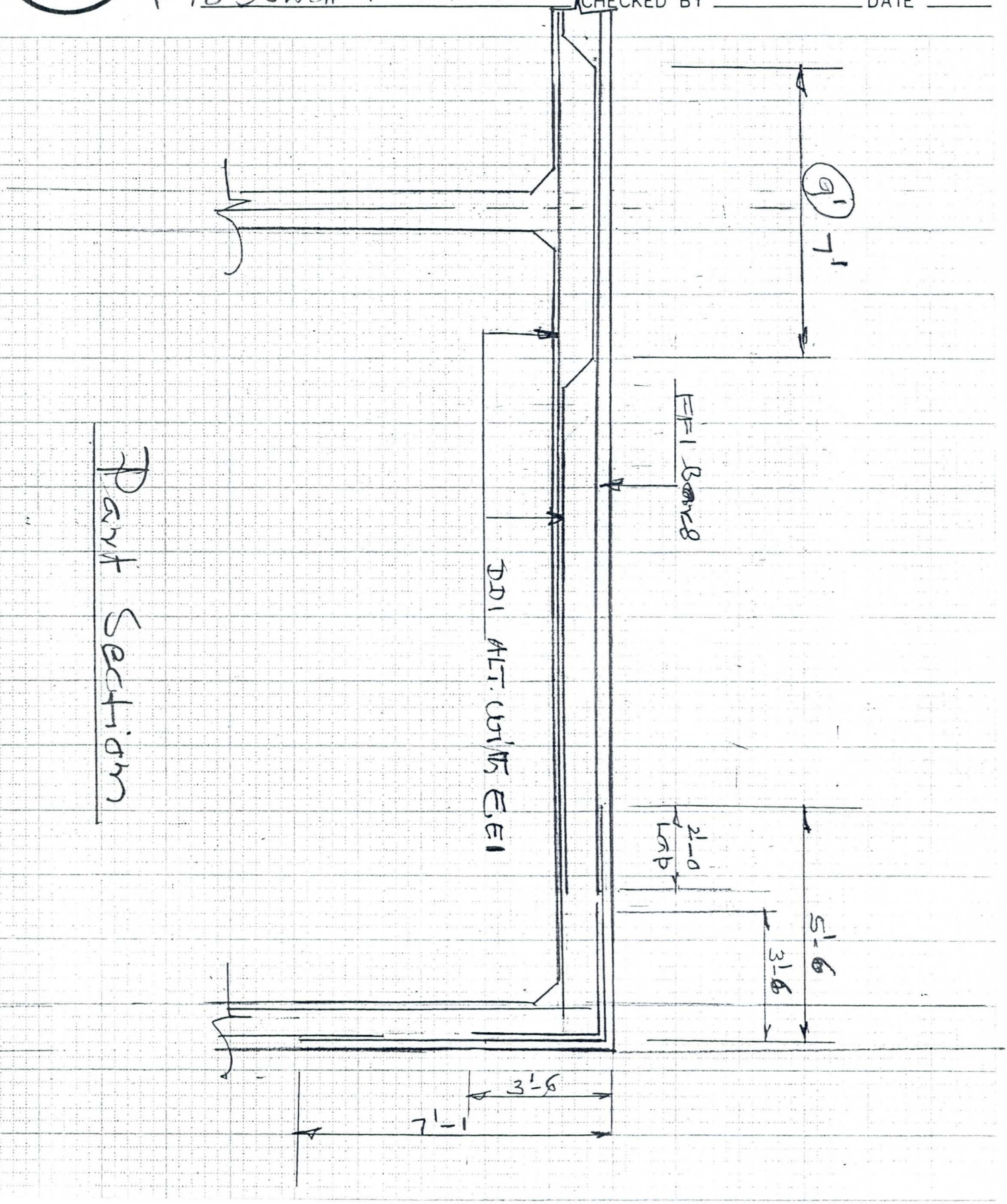


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grand Cut PAGE 2 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/96

McDowell To Thomas CHECKED BY ____ DATE ____

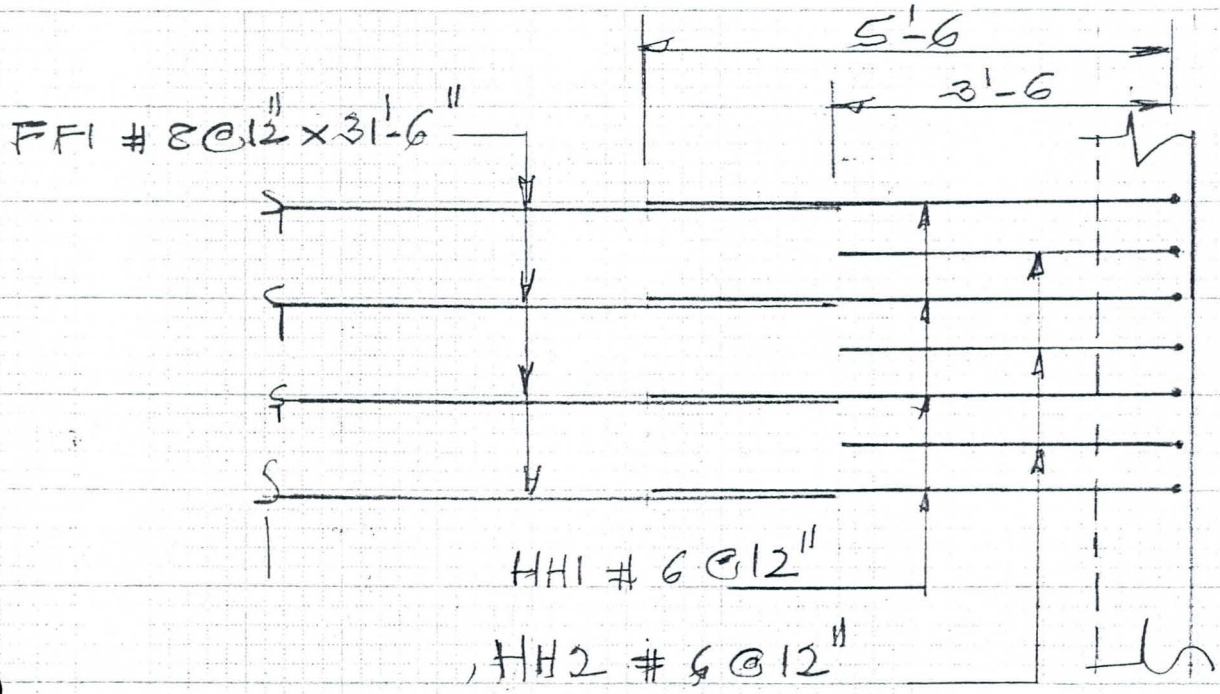


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 3 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/96

CHECKED BY ____ DATE ____



Part Plan - Top Slab Reinf.

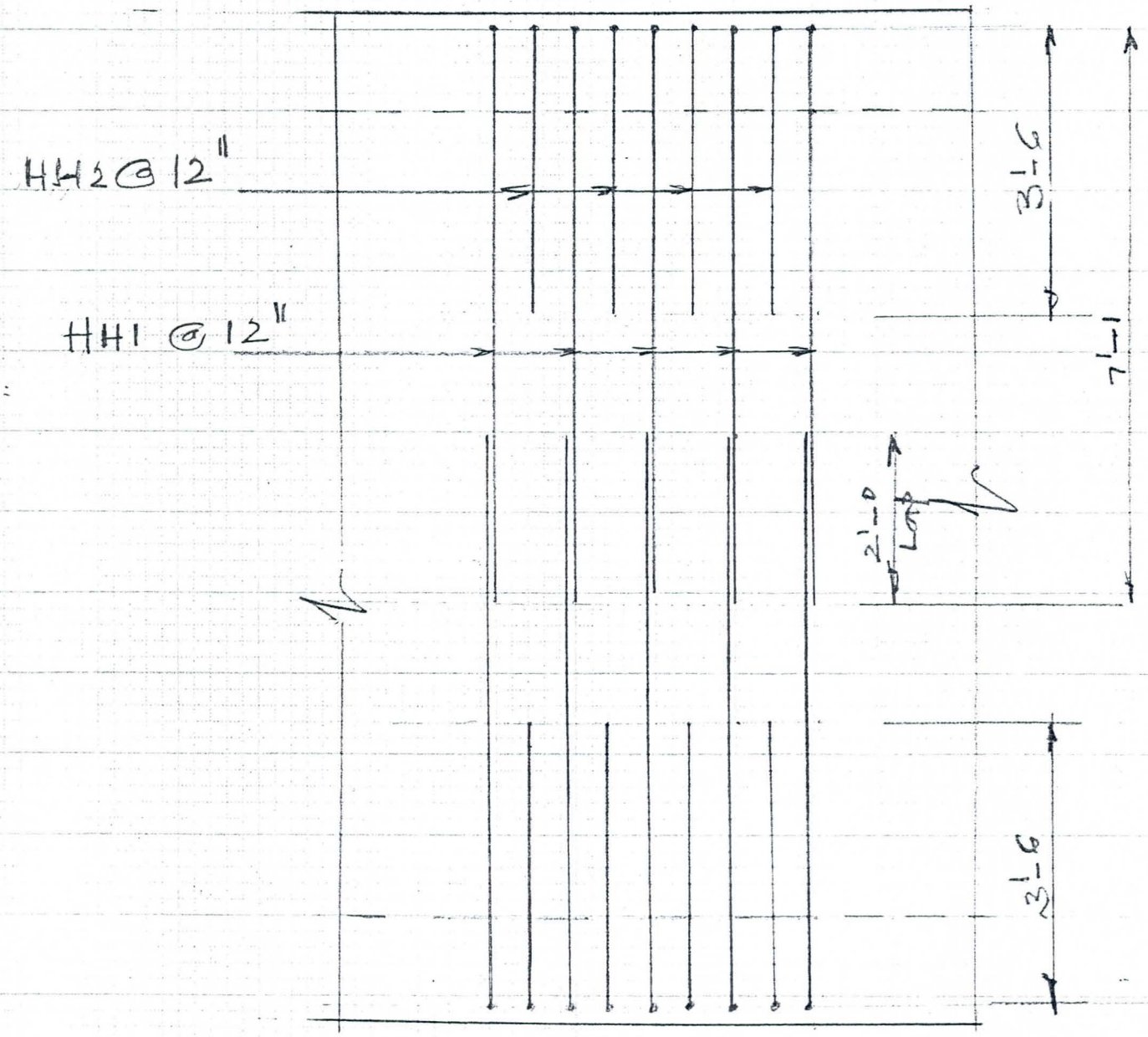
Scale ½" = 1'-0

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 4 OF ____

DETAIL 15' x 10' Box COMPUTED KVH DATE 8/96

CHECKED BY ____ DATE ____



Part Wall Elev. - Out Side Reinf.

½" = 1'-0

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 5 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/13/96

McDowell To Thomas CHECKED BY ____ DATE ____

Reinf. (Saving)

Top Slab: Top Steel #8 @ 12"

Saving L = (35'-6") - (31'-6") = 7'

(4.900 x 7) 2.67 = 91581 lbs

Bottom Steel: #8 @ 12 Truss Bars

Same as Top Bars. 91581

183,162

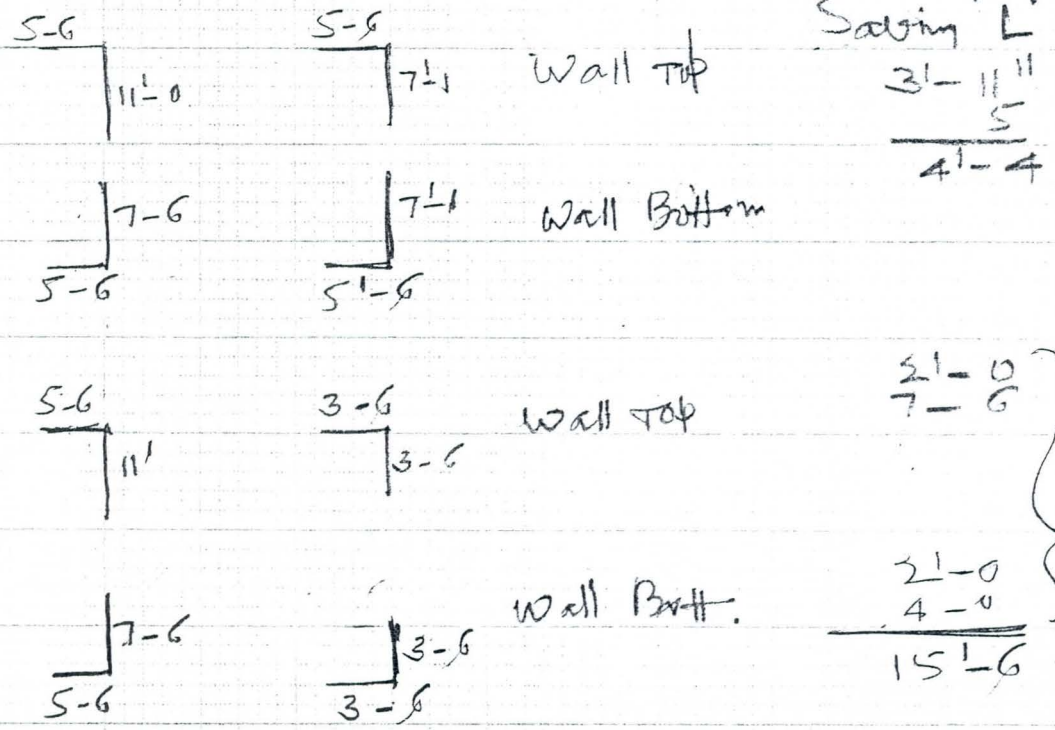
Batt. Slab: #7 @ 12"

Top Stl. (4.900 x 7) 2.044 = 70109

Batt. Stl: Same 70109

140218

Wall Steel



Saving "L"

3'-11"
5
4'-4

2'-0
7-6

2'-0
4-0
15'-6

Before Now

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 6 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/13/96

McDowell To Thomas CHECKED BY ____ DATE ____

Wall Steel (Contd)

#5 @ 12": [(4900 x 4.33) 1.502] 2 (2 walls)	=	63736 lbs
[(4900 x 15.5) 1.502] 2 (2 walls)	=	228,154
	Wall St.	291,890
Top Slab (Previous Page)		183,162
Bot. Slab — " —		140,218
Total Savings		615,270 lbs

a) Original Steel Qty = 3,886,290 lbs

lbs/ft = 3,886,290/4900 = 793 lbs/ft

b) Revised Steel Qty

= (3,886,290 - 615,270)

= 3,271,020

lbs/ft = 3,271,020/4900 = 668 lbs/ft

Total Conc. Qty = 23575 cy

c) Original Reinf. Steel/cy = 3,886,290/23575 = 165 lbs/cyd

d) Revised Reinf. Steel/cy = 3,271,020/23575 = 139 lbs/cyd

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Gross Cut PAGE 7 OF

DETAIL 18'x10' Box COMPUTED KVH DATE 8/16/96

McDowell To Thomas CHECKED BY DATE

Reinf Steel lbs/LF (Recurved Steel)

		lbs/LF
Top Slab:		
ff1: L=32', (32 x 2.67) =	85.44	85.44
dd1: L=32-4, (32.33 x 2.67) =		86.32
ee1: L=38-6, (38.5 x 1.043) =		40.15
Bott. Slab:		
ff2: L=32, (32 x 2.044) =		65.41
dd2: L=32-2 (32.17 x 2.044) =		65.75
ee2: L=37-10 (39.0 x 1.043) =		40.68
Walls:		
hh1: L=12-7 (12.583 x 2) 2 x 1.502 = (Top & Bott; 2 walls)		75.60
hh2: L=7' (7.0 x 2) 2 x 1.502 =		42.06
Ext. Walls: aa: (12.17 x 1.043) 2 = (2 walls)		25.39
Int. walls: bb: (15.19 x 1.043) 2 = (Both faces)		31.64
CC & gg Bars: (42 + 112) 0.668 =		102.87
		661.31

Andy Dileo's Qty = 675 lbs/LF

Say OK if we include the Tab tangent to 661.31 lbs/LF

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 8 OF

DETAIL 18'x10' Box COMPUTED KNH DATE 8/16/[illegible]

McDowell To Thomas CHECKED BY DATE

Bar Type	Original Length	New Length	Bar Size	Weight Per ft.	Saving Length	Saving lbs. per Lft.
ff1	38'-6	32'-0	#8	2.670	6'-6"	17.35
dd1	39'-4	32-4	#8	2.670	7'-0	18.69
ff2	39'-0	32'-0	#7	2.044	7'-0	14.30
dd2	39'-9	32'-2	#7	2.044	7'-5	15.16
hh1, hh2	59'-0*	39'-2*	#6	1.502	39'-8*	59.58
					Total Savings lbs. per Lft	125.08

* hh1 & hh2 Bars:

[(16'-6)+(13'-0)]2 @ 6" Spacing = 59'-0

[(12'-7)+(7'-0)]2 @ 12" Spacing = 39'-2

For 2 walls = 2[(59'-0)-(39'-2)] = 39'-8"

Total Savings = (125.08 x 4900) = 612,892 lbs

DiLEO Engineering
Structural & Civil

ANDREW G. DILEO, P.E.
AZ Structural 14423
AZ Civil 9912
AZ R.L.S. 16523
Calif. R.C.E. 23810
Nev. Civil 9544
New Mexico P.E. 11878

2432 W. Peoria • Phoenix, Arizona 85029-4727 • (602) 395-0756 • FAX (602) 395-1150

Fax Cover Sheet

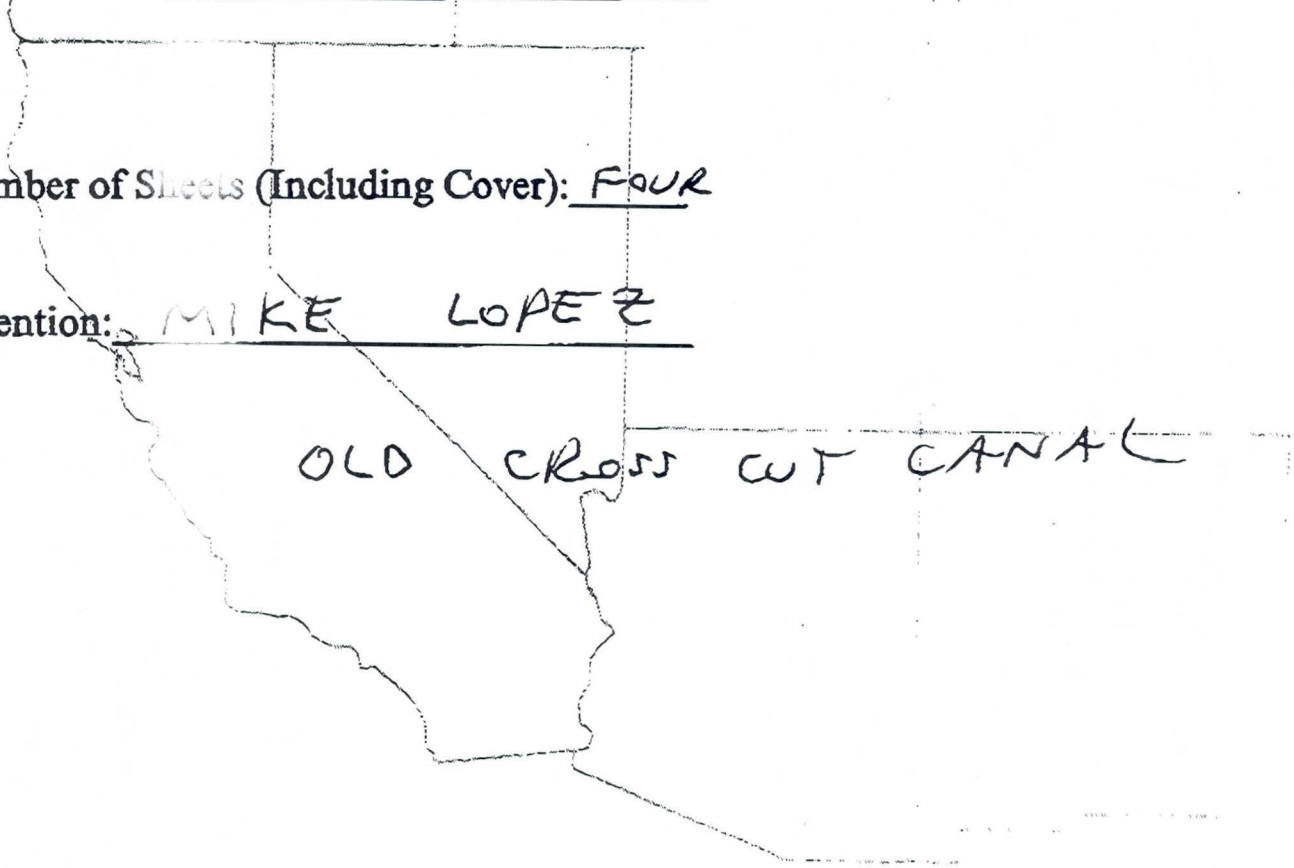
Date: AUG 22, 1996

Firm: FCDMC

Fax Number: 506-4601

Number of Sheets (Including Cover): FOUR

Attention: MIKE LOPEZ



DILEO Engineering
Structural & Civil
2432 W. Peoria • Phoenix, AZ 85029-4727
(602) 395-0756

JOB NO. 9601 SHT. 1 OF 1
DESC. BY A GD
DATE AUG 14, 1996

REDUCTIONS IN REBAR WT.

aa - none
bb - none
cc - none

BEGINING WT./FT = 800 #

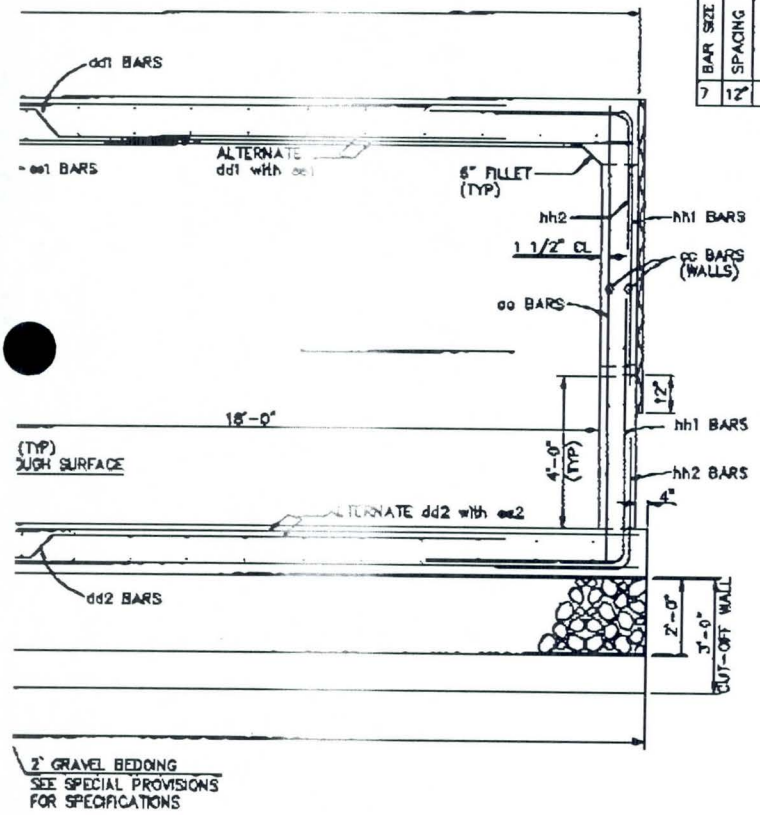
dd1 - #8 CUT 7'-0" ✓	2.67 x 7.0	= - 19
ee1 - none ✓		
ff1 - #8 CUT 6'-6" ✓	2.67 x 6.5	= - 17
gg - none ✓		
hh1 - #6 CUT 3'-11" ✓	4 x 1.502 x 3.92	= - 24
dd2 - #7 CUT 7'-7" ✓	2.044 x 7.58	= - 15
ee2 - none ✓		
ff2 - #7 CUT 7'-0" ✓	2.044 x 7.0	= - 14
hh2 - #6 CUT 6'-0" ✓	4 x 1.502 x 6.0	= - 36

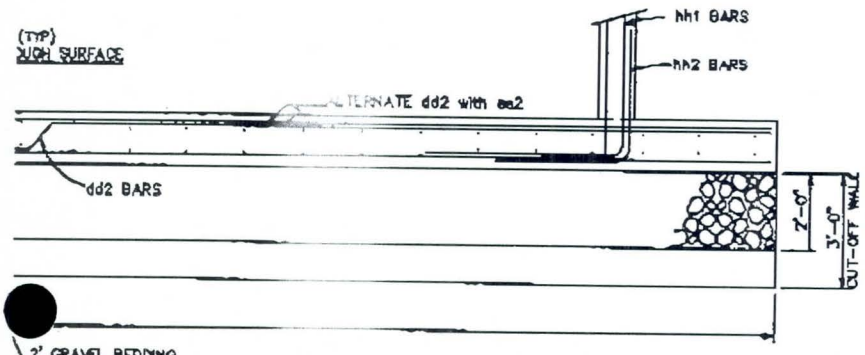
REVISED WEIGHT = 675 PLF

SPAN "S"	HEIGHT "H"	QUANTITIES CONCRETE CY/LF	QUANTITIES REINF STEEL LBS/LF	TOP SLAB "T"	BOT SLAB "T2"	aa BAR SIZE	aa SPACING	aa LENGTH	bb BAR SIZE	bb SPACING	bb LENGTH	cc NUMBER *	dd1 TOP BAR SIZE	dd1 TOP SPACING	dd1 TOP LENGTH	dd1 TOP A	dd1 TOP B	dd1 TOP C	ee1 TOP BAR SIZE	ee1 TOP SPACING	ee1 TOP LENGTH	ff1 BAR SIZE	ff1 SPACING	ff1 LENGTH	gg NUMBER **	hh1 BAR SIZE	hh1 SPACING	hh1 LENGTH	hh1 D1
18'	10'	4.62	875	1'-3"	1'-4"	5	12"	12'-2"	8	12"	15'-2"	42	8	12"	32'-4"	11'-3"	7'-0"	1'-0"	5	12"	38'-6"	8	12"	32'-0"	112	6	12"	12'-7"	7'-1"

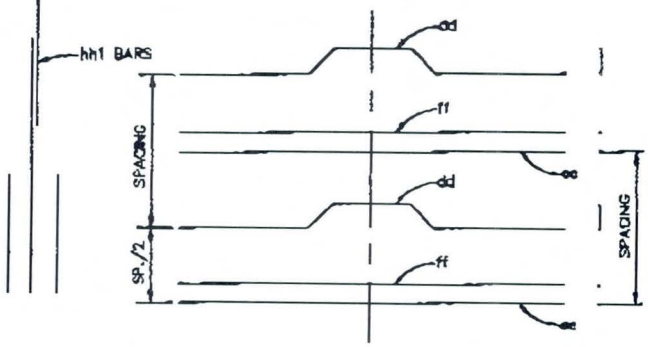
dd2 BOT BAR SIZE	dd2 BOT SPACING	dd2 BOT LENGTH	dd2 BOT A	dd2 BOT B	dd2 BOT C	ee2 BOT BAR SIZE	ee2 BOT SPACING	ee2 BOT LENGTH	ff2 BAR SIZE	ff2 SPACING	ff2 LENGTH	hh2 BAR SIZE	hh2 SPACING	hh2 LENGTH	hh2 D2
7	12"	32'-2"	11'-3"	7'-0"	11"	5	12"	38'-0"	7	12"	32'-0"	6	12"	7'-0"	3'-8"

* TOTAL NUMBER OF #4(CONT.) BARS IN WALLS
** TOTAL NUMBER OF #4(CONT.) BARS IN TOP/BOT SLABS

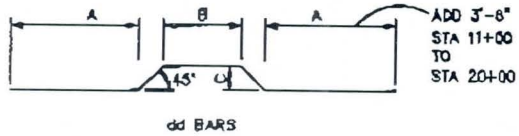




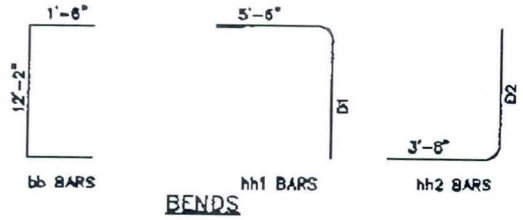
10 TO 20+00



REINFORCING BAR PLACING DIAGRAM



dd BARS



BENDS

NOTE 1: SEE ADOT STD NO. B-19.10 WALL DRAINAGE DETAIL AND REFER TO SECTION 206 OF THE SPECIAL PROVISIONS OF THE PROJECT SPECIFICATIONS FOR REQUIREMENTS OF THE GEOCOMPOSITE DRAIN.

NO.	REVISION OF BOILERPLATE DETAIL REVISION	BY	DATE
3			
2			
1	REVISION OF BOILERPLATE DETAIL REVISION	ADD	8/15/96

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

OLD CROSS CUT CANAL
McDOWELL RD TO THOMAS RD
PROJECT NO. FCD 95-08

	BY	DATE
DESIGNED	A. G. DILEO	08/13/96
DRAWN	A. G. DILEO	08/13/96
CHECKED	A. G. DILEO	08/13/96

DiLEO Engineering
2432 West Peoria Ave., Phoenix, AZ 85029
(602) 395-0756

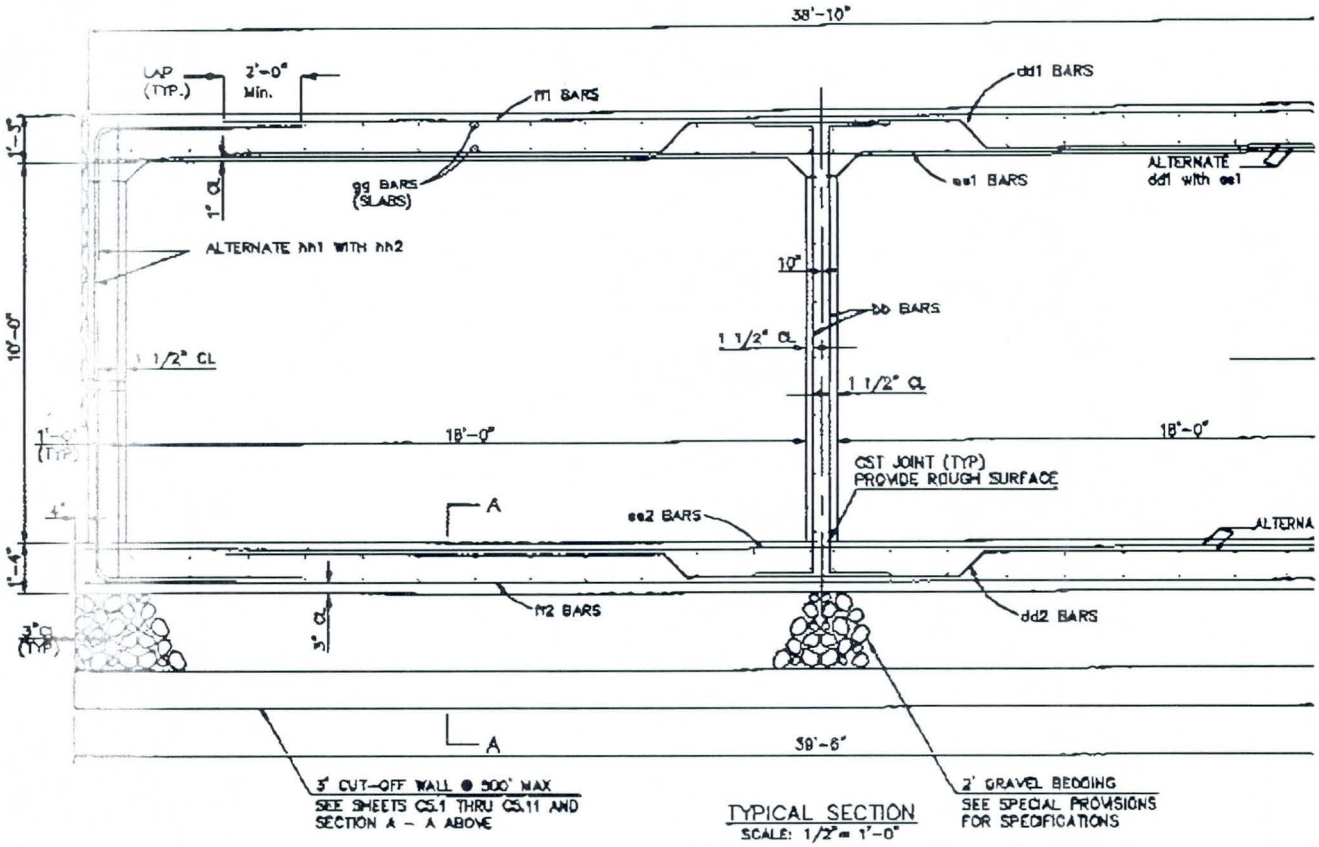
TYPICAL SECTION
18'X 10' DOUBLE BARREL BOX CULVERT

SHT 1 OF 1
CB.1A

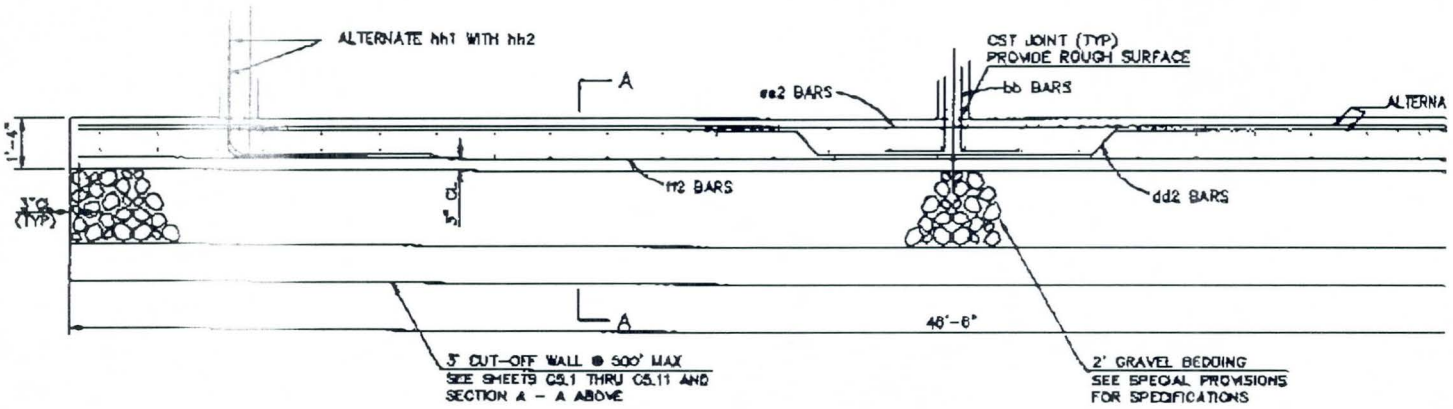
GENERAL NOTES:

1. THIS SHEET WAS CREATED FOR REVISING REINFORCING BAR DETAILS ONLY.
2. SEE SHEET C5.1 FOR GENERAL NOTES.
3. SEE SHEET C5.1 FOR SECTION A-A (CUT-OFF WALL)

SPAN "S"	HEIGHT "H"	QUANTITIES		TOP SLAB "T"
		CONCRETE CY/LF	REINF STEEL LBS/LF	
18'	10'	4.82	875	1'-3"



TYPICAL SECTION
SCALE: 1/2"= 1'-0"



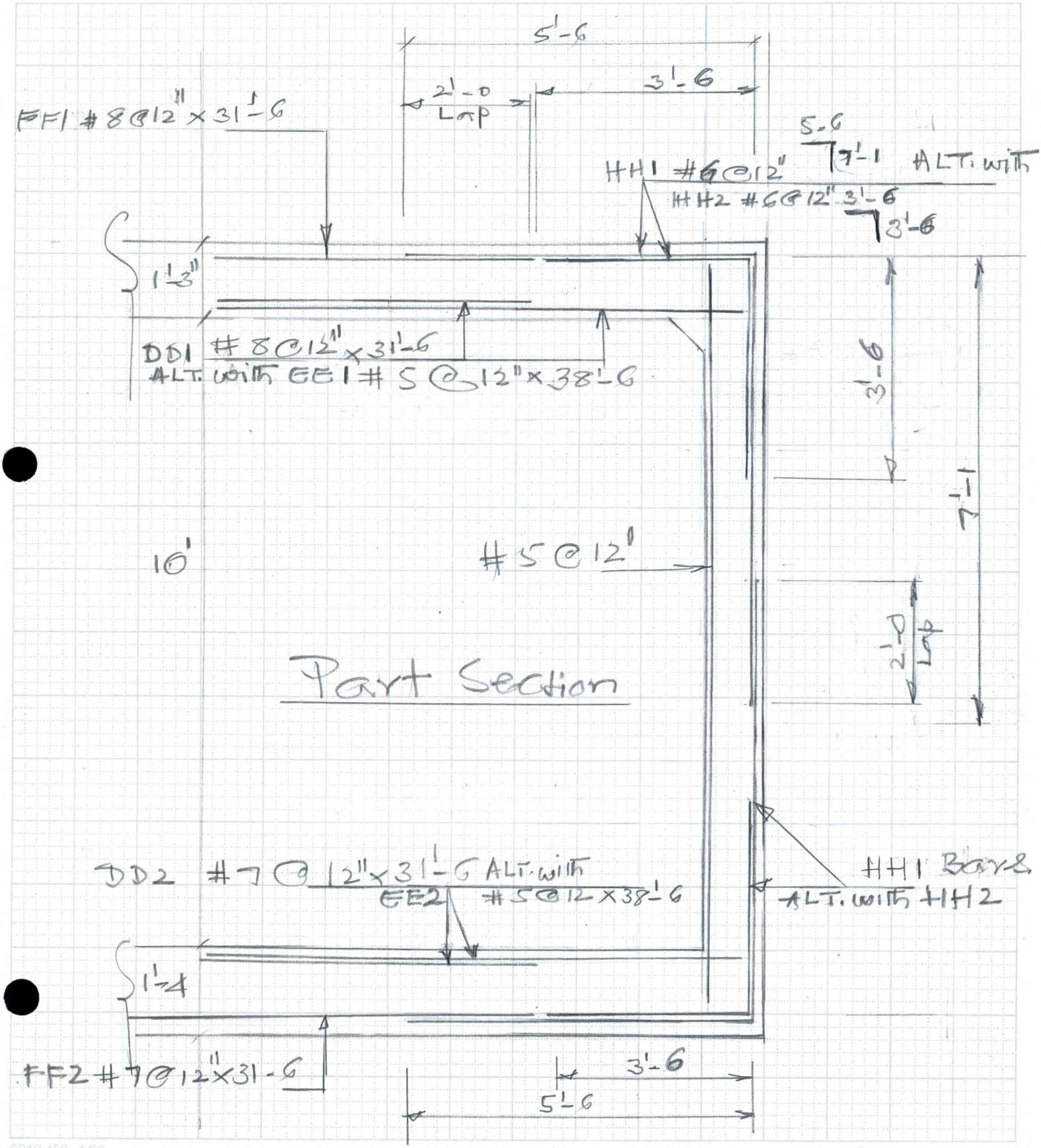
TYPICAL SECTION FROM STA 11+00 TO 20+00
SCALE: 1/2"= 1'-0"

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 1 OF

DETAIL 15'x10' Box COMPUTED KNH DATE 8/96

McDowell To Thomas CHECKED BY DATE

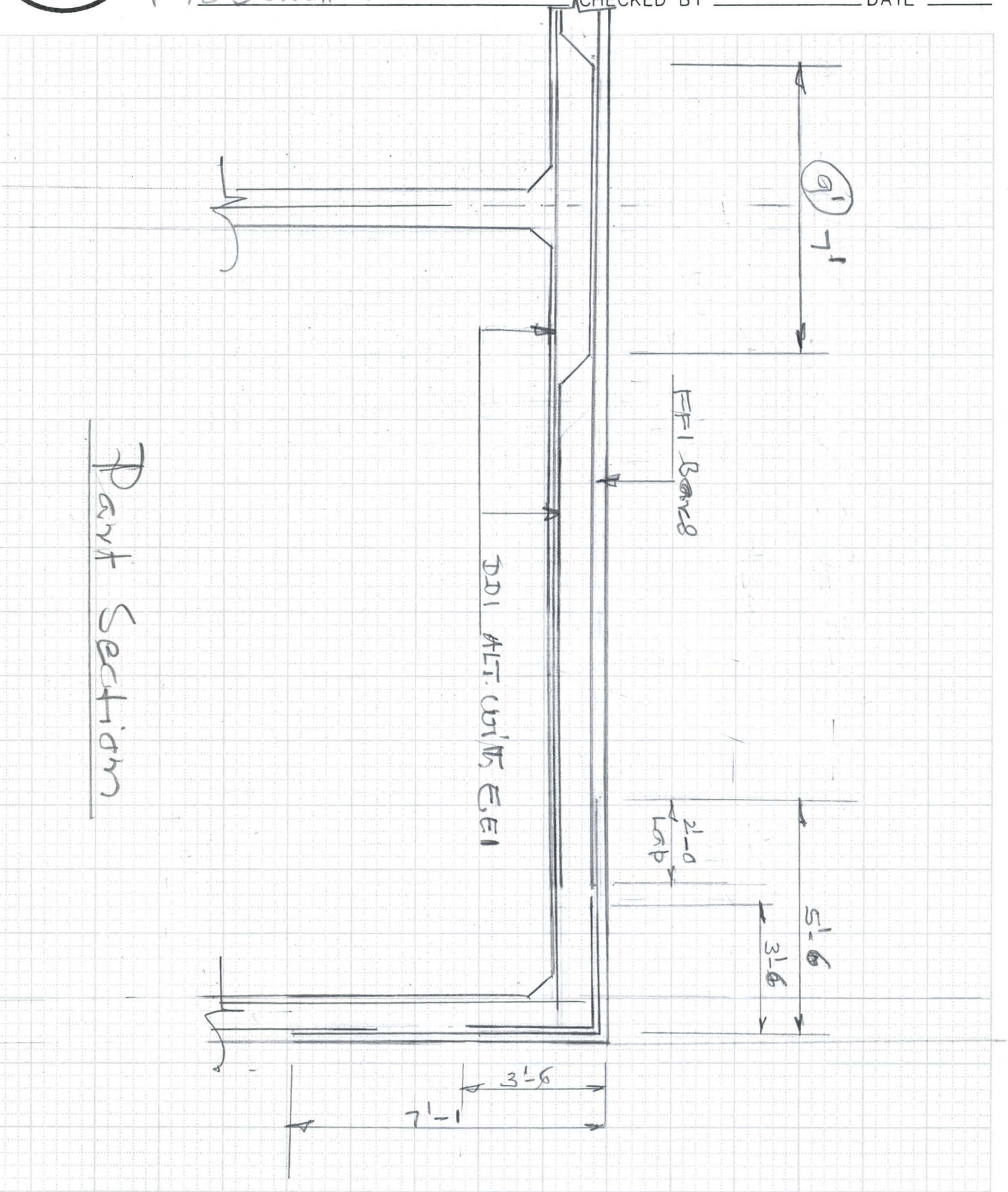


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grade Cut PAGE 2 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/96

McDowell To Thomas CHECKED BY ____ DATE ____

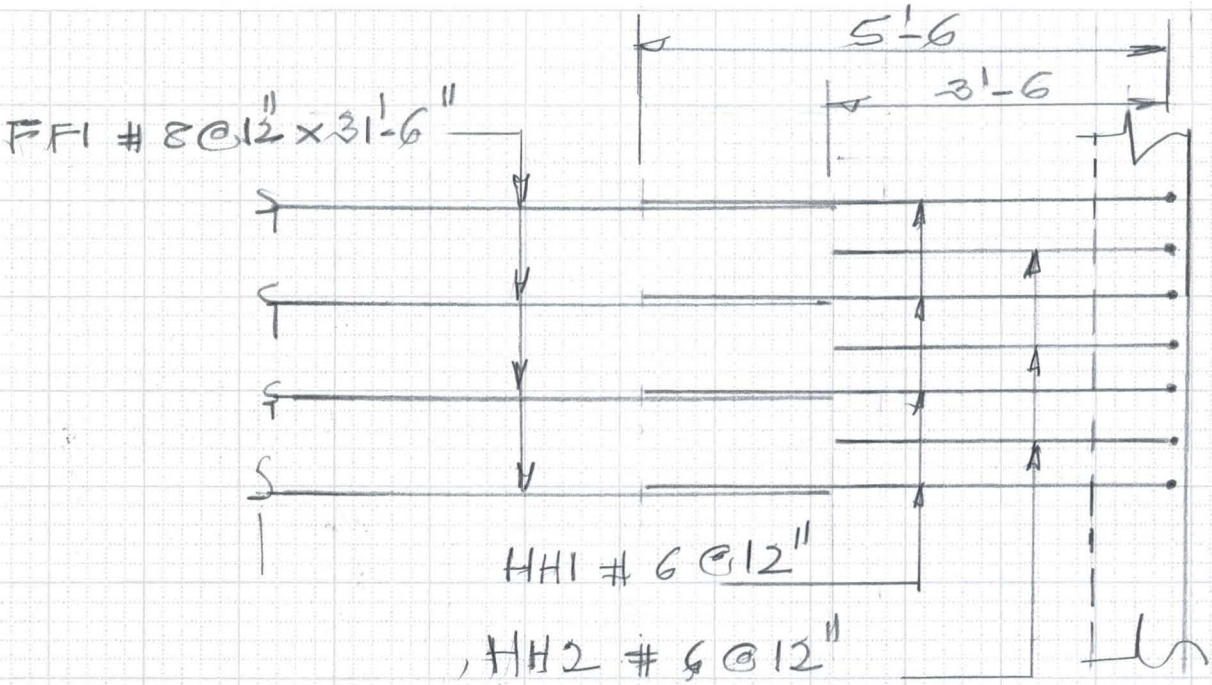


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grass Cut PAGE 3 OF ___

DETAIL 18'x10' Box COMPUTED KVH DATE 8/96

CHECKED BY ___ DATE ___



Part Plan - Top Slab Reinf.

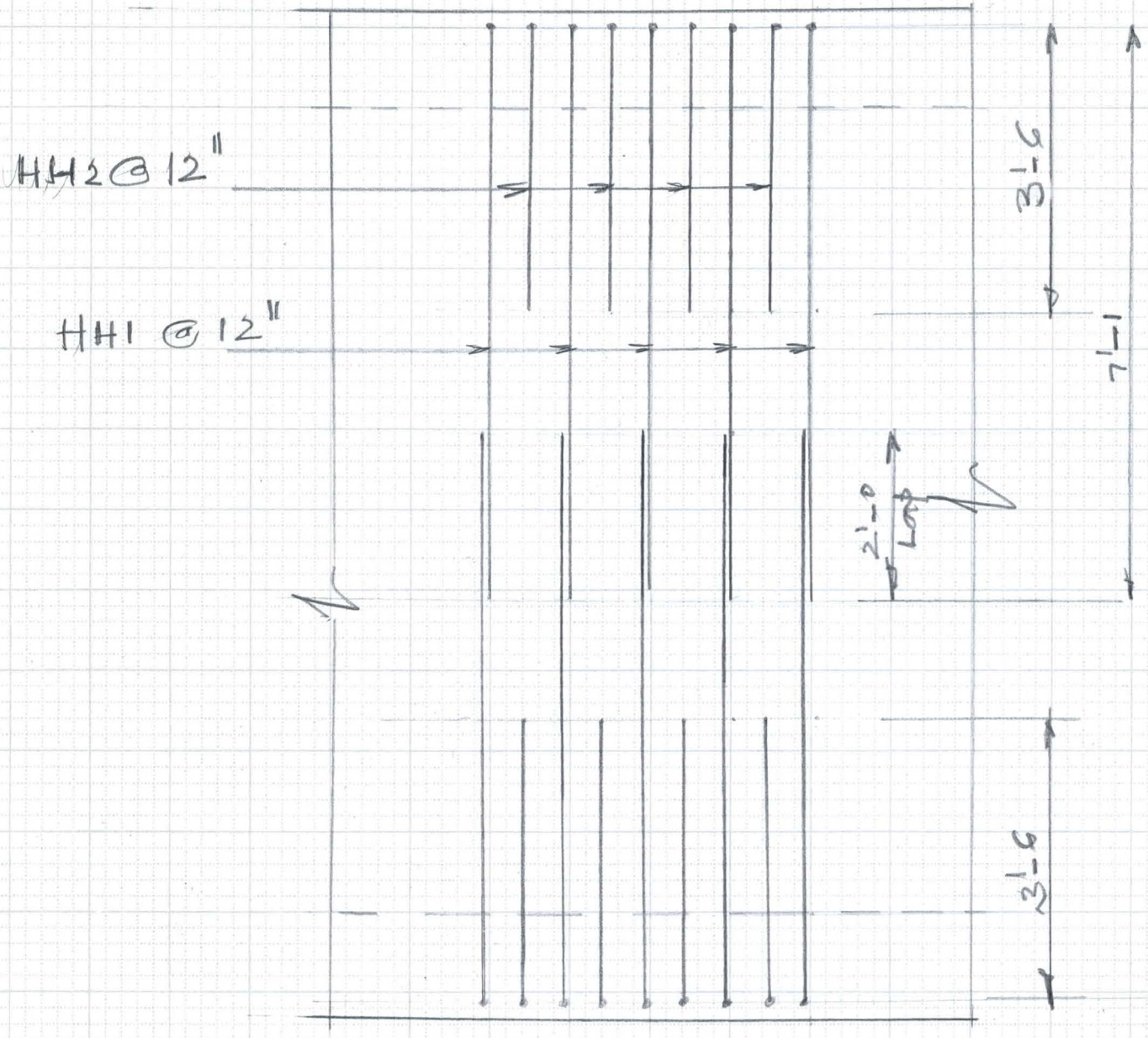
Scale ½" = 1'-0

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Creek Cut PAGE 4 OF ____

DETAIL 15'x10' Box COMPUTED KVH DATE 8/96

CHECKED BY ____ DATE ____



Part Wall Elev. - Out Side Reinf.

1/2" = 1'-0

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 5 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/13/96

McDowell To Thomas CHECKED BY ____ DATE ____

Reinf. (Saving)

Top Slab: Top Steel #8 @ 12"

Saving L = (38'-6") - (31-6") = 7'

(4900 x 7) 2.67 = 91581

Bottom Steel: #8 @ 12 Truss Bars

Same as Top Bars. 91581

183,162

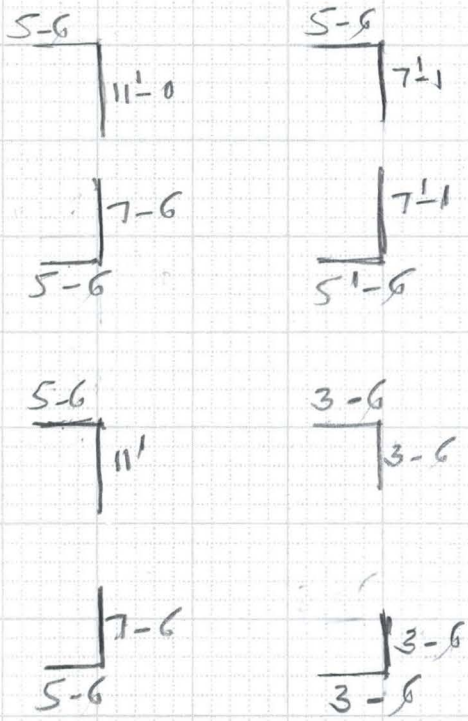
Bott. Slab: #7 @ 12"

Top Stl. (4900 x 7) 2.044 = 70109

Bott. Stl: Same 70109

140218

Wall Steel



Saving "L"

3'-11"
5
4'-4

21'-0
7'-6

21'-0
4'-0
15'-6

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 6 OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 8/13/96

(McDowell To Thomas) CHECKED BY ____ DATE ____

Wall Steel (Contd)

#5 @12": $[(4900 \times 4.33) 1.50 2] \frac{2}{\text{2 walls}}$ = 63736 lbs

$[4900 \times 15.5) 1.50 2] \frac{2}{\text{2 walls}}$ = 228,154

Wall St. 291,890

Top Slab (Previous Page) 183,162

Bot. Slab —,,— 140,218

Total Savings 615,270 lbs

a) Original Steel Qty = 3,886,290 lbs

lbs/ft = 3,886,290/4900 = 793 lbs/ft

b) Revised Steel Qty

= (3,886,290 − 615,270)

= 3,271,020

lbs/ft = 3,271,020/4900 = 668 lbs/ft

Total Conc. Qty = 23575 cy

c) Original Reinf. Steel/cy = $\frac{3,886,290}{23575}$ = 165 lbs/cyd

d) Revised Reinf. Steel/cy = $\frac{3,271,020}{23575}$ = 139 lbs/cyd

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE 7 OF

DETAIL 18'x10' Box COMPUTED KVH DATE 8/16/96

McDowell To Thomas CHECKED BY DATE

Reinf Steel lbs/LF (Recived Steel)

		lbs/LF
Top Slab:		
ff1:	L=32', (32 x 2.67) = 85.44 lbs/LF	85.44
dd1:	L=32-4, (32.33 x 2.67) =	86.32
ee1:	L=38-6, (38.5 x 1.043) =	40.15
Both. Slab:		
ff2:	L=32, (32 x 2.044) =	65.41
dd2:	L=32-2 (32.17 x 2.044) =	65.75
ee2:	L=38-0 (39.0 x 1.043) =	40.68
walls:		
hh1:	L=12-7 (12.583 x 2) 2 x 1.502 = (Top & Both, 2 walls)	75.60
hh2:	L=7' (7.0 x 2) 2 x 1.502 =	42.06
Ext. walls:	aa: (12.17 x 1.043) 2 = (2 walls)	25.39
Int. walls:	bb: (15.17 x 1.043) 2 = (Both faces)	31.64
CC & gg Bars:	(42 + 112) 0.668 =	102.87
		661.31

Andy Dileo's QTY = 675 lbs/LF

Say OK if we include the tack tags to 661.31 lbs/LF

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Creek Culv PAGE 8 OF

DETAIL 18'x10' Box COMPUTED KNH DATE 8/16/86

McDowell To Thomas CHECKED BY DATE

Bar Type	Original Length	New Length	Bar Size	Weight Per Ft.	Saving Length	Saving lbs. per Lft.
ff1	38'-6	32'-0	#8	2.670	6'-6"	17.35
dd1	39'-4	32-4	#8	2.670	7'-0	18.69
ff2	39'-0	32'-0	#7	2.044	7'-0	14.30
dd2	39'-9	32'-2	#7	2.044	7'-5	15.16
hh1, hh2	59'-0*	39'-2*	#6	1.502	39'-8*	59.58
				Total Savings lbs. per Lft		125.08

* hh1 & hh2 Bars:

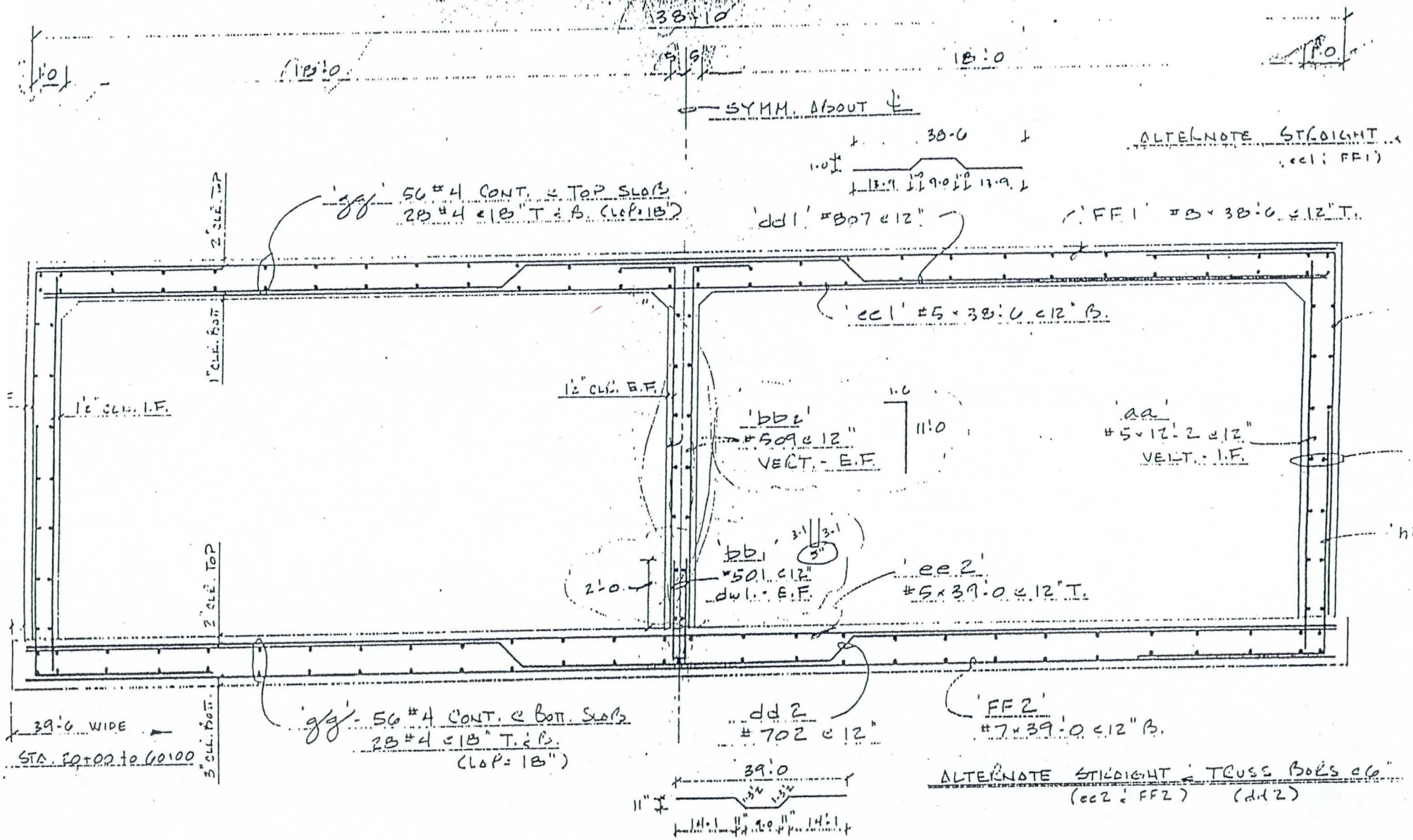
[(16'-6)+(13'-0)]2 @ 6" Spacing = 59'-0

[(12'-7)+(7'-0)]2 @ 12" Spacing = 39'-2

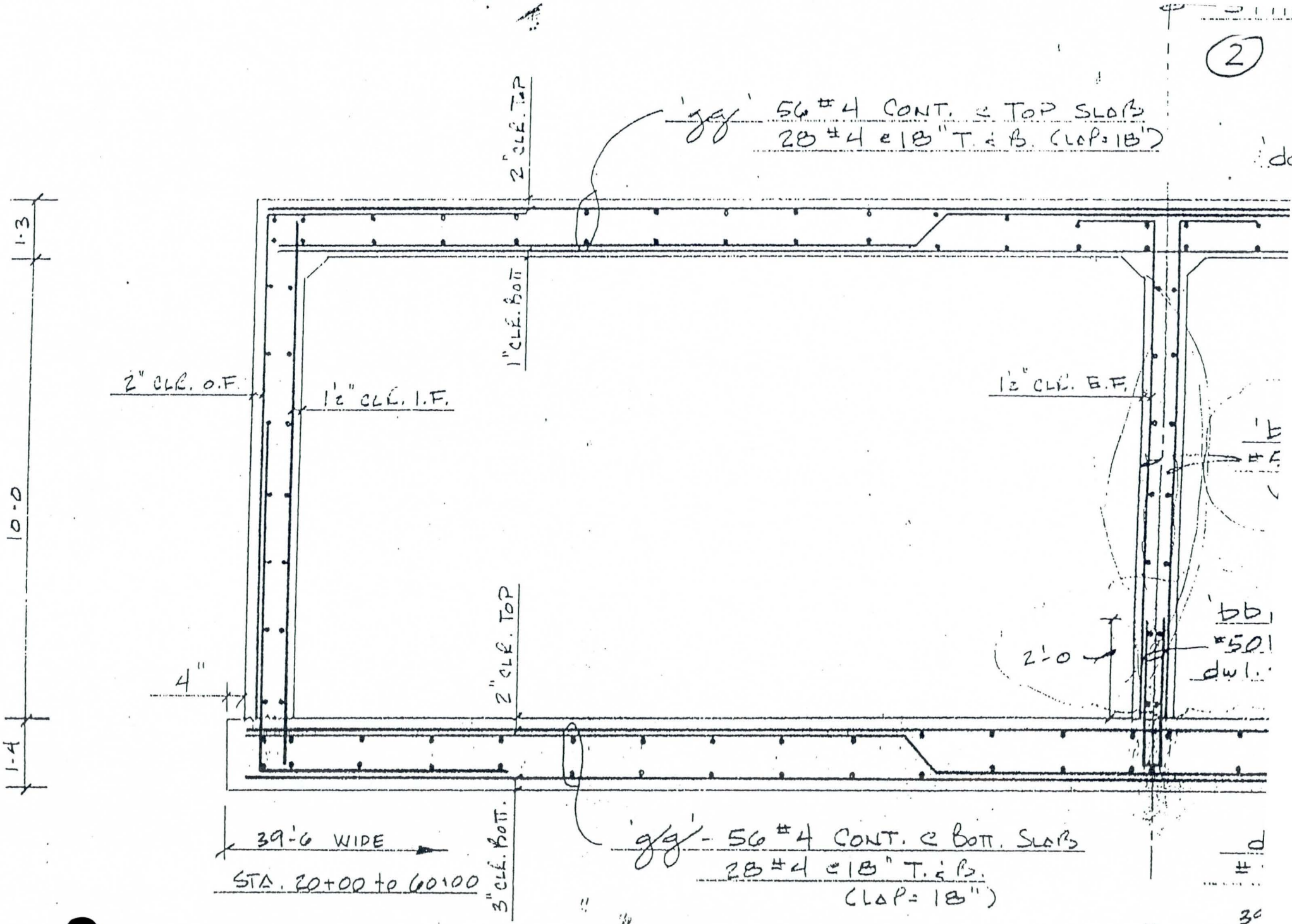
For 2 walls = 2[(59'-0)-(39'-2)] = 39'-8"

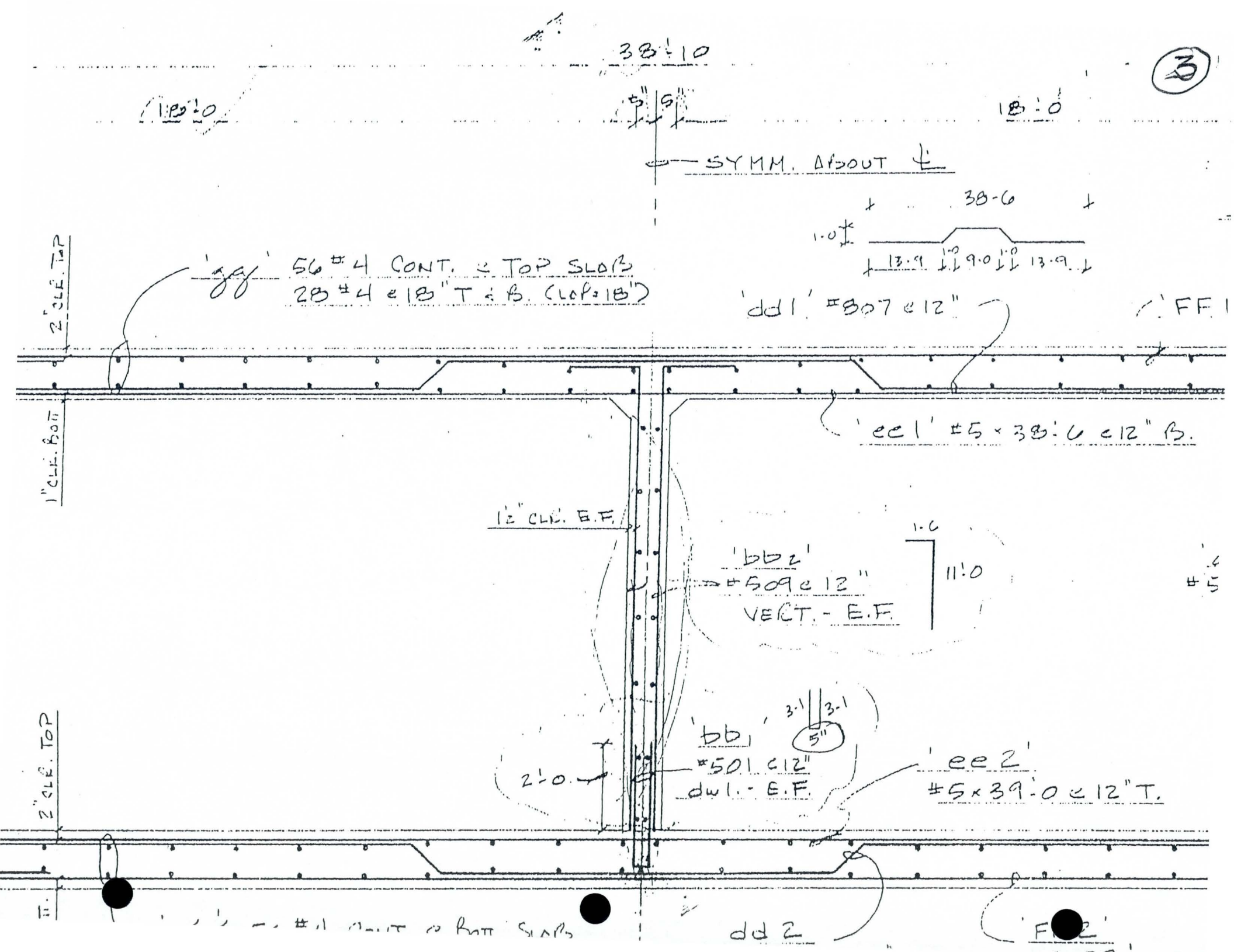
Total Savings = (125.08 x 4900) = 612,892 lbs

6910-153 4-80



TYPICAL SECTION @ DOUBLE 18' x 10' BOX
(EXCEPT AS NOTED)


(2)
'gg' 56 #4 CONT. @ TOP SLAB
28 #4 @ 18" T. & B. (LAP = 18')
2" CLR. TOP
1" CLR. BOTT
2" CLR. O.F.
1½" CLR. I.F.
1½" CLR. B.F.
1'-3
10'-0
1'-4
4"
2" CLR. TOP
2'-0
3" CLR. BOTT.
39'-6 WIDE
STA. 20+00 to 60+00
'gg' - 56 #4 CONT. @ BOTT. SLAB
28 #4 @ 18" T. & B.
(LAP = 18")


3
38'-10
18'-0
18'-0
5"
5"
SYMM. ABOUT ℄
38-6
1.0
13.9
1.0
9.0
1.0
13.9
'gg' 56 #4 CONT. ℄ TOP SLAB
28 #4 @ 18" T & B. (LAP=18")
'dd1' #807 @ 12"
FF1
2" CLR. TOP
1" CLR. BOT
'ee1' #5 x 38'-6 @ 12" B.
12" CLR. E.F.
'bb2'
#509 @ 12"
VERT. - E.F.
1.0
11'-0
#5
3.1
3.1
5"
'bb1'
#501 @ 12"
dw1. - E.F.
2'-0
'ee2'
#5 x 39'-0 @ 12" T.
2" CLR. TOP
dd2
FF2

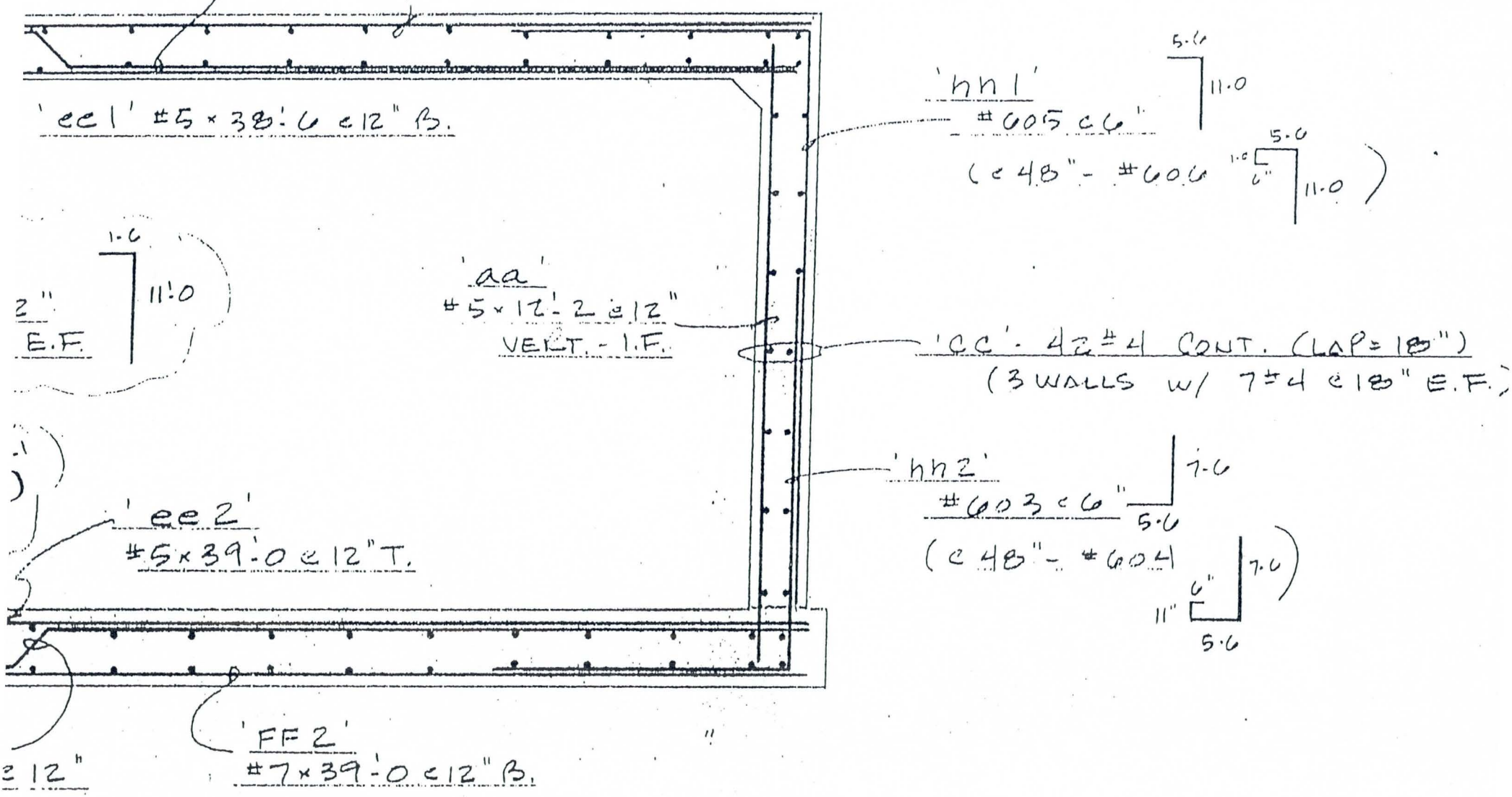
3

OUT ℄

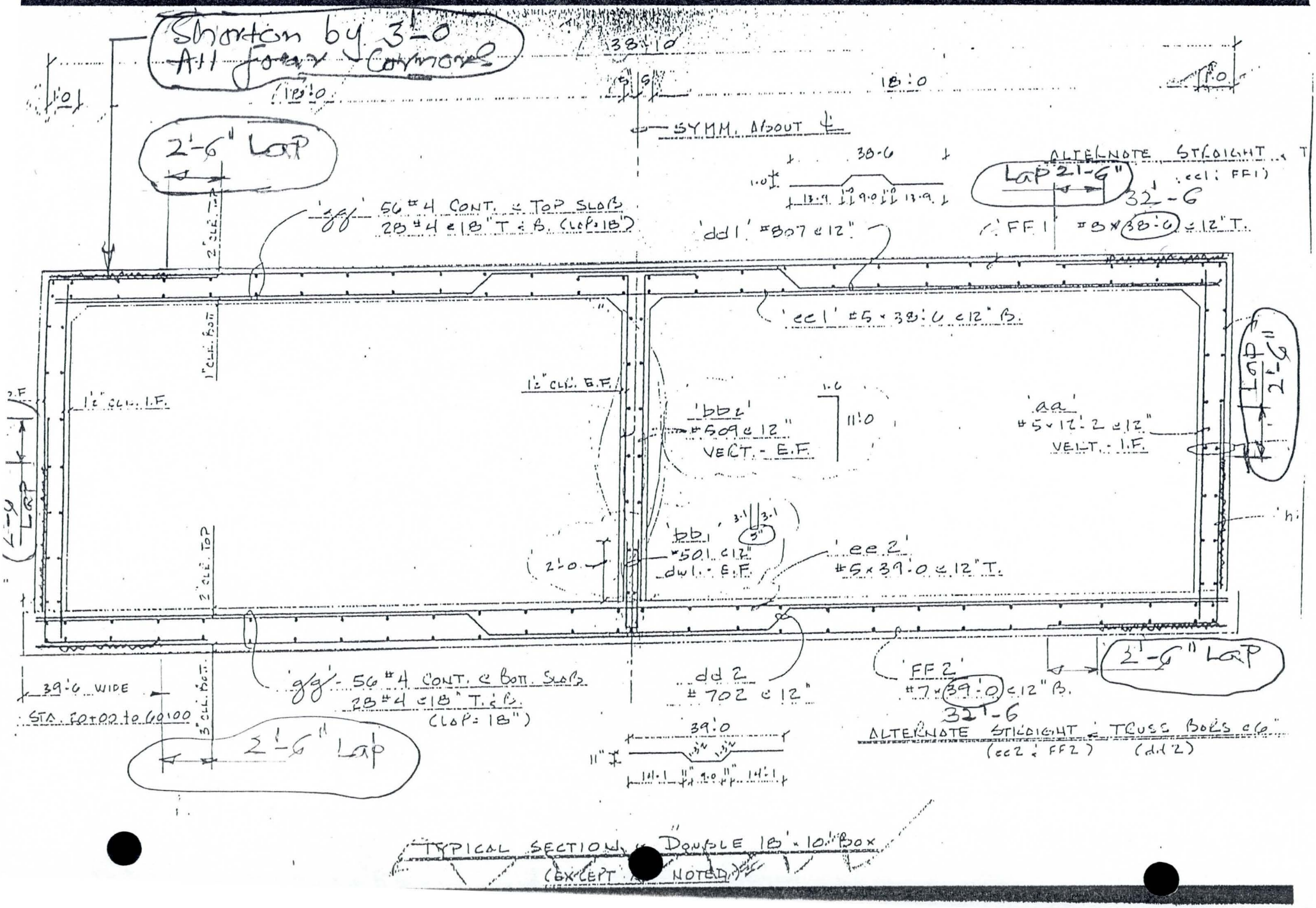
38-6

13-9 1-0 9-0 1-0 13-9

ALTERNATE STRAIGHT & TRUSS BARS c6"
('ee1' : FF1) (dd1)



ALTERNATE STRAIGHT & TRUSS BARS c6"
('ee1' : FF2) (dd2)


Shorten by 3'-0 All four corners
2'-6" Lap
SYMM. ABOUT ℄
ALTERNATE STRAIGHT (ecl ; FF1)
Lap 2'-6"
32'-6
FF1 #8 x 38'-0 @ 12" T.
'gf' 56 #4 CONT. @ TOP SLAB
28 #4 @ 18" T. & B. (LAP=18")
'dd1' #807 @ 12"
'ecl' #5 x 38'-0 @ 12" B.
1½" CLR. B.F.
1½" CLR. I.F.
'bb2' #509 @ 12" VERT. - E.F.
'aa' #5 x 12'-2 @ 12" VERT. - I.F.
'bb1' #501 @ 12" dwl. - E.F.
'ee2' #5 x 39'-0 @ 12" T.
'gg' - 56 #4 CONT. @ BOT. SLAB
28 #4 @ 18" T. & B. (LAP=18")
dd2 #702 @ 12"
FF2 #7 x 39'-0 @ 12" B.
32'-6
ALTERNATE STRAIGHT & TRUSS BARS @ 6"
(ec2 & FF2) (dd2)
39'-6 WIDE
STA. 50+00 to 60+00
2'-6" Lap
TYPICAL SECTION - DOUBLE 18' x 10' BOX
(EXCEPT AS NOTED)

3

OUT ℄

38-6

13-9 1'-0 9'-0 1'-0 13-9

ALTERNATE STRAIGHT & TRUSS BARS c6"

(ee1 & FF1) (dd1)

Shorten # 8 Bars by 3'-0 ALL four Corners

2'-6" Lap

'FF1' #8 × 38'-6 c12" T.

32-6

807 c12"

'ee1' #5 × 38'-6 c12" B.

'hh1' #605 c6"

(c48" - #606)

5.6

11.0

1.0

6"

'aa' #5 × 12'-2 c12" VERT. - I.F.

2'-6" Lap

'CC' - 42#4 CONT. (LAP=18")

(3 WALLS w/ 7#4 c18" E.F.)

1.6

11'0

2"

E.F.

'hh2' #603 c6"

(c48" - #604)

7.6

5.6

11"

'ee2' #5 × 39'-0 c12" T.

'FF2' #7 × 39'-0 c12" B.

2'-6" Lap

32'-6

ALTERNATE STRAIGHT & TRUSS BARS c6"

(ee2 & FF2) (dd2)

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

ITEM NO.	DESCRIPTION	UNIT	APPROX QTY	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				ENGINEER'S ESTIMATE		AMES CONSTRUCTION*		PCL CIVIL CONSTRUCTORS, INC.*		MEADOW VALLEY	
105-1	Partnering	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
105-2	Protection of water and sewer lines	L.S.	1	$75,000.00	$75,000.00	$4,000.00	$4,000.00	$2,000.00	$2,000.00	$30,000.00	$30,000.00
107-1	NPDES/SWPPP Permits	L.S.	1	$20,000.00	$20,000.00	$5,000.00	$5,000.00	$2,000.00	$2,000.00	$17,000.00	$17,000.00
107-2	Preparation of Health and Safety Plan	L.S.	1	$5,000.00	$5,000.00	$3,000.00	$3,000.00	$2,000.00	$2,000.00	$1,000.00	$1,000.00
107-3	Public Information & Notification allowance	L.S.	1	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00
107-4	Project Signs allowance	L.S.	1	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00
107-5	Groundwater dewatering	L.S.	1	$200,000.00	$200,000.00	$40,000.00	$40,000.00	$134,942.00	$134,942.00	$300,000.00	$300,000.00
107-6	Ground Breaking and Dedication Ceremonies allowance	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
202	Mobilization	L.S.	1	$100,000.00	$100,000.00	$200,000.00	$200,000.00	$211,366.00	$211,366.00	$565,000.00	$565,000.00
206-1	Structure excavation	C.Y.	148,214	$6.00	$889,284.00	$2.00	$296,428.00	$3.00	$444,642.00	$4.00	$592,856.00
206-2	Structure backfill	C.Y.	29,438	$22.00	$647,636.00	$13.00	$382,694.00	$16.50	$485,727.00	$14.00	$412,132.00
206-3	Geocomposite drain	S.Y.	9,107	$10.00	$91,070.00	$2.00	$18,214.00	$4.00	$36,428.00	$5.00	$45,535.00
211	Fill construction	C.Y.	44,205	$8.00	$353,640.00	$1.25	$55,256.25	$2.00	$88,410.00	$1.00	$44,205.00
215	Earthwork for open channels (excavation)	C.Y.	10,419	$3.50	$36,466.50	$2.50	$26,047.50	$2.00	$20,838.00	$1.50	$15,628.50
222	Grasscrete construction	S.F.	22,457	$6.00	$134,742.00	$3.00	$67,371.00	$3.50	$78,599.50	$4.50	$101,056.50
301	Subgrade preparation under pavement	S.Y.	6,004	$2.00	$12,008.00	$0.35	$2,101.40	$0.60	$3,602.40	$1.50	$9,006.00
310-1	Aggregate base course	C.Y.	666	$12.00	$7,992.00	$15.00	$9,990.00	$19.00	$12,654.00	$22.00	$14,652.00
310-2	Gravel bedding	C.Y.	15,426	$25.00	$385,650.00	$10.00	$154,260.00	$15.00	$231,390.00	$12.00	$185,112.00
321	Asphalt concrete pavement C-3/4	TON	652	$32.00	$20,864.00	$30.00	$19,560.00	$31.00	$20,212.00	$29.00	$18,908.00
340-1	Concrete curb and gutter, MAG Det 220, Type A, H=9"	L.F.	4,492	$7.00	$31,444.00	$6.50	$29,198.00	$8.00	$35,936.00	$10.00	$44,920.00
340-2	6"x 6" Concrete edging	L.F.	9,990	$3.00	$29,970.00	$1.00	$9,990.00	$10.00	$99,900.00	$4.00	$39,960.00
340-3	Concrete header	L.F.	3,385	$3.50	$11,847.50	$1.50	$5,077.50	$15.00	$50,775.00	$6.00	$20,310.00
340-4	Concrete driveway, COP Det. P-1255	S.F.	180	$4.00	$720.00	$4.00	$720.00	$2.00	$360.00	$4.00	$720.00
345-1	Adjust box frame and cover	EA.	4	$250.00	$1,000.00	$100.00	$400.00	$330.00	$1,320.00	$300.00	$1,200.00
345-2	Adjust manhole frame and cover	EA.	10	$240.00	$2,400.00	$100.00	$1,000.00	$170.00	$1,700.00	$300.00	$3,000.00
350-1	Remove fence, handrail, guardrail, posts, and barricades	L.S.	1	$1,000.00	$1,000.00	$6,000.00	$6,000.00	$3,000.00	$3,000.00	$2,500.00	$2,500.00
350-2	Remove curb and gutter	L.S.	1	$50.00	$50.00	$1,000.00	$1,000.00	$520.00	$520.00	$6,000.00	$6,000.00
350-3	Remove pipe	L.S.	1	$4,400.00	$4,400.00	$2,000.00	$2,000.00	$7,200.00	$7,200.00	$5,000.00	$5,000.00
350-4	Remove spillways and channel lining	L.S.	1	$3,000.00	$3,000.00	$30,000.00	$30,000.00	$20,000.00	$20,000.00	$9,000.00	$9,000.00
350-5	Remove asphalt pavement	L.S.	1	$1,500.00	$1,500.00	$5,000.00	$5,000.00	$2,000.00	$2,000.00	$3,000.00	$3,000.00
350-6	Remove bike path pavement	L.S.	1	$3,200.00	$3,200.00	$2,000.00	$2,000.00	$5,200.00	$5,200.00	$5,000.00	$5,000.00
350-7	Remove pedestrian crossing and drop structure	L.S.	1	$20,000.00	$20,000.00	$10,000.00	$10,000.00	$19,000.00	$19,000.00	$11,000.00	$11,000.00
350-8	Remove gabions	L.S.	1	$1,200.00	$1,200.00	$3,000.00	$3,000.00	$2,000.00	$2,000.00	$1,500.00	$1,500.00
350-9	Remove rip rap	L.S.	1	$1,400.00	$1,400.00	$1,000.00	$1,000.00	$2,000.00	$2,000.00	$1,500.00	$1,500.00
350-10	Remove chain link fence	L.S.	1	$300.00	$300.00	$1,000.00	$1,000.00	$175.00	$175.00	$2,000.00	$2,000.00
350-11	Miscellaneous removals	L.S.	1	$1,000.00	$1,000.00	$5,000.00	$5,000.00	$1,700.00	$1,700.00	$72,000.00	$72,000.00
350-12	Remove trees	EA.	20	$350.00	$7,000.00	$150.00	$3,000.00	$240.00	$4,800.00	$250.00	$5,000.00
401-1	Traffic control	L.S.	1	$30,000.00	$30,000.00	$15,000.00	$15,000.00	$50,000.00	$50,000.00	$55,000.00	$55,000.00
401-2	Off-duty uniformed officer	M.H.	600	$21.00	$12,600.00	$34.00	$20,400.00	$20.00	$12,000.00	$20.00	$12,000.00
415-1	Guardrail, ADOT Std. Dwg. No. C-10.04	L.F.	50	$25.00	$1,250.00	$25.00	$1,250.00	$15.00	$750.00	$32.00	$1,600.00
415-2	Dwg. No. C-10.15	EA.	1	$1,300.00	$1,300.00	$1,500.00	$1,500.00	$2,000.00	$2,000.00	$1,600.00	$1,600.00
430-1	Seeded turf	ACRE	7.27	$2,100.00	$15,267.00	$850.00	$6,179.50	$2,500.00	$18,175.00	$8,000.00	$58,160.00
430-2	Sodded turf	S.Y.	16,856	$4.00	$67,424.00	$1.75	$29,498.00	$1.40	$23,598.40	$4.50	$75,852.00
432	Gravel mulch	S.Y.	2,839	$3.00	$8,517.00	$2.00	$5,678.00	$2.00	$5,678.00	$2.20	$6,245.80
440-1	Irrigation system	L.S.	1	$100,000.00	$100,000.00	$75,000.00	$75,000.00	$117,650.00	$117,650.00	$120,000.00	$120,000.00
440-2	4" PVC sleeves	L.F.	470	$2.00	$940.00	$8.00	$3,760.00	$10.00	$4,700.00	$16.00	$7,520.00
440-3	6" PVC sleeves	L.F.	544	$4.00	$2,176.00	$10.00	$5,440.00	$15.00	$8,160.00	$19.00	$10,336.00
505-1	Double 18'x 10' concrete box culvert	L.F.	4,900	$1,100.00	$5,390,000.00	$900.00	$4,410,000.00	$795.00	$3,895,500.00	$825.00	$4,042,500.00
505-2	Concrete open channel	L.F.	100	$655.00	$65,500.00	$710.00	$71,000.00	$1,200.00	$120,000.00	$875.00	$87,500.00
505-3	Concrete encasement for 8" water line, MAG Det. 402	L.F.	44	$40.00	$1,760.00	$90.00	$3,960.00	$44.00	$1,936.00	$20.00	$880.00
505-4	Retaining wall (ADOT B-18.10 & B-18.20)	L.F.	805	$85.00	$68,425.00	$100.00	$80,500.00	$200.00	$161,000.00	$100.00	$80,500.00
505-5	Retaining wall (STA. 17+75 to STA. 18+95)	L.F.	120	$90.00	$10,800.00	$90.00	$10,800.00	$190.00	$22,800.00	$110.00	$13,200.00
505-6	Concrete apron	S.F.	3,587	$3.00	$10,761.00	$4.00	$14,348.00	$4.00	$14,348.00	$3.50	$12,554.50

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

ITEM NO.	DESCRIPTION	UNIT	APPROX QTY.	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				ENGINEER'S ESTIMATE		AMES CONSTRUCTION*		PCL CIVIL CONSTRUCTORS, INC.*		MEADOW VALLEY	
505-7	Concrete spillways	S.Y.	1,890	$54.00	$102,060.00	$60.00	$113,400.00	$56.00	$105,840.00	$65.00	$122,850.00
505-8	Single gate drop inlets	EA.	28	$1,000.00	$28,000.00	$1,000.00	$28,000.00	$2,000.00	$56,000.00	$1,000.00	$28,000.00
505-9	Inlet structure at Oak Street	L.S.	1	$50,000.00	$50,000.00	$80,000.00	$80,000.00	$131,000.00	$131,000.00	$80,000.00	$80,000.00
515-1	Fixed bollards	EA.	81	$150.00	$12,150.00	$125.00	$10,125.00	$160.00	$12,960.00	$150.00	$12,150.00
515-2	Removable bollards	EA.	6	$100.00	$600.00	$125.00	$750.00	$85.00	$510.00	$155.00	$930.00
520-1	Handrail	L.F.	1,137	$15.00	$17,055.00	$25.00	$28,425.00	$18.00	$20,466.00	$28.00	$31,836.00
520-2	Steel picket fence	L.F.	268	$31.50	$8,442.00	$75.00	$20,100.00	$80.00	$21,440.00	$60.00	$16,080.00
609	Well closure	EA.	2	$1,000.00	$2,000.00	$1,000.00	$2,000.00	$2,500.00	$5,000.00	$3,000.00	$6,000.00
610-1	Water line relocation (8")	L.F.	107	$200.00	$21,400.00	$50.00	$5,350.00	$37.00	$3,959.00	$90.00	$9,630.00
610-2	Water line construction (12")	L.F.	119	$130.00	$15,470.00	$75.00	$8,925.00	$29.00	$3,451.00	$115.00	$13,685.00
610-3	Cut and plug water line	EA.	10	$600.00	$6,000.00	$250.00	$2,500.00	$755.00	$7,550.00	$300.00	$3,000.00
610-4	Cut and plug sanitary sewer line	EA.	2	$200.00	$400.00	$250.00	$500.00	$753.00	$1,506.00	$150.00	$300.00
618-1	12" RGRCP	L.F.	14	$60.00	$840.00	$100.00	$1,400.00	$131.00	$1,834.00	$95.00	$1,330.00
618-2	18" RGRCP	L.F.	15	$80.00	$1,200.00	$100.00	$1,500.00	$231.00	$3,465.00	$220.00	$3,300.00
618-3	24" RGRCP	L.F.	14	$100.00	$1,400.00	$100.00	$1,400.00	$256.00	$3,584.00	$190.00	$2,660.00
618-4	42" RGRCP	L.F.	5	$120.00	$600.00	$100.00	$500.00	$230.00	$1,150.00	$275.00	$1,375.00
618-5	48" RGRCP	L.F.	8	$135.00	$1,080.00	$100.00	$800.00	$187.00	$1,496.00	$250.00	$2,000.00
618-6	Relocate 24" SRP siphon	L.S.	1	$65,000.00	$65,000.00	$5,000.00	$5,000.00	$6,900.00	$6,900.00	$20,000.00	$20,000.00
621-1	18" Slotted drain	L.F.	212	$60.00	$12,720.00	$50.00	$10,600.00	$100.00	$21,200.00	$60.00	$12,720.00
621-2	18" Corrugated steel pipe	L.F.	112	$25.00	$2,800.00	$30.00	$3,360.00	$59.00	$6,608.00	$35.00	$3,920.00
625-1	Access manholes	EA.	10	$2,000.00	$20,000.00	$1,500.00	$15,000.00	$1,700.00	$17,000.00	$1,500.00	$15,000.00
625-2	Water-tight frames and covers	EA.	3	$275.00	$825.00	$250.00	$750.00	$450.00	$1,350.00	$550.00	$1,650.00
							$0.00		$0.00		$0.00
	*** ALTERNATE BID ITEM ***						$0.00		$0.00		$0.00
450	Lighting	L.S.	1	$80,000.00	$80,000.00	$90,000.00	$90,000.00	$84,615.00	$84,615.00	$90,000.00	$90,000.00
	BID TOTAL				$9,397,546.00		$6,644,006.15		$7,069,576.30		$7,709,565.30
	Difference, Dollars from Engineer's Estimate						($2,753,539.85)		($2,327,969.70)		($1,687,980.70)
	Difference, Dollars from Low Bid								$425,570.15		$1,065,559.15

*** Corrected Bid Amount**

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

ITEM NO.	DESCRIPTION	UNIT	APPROX QTY.	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				EDWARD KRAEMER & SONS		HUNTER CONTRACTING		KIEWIT WESTERN CO.		SUNDT CORP.	
105-1	Partnering	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
105-2	Protection of water and sewer lines	L.S.	1	$50,000.00	$50,000.00	$100,000.00	$100,000.00	$120,000.00	$120,000.00	$120,000.00	$120,000.00
107-1	NPDES/SWPPP Permits	L.S.	1	$5,000.00	$5,000.00	$10,000.00	$10,000.00	$2,500.00	$2,500.00	$30,000.00	$30,000.00
107-2	Preparation of Health and Safety Plan	L.S.	1	$5,000.00	$5,000.00	$10,000.00	$10,000.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00
107-3	Public Information & Notification allowance	L.S.	1	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00	$50,000.00
107-4	Project Signs allowance	L.S.	1	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00
107-5	Groundwater dewatering	L.S.	1	$213,051.00	$213,051.00	$225,000.00	$225,000.00	$202,000.00	$202,000.00	$270,900.00	$270,900.00
107-6	Ground Breaking and Dedication Ceremonies allowance	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
202	Mobilization	L.S.	1	$90,000.00	$90,000.00	$390,000.00	$390,000.00	$250,000.00	$250,000.00	$250,000.00	$250,000.00
206-1	Structure excavation	C.Y.	148,214	$3.00	$444,642.00	$3.75	$555,802.50	$4.70	$696,605.80	$5.50	$815,177.00
206-2	Structure backfill	C.Y.	29,438	$15.00	$441,570.00	$21.00	$618,198.00	$15.00	$441,570.00	$18.00	$529,884.00
206-3	Geocomposite drain	S.Y.	9,107	$6.00	$54,642.00	$7.00	$63,749.00	$2.00	$18,214.00	$6.00	$54,642.00
211	Fill construction	C.Y.	44,205	$1.20	$53,046.00	$3.50	$154,717.50	$5.00	$221,025.00	$5.00	$221,025.00
215	Earthwork for open channels (excavation)	C.Y.	10,419	$2.00	$20,838.00	$6.00	$62,514.00	$2.00	$20,838.00	$2.00	$20,838.00
222	Grasscrete construction	S.F.	22,457	$4.00	$89,828.00	$4.50	$101,056.50	$4.50	$101,056.50	$4.20	$94,319.40
301	Subgrade preparation under pavement	S.Y.	6,004	$1.00	$6,004.00	$1.00	$6,004.00	$1.65	$9,906.60	$2.00	$12,008.00
310-1	Aggregate base course	C.Y.	666	$18.00	$11,988.00	$18.00	$11,988.00	$30.00	$19,980.00	$30.00	$19,980.00
310-2	Gravel bedding	C.Y.	15,426	$11.00	$169,686.00	$22.00	$339,372.00	$25.00	$385,650.00	$30.00	$462,780.00
321	Asphalt concrete pavement C-3/4	TON	652	$31.00	$20,212.00	$28.00	$18,256.00	$50.00	$32,600.00	$40.00	$26,080.00
340-1	Concrete curb and gutter, MAG Det 220, Type A, H=9"	L.F.	4,492	$14.00	$62,888.00	$5.00	$22,460.00	$7.50	$33,690.00	$6.00	$26,952.00
340-2	6"x 6" Concrete edging	L.F.	9,990	$5.00	$49,950.00	$2.50	$24,975.00	$3.85	$38,461.50	$3.00	$29,970.00
340-3	Concrete header	L.F.	3,385	$7.00	$23,695.00	$4.50	$15,232.50	$5.25	$17,771.25	$4.00	$13,540.00
340-4	Concrete driveway, COP Det. P-1255	S.F.	180	$6.00	$1,080.00	$7.00	$1,260.00	$3.50	$630.00	$4.00	$720.00
345-1	Adjust box frame and cover	EA.	4	$350.00	$1,400.00	$275.00	$1,100.00	$300.00	$1,200.00	$210.00	$840.00
345-2	Adjust manhole frame and cover	EA.	10	$350.00	$3,500.00	$275.00	$2,750.00	$350.00	$3,500.00	$250.00	$2,500.00
350-1	Remove fence, handrail, guardrail, posts, and barricades	L.S.	1	$3,000.00	$3,000.00	$1,500.00	$1,500.00	$2,000.00	$2,000.00	$3,500.00	$3,500.00
350-2	Remove curb and gutter	L.S.	1	$300.00	$300.00	$1,000.00	$1,000.00	$200.00	$200.00	$2,200.00	$2,200.00
350-3	Remove pipe	L.S.	1	$32,000.00	$32,000.00	$5,000.00	$5,000.00	$20,000.00	$20,000.00	$1,500.00	$1,500.00
350-4	Remove spillways and channel lining	L.S.	1	$1,500.00	$1,500.00	$15,000.00	$15,000.00	$6,000.00	$6,000.00	$15,000.00	$15,000.00
350-5	Remove asphalt pavement	L.S.	1	$1,000.00	$1,000.00	$10,000.00	$10,000.00	$7,500.00	$7,500.00	$15,000.00	$15,000.00
350-6	Remove bike path pavement	L.S.	1	$4,000.00	$4,000.00	$10,000.00	$10,000.00	$4,000.00	$4,000.00	$6,500.00	$6,500.00
350-7	Remove pedestrian crossing and drop structure	L.S.	1	$20,000.00	$20,000.00	$30,000.00	$30,000.00	$20,000.00	$20,000.00	$39,200.00	$39,200.00
350-8	Remove gabions	L.S.	1	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$2,500.00	$2,500.00	$4,000.00	$4,000.00
350-9	Remove rip rap	L.S.	1	$4,000.00	$4,000.00	$5,000.00	$5,000.00	$4,000.00	$4,000.00	$3,200.00	$3,200.00
350-10	Remove chain link fence	L.S.	1	$800.00	$800.00	$4,000.00	$4,000.00	$5,000.00	$5,000.00	$1,300.00	$1,300.00
350-11	Miscellaneous removals	L.S.	1	$10,000.00	$10,000.00	$13,000.00	$13,000.00	$9,000.00	$9,000.00	$26,000.00	$26,000.00
350-12	Remove trees	EA.	20	$200.00	$4,000.00	$250.00	$5,000.00	$230.00	$4,600.00	$115.00	$2,300.00
401-1	Traffic control	L.S.	1	$90,000.00	$90,000.00	$50,000.00	$50,000.00	$90,000.00	$90,000.00	$84,000.00	$84,000.00
401-2	Off-duty uniformed officer	M.H.	600	$27.00	$16,200.00	$25.00	$15,000.00	$25.00	$15,000.00	$27.50	$16,500.00
415-1	Guardrail, ADOT Std. Dwg. No. C-10.04	L.F.	50	$30.00	$1,500.00	$35.00	$1,750.00	$25.00	$1,250.00	$25.00	$1,250.00
415-2	Dwg. No. C-10.15	EA.	1	$1,600.00	$1,600.00	$1,600.00	$1,600.00	$800.00	$800.00	$1,200.00	$1,200.00
430-1	Seeded turf	ACRE	7.27	$7,400.00	$53,798.00	$1,000.00	$7,270.00	$7,400.00	$53,798.00	$7,525.00	$54,706.75
430-2	Sodded turf	S.Y.	16,856	$4.25	$71,638.00	$2.25	$37,926.00	$4.25	$71,638.00	$4.65	$78,380.40
432	Gravel mulch	S.Y.	2,839	$2.00	$5,678.00	$2.25	$6,387.75	$2.00	$5,678.00	$2.00	$5,678.00
440-1	Irrigation system	L.S.	1	$115,000.00	$115,000.00	$115,000.00	$115,000.00	$100,000.00	$100,000.00	$113,000.00	$113,000.00
440-2	4" PVC sleeves	L.F.	470	$15.00	$7,050.00	$16.00	$7,520.00	$6.00	$2,820.00	$4.00	$1,880.00
440-3	6" PVC sleeves	L.F.	544	$17.00	$9,248.00	$18.00	$9,792.00	$7.00	$3,808.00	$6.00	$3,264.00
505-1	Double 18'x 10' concrete box culvert	L.F.	4,900	$1,000.00	$4,900,000.00	$855.00	$4,189,500.00	$910.00	$4,459,000.00	$891.00	$4,365,900.00
505-2	Concrete open channel	L.F.	100	$1,000.00	$100,000.00	$960.00	$96,000.00	$850.00	$85,000.00	$1,000.00	$100,000.00
505-3	Concrete encasement for 8" water line, MAG Det. 402	L.F.	44	$50.00	$2,200.00	$70.00	$3,080.00	$12.00	$528.00	$60.00	$2,640.00
505-4	Retaining wall (ADOT B-18.10 & B-18.20)	L.F.	805	$170.00	$136,850.00	$185.00	$148,925.00	$250.00	$201,250.00	$120.00	$96,600.00
505-5	Retaining wall (STA. 17+75 to STA. 18+95)	L.F.	120	$170.00	$20,400.00	$225.00	$27,000.00	$350.00	$42,000.00	$140.00	$16,800.00
505-6	Concrete apron	S.F.	3,587	$5.00	$17,935.00	$6.50	$23,315.50	$2.55	$9,146.85	$4.00	$14,348.00
505-7	Concrete spillways	S.Y.	1,890	$70.00	$132,300.00	$60.00	$113,400.00	$80.00	$151,200.00	$75.00	$141,750.00

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

ITEM NO.	DESCRIPTION	UNIT	APPROX QTY.	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				EDWARD KRAEMER & SONS		HUNTER CONTRACTING		KIEWIT WESTERN CO.		SUNDT CORP.	
505-8	Single gate drop inlets	EA.	28	$1,000.00	$28,000.00	$1,000.00	$28,000.00	$1,000.00	$28,000.00	$825.00	$23,100.00
505-9	Inlet structure at Oak Street	L.S.	1	$120,000.00	$120,000.00	$95,000.00	$95,000.00	$126,000.00	$126,000.00	$91,225.00	$91,225.00
515-1	Fixed bollards	EA.	81	$105.00	$8,505.00	$90.00	$7,290.00	$230.00	$18,630.00	$160.00	$12,960.00
515-2	Removable bollards	EA.	6	$80.00	$480.00	$160.00	$960.00	$100.00	$600.00	$200.00	$1,200.00
520-1	Handrail	L.F.	1,137	$25.00	$28,425.00	$27.00	$30,699.00	$25.00	$28,425.00	$32.00	$36,384.00
520-2	Steel picket fence	L.F.	268	$57.00	$15,276.00	$60.00	$16,080.00	$105.00	$28,140.00	$65.00	$17,420.00
609	Well closure	EA.	2	$4,250.00	$8,500.00	$12,000.00	$24,000.00	$4,000.00	$8,000.00	$2,500.00	$5,000.00
610-1	Water line relocation (8")	L.F.	107	$175.00	$18,725.00	$60.00	$6,420.00	$60.00	$6,420.00	$200.00	$21,400.00
610-2	Water line construction (12")	L.F.	119	$185.00	$22,015.00	$75.00	$8,925.00	$70.00	$8,330.00	$85.00	$10,115.00
610-3	Cut and plug water line	EA.	10	$500.00	$5,000.00	$650.00	$6,500.00	$400.00	$4,000.00	$375.00	$3,750.00
610-4	Cut and plug sanitary sewer line	EA.	2	$500.00	$1,000.00	$850.00	$1,700.00	$400.00	$800.00	$275.00	$550.00
618-1	12" RGRCP	L.F.	14	$400.00	$5,600.00	$75.00	$1,050.00	$150.00	$2,100.00	$50.00	$700.00
618-2	18" RGRCP	L.F.	15	$1,000.00	$15,000.00	$140.00	$2,100.00	$300.00	$4,500.00	$145.00	$2,175.00
618-3	24" RGRCP	L.F.	14	$850.00	$11,900.00	$150.00	$2,100.00	$225.00	$3,150.00	$125.00	$1,750.00
618-4	42" RGRCP	L.F.	5	$1,420.00	$7,100.00	$250.00	$1,250.00	$350.00	$1,750.00	$295.00	$1,475.00
618-5	48" RGRCP	L.F.	8	$890.00	$7,120.00	$200.00	$1,600.00	$375.00	$3,000.00	$265.00	$2,120.00
618-6	Relocate 24" SRP siphon	L.S.	1	$46,200.00	$46,200.00	$35,000.00	$35,000.00	$40,000.00	$40,000.00	$45,000.00	$45,000.00
621-1	18" Slotted drain	L.F.	212	$55.00	$11,660.00	$61.00	$12,932.00	$50.00	$10,600.00	$38.00	$8,056.00
621-2	18" Corrugated steel pipe	L.F.	112	$62.00	$6,944.00	$54.00	$6,048.00	$50.00	$5,600.00	$48.00	$5,376.00
625-1	Access manholes	EA.	10	$1,900.00	$19,000.00	$2,700.00	$27,000.00	$1,500.00	$15,000.00	$1,600.00	$16,000.00
625-2	Water-tight frames and covers	EA.	3	$1,000.00	$3,000.00	$650.00	$1,950.00	$500.00	$1,500.00	$725.00	$2,175.00
					$0.00		$0.00		$0.00		$0.00
	*** ALTERNATE BID ITEM ***				$0.00		$0.00		$0.00		$0.00
450	Lighting	L.S.	1	$83,240.00	$83,240.00	$90,000.00	$90,000.00	$85,000.00	$85,000.00	$107,000.00	$107,000.00
					$0.00						
	BID TOTAL				$8,117,707.00		$8,159,005.25		$8,486,960.50		$8,697,183.55
	Difference, Dollars from Engineer's Estimate				($1,279,839.00)		($1,238,540.75)		($910,585.50)		($700,362.45)
	Difference, Dollars from Low Bid				$1,473,700.85		$1,514,999.10		$1,842,954.35		$2,053,177.40

* Corrected Bid Amount

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

ITEM NO.	DESCRIPTION	UNIT	APPROX QTY.	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				FNF CONSTRUCTION*		MINGUS CONSTRUCTORS*					
105-1	Partnering	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00				
105-2	Protection of water and sewer lines	L.S.	1	$200,000.00	$200,000.00	$37,200.00	$37,200.00				
107-1	NPDES/SWPPP Permits	L.S.	1	$3,000.00	$3,000.00	$2,480.00	$2,480.00				
107-2	Preparation of Health and Safety Plan	L.S.	1	$3,000.00	$3,000.00	$620.00	$620.00				
107-3	Public Information & Notification allowance	L.S.	1	$50,000.00	$50,000.00	$50,000.00	$50,000.00				
107-4	Project Signs allowance	L.S.	1	$2,000.00	$2,000.00	$2,000.00	$2,000.00				
107-5	Groundwater dewatering	L.S.	1	$500,000.00	$500,000.00	$309,256.00	$309,256.00				
107-6	Ground Breaking and Dedication Ceremonies allowance	L.S.	1	$4,000.00	$4,000.00	$4,000.00	$4,000.00				
202	Mobilization	L.S.	1	$790,000.00	$790,000.00	$250,000.00	$250,000.00				
206-1	Structure excavation	C.Y.	148,214	$3.00	$444,642.00	$10.23	$1,516,229.22				
206-2	Structure backfill	C.Y.	29,438	$14.00	$412,132.00	$17.14	$504,567.32				
206-3	Geocomposite drain	S.Y.	9,107	$4.00	$36,428.00	$9.49	$86,425.43				
211	Fill construction	C.Y.	44,205	$4.00	$176,820.00	$16.72	$739,107.60				
215	Earthwork for open channels (excavation)	C.Y.	10,419	$3.00	$31,257.00	$10.23	$106,586.37				
222	Grasscrete construction	S.F.	22,457	$4.00	$89,828.00	$4.96	$111,386.72				
301	Subgrade preparation under pavement	S.Y.	6,004	$1.00	$6,004.00	$0.84	$5,043.36				
310-1	Aggregate base course	C.Y.	666	$20.00	$13,320.00	$20.03	$13,339.98				
310-2	Gravel bedding	C.Y.	15,426	$20.00	$308,520.00	$16.93	$261,162.18				
321	Asphalt concrete pavement C-3/4	TON	652	$26.00	$16,952.00	$44.70	$29,144.40				
340-1	Concrete curb and gutter, MAG Det 220, Type A, H=9"	L.F.	4,492	$8.00	$35,936.00	$13.02	$58,485.84				
340-2	6"x 6" Concrete edging	L.F.	9,990	$4.50	$44,955.00	$2.91	$29,070.90				
340-3	Concrete header	L.F.	3,385	$6.00	$20,310.00	$3.72	$12,592.20				
340-4	Concrete driveway, COP Det. P-1255	S.F.	180	$5.00	$900.00	$4.76	$856.80				
345-1	Adjust box frame and cover	EA.	4	$450.00	$1,800.00	$171.00	$684.00				
345-2	Adjust manhole frame and cover	EA.	10	$450.00	$4,500.00	$151.30	$1,513.00				
350-1	Remove fence, handrail, guardrail, posts, and barricades	L.S.	1	$2,500.00	$2,500.00	$4,935.00	$4,935.00				
350-2	Remove curb and gutter	L.S.	1	$1,000.00	$1,000.00	$595.00	$595.00				
350-3	Remove pipe	L.S.	1	$2,000.00	$2,000.00	$5,208.00	$5,208.00				
350-4	Remove spillways and channel lining	L.S.	1	$15,000.00	$15,000.00	$11,346.00	$11,346.00				
350-5	Remove asphalt pavement	L.S.	1	$10,000.00	$10,000.00	$7,099.00	$7,099.00				
350-6	Remove bike path pavement	L.S.	1	$5,000.00	$5,000.00	$8,401.00	$8,401.00				
350-7	Remove pedestrian crossing and drop structure	L.S.	1	$25,000.00	$25,000.00	$83,576.00	$83,576.00				
350-8	Remove gabions	L.S.	1	$1,000.00	$1,000.00	$5,307.00	$5,307.00				
350-9	Remove rip rap	L.S.	1	$5,000.00	$5,000.00	$5,059.00	$5,059.00				
350-10	Remove chain link fence	L.S.	1	$1,000.00	$1,000.00	$2,686.00	$2,686.00				
350-11	Miscellaneous removals	L.S.	1	$5,000.00	$5,000.00	$4,315.00	$4,315.00				
350-12	Remove trees	EA.	20	$250.00	$5,000.00	$292.00	$5,840.00				
401-1	Traffic control	L.S.	1	$25,000.00	$25,000.00	$30,157.00	$30,157.00				
401-2	Off-duty uniformed officer	M.H.	600	$25.00	$15,000.00	$24.39	$14,634.00				
415-1	Guardrail, ADOT Std. Dwg. No. C-10.04	L.F.	50	$35.00	$1,750.00	$39.68	$1,984.00				
415-2	Dwg. No. C-10.15	EA.	1	$1,600.00	$1,600.00	$651.00	$651.00				
430-1	Seeded turf	ACRE	7.27	$7,500.00	$54,525.00	$1,922.15	$13,974.03				
430-2	Sodded turf	S.Y.	16,856	$5.00	$84,280.00	$3.35	$56,467.60				
432	Gravel mulch	S.Y.	2,839	$2.00	$5,678.00	$3.32	$9,425.48				
440-1	Irrigation system	L.S.	1	$115,000.00	$115,000.00	$93,000.00	$93,000.00				
440-2	4" PVC sleeves	L.F.	470	$18.00	$8,460.00	$6.20	$2,914.00				
440-3	6" PVC sleeves	L.F.	544	$20.00	$10,880.00	$7.34	$3,992.96				
505-1	Double 18'x 10' concrete box culvert	L.F.	4,900	$865.00	$4,238,500.00	$780.24	$3,823,176.00				
505-2	Concrete open channel	L.F.	100	$1,000.00	$100,000.00	$913.67	$91,367.00				
505-3	Concrete encasement for 8" water line, MAG Det. 402	L.F.	44	$70.00	$3,080.00	$19.77	$869.88				
505-4	Retaining wall (ADOT B-18.10 & B-18.20)	L.F.	805	$200.00	$161,000.00	$164.00	$132,020.00				
505-5	Retaining wall (STA. 17+75 to STA. 18+95)	L.F.	120	$200.00	$24,000.00	$153.08	$18,369.60				
505-6	Concrete apron	S.F.	3,587	$4.00	$14,348.00	$4.58	$16,428.46				
505-7	Concrete spillways	S.Y.	1,890	$70.00	$132,300.00	$47.21	$89,226.90				

PROJECT: OLD CROSS CUT CANAL - PHASE II - CONTRACT FCD 95-08

ITEM NO.	DESCRIPTION	UNIT	APPROX QTY.	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT	UNIT COST NUMBERS	EXTENDED AMOUNT
				FNF CONSTRUCTION*		MINGUS CONSTRUCTORS*					
505-8	Single gate drop inlets	EA.	28	$1,000.00	$28,000.00	$1,363.32	$38,172.96				
505-9	Inlet structure at Oak Street	L.S.	1	$100,000.00	$100,000.00	$120,105.00	$120,105.00				
515-1	Fixed bollards	EA.	81	$150.00	$12,150.00	$122.77	$9,944.37				
515-2	Removable bollards	EA.	6	$125.00	$750.00	$55.33	$331.98				
520-1	Handrail	L.F.	1,137	$30.00	$34,110.00	$43.40	$49,345.80				
520-2	Steel picket fence	L.F.	268	$70.00	$18,760.00	$47.57	$12,748.76				
609	Well closure	EA.	2	$5,000.00	$10,000.00	$4,960.00	$9,920.00				
610-1	Water line relocation (8")	L.F.	107	$90.00	$9,630.00	$21.07	$2,253.96				
610-2	Water line construction (12")	L.F.	119	$1,000.00	$119,000.00	$32.98	$3,924.98				
610-3	Cut and plug water line	EA.	10	$250.00	$2,500.00	$121.50	$1,215.00				
610-4	Cut and plug sanitary sewer line	EA.	2	$500.00	$1,000.00	$183.50	$367.00				
618-1	12" RGRCP	L.F.	14	$300.00	$4,200.00	$47.86	$670.04				
618-2	18" RGRCP	L.F.	15	$550.00	$8,250.00	$65.53	$982.95				
618-3	24" RGRCP	L.F.	14	$575.00	$8,050.00	$76.93	$1,077.02				
618-4	42" RGRCP	L.F.	5	$800.00	$4,000.00	$205.20	$1,026.00				
618-5	48" RGRCP	L.F.	8	$850.00	$6,800.00	$174.38	$1,395.04				
618-6	Relocate 24" SRP siphon	L.S.	1	$35,000.00	$35,000.00	$14,320.00	$14,320.00				
621-1	18" Slotted drain	L.F.	212	$90.00	$19,080.00	$40.01	$8,482.12				
621-2	18" Corrugated steel pipe	L.F.	112	$90.00	$10,080.00	$12.55	$1,405.60				
625-1	Access manholes	EA.	10	$1,500.00	$15,000.00	$1,789.30	$17,893.00				
625-2	Water-tight frames and covers	EA.	3	$500.00	$1,500.00	$251.00	$753.00				
					$0.00		$0.00				
	*** ALTERNATE BID ITEM ***				$0.00		$0.00				
450	Lighting	L.S.	1	$85,000.00	$85,000.00	$136,400.00	$136,400.00				
	BID TOTAL				$8,806,065.00		$9,111,510.80				
	Difference, Dollars from Engineer's Estimate				($591,481.00)		($286,035.20)				
	Difference, Dollars from Low Bid				$2,162,058.85		$2,467,504.65				

* Corrected Bid Amount

AMES CONSTRUCTION, INC.
1801 SOUTH 51ST AVE.
PHOENIX, ARIZONA 85043
TELEPHONE: (602) 995-0622
FAX: (602) 995-8137
AZ. LIC. # 074995-002 CLASS A

July 10, 1996

Maricopa County Flood Control District
2801 West Durango Street
Phoenix, Arizona 85009

Attn: Tom Johnson, P.E.
Manager - Construction Operations

Re: Contract FCD 95-08
Old Cross Cut Canal Project, Phase II
Weep Hole Modification - Box Culvert Section

Gentlemen,

Ames Construction respectfully requests the MCFCD allow us to replace the 3 inch diameter / 6 foot OC / 4 foot from floor weep holes with 1-1/2 inch diameter / 4 foot OC / 3.5 feet from floor weep holes.

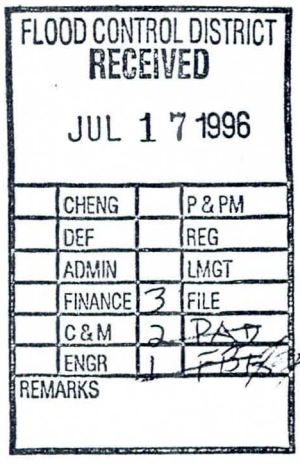
The traveling form system Ames is using for this project is already fabricated with a taper tie removal system which in it self forms the weep holes. The spacing of these taper ties is as stated above. We do not see it necessary to generate an additional row of weep holes when the taper tie holes will serve the same purpose.

Please call me if you require any additional information at 995-0622.

Sincerely,

David M. Reeg, P.E.
Division Engineer

cc: Brad Hill
Bill Spies
Jack VanMarter
File



AMES CONSTRUCTION, INC.
1801 SOUTH 51ST AVE.
PHOENIX, ARIZONA 85043
TELEPHONE: (602) 995-0622
FAX: (602) 995-8137
AZ. LIC. # 074995-002 CLASS A

July 10, 1996

Maricopa County Flood Control District
2801 West Durango Street
Phoenix, Arizona 85009

Attn: Tom Johnson, P.E.
Manager - Construction Operations

Re: Contract FCD 95-08
Old Cross Cut Canal Project, Phase II
Move Construction Joint

Gentlemen,

Ames Construction respectfully requests the MCFCD allow us to build the double 18' x 10' box culvert with the wall and roof construction joints placed at 39' 10" spacing. This is contrary to the project construction notes on page C8.1 of the Project Plans that indicate a joint spacing of 38' 6". Ames does not believe that this change will effect the structural integrity of the box culvert. We do understand that the Engineer of record has the final say on that issue.

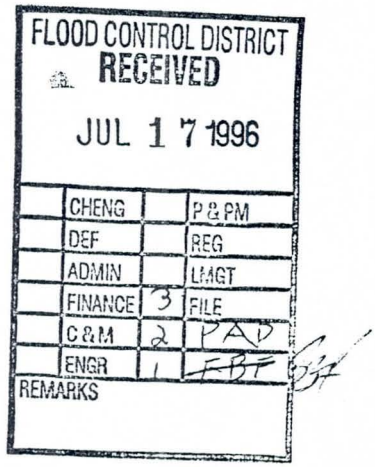
The sole purpose of this change is to make the most efficient use of our traveling form system which is prefabricated at 40 feet.

Thank you for the consideration and we will be looking forward to hearing from you on this matter.

Sincerely,

David M. Reeg, P.E.
Division Engineer

cc: Brad Hill
Bill Spies
Jack VanMarter
File



FLOOD CONTROL DISTRICT
of
Maricopa County

Interoffice Memorandum

TO: FBF, PAD

VIA: **EAR,** DJR

FROM: MAL

DATE: July 25, 1996

SUBJECT: Old Cross Cut Canal, Phase II - CICOP Request No. 1

The CICOP submitted by AMES Construction for reducing the gravel base material from 24" to 12" has been reviewed by Engineering. The reason for the gravel base material was to provide the contractor with a workable surface and provide material that will function as a drain in the wet conditions that exist at the site due to the high water table.

Regardless of the depth of the gravel mix, the de-watering requirement does not change and the working surface that the District was willing to provide the contractor does not change. Placing a working slab of any thickness only improves the working conditions from those the District was willing to provide. The District should agree to reducing the gravel bedding thickness and sharing the cost savings as a result of the reduction, but should not agree to share in the additional cost of improving the contractors working conditions; that should be done at the contracts expense as he is the direct beneficiary of the change.

The savings costs associated with reducing the gravel thickness from 24" to 12" is $92,546.00 according to the letter from Ames dated July 11, 1996. Of that amount, the District and Ames would each save $46,273. If Ames feels that it is in their best interest to place a concrete slab above the gravel bed to improve the working conditions, Engineering sees no problem except it is a change of conditions for the structural design of the concrete box and the second phase of this CICOP should address this issue.

File Folder: IO-MEM96

Greiner

7878 N. 16th Street, Suite #200
Phoenix, Arizona 85020-4449
(602) 371-1100
FAX: (602) 371-1615

MEMORANDUM

DATE: June 26, 1996

TO: Don Rerick
Fred Fuller

FROM: Marty Bressor
Ron Ewing

INFO

SUBJECT: Old Cross Cut Canal

Per our telephone conversation June 19, we have reviewed the issues you requested and submit the following responses:

1) Why is there a limiting pH range of 6-9 for the structural backfill, and can the this requirement be waived?

The pH range is consistent with ADOT specification 203-5.03 (B) (1) for structural backfill. The pH is specified to ensure the backfill is neutral and to minimize the potential for corrosion of exposed metal. Recommend the specification remain as stated.

2) Can the 2-foot thick gravel base foundation for the box culverts be reduced to a 1-foot thick gravel base with a 4-inch concrete slab overlay for the working surface?

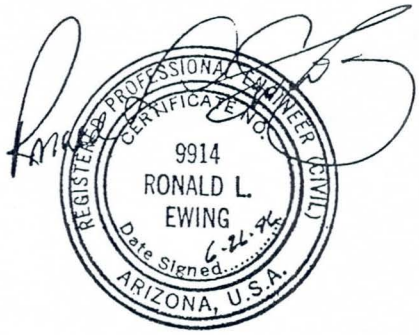
The 2-foot gravel lens was recommended by Huntingdon in their original soils report February 12, 1991). In a Greiner memo (May 20, 1994), Huntingdon was asked to address the need for the 2-foot gravel layer to which they responded in their letter (June 28, 1994) they continued to recommend the gravel base for a working platform. The initial purpose of the gravel foundation recommended by Huntingdon was to provide groundwater drainage below the box culvert and to provide a working surface for installation of the box culverts. Since Huntingdon's geotechnical report was completed, groundwater pumping has been recommended for the project, thereby eliminating the drainage requirement of the gravel. The remaining purpose of the gravel is to provide a workable surface for installation of the box culverts.

The Huntingdon report provided an allowable bearing capacity for the compacted underlying soil of 5000 psf which is substantially less than the normal stress applied by the box culvert per the structural calculations provided by ENTRANCO (November 1994). The gravel layer was not intended to provide a structural foundation for the box culvert, nor was it included in the structural calculations for the box culvert.

Since the sole purpose of the gravel is intended to provide a working surface, and no longer is required to provide groundwater drainage, Greiner does not object to the reduction of the gravel layer from 2 feet to 1 foot. However, Greiner would request the Contractor, in accordance with MAG specification 105, to submit a value engineering plan, including sealed structural calculations, for the use of a 4-inch concrete slab. The concrete slab represents a change of conditions assumed by the structural engineer, that is the foundation has changed from a flexible base to a rigid base. While Greiner does not anticipate a problem using the 4-inch concrete slab, we recommend the Contractor submit a plan. We would also recommend the Contractor provide a detail for the installation of the longitudinal cutoff walls at 500-foot spacing intervals.

3) Can the construction joint spacing requirement shown on plans for the walls and the top slab, Sheet C8.1, be extended from 38'-6" to 40' to accommodate the Contractor's forms and eliminate the need to bulkhead the forms?

Per a telephone message from Kevin Dusenberry of ENTRANCO on July 25, 1996, the structural engineer does not object to changing the maximum construction joint spacing to 40'.



Date: December 17, 1996

Memo To: FBF, HNS, PAD

Cc: RCS, KVH, MAL

Memo From: DJR

Subject: OCC Phase 2 - Adjustment to Retaining Wall Location

During excavation for construction of the project retaining wall from Station 11+00 to 20+25, the contractor discovered that the recently placed SRP underground ductbank was not installed in its correct location, causing a conflict with the project retaining wall.

Based on field meetings, an "as-built" survey by the contractor of the ductbank location, and review by District Engineering the following modifications are suggested for construction of the retaining wall:

1. Maintain the present wall alignment at Station 11+00. At Station 11+00 begin to transition the wall alignment to 1.00' east of the design alignment, achieving the 1.00' east shift by Station 12+00. From Station 12+00 to Station 16+35, maintain the 1.00' east shift of the wall alignment, while maintaining the same alignment configuration.

2. Beginning at Station 16+35, and through Station 17+35, begin a transition of the wall alignment from the 1.00' east shift back to the original plan alignment location.

3. Maintain the original wall alignment from Station 17+35 to the end of the wall at Station 20+25.

4. A minimum clear gap of 1-inch (1") must be maintained between the east face of the SRP ductbank, and the existing S.S. manhole, and the west vertical face of the retaining wall footing. This should be accomplished using styrofoam, rodofoam or other type of similar material.

5. The backfill placed behind the wall should be as required per the specifications, and placed at minimum 95% compaction.

Attached to this memo are copies of Engineer responses to the wall ductbank conflict, as well as the "as-built" plan of the ductbank.

FLOOD CONTROL DISTRICT
of
MARICOPA COUNTY

Interoffice memorandum

DATE; DEC.17, 1996

TO: DJR

FROM; KVH

SUB: OLD CROSS CUT CANAL

As I discussed with you yesterday, moving the retaining wall about 1'-0" to 1'-6" away from the duct bank and still keeping the same cross sectional area as before, 2'-4" heel and total footing width of 4'-8" would be best possible solution.

The same shear key detail as before should be maintained to avoid any possible sliding of the wall.
Gap of about 3/4" with some filler material between the duct bank and the retaining wall footing is recommended in, case of any rotation of the wall.

MESSAGE DISPLAY FOR DON RERICK

To: Don Rerick:TALOS

From: Raju Shah:TALOS
Postmark: 12/16/96 04:03PM
Status: Previously read

Host: TALOS
Delivered: 12/16/96 04:03PM

Subject: Reply to: OCC - CHIMP Hydraulics Check

Reply Text:
Re: Old Cross Cut Canal. West Retaining wall at Mcdowell Road North.

According to our Friday's (12/13) converstation, I have analyzed the effects of moving the west wall 3' east. The Water surface elevation does not change at all because the increase is probably less than 1/100th. But, the encroachment reduces the conveyance area, resulting in increase in velocity as I expected. However, the increase is an average of .02 ft/sec and the highest change is .11 ft/sec so, it is minor and ignorable.

So, in conclusion, the 3' shift of the west wall toward east will not make any significant change in hydraulics.

Previous Comments:
From: Don Rerick:TALOS
Date: 12/11/96 04:34PM
Raj, per our discussion today, please check the HEC-2 runs for the CHIMP assuming the retaining wall at the south end is moved 5' east. Need to determine the impacts on the already approved 100-yr WSE in the CHIMP.

We need to back out a new "Q" for the CHIMP if the wall is moved 5' east and if we hold the already approved WSE. Then we will need to determine what impact this has on the allowable discharge from the Arcadia project. You, me, and AMM will need to discuss these results.

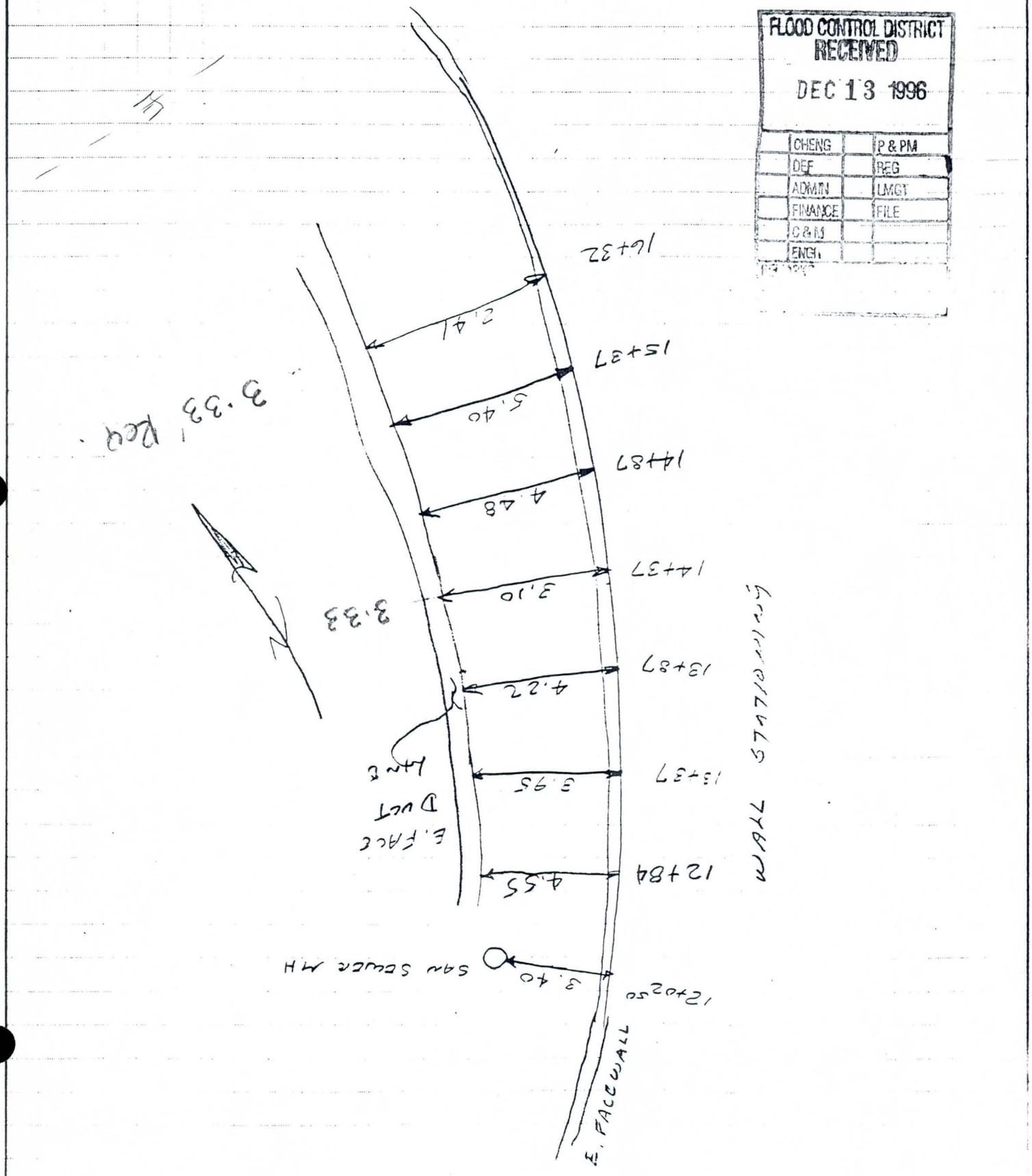
Please have this analysis done ASAP so we can get some direction to HNS on how to deal with the wall construction.

Thanks!!!!

Morrison Maierle/CSSA INC.
ENGINEERS
PLANNERS
SURVEYORS
4621 North 16th Street • Suite D-401 • Phoenix, Arizona 85016 • 602/277-2828

PROJECT Cross Cut
PROJECT NO. 8184.016 SHEET 1 OF 1
CALCULATED BY TS DATE 12-12-96
CHECKED BY _____ DATE _____

AS-BUILT MH & DUCT BANK FROM E. FACE RET WALL



ENTRANCO Engineers . Planners . Surveyors

2400 West Dunlap Ave., Suite 100
Phoenix, Arizona 85021-2813
(602) 264-1228 / FAX (602) 943-5068

FAX TRANSMITTAL SHEET

DATE: 8/14/95 TIME BEGIN:

NUMBER OF PAGES (INCLUDING COVER SHEET): 2
If you do not receive all pages, please let us know immediately

TO (Person): KUMAR H.

COMPANY: FCDMC ENGINEERING

FAX NUMBER: 506-4601

FROM: BILL KANTOR

RE:

HARD COPY TO FOLLOW: YES ☐ NO ☒

MESSAGE: KUMAR – Review this with Mike Lopez and Don Rerick. It is essentially what we talked about 10 days ago. I will call you tomarrow. 8/15

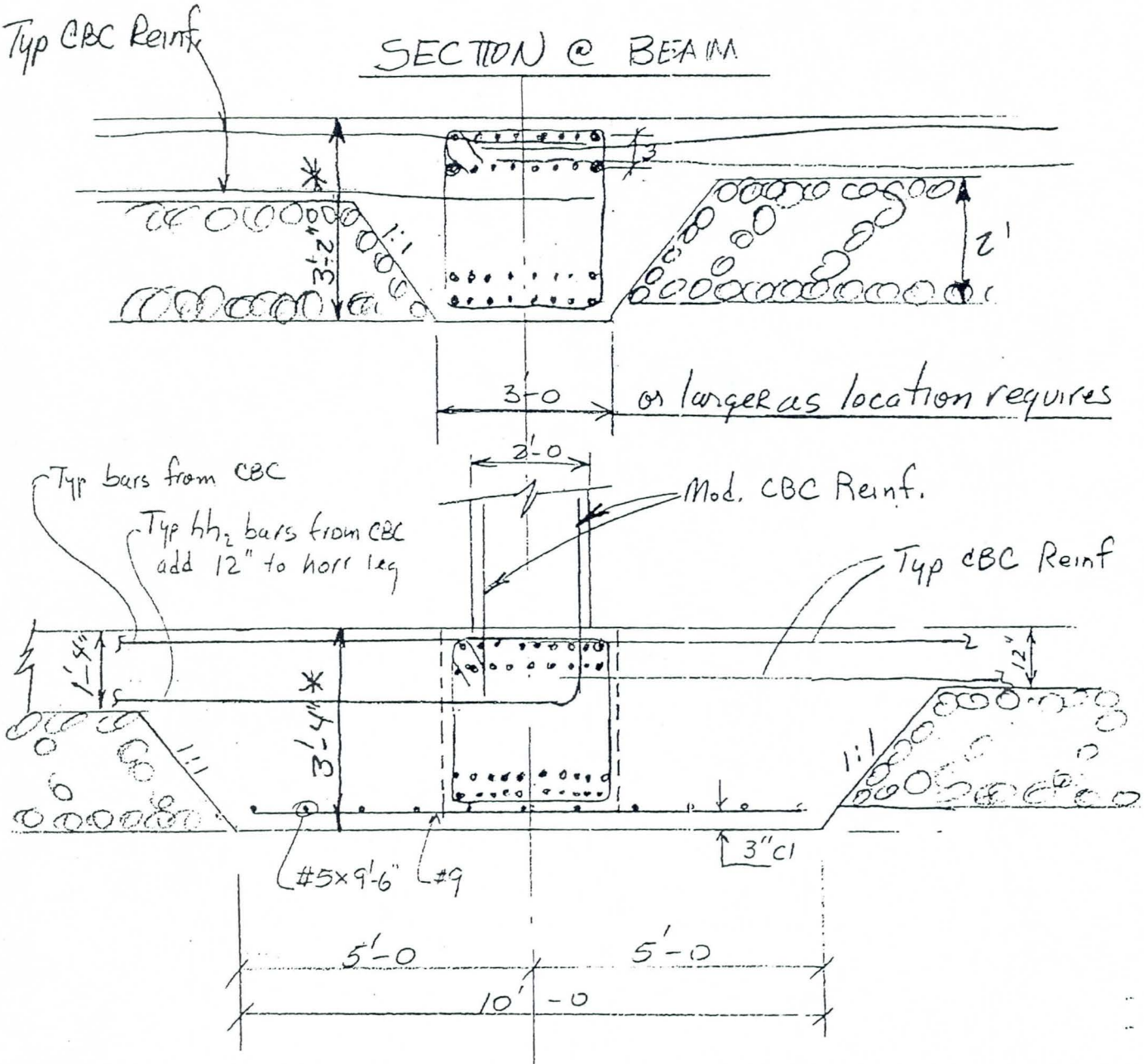
PROJECT/PROMO NAME:

PROJECT/PROMO NUMBER:

ENTRANCO

SHEET NO 1 OF 1
PROJECT NO

PROJECT X-CUT
SUBJECT INLET OPENING BEAM CONCEPT
MADE BY NSK DATE 8/14/95 CHECKED BY DATE
REVISED BY DATE RECHECKED BY DATE



*Depths may need to be 6" deeper to accomodate Strength requirements

FLOOD CONTROL DISTRICT
of
MARICOPA COUNTY

Interoffice memorandum

DATE: JULY 25, 1996

TO: PAD

FROM: KVH

SUB: OLD CROSS CUT CANAL, PHASE II

The shop drawings R-6 and R-7 of open concrete channel section, station 10+00 to station 11+00 are ok and have no review comments.

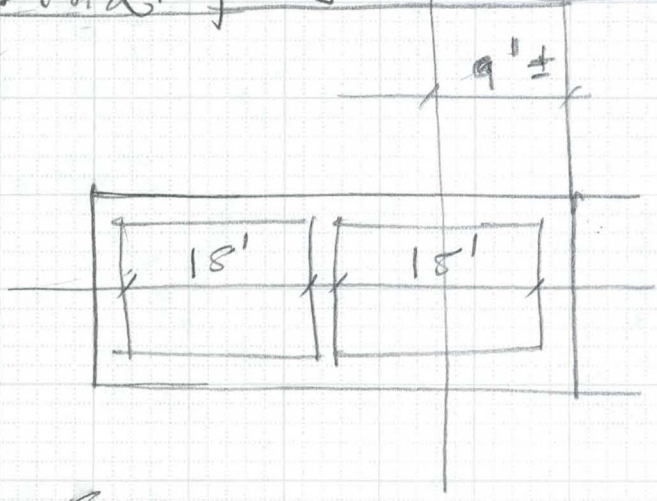
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT 105 X-Cut PAGE 1 OF

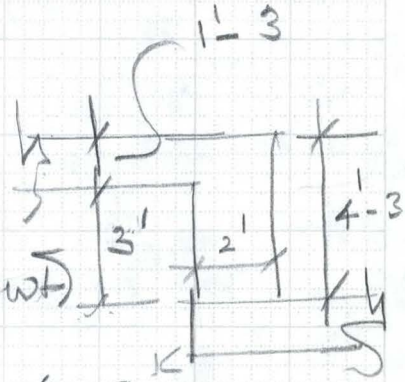
DETAIL Box Connection COMPUTED KVH DATE 8/95

Top Beam-Roof Load CHECKED BY DATE

Loading from 2 - 18 x 10 C.B.C

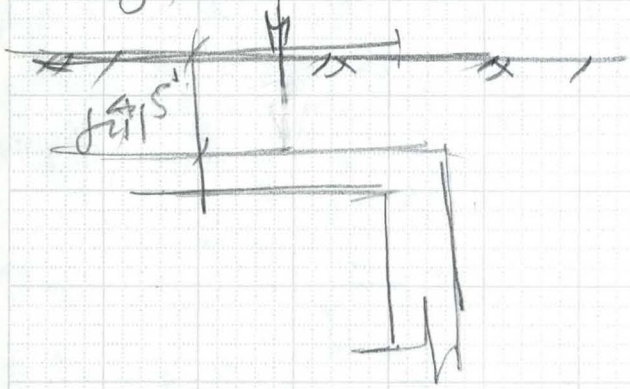


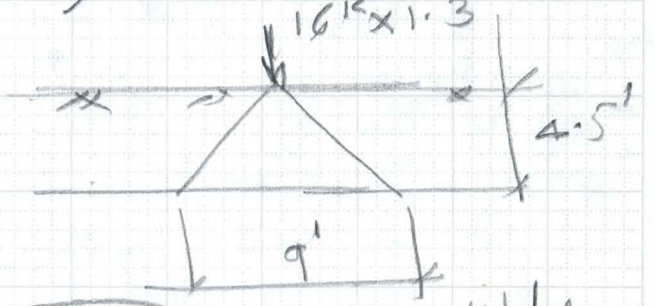
36 + 0 G
35 + 65
Beam = 41
(C1)



(3. x 2.0) 0.12 = 0.72 K/lr (Self wt)

fill = 4.5' x 0.12 = (0.54) 9 = 4.9





$\frac{(16 \times 1.3)}{9}$ = 2.31 K/lr

D.L + L.L = (4.9 + 2.31) = 7.21 K/lr
< 8.34 K/lr (Entrance)

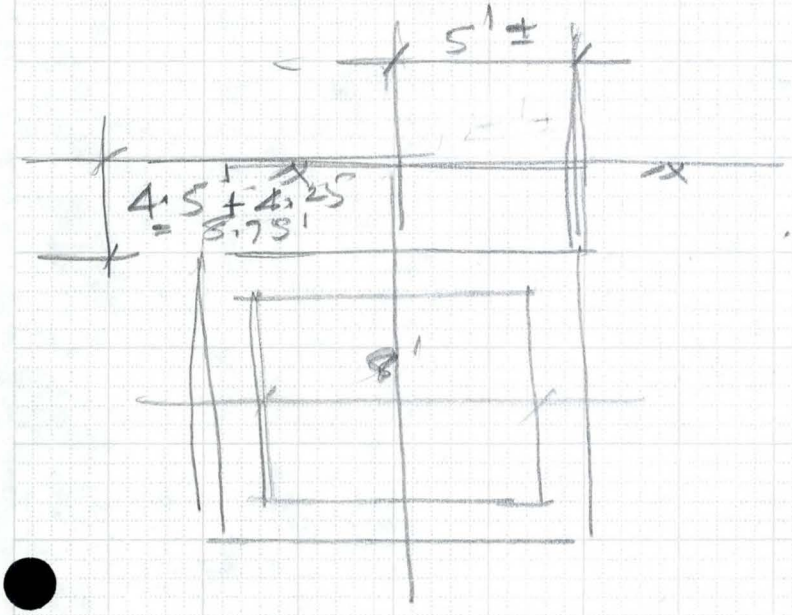
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT OLD x-Cut PAGE (2) OF ____

DETAIL Box Connection COMPUTED KVH DATE 8/95

Top Beam-Roof level CHECKED BY ____ DATE ____

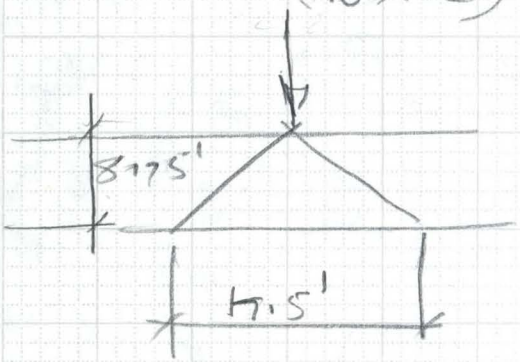
Load from 8'x6' CBC



fill : (8.75' x 5) 0.12 = 5.25 K/ft

conc = (5 x 1.) 0.15 = 0.75 K/ft

6.00 K/ft ⇒ 5.5 (Control)



$$\left(\frac{16^{K} \times 1.3}{17.5 \times 17.5}\right) = 0.07^{Ksf}$$

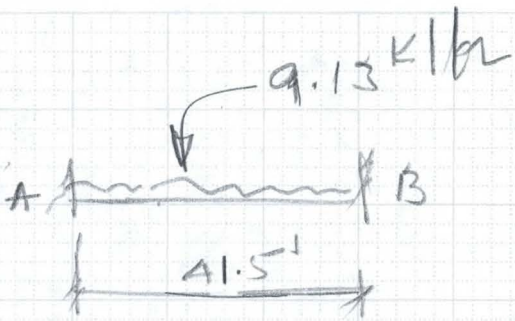
L.L. is neglected after 8' of fill.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT 61D X-Cut PAGE (3) OF ____

DETAIL Box Connecting COMPUTED KVH DATE 8/95

Top Beam - Roof Level CHECKED BY ____ DATE ____



(Neg) $M_A = M_B = \frac{wl^2}{12} = -\frac{9.13 \times 41.5^2}{12}$

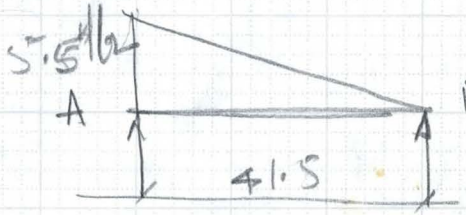
$= -1310$ K-ft

$M(Pos) = \frac{wl^2}{24} = +655$ K-ft

$M_{max}(Neg) = \frac{1}{10} WL$

$W = \left(\frac{w}{2}\right) L = \left(\frac{5.5}{2}\right) 41.5$

$= 114$ K



$M_{A\,max}(Neg) = -\frac{1}{10} \times 114 \times 41.5$

$= -473$

$M_{max}(Pos) = 0.043\,WL = 0.043 \times 114 \times 41.5$

$= 203$ K-ft

$M_B(Neg) = -\frac{1}{15} WL = \left(-\frac{1}{15} \times 114 \times 41.5\right) = -315$ K-ft

$M_A(Neg)\ Total = (-1310 - 473) = -1783$

$M_B(Neg) = (-1310 - 315) = -1625$

$M(Pos) = (655 + 203) = 858$

Shear:

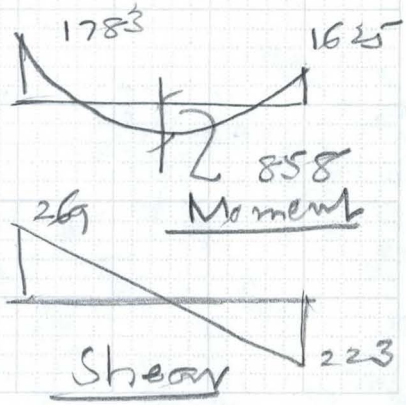
$V_A = V_B = \left(\frac{9.13 \times 41.5}{2}\right) = 189$ K

$V_A = \frac{7}{10} W = \left(\frac{7}{10} \times \frac{5.5}{2} \times 41.5\right) = 80$ K

$V_B = \frac{3}{10} \left(\frac{5.5}{2} \times 41.5\right) = 34$

$V_A(Total) = (189 + 80) = 269$ K

$V_B(Total) = (189 + 34) = 223$



Mom (Neg) = 1783

$d_t = 5'-3$, $d_{eff} = 60''$, $A_s = \frac{1783 \times 12}{24 \times 0.85 \times 60}$

$= 16.9 \text{ in}^2$

Shear check:

using #5 Stirrups, $A_v = 0.31 \times 2 = 0.62$

$$S = \frac{A_v f_v}{(v - v_c) b_w} = \frac{0.62 \times 24000}{(138.4 - 60) 24}$$

78.4

$S = 7.9''$

Using Double Stirrups:

$$S = \frac{(0.62 \times 2) 24000}{78.4 \times 24}$$

$= 15.8''$

Spacing used 12" at the ends.

ok.

Bottom Beam

$W_1 = 8.34^K$, $\frac{8.34}{20} = 0.42^{K/ft}$

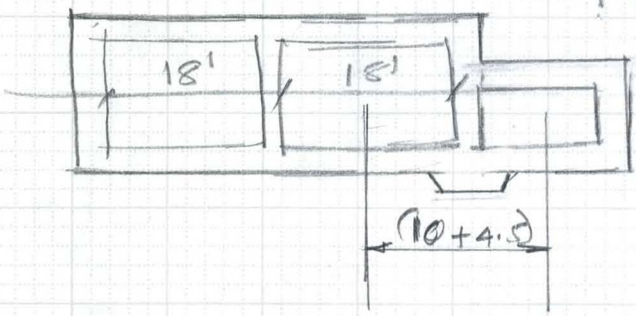
Eff. width $0.42 \times 10' = 4.2^{K/ft}$

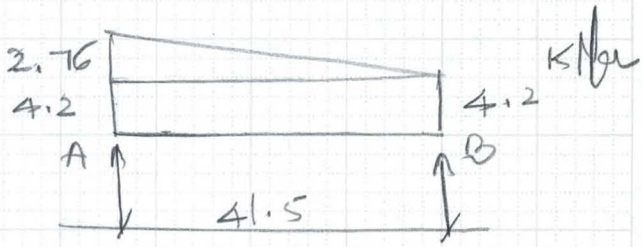
$W_2 = (8.34 + 5.5) = \left(\frac{13.84^K}{20+9}\right) = 0.48^{K/ft}$

Load from 8'x6 Box

Eff. width $0.48 \times (10 + 4.5) = 6.96^{K/ft}$

$+ 8' + 1' \pm$





$M_{1-A} = M_{1-B} = -\frac{4.2 \times 41.5^2}{12} = -603^{K/ft}$

$M_{2-A} = \left(\frac{4.2 \times 41.5^2}{20}\right) = -362$

$M_{3-B} = \left(\frac{4.2 \times 41.5^2}{30}\right) = -241$

$M_{1(A-B)\ Pos} = +\frac{4.2 \times 41.5^2}{24} = +301^{K/ft}$

$M_{2(A-B)\ Pos} = +0.043WL$

$W = \left(\frac{w}{2}\right)L = 0.043 \times 57.3 \times 41.5 = +102$

$= \left(\frac{2.76}{2} \times 41.5\right)$

$= 57.3$

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT OLD X-Cut PAGE (6) OF ____

DETAIL Box Connecting Base Slab COMPUTED KVH DATE 8/95

Bottom Beam - Level 1 CHECKED BY ____ DATE ____

$M_{AB} = (-603 - 362) = -965$ K-ft

$M_{BA} = (-603 - 241) = -844$

M_{AB} (Pos) $= (301 + 102) = 404$ K-ft

Shear:

$V_A = V_B = \frac{(4.2 \times 41.5)}{2} = 87^K$

$V_A = \frac{7}{10} W = \frac{7}{10}\left(\frac{2.76}{2} \times 41.5\right)$

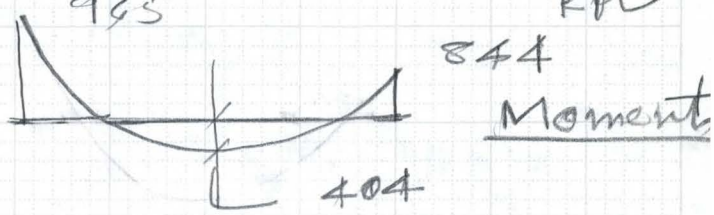
$= 40^K$

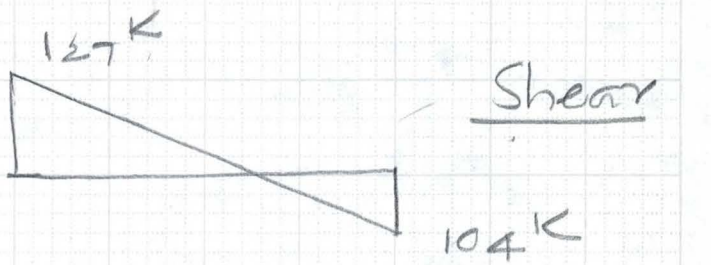
$V_B = \frac{3}{10}\left(\frac{2.76}{2} \times 41.5\right)$.

$= 17^K$

V_A (total) $= (87 + 40) = 127^K$

V_B (total) $= (87 + 17) = 104$





$d_{tot} = 3'-4" = 40"$

$d_{eff} = 36"$

$A_{s_1} = \frac{965 \times 12}{24 \times 0.85 \times 36} = 15.2 in^2$

10 # 11

unbd (12 #11)

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut PAGE ____ OF ____

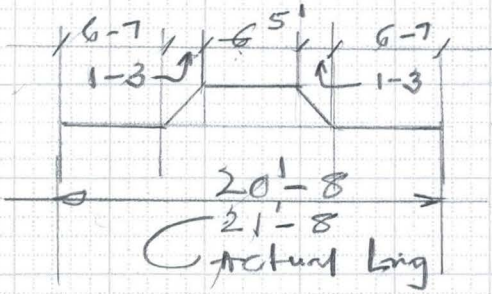
DETAIL 12'x10' Box COMPUTED KVH DATE 3/97

CHECKED BY ____ DATE ____

12'x10' Box:

$tf_1 = (26-8) - 4$

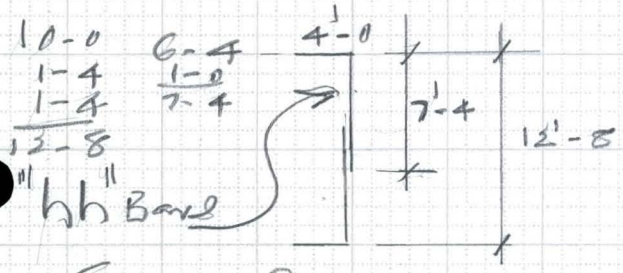
$tf_1 = 22'-8$



$dd_1 = 21-8$

$tf_2 = 22'-8$

$dd_2 = 21-8$



Savings:

tf_1 #6 : $(26-8) - (22'-8) = 4$

tf_2 #7 : $(27-2) - (23-8) = 4'-6"$

dd_1 #7 : $(27'-8) - (21-8) = 6.0$

dd_2 #7 : $(28-2) - (21-8) = 6.5'$

hh_1 #6 : $(15-3) - (11-4) = 3'-11$

hh_2 #6 : $(11'-0) - (11-4) = -4"$

	lbs/ft
1.502×4	$= 6.01$
2.044×4.5	$= 9.19$
2.044×6.0	$= 12.26$
2.044×6.5	$= 13.29$
$(1.502 \times 3.924) 4$	$= 23.55$
$-(1.502 \times 0.33) 4$	$= -1.98$
	62.3

Say 62 lbs.

Revised Qty = $(600 - 62) = 538$ lbs/ft

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grade Cut PAGE ____ OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 3/97

CHECKED BY ____ DATE ____

18' x 10' Box:

ff1 — 32'-0
ff2 — 32-0

use 2'-0 Laps Walls & Slabs

hh 15'-6 / 7'-1 L = 12'-7

dd1 11'-3 | 7 | 11'-3 | 1'-5" | 1'-0 L = 32'-4

2'-6
2-10
7
1-4
32-4"

(38-6) - (31-6) = 7'-0

dd2 = 32'-2

hh1 5-6 / 7'-1 L=12-7
hh2 5-6 / 7'-1 L=12-7
use hh Bar

Savings:

#8 ff1 : (38-6) - (32-0) = 6'.5	2.67 x 6.5 =	16.02	lbs/ft
#7 ff2 : (39-0) - (32-0) = 7.0	2.044 x 7.0 =	13.29	
#8 dd1 : (39-4) - (32-4) = 7'-0	2.67 x 7 =	18.69	
#7 dd2 : (39-9) - (32-2) = 7'-7	2.044 x 7.58 =	15.49	
#6 hh1 : (16-6) - (12-7) = 3'-11	(1.502 x 3.92) 4 =	23.55	
#6 hh2 : (13-0) - (12-7) = 5'11	(1.502 x 0.42) 4 =	2.52	
(2x2) At 6" Stgs & Bott Sides		91.92	

Say 92 lbs/ft Savings on 18'x10' Box

Revised Qty = (800 - 92) = 708 lbs/ft

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT old Cross Cut PAGE ____ OF ____

DETAIL 18'x10' Box COMPUTED KVH DATE 3/97

CHECKED BY ____ DATE ____

Label:

Walls

#6 — 18" — 25"

#7 — 24" — 34"

Slab

#6 — 25" — 33"

#7 — 32" — 41"

15" = 1'-3"

20" = 1-8"

Use 2'-0" Lap

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grand Cut Canal PAGE ____ OF ____

DETAIL Reinforcing Steel COMPUTED KVH DATE 9/96

CHECKED BY ____ DATE ____

Tel Call to Consolidated Rebar:

Reinf. Steel Basic Material = $0.25 to 0.26

Installation = 0.10

$0.35 / lb

Total Reinf. Steel = 587,793 lb

Total Savings = $0.35 × 587,793

= $ 205,727.55

Old Cross Cut Canal Reinforcing Steel

Bar Type	Original Length ft in	New Length ft in	Bar Size	Unit Weight lbs/LF	Savings Length ft in	Unit Savings lbs/ft		Length ft	Total Savings lbs
ff1	38 - 6	32 - 0	8	2.670	6 - 6	17.36		4,900	85,040
dd1	39 - 4	32 - 4	8	2.670	7 - 0	18.69		4,900	91,581
ff2	39 - 0	32 - 0	7	2.044	7 - 0	14.31	*	4,000	57,232
*dd2	39 - 9	32 - 2	7	2.044	7 - 7	15.50	*	4,000	62,001
hh1	66 - 0	50 - 4	6	1.502	15 - 8	23.53		4,900	115,304
hh2	52 - 0	28 - 0	6	1.502	24 - 0	36.05		4,900	176,635
						125.43			587,793

* No reduction between Station 11+00 and Station 20+00 where footing is extended on each side

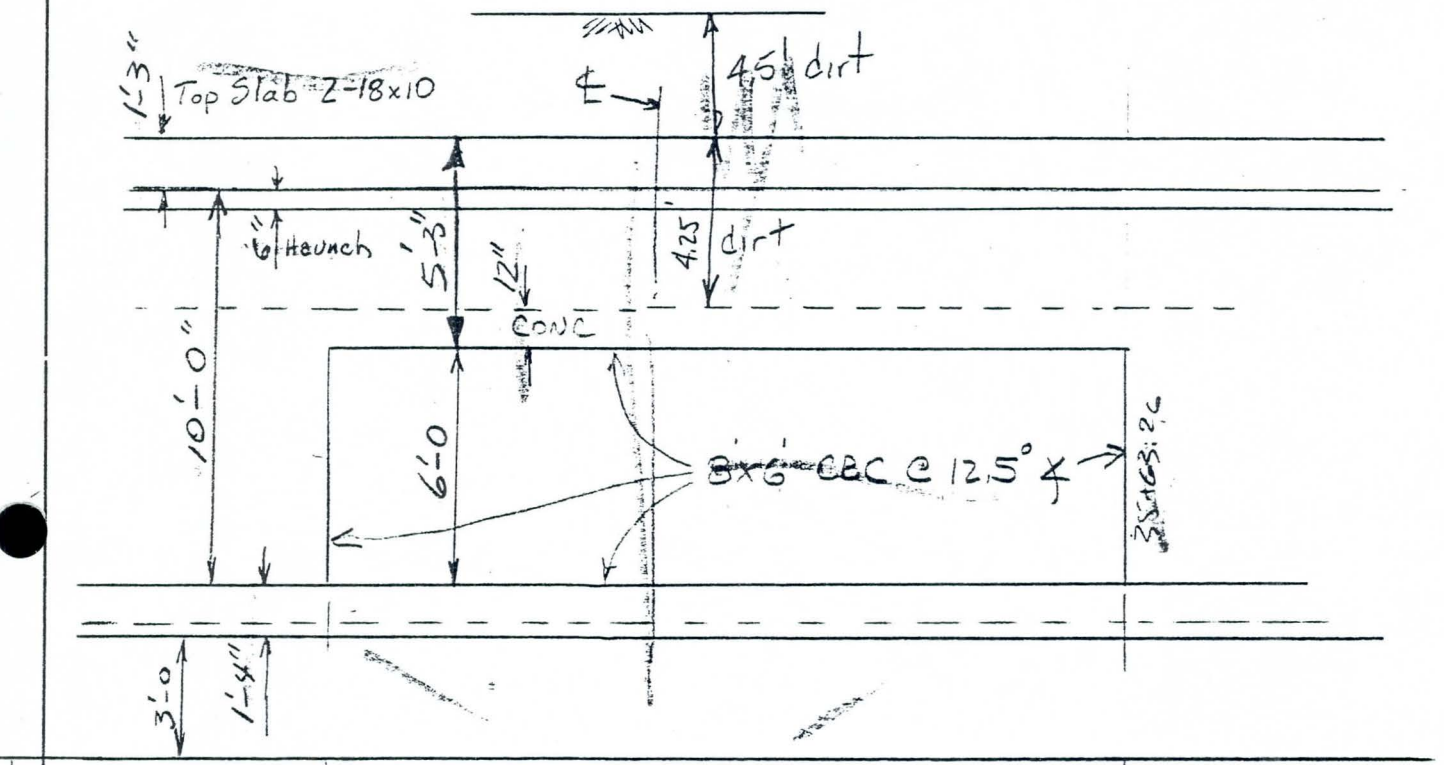
Item 6c

ENTRANCO

SHEET NO 1 OF _____
PROJECT NO _____

PROJECT OLD X-CUT ϕ2
SUBJECT 2-18x10 CBC to 8x6 CBC CONNECTION
MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95
REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____

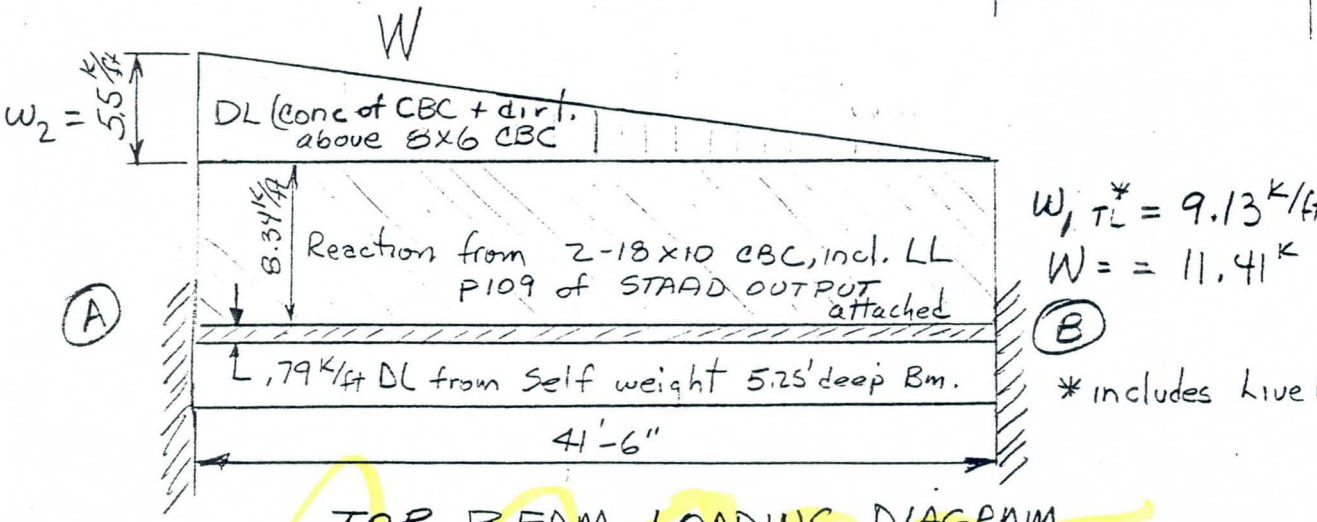
DEEP BEAM ABOVE 8'x6' CBC INTERSECTION



ELEVATION (Looking into 8x6 box)

D/S = 5.25'/41.5 = .127 deep beam

10'± (Looking into 8x6 box)



$W_{1,TL}$* = 9.13 K/ft

W = = 11.41 K

* includes Live Ld.

TOP BEAM LOADING DIAGRAM

Item 6c

ENTRANCO

SHEET NO 2 OF _____

PROJECT NO _____

PROJECT OLD X-CUT

SUBJECT _____

MADE BY WSK DATE 3/95 CHECKED BY IA DATE 3/95

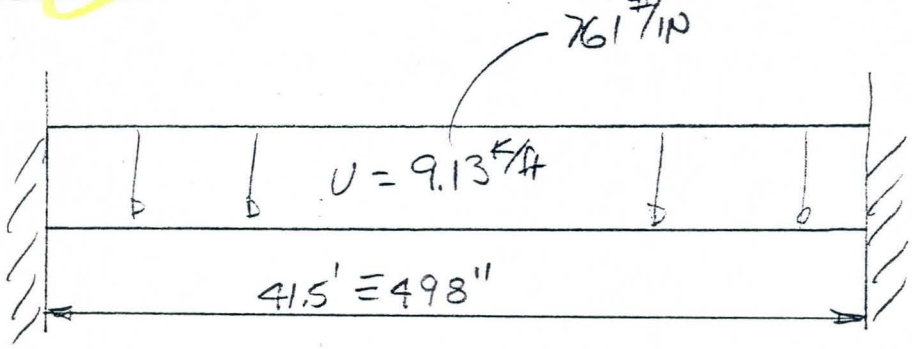
REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____

BEAM LOADING DIAGRAM FOR TOP BM.

See "CASEFRAME" COMPUTER OUTPUT FOLLOWING

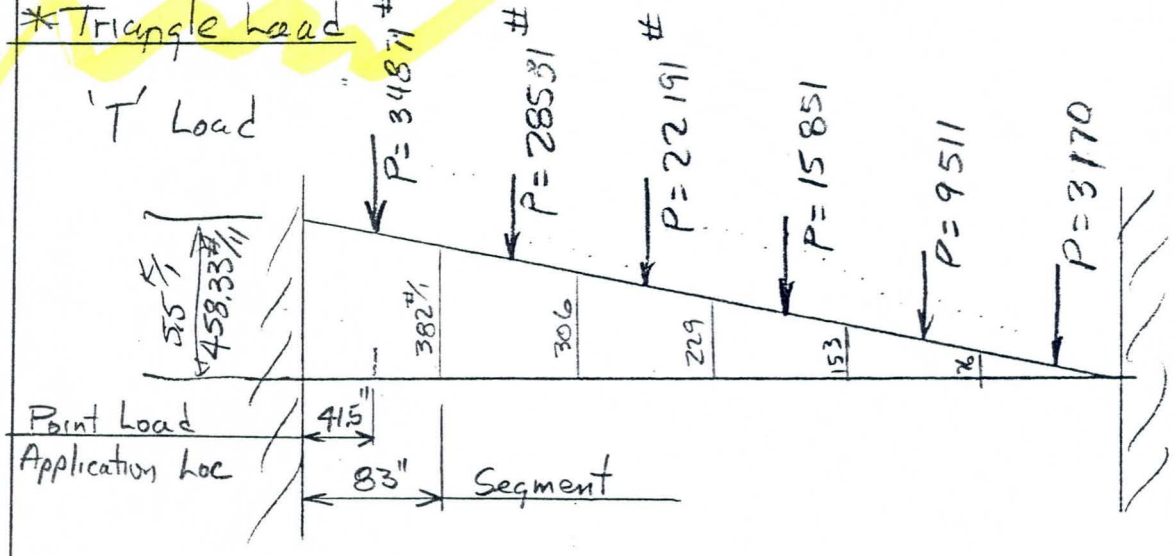
Uniform Load

'U' Load



*Triangle Load

'T' Load



* Prog. Can't handle Var. Load.
Load Replaced w/ 6 Point Loads
This will be a very close equivalent

$\Sigma U = 114{,}125^{\#}$

$= \frac{1}{2}(5500^{\#}) \times 41.5'$

2a

MEMBER FORCE ENVELOPE

ALL UNITS ARE KIP FEET

MEMB	DISTANCE		FY	LD	MZ	LD	FZ	LD	MY	LD
1	0.00	MAX.	8.34	136	17.12	133	0.00	138	0.00	138
		MIN.	1.66	121	0.42	127	0.00	138	0.00	138
	0.79	MAX.	7.57	136	10.88	133	0.00	138	0.00	138
		MIN.	1.51	127	-0.85	127	0.00	138	0.00	138
	1.58	MAX.	6.80	136	5.24	133	0.00	138	0.00	138
		MIN.	1.32	127	-1.96	127	0.00	138	0.00	138
	2.36	MAX.	6.03	136	1.77	131	0.00	138	0.00	138
		MIN.	1.14	127	-2.93	127	0.00	138	0.00	138
	3.15	MAX.	5.26	136	0.79	131	0.00	138	0.00	138
		MIN.	0.96	127	-6.65	134	0.00	138	0.00	138
	3.94	MAX.	4.49	136	-0.07	131	0.00	138	0.00	138
		MIN.	0.77	127	-10.42	134	0.00	138	0.00	138
	4.73	MAX.	3.72	136	-0.82	131	0.00	138	0.00	138
		MIN.	0.59	127	-13.59	134	0.00	138	0.00	138
	5.52	MAX.	2.94	136	-1.45	131	0.00	138	0.00	138
		MIN.	0.40	127	-16.15	134	0.00	138	0.00	138
	6.31	MAX.	2.17	136	-1.96	131	0.00	138	0.00	138
		MIN.	0.22	127	-18.10	134	0.00	138	0.00	138
	7.09	MAX.	1.40	136	-2.36	131	0.00	138	0.00	138
		MIN.	0.04	127	-19.44	134	0.00	138	0.00	138
	7.88	MAX.	0.63	136	-2.64	131	0.00	138	0.00	138
		MIN.	-0.15	127	-20.18	134	0.00	138	0.00	138
	8.67	MAX.	0.13	131	-2.80	131	0.00	138	0.00	138
		MIN.	-0.40	125	-20.31	134	0.00	138	0.00	138
	9.46	MAX.	-0.01	131	-2.85	131	0.00	138	0.00	138
		MIN.	-1.11	135	-19.83	134	0.00	138	0.00	138
	10.25	MAX.	-0.16	131	-2.78	131	0.00	138	0.00	138
		MIN.	-1.88	135	-18.75	134	0.00	138	0.00	138
	11.03	MAX.	-0.31	131	-2.59	131	0.00	138	0.00	138
		MIN.	-2.65	135	-17.06	134	0.00	138	0.00	138
	11.82	MAX.	-0.46	131	-2.29	131	0.00	138	0.00	138
		MIN.	-3.42	135	-14.76	134	0.00	138	0.00	138
	12.61	MAX.	-0.60	131	-1.84	121	0.00	138	0.00	138
		MIN.	-4.19	135	-11.85	134	0.00	138	0.00	138
	13.40	MAX.	-0.75	131	-1.23	121	0.00	138	0.00	138
		MIN.	-4.96	135	-8.40	136	0.00	138	0.00	138
	14.19	MAX.	-0.90	131	-0.08	127	0.00	138	0.00	138
		MIN.	-5.73	135	-4.34	136	0.00	138	0.00	138
	14.98	MAX.	-1.05	131	2.82	135	0.00	138	0.00	138
		MIN.	-6.50	135	-1.23	128	0.00	138	0.00	138
	15.76	MAX.	-1.20	131	8.25	135	0.00	138	0.00	138
		MIN.	-7.27	135	0.11	128	0.00	138	0.00	138
	16.55	MAX.	-1.34	131	14.28	135	0.00	138	0.00	138
		MIN.	-8.04	135	1.59	128	0.00	138	0.00	138
	17.34	MAX.	-1.49	131	20.92	135	0.00	138	0.00	138
		MIN.	-8.81	135	3.08	131	0.00	138	0.00	138

MAX V @ Lt. end of Mem #1 = Axial MAX Jt #1 see Sht 52

25

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	126	1	7.24	-2.42	0.00	0.00	0.00	-12.39
		4	-8.93	-1.06	0.00	0.00	0.00	4.13
	127	1	1.69	1.58	0.00	0.00	0.00	-0.42
		4	-3.39	1.98	0.00	0.00	0.00	-2.42
	128	1	1.89	1.54	0.00	0.00	0.00	-0.94
		4	-3.59	2.02	0.00	0.00	0.00	-2.38
	131	1	1.76	-2.10	0.00	0.00	0.00	-5.41
		4	-3.45	-4.29	0.00	0.00	0.00	7.05
	132	1	6.46	-4.60	0.00	0.00	0.00	-14.46
		4	-8.15	-5.84	0.00	0.00	0.00	10.73
	133	1	8.31	-4.82	0.00	0.00	0.00	-17.12
		4	-10.00	-5.62	0.00	0.00	0.00	10.92
	134	1	8.25	-2.86	0.00	0.00	0.00	-14.52
		4	-9.95	-2.37	0.00	0.00	0.00	6.40
	135	1	8.14	-3.75	0.00	0.00	0.00	-15.06
		4	-9.83	-3.18	0.00	0.00	0.00	7.72
	136	1	8.34	-3.79	0.00	0.00	0.00	-15.58
		4	-10.03	-3.13	0.00	0.00	0.00	7.76
	137	1	2.77	0.26	0.00	0.00	0.00	-3.41
		4	-4.47	-0.14	0.00	0.00	0.00	1.58
	138	1	2.98	0.22	0.00	0.00	0.00	-3.93
		4	-4.67	-0.10	0.00	0.00	0.00	1.61
4	1	2	4.17	0.00	0.00	0.00	0.00	0.00
		14	-5.59	0.00	0.00	0.00	0.00	0.00
	2	2	9.58	0.00	0.00	0.00	0.00	0.00
		14	-9.58	0.00	0.00	0.00	0.00	0.00
	3	2	-0.68	0.00	0.00	0.00	0.00	0.00
		14	0.68	0.00	0.00	0.00	0.00	0.00
	13	2	-0.40	0.00	0.00	0.00	0.00	0.00
		14	0.40	0.00	0.00	0.00	0.00	0.00
	4	2	12.20	0.00	0.00	0.00	0.00	0.00
		14	-12.20	0.00	0.00	0.00	0.00	0.00
	5	2	-1.01	0.00	0.00	0.00	0.00	0.00
		14	1.01	0.00	0.00	0.00	0.00	0.00
	15	2	-0.60	0.00	0.00	0.00	0.00	0.00
		14	0.60	0.00	0.00	0.00	0.00	0.00
	10	2	5.01	0.00	0.00	0.00	0.00	0.00
		14	-5.01	0.00	0.00	0.00	0.00	0.00
	11	2	2.50	0.31	0.00	0.00	0.00	2.32
		14	-2.50	-0.31	0.00	0.00	0.00	1.13
	18	2	0.10	0.00	0.00	0.00	0.00	0.00
		14	-0.10	0.00	0.00	0.00	0.00	0.00
	19	2	0.28	0.00	0.00	0.00	0.00	0.00
		14	-0.28	0.00	0.00	0.00	0.00	0.00
	20	2	-12.64	0.00	0.00	0.00	0.00	0.00
		14	12.64	0.00	0.00	0.00	0.00	0.00
	100	2	4.17	0.00	0.00	0.00	0.00	0.00
		14	-5.59	0.00	0.00	0.00	0.00	0.00
	101	2	3.98	0.00	0.00	0.00	0.00	0.00

$\Delta = 1.69^{K}$

Weight of Mem 1

$wt = 1' \times 11.29^{\#/ft} \times .15^{K/ft^3}$

$= 1.69^{K}$

CASE Frame (c) 1986,87,88,89 ENTRANCO ENGINEERS

System Parameters

Number of Nodes 7
Number of Elements 6

Node Coordinates

Node Symbol	X Coordinate(IN)	Y Coordinate(IN)
1	0.0000	0.0000
2	83.0000	0.0000
3	166.0000	0.0000
4	249.0000	0.0000
5	332.0000	0.0000
6	415.0000	0.0000
7	498.0000	0.0000

Support Constraints

Node Symbol	X Translation (IN)	Y Translation (IN)	Rotation (Rad)
1	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000

Property Set Data

Set Symbol	Area (IN^2)	Elastic Modulus (LB/IN^2)	Inertia (IN^4)
A	1512.0000	3000000.0000	500094.0000

24x63 $\left(\frac{24 \times 63^3}{12}\right)$

Element Connectivity

Element Symbol	Origin Node	Terminal Node	Property Symbol	Moment Releases Origin	Moment Releases Terminal
A	1	2	A	No	No
B	2	3	A	No	No
C	3	4	A	No	No
D	4	5	A	No	No
E	5	6	A	No	No
F	6	7	A	No	No

Local Uniform Element Loads

Element Symbol	Primary Loading	X Uniform Load (LB/IN)	Y Uniform Load (LB/IN)
A	U	0.0000	-761.0000
B	U	0.0000	-761.0000
C	U	0.0000	-761.0000
D	U	0.0000	-761.0000
E	U	0.0000	-761.0000
F	U	0.0000	-761.0000

$9.13^{k} \times 10^{3} \times \frac{1}{12} = 760.83\ \#/\text{in}$

USE 761

Local Concentrated Element Loads

Element Symbol	Primary Loading	Load Location Type		Distance (IN)	X Load (LB)	Y Load (LB)
A	T	Local	X	41.5000	0.0000	-34871.0000
B	T	Local	X	41.5000	0.0000	-28531.0000
C	T	Local	X	41.5000	0.0000	-22191.0000
D	T	Local	X	41.5000	0.0000	-15851.0000
E	T	Local	X	41.5000	0.0000	-9511.0000
F	T	Local	X	41.5000	0.0000	-3170.0000

See Item 6c sht 2 of 9

SuperImposed Load Case Specifications

Load Case		Specification
U	==>	U
T	==>	T
UT	==>	U+T

Nodal Displacements

Node Symbol	Load Case	X Translation (IN)	Y Translation (IN)	Rotation (Rad)
1	U	0.0000	0.0000	0.0000
	T	0.0000	0.0000	0.0000
	UT	0.0000	0.0000	0.0000
2	U	0.0000	-0.0251	-0.0005
	T	0.0000	-0.0086	-0.0002
	UT	0.0000	-0.0336	-0.0006
3	U	0.0000	-0.0642	-0.0004
	T	0.0000	-0.0206	-0.0001
	UT	0.0000	-0.0848	-0.0005
4	U	0.0000	-0.0812	0.0000
	T	0.0000	-0.0245	0.0000
	UT	0.0000	-0.1057	0.0000
5	U	0.0000	-0.0642	0.0004
	T	0.0000	-0.0180	0.0001
	UT	0.0000	-0.0822	0.0005
6	U	0.0000	-0.0251	0.0005
	T	0.0000	-0.0065	0.0001
	UT	0.0000	-0.0316	0.0006
7	U	0.0000	0.0000	0.0000
	T	0.0000	0.0000	0.0000
	UT	0.0000	0.0000	0.0000

Nodal Reactions

Node Symbol	Load Case	X Reaction (LB)	Y Reaction (LB)	Moment (IN-LB)
1	U	0.0000	189489.0000	15727587.0000
	T	0.0000	79612.5405	5812422.2743
	UT	0.0000	269101.5405	21540009.2743
7	U	0.0000	189489.0000	-15727587.0000
	T	0.0000	34512.4595	-3791559.6007
	UT	0.0000	224001.4595	-19519146.6007

Element Forces

Element Symbol	Load Case	Node Symbol	Axial (LB)	Shear (LB)	Moment (IN-LB)	Deflection (IN)
A	U	1	0.000	189489.000	-15727586.990	
		MID	0.000	157907.500	-8519109.615	0.0050
		2	0.000	126326.000	-2621264.490	
	T	1	0.000	79612.541	-5812422.274	
		MID	0.000	44741.541	-2508501.843	0.0016
		2	0.000	44741.541	-651727.912	
	UT	1	0.000	269101.541	-21540009.264	
		MID	0.000	202649.041	-11027611.458	0.0065
		2	0.000	171067.541	-3272992.402	
B	U	2	0.000	126326.000	-2621264.490	
		MID	0.000	94744.500	1965948.385	-0.0011
		3	0.000	63163.000	5242529.010	
	T	2	0.000	44741.541	-651727.912	
		MID	0.000	16210.541	1205046.019	-0.0006
		3	0.000	16210.541	1877783.450	
	UT	2	0.000	171067.541	-3272992.402	
		MID	0.000	110955.041	3170994.405	-0.0016
		3	0.000	79373.541	7120312.461	

1311 'K

261.1 K = V

1795 = M

V = 171.1

273 'K = M

Element Forces

Element Symbol	Load Case	Node Symbol	Axial (LB)	Shear (LB)	Moment (IN-LB)	Deflection (IN)
C	U	3	0.000	63163.000	5242529.010	
		MID	0.000	31581.500	7208477.385	-0.0041
		4	0.000	-0.000	7863793.510	
	T	3	0.000	16210.541	1877783.450	
		MID	0.000	-5980.459	2550520.881	-0.0014
		4	0.000	-5980.459	2302331.812	
	UT	3	0.000	79373.541	7120312.461	
		MID	0.000	25601.041	9758998.267	-0.0055
		4	0.000	-5980.459	10166125.323	
D	U	4	0.000	-0.000	7863793.510	
		MID	0.000	-31581.500	7208477.385	-0.0041
		5	0.000	-63163.000	5242529.010	
	T	4	0.000	-5980.459	2302331.812	
		MID	0.000	-21831.459	2054142.744	-0.0011
		5	0.000	-21831.459	1148137.175	
	UT	4	0.000	-5980.459	10166125.323	
		MID	0.000	-53412.959	9262620.129	-0.0052
		5	0.000	-84994.459	6390666.185	
E	U	5	0.000	-63163.000	5242529.010	
		MID	0.000	-94744.500	1965948.385	-0.0011
		6	0.000	-126326.000	-2621264.490	
	T	5	0.000	-21831.459	1148137.175	
		MID	0.000	-31342.459	242131.606	-0.0001
		6	0.000	-31342.459	-1058580.463	
	UT	5	0.000	-84994.459	6390666.185	
		MID	0.000	-126086.959	2208079.991	-0.0012
		6	0.000	-157668.459	-3679844.953	
F	U	6	0.000	-126326.000	-2621264.490	
		MID	0.000	-157907.500	-8519109.615	0.0050
		7	0.000	-189489.000	-15727586.990	
	T	6	0.000	-31342.459	-1058580.463	
		MID	0.000	-34512.459	-2359292.532	0.0014
		7	0.000	-34512.459	-3791559.601	
	UT	6	0.000	-157668.459	-3679844.953	
		MID	0.000	-192419.959	-10878402.146	0.0063
		7	0.000	-224001.459	-19519146.590	

M = 593'K

M = 192'K

M = 847'K

M = 533'K

M = 307'K

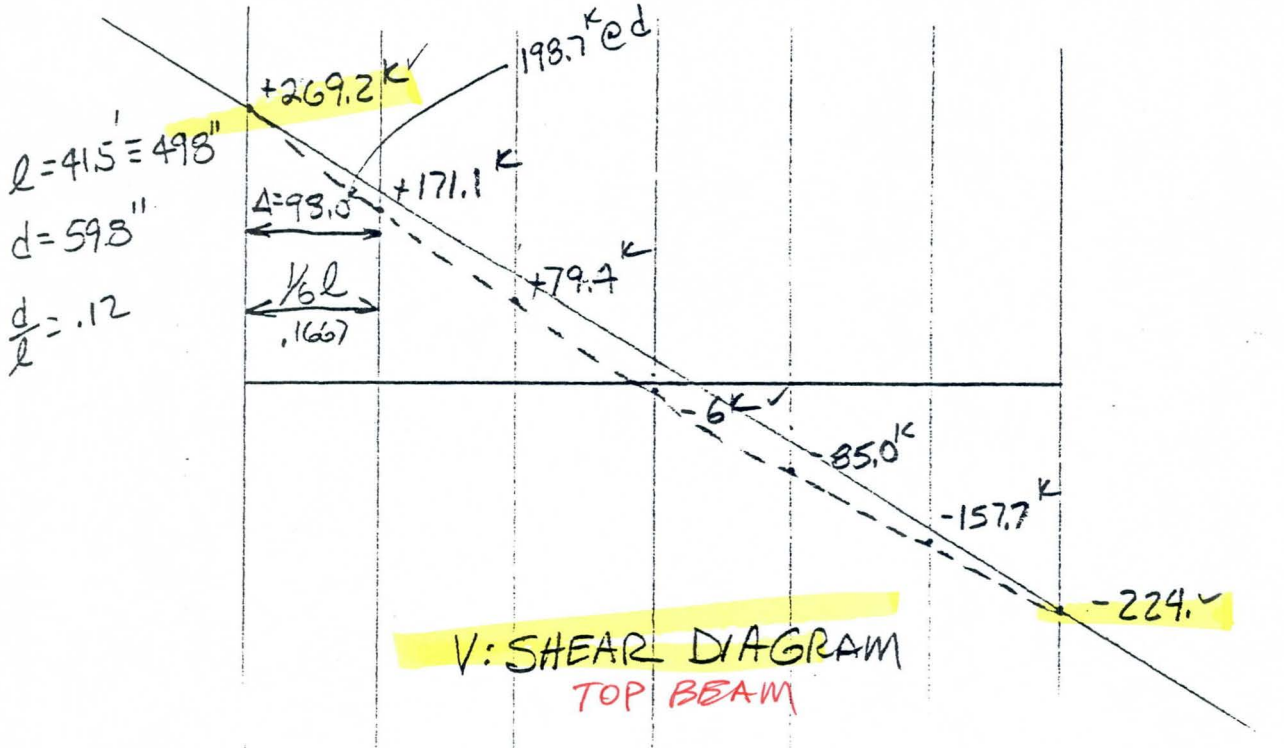
M = 1627'K

Item 6c

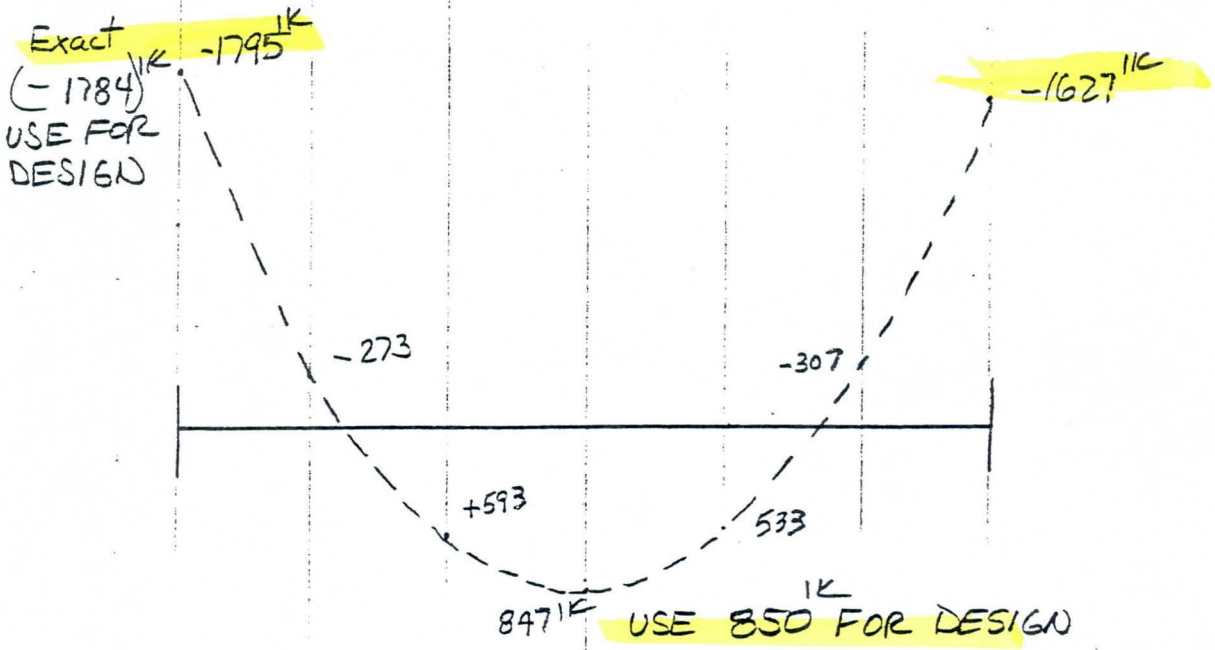
ENTRANCO

SHEET NO 3 OF _____
PROJECT NO _____

PROJECT OLD XCUT
SUBJECT CASE FRAME SUMMARY OF V & M
MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95
REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____



V: SHEAR DIAGRAM
TOP BEAM



USE 850 K FOR DESIGN

MOMENT DIAGRAM
TOP BEAM

Item 6c

ENTRANCO

SHEET NO 4 OF _____
PROJECT NO _____

PROJECT OLD X-CUT
SUBJECT INLET OPENING TOP – WORKING STRESS DESIGN
MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95
REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____

Bending: Neg M in Bm Top $w_1 = 9.13^{1-k}$ $w_2 = 5.5^{1k}$

$-M_A = (9.13)\,41.5^2/12 + 5.5\,41.5^2/20$

$= 1310^{1-k} + 474$

$M_A = 1784^{1-k}$ (1) M_B { for Constr Simplicity design for M_A only.

Try $b = 24''$ $d = 60''$ #8 bars

$f'_c = 4000$ psi $f_y = 60$ ksi $f_s = 24$ ksi $n = 8$

Est $A_s = .56\,M/d = .56 \times 1784^{1k}/60 = 16.65\ in^2$

Revise bars to #10s $A_s = 1.27\ in^2$ dia = 1.27"

$\# = 16.65/1.27 = 13.1$ Try 14 bars 7 ea in 2 rows

Check spacing $24'' - 2\times 2''$ clr $- 1.0''$ (#4 ties) $= 19.0''$ available

Req'd Space $= 7\times 1.27 + 6\times 1.5\times 1.27 = 20.3$ (1.5 dia (min))

not enough Room USE #11s

$\# 16.65/1.56 = 10.7$ Try 12 #11 in 2 layers

Req'd Space $6\times 1.41 + 5\times 1.5\times 1.41 = 19.04$ say OK

$A_s = 12 \times 1.56 = 18.72''$

$d = 63 - 2''$ Clr $- \frac{5}{8}$(#5) $- 1.41''$ (#11) $- 1.5''$ ($\frac{1}{2}$ layer $3''/2''$) $= 57.5''$

Check Est $A_s = .56\times 1784^{1k}/57.5'' = 17.4\ in^2 < 18.72\ in^2$ OK

Check Stresses: $p = 0135$ $J = .369$ $k = .877$

$f_b = M/A_s jd = 1784^{1k}/(18.72\ in^2)(.877)(57.6)$

$f_b = 22,639 < 24$ ksi OK

$f_c = 1457 < 1600$ psi OK

(1) Computer Analysis computed 1785^{1k}

ENTRANCO

SHEET NO 5 OF _____
PROJECT NO _____

PROJECT OLD X CUT
SUBJECT _____
MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95
REVISED BY WSK DATE 6/95 RECHECKED BY _____ DATE _____

Bending: Pos M in BOT Bm

$M = wl^2/24 + (\text{See}^{**}$ "CASEFRAM ANALYSIS")

$+M_{\ell} = 9.13\ 41.5^2/24 + 193^{**} = 655 + 193$ → USE 195

$+M = 850^{K}$ ** $d = 63 - 2"\text{clr} - 5/8"(\#5) - 1.41/2 = 59.7"$

Est $A_S = .56M/d = .56 \times 850/59.7 = 7.97$

#11 ⇒ 7.97/1.56 = 5.11 Try 6#11 $A_S = 9.36\ in^2$

Check σ $\rho = .0065$ $k = .275$ $J = .908$

$f_b = 20{,}070$ psi < 24 KSI OK

$f_c = 952$ psi < 1600 OK

bar spacing ok by inspection.

Shear Analysis — Stirrup Design

See Shear Diagram $\ell = 41.5' \equiv 498"$ $d = 59.8"$ $d/\ell = .12$

$V(@\ d \text{ from Face}) = 269.2 - \frac{.12}{.17}(98.0) = 198.7^{K}$

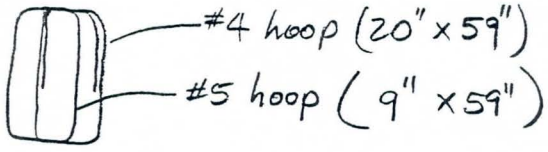
$v_c = .95\sqrt{f'_c} = 60$ psi $v = 198.7^{K}/24 \times 59.8 = 138.4$ psi

$$A_V = \frac{(v - v_c) b_w s}{f_s} = \frac{(138.4 - 60)\ 24" \times 12"}{24{,}000} = .94\ in^2$$

Do #4 hoop on out side $A_s = 2 \times .2 = .4\ in^2$

#5 hoop on inside $A_s = 2 \times .31 = .61$

$1.01\ in^2 > .94$ OK



Item 6c

ENTRANCO

SHEET NO 6 OF _____

PROJECT NO _____

PROJECT OLD X-CUT

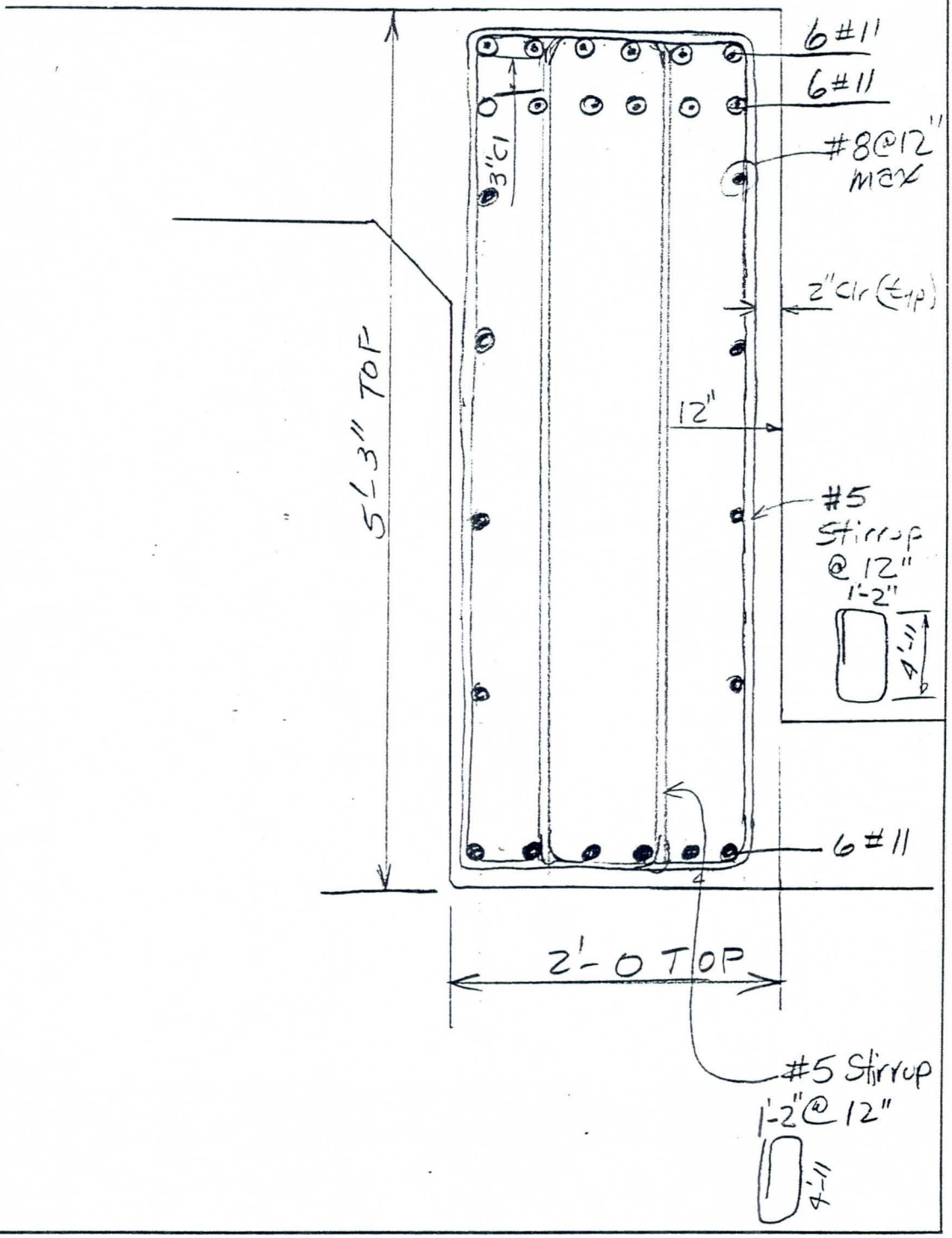
SUBJECT _____

MADE BY WSK DATE 3/95 CHECKED BY YA DATE 3/95

REVISED BY WSK DATE 9/96 RECHECKED BY _____ DATE _____

MAIN BEAMS

TOP BM



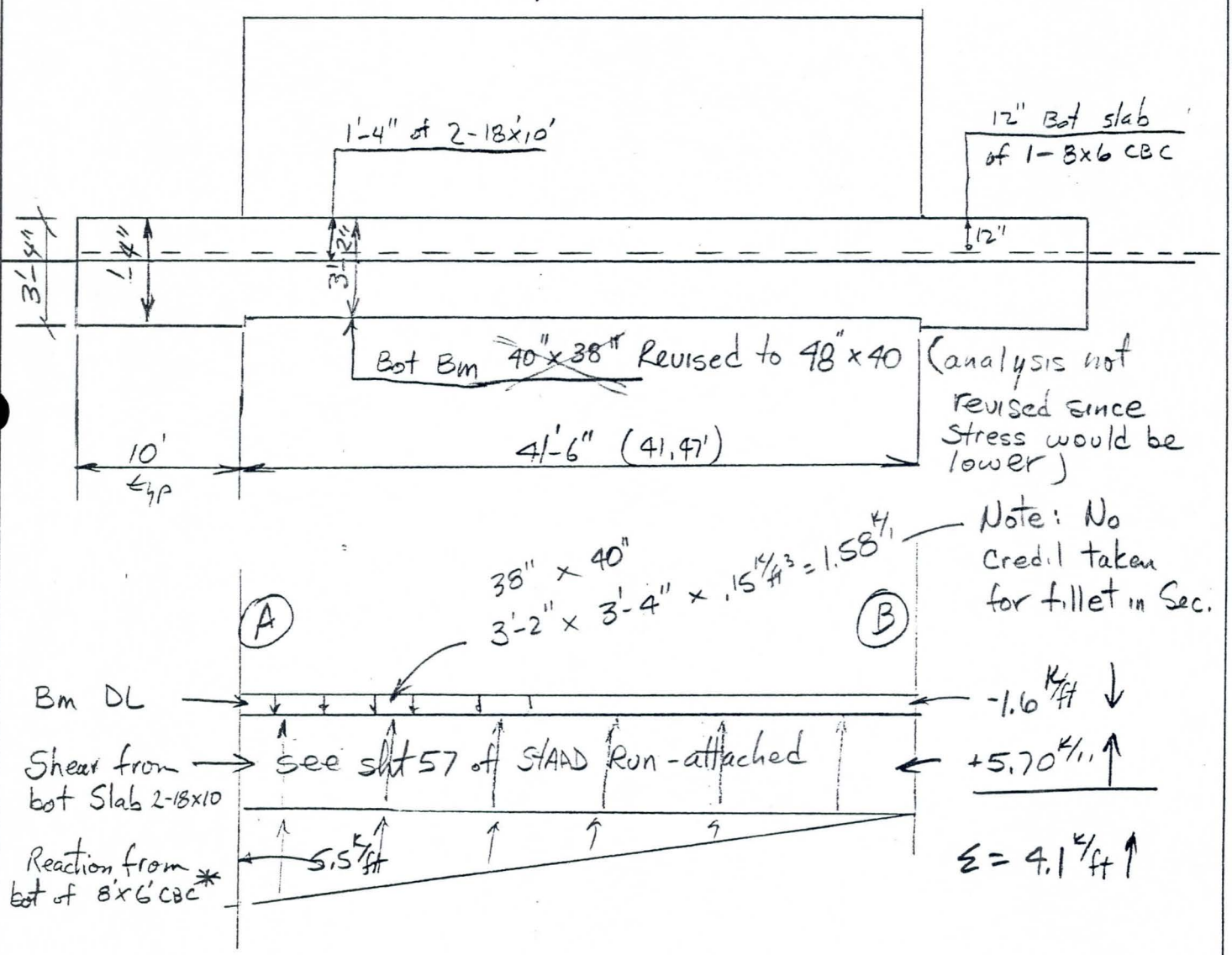
Item 6c

ENTRANCO

SHEET NO 7 OF _____
PROJECT NO _____

PROJECT OLD KCUT
SUBJECT _____
MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95
REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____

BOT. BEAM OF 2-18x10 / 8'x6' CBC INTERSECTION



* Equivalent to Top Slab shear - quite conservative

For "Caseframe Analysis - USE 'U'(LOAD) = 4.1 K/ft = 342 #/in
'T'(LOAD) = Same as Top BM

7a

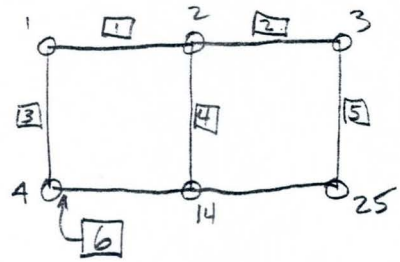
MEMBER END FORCES STRUCTURE TYPE = PLANE

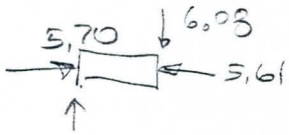
ALL UNITS ARE -- KIP FEET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
6	114	4	2.36	-5.15	0.00	0.00	0.00	-6.40
		5	-2.36	5.53	0.00	0.00	0.00	-3.71
	115	4	-0.04	-4.85	0.00	0.00	0.00	-3.17
		5	0.04	4.92	0.00	0.00	0.00	-6.07
	116	4	-0.08	-4.93	0.00	0.00	0.00	-3.20
		5	0.08	5.00	0.00	0.00	0.00	-6.19
	117	4	-3.07	-1.51	0.00	0.00	0.00	2.98
		5	3.07	1.73	0.00	0.00	0.00	-6.05
	118	4	-3.11	-1.59	0.00	0.00	0.00	2.94
		5	3.11	1.81	0.00	0.00	0.00	-6.16
	121	4	2.82	-1.88	0.00	0.00	0.00	-5.07
		5	-2.82	2.26	0.00	0.00	0.00	1.15
	122	4	3.83	-3.92	0.00	0.00	0.00	-7.63
		5	-3.83	4.30	0.00	0.00	0.00	-0.14
	123	4	3.61	-4.82	0.00	0.00	0.00	-7.82
		5	-3.61	5.20	0.00	0.00	0.00	-1.65
	124	4	3.57	-4.90	0.00	0.00	0.00	-7.85
		5	-3.57	5.28	0.00	0.00	0.00	-1.77
	125	4	1.10	-3.53	0.00	0.00	0.00	-4.10
		5	-1.10	5.09	0.00	0.00	0.00	-4.05
	126	4	1.06	-3.61	0.00	0.00	0.00	-4.13
		5	-1.06	5.16	0.00	0.00	0.00	-4.17
	127	4	-1.98	0.55	0.00	0.00	0.00	2.42
		5	1.98	2.19	0.00	0.00	0.00	-3.97
	128	4	-2.02	0.47	0.00	0.00	0.00	2.38
		5	2.02	2.27	0.00	0.00	0.00	-4.08
	131	4	4.27	-2.15	0.00	0.00	0.00	-7.05
		5	-4.27	2.53	0.00	0.00	0.00	2.62
	132	4	5.83	-4.80	0.00	0.00	0.00	-10.73
		5	-5.83	5.18	0.00	0.00	0.00	1.29
6	133	4	5.61	-5.70	0.00	0.00	0.00	-10.92
		5	-5.61	6.08	0.00	0.00	0.00	-0.23
	134	4	2.36	-5.15	0.00	0.00	0.00	-6.40
		5	-2.36	5.53	0.00	0.00	0.00	-3.71
	135	4	3.17	-5.47	0.00	0.00	0.00	-7.72
		5	-3.17	5.55	0.00	0.00	0.00	-2.70
	136	4	3.12	-5.55	0.00	0.00	0.00	-7.76
		5	-3.12	5.63	0.00	0.00	0.00	-2.82
	137	4	0.14	-2.14	0.00	0.00	0.00	-1.58
		5	-0.14	2.36	0.00	0.00	0.00	-2.68
	138	4	0.10	-2.21	0.00	0.00	0.00	-1.61
		5	-0.10	2.44	0.00	0.00	0.00	-2.79
7	1	5	-0.05	-0.37	0.00	0.00	0.00	1.76
		6	0.05	0.75	0.00	0.00	0.00	-2.83
	2	5	-0.42	-0.56	0.00	0.00	0.00	2.90
		6	0.42	0.56	0.00	0.00	0.00	-3.95
	3	5	4.30	-0.89	0.00	0.00	0.00	-4.52
		6	-4.30	0.89	0.00	0.00	0.00	2.84

Max V @ Lt end of member 6 bottom slab

○ : Jt
□ : member





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SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
	134	0.00	2.72	0.00	0.00	0.00	0.00
	135	0.00	3.16	0.00	0.00	0.00	0.00
	136	0.00	2.45	0.00	0.00	0.00	0.00
	137	0.00	1.65	0.00	0.00	0.00	0.00
	138	0.00	0.95	0.00	0.00	0.00	0.00
(4)	1	0.00	1.80	0.00	0.00	0.00	0.00
	2	0.00	1.81	0.00	0.00	0.00	0.00
	3	-0.01	-0.50	0.00	0.00	0.00	0.00
	13	-0.01	-0.33	0.00	0.00	0.00	0.00
	4	0.00	2.30	0.00	0.00	0.00	0.00
	5	-0.02	-0.74	0.00	0.00	0.00	0.00
	15	-0.01	-0.50	0.00	0.00	0.00	0.00
	10	0.00	0.95	0.00	0.00	0.00	0.00
	11	0.00	1.07	0.00	0.00	0.00	0.00
	18	0.00	-1.85	0.00	0.00	0.00	0.00
	19	0.01	1.15	0.00	0.00	0.00	0.00
	20	0.02	-0.12	0.00	0.00	0.00	0.00
	100	0.00	1.80	0.00	0.00	0.00	0.00
	101	0.00	1.63	0.00	0.00	0.00	0.00
	102	0.00	3.36	0.00	0.00	0.00	0.00
	103	0.00	4.30	0.00	0.00	0.00	0.00
	104	0.00	4.42	0.00	0.00	0.00	0.00
	105	0.00	5.45	0.00	0.00	0.00	0.00
	106	0.00	5.57	0.00	0.00	0.00	0.00
	107	0.01	4.18	0.00	0.00	0.00	0.00
	108	0.01	4.31	0.00	0.00	0.00	0.00
	111	-0.01	1.55	0.00	0.00	0.00	0.00
	112	-0.01	3.73	0.00	0.00	0.00	0.00
	113	-0.01	4.67	0.00	0.00	0.00	0.00
	114	-0.01	4.80	0.00	0.00	0.00	0.00
	115	0.00	4.73	0.00	0.00	0.00	0.00
	116	0.00	4.85	0.00	0.00	0.00	0.00
	117	0.01	2.70	0.00	0.00	0.00	0.00
	118	0.01	2.83	0.00	0.00	0.00	0.00
	121	-0.01	1.47	0.00	0.00	0.00	0.00
	122	-0.01	3.11	0.00	0.00	0.00	0.00
	123	-0.01	4.05	0.00	0.00	0.00	0.00
	124	-0.01	4.17	0.00	0.00	0.00	0.00
	125	0.00	5.20	0.00	0.00	0.00	0.00
	126	0.00	5.32	0.00	0.00	0.00	0.00
	127	0.01	3.93	0.00	0.00	0.00	0.00
	128	0.01	4.06	0.00	0.00	0.00	0.00
	131	-0.01	1.30	0.00	0.00	0.00	0.00
	132	-0.02	3.35	0.00	0.00	0.00	0.00
	133	-0.02	4.30	0.00	0.00	0.00	0.00
	134	-0.01	4.80	0.00	0.00	0.00	0.00
	135	-0.01	4.36	0.00	0.00	0.00	0.00
	136	-0.01	4.48	0.00	0.00	0.00	0.00
	137	0.00	2.33	0.00	0.00	0.00	0.00
	138	0.00	2.45	0.00	0.00	0.00	0.00

Job : 2BM35BOT - BOT DEEP BM A OAK STREET

CASE Frame (c) 1986,87,88,89 ENTRANCO ENGINEERS

System Parameters

Number of Nodes 7
Number of Elements 6

Node Coordinates

Node Symbol	X Coordinate(IN)	Y Coordinate(IN)
1	0.0000	0.0000
2	83.0000	0.0000
3	166.0000	0.0000
4	249.0000	0.0000
5	332.0000	0.0000
6	415.0000	0.0000
7	498.0000	0.0000

Support Constraints

Node Symbol	X Translation (IN)	Y Translation (IN)	Rotation (Rad)
1	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000

Property Set Data

Set Symbol	Area (IN^2)	Elastic Modulus (LB/IN^2)	Inertia (IN^4)
A	1520.0000 (40"×38")	3000000.0000 ✓	182907.0000 $\left(\frac{40\times 38^3}{12}\right)$

→ Final 48×40"

Element Connectivity

Element Symbol	Origin Node	Terminal Node	Property Symbol	Moment Releases Origin	Moment Releases Terminal
A	1	2	A	No	No
B	2	3	A	No	No
C	3	4	A	No	No
D	4	5	A	No	No
E	5	6	A	No	No
F	6	7	A	No	No

Local Uniform Element Loads

Element Symbol	Primary Loading	X Uniform Load (LB/IN)	Y Uniform Load (LB/IN)
A	U	0.0000	-342.0000
B	U	0.0000	-342.0000
C	U	0.0000	-342.0000
D	U	0.0000	-342.0000
E	U	0.0000	-342.0000
F	U	0.0000	-342.0000

$U = \frac{45^{\#/ft} \times 10^{3\#/k}}{12"/ft}$

$U = 342^{\#/in}$

Local Concentrated Element Loads

Element Symbol	Primary Loading	Load Location Type		Distance (IN)	X Load (LB)	Y Load (LB)
A	T	Local	X	41.5000	0.0000	-34871.0000
B	T	Local	X	41.5000	0.0000	-28531.0000
C	T	Local	X	41.5000	0.0000	-22191.0000
D	T	Local	X	41.5000	0.0000	-15851.0000
E	T	Local	X	41.5000	0.0000	-9511.0000
F	T	Local	X	41.5000	0.0000	-3170.0000

see sheet 2

SuperImposed Load Case Specifications

Load Case		Specification
U	==>	U
T	==>	T
UT	==>	U+T

Nodal Displacements

Node Symbol	Load Case	X Translation (IN)	Y Translation (IN)	Rotation (Rad)
1	U	0.0000	0.0000	0.0000
	T	0.0000	0.0000	0.0000
	UT	0.0000	0.0000	0.0000
2	U	0.0000	-0.0308	-0.0006
	T	0.0000	-0.0234	-0.0004
	UT	0.0000	-0.0542	-0.0010
3	U	0.0000	-0.0789	-0.0005
	T	0.0000	-0.0564	-0.0003
	UT	0.0000	-0.1353	-0.0008
4	U	0.0000	-0.0998	0.0000
	T	0.0000	-0.0669	0.0001
	UT	0.0000	-0.1667	0.0001
5	U	0.0000	-0.0789	0.0005
	T	0.0000	-0.0493	0.0003
	UT	0.0000	-0.1282	0.0008
6	U	0.0000	-0.0308	0.0006
	T	0.0000	-0.0179	0.0004
	UT	0.0000	-0.0487	0.0010
7	U	0.0000	0.0000	0.0000
	T	0.0000	0.0000	0.0000
	UT	0.0000	0.0000	0.0000

Nodal Reactions

Node Symbol	Load Case	X Reaction (LB)	Y Reaction (LB)	Moment (IN-LB)
1	U	0.0000	85158.0000	7068114.0000
	T	0.0000	79612.5405	5812422.2743
	UT	0.0000	164770.5405	12880536.2743
7	U	0.0000	85158.0000	-7068114.0000
	T	0.0000	34512.4595	-3791559.6007
	UT	0.0000	119670.4595	-10859673.6007

Element Forces

Element Symbol	Load Case	Node Symbol	Axial (LB)	Shear (LB)	Moment (IN-LB)	Deflection (IN)
A	U	1	0.000	85158.000	-7068114.000	
		MID	0.000	70965.000	-3828561.750	0.0061
		2	0.000	56772.000	-1178019.000	
	T	1	0.000	79612.541	-5812422.274	
		MID	0.000	44741.541	-2508501.843	0.0043
		2	0.000	44741.541	-651727.912	
	UT	1	0.000	164770.541	-12880536.274	
		MID	0.000	115706.541	-6337063.593	0.0104
		2	0.000	101513.541	-1829746.912	
B	U	2	0.000	56772.000	-1178019.000	
		MID	0.000	42579.000	883514.250	-0.0013
		3	0.000	28386.000	2356038.000	
	T	2	0.000	44741.541	-651727.912	
		MID	0.000	16210.541	1205046.019	-0.0016
		3	0.000	16210.541	1877783.450	
	UT	2	0.000	101513.541	-1829746.912	
		MID	0.000	58789.541	2088560.269	-0.0029
		3	0.000	44596.541	4233821.450	

M = 589.1

V = 164.8 K

M = 1073.4 '-K

V = 164.8

M = 152.5

101.5 = V

Element Forces

Element Symbol	Load Case	Node Symbol	Axial (LB)	Shear (LB)	Moment (IN-LB)	Deflection (IN)
C	U	3	0.000	28386.000	2356038.000	
		MID	0.000	14193.000	3239552.250	-0.0050
		4	0.000	-0.000	3534057.000	
	T	3	0.000	16210.541	1877783.450	
		MID	0.000	-5980.459	2550520.881	-0.0038
		4	0.000	-5980.459	2302331.812	
	UT	3	0.000	44596.541	4233821.450	
		MID	0.000	8212.541	5790073.131	-0.0088
		4	0.000	-5980.459	5836388.812	
D	U	4	0.000	0.000	3534057.000	
		MID	0.000	-14193.000	3239552.250	-0.0050
		5	0.000	-28386.000	2356038.000	
	T	4	0.000	-5980.459	2302331.812	
		MID	0.000	-21831.459	2054142.744	-0.0031
		5	0.000	-21831.459	1148137.175	
	UT	4	0.000	-5980.459	5836388.812	
		MID	0.000	-36024.459	5293694.994	-0.0081
		5	0.000	-50217.459	3504175.175	
E	U	5	0.000	-28386.000	2356038.000	
		MID	0.000	-42579.000	883514.250	-0.0013
		6	0.000	-56772.000	-1178019.000	
	T	5	0.000	-21831.459	1148137.175	
		MID	0.000	-31342.459	242131.606	-0.0003
		6	0.000	-31342.459	-1058580.463	
	UT	5	0.000	-50217.459	3504175.175	
		MID	0.000	-73921.459	1125645.856	-0.0016
		6	0.000	-88114.459	-2236599.463	
F	U	6	0.000	-56772.000	-1178019.000	
		MID	0.000	-70965.000	-3828561.750	0.0061
		7	0.000	-85158.000	-7068114.000	
	T	6	0.000	-31342.459	-1058580.463	
		MID	0.000	-34512.459	-2359292.532	0.0037
		7	0.000	-34512.459	-3791559.601	
	UT	6	0.000	-88114.459	-2236599.463	
		MID	0.000	-105477.459	-6187854.282	0.0098
		7	0.000	-119670.459	-10859673.602	

V = 44.6
V = 44.6K
M = 352.8'K
V = 6.0K
M = 486.4'K
V = 50.2K
M = 292.0'K
V = 88.1K
M = 186.4
V = 119.7K
M = 904.5

Item 6c

ENTRANCO

SHEET NO 8 OF _____

PROJECT NO _____

PROJECT OLD XCUT

SUBJECT _____

MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95

REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____

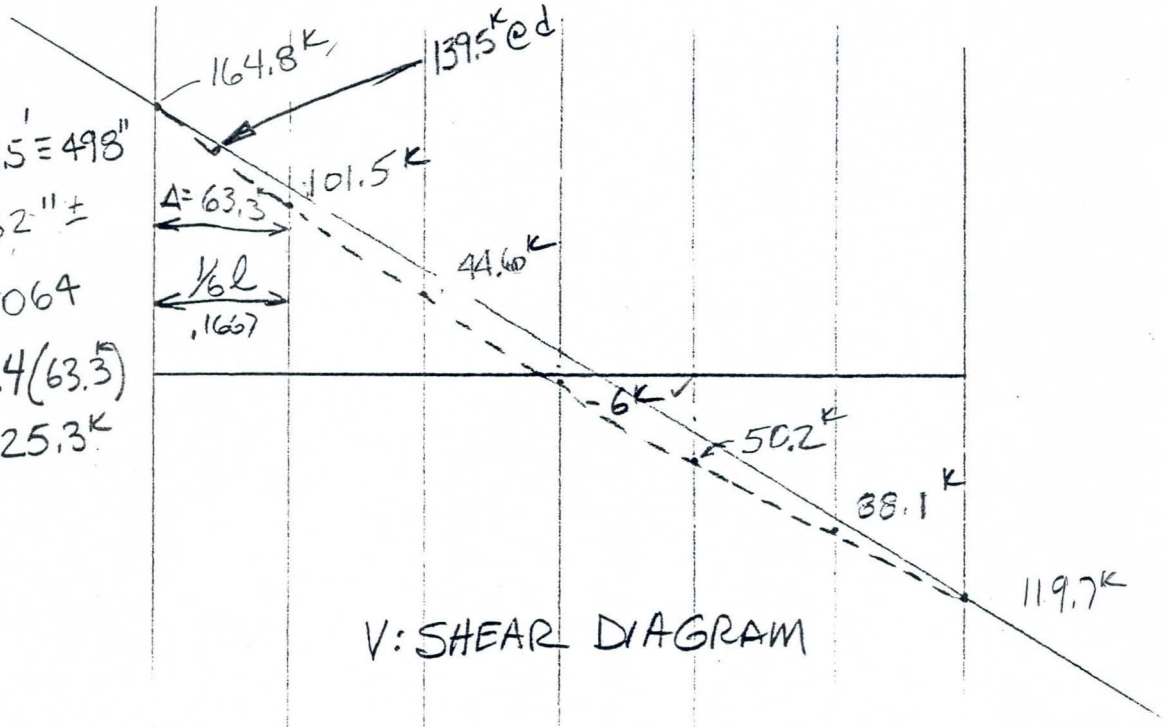
$\ell = 41.5' \equiv 498''$

$d = 32'' \pm$

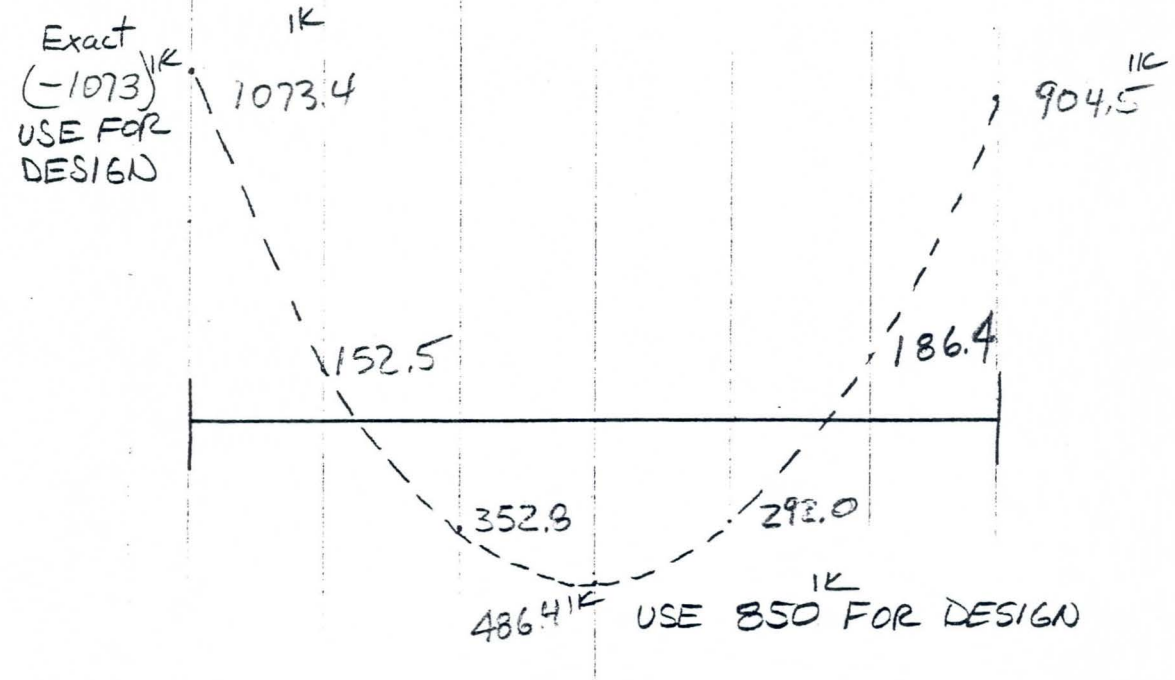
$\frac{d}{\ell} = .064$

$\Delta V = .4(63.3^K)$

$\Delta V = 25.3^K$



V: SHEAR DIAGRAM



MOMENT DIAGRAM

ENTRANCO

SHEET NO 9 OF _____
PROJECT NO _____

PROJECT OLD X-CUT
SUBJECT _____
MADE BY WSK DATE 3/95 CHECKED BY VA DATE 3/95
REVISED BY WSK DATE 8/95 RECHECKED BY _____ DATE _____

BOTTOM BEAM BENDING

B = 48" D = 38" d = 34 (40" to bot of 10'x10' footing)

Neg Mom (bot bars) Use Max @ A for both sides

M = 1073.4'-K

Est. A_s = .56 M/d = .56 × 1073.1K / 34 = 17.67 in²

Try 12 #11 A_s = 18.72 in² (1 × 1.56 in²)

d = 40" − 4 clr − 1¼" (1=5 hoops) − 1.41"/2 (#11) = 34.05"

(#5 ftg)

ρ = 18.72/40 × 34 = .0138 J = .876 K = .372

Check Stresses b = 48 d = 34

f_b = 1073.4K / 18.72 × 876 × 34.0 = 23,102 psi < 24000 OK

f_c = 2 × M / KJbd² = 1425 psi ≅ 1600 psi OK

USE 12 #11s bundled just above #5 stirrup

POS MOM (Top bars) M = 486.4'K b = 48" d = 34" + 2" = 36"

Try 6 #11 As = 9.36 d = 36" ρ = .0054 J = .915 K = .254

Check f_b = 486.4K / 9.36 × .915 × 36" = 16,931 psi OK

f_c = 807 psi < 1600 psi OK

USE 6 #11 To continue pattern used in other areas

Shear Analysis – Stirrup Design

V @ d = 34" d/ℓ = .068 .068/.1667 = .41 ⇒ % of Segment V = 139.5 at d from face see Str 8

v_c = 60 psi v = 139.5/48 × 34 = 85.5 psi

USE #5 hoops

A_v = (85.5 − 60) 48" 12" / 24,000 = .61 in² use at least 2#5 Stirrups: As = .62 in²

FOOTING DESIGN — WALL FOOTING 10' LONG

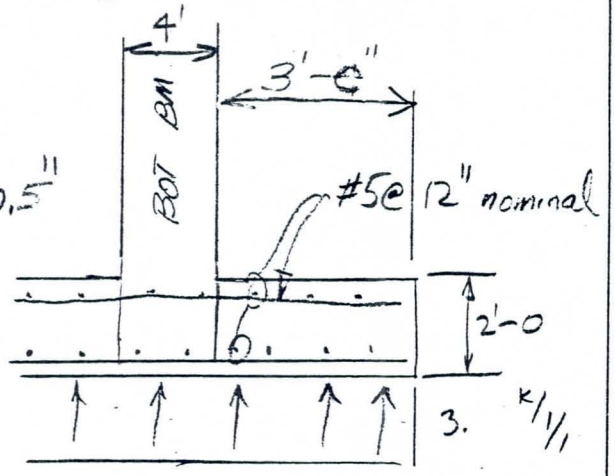
REACTIONS

TOP BM V	269.2^K ↓	see Sht 2f	Load UT (Sht 3) @ Jt 1.
WALL DL	37.7^K ↓	(2' × 10' × 12.58' × .15)	
Resultant BOT BM	(Neglect) ↑	Very Conservative	
FOOTING	30^K ↓	10 × 10 × 2 × .15	
	336.9^K		

FTG BEARING

$f = 337^K/100ft^2 = 3.37^K/ft^2 < 5$ KSF OK

$M = 3.37^{K/1} \times \frac{3'^2}{2} = 15.2^{1K}$



Est $A_s = .56\ M/d$ $d = 24" - 3" - 1.0/2 = 20.5"$

Est $A_s = .41$ use #7@12"

$\phi_0\ A_s = .60\ in^2$ $d = 20.6"$

$\rho = .0024$ $J = .941$ $K = .178$

$f_b = 15{,}683$ psi OK

$f_c = 428$ psi OK

USE #7@12"

MADE W.S.K.

CHECKED G.R.H.

HIGHWAY DIVISION
STRUCTURES SECTION
VALUES OF "K" AND "J" FOR "N" = 8

SHEET 3 OF 7

DATE 4-75

$P = As/bd$ $\qquad K = \sqrt{2NP + (NP)^2} - NP \qquad$ (1340 T.O) $\qquad J = 1 - K/3$

P	K	J	P	K	J	P	K	J	P	K	J
.0001	.039	.987	.0051	.248	.917	.0101	.329	.890	.0151	.385	.872
.0002	.055	.982	.0052	.250	.917	.0102	.331	.890	.0152	.386	.871
.0003	.067	.978	.0053	.252	.916	.0103	.332	.889	.0153	.387	.871
.0004	.077	.974	.0054	.254	.915	.0104	.333	.889	.0154	.388	.871
.0005	.086	.971	.0055	.256	.915	.0105	.334	.889	.0155	.389	.870
.0006	.093	.969	.0056	.258	.914	.0106	.336	.888	.0156	.390	.870
.0007	.100	.967	.0057	.260	.913	.0107	.337	.888	.0157	.391	.870
.0008	.107	.964	.0058	.262	.913	.0108	.338	.887	.0158	.392	.869
.0009	.113	.962	.0059	.264	.912	.0109	.339	.887	.0159	.393	.869
.0010	.119	.960	.0060	.266	.911	.0110	.341	.886	.0160	.394	.869
.0011	.124	.959	.0061	.267	.911	.0111	.342	.886	.0161	.395	.868
.0012	.129	.957	.0062	.269	.910	.0112	.343	.886	.0162	.396	.868
.0013	.134	.955	.0063	.271	.910	.0113	.344	.885	.0163	.397	.868
.0014	.139	.954	.0064	.273	.909	.0114	.346	.885	.0164	.398	.867
.0015	.143	.952	.0065	.275	.908	.0115	.347	.884	.0165	.398	.867
.0016	.148	.951	.0066	.276	.908	.0116	.348	.884	.0166	.399	.867
.0017	.152	.949	.0067	.278	.907	.0117	.349	.884	.0167	.400	.867
.0018	.156	.948	.0068	.280	.907	.0118	.350	.883	.0168	.401	.866
.0019	.160	.947	.0069	.282	.906	.0119	.351	.883	.0169	.402	.866
.0020	.164	.945	.0070	.283	.906	.0120	.353	.882	.0170	.403	.866
.0021	.167	.944	.0071	.285	.905	.0121	.354	.882	.0171	.404	.865
.0022	.171	.943	.0072	.287	.904	.0122	.355	.882	.0172	.405	.865
.0023	.174	.942	.0073	.288	.904	.0123	.356	.881	.0173	.406	.865
.0024	.178	.941	.0074	.290	.903	.0124	.357	.881	.0174	.406	.865
.0025	.181	.940	.0075	.292	.903	.0125	.358	.881	.0175	.407	.864
.0026	.184	.939	.0076	.293	.902	.0126	.359	.880	.0176	.408	.864
.0027	.187	.938	.0077	.295	.902	.0127	.360	.880	.0177	.409	.864
.0028	.190	.937	.0078	.296	.901	.0128	.362	.879	.0178	.410	.863
.0029	.193	.936	.0079	.298	.901	.0129	.363	.879	.0179	.411	.863
.0030	.196	.935	.0080	.299	.900	.0130	.364	.879	.0180	.412	.863
.0031	.199	.934	.0081	.301	.900	.0131	.365	.878	.0181	.412	.863
.0032	.202	.933	.0082	.303	.899	.0132	.366	.878	.0182	.413	.862
.0033	.205	.932	.0083	.304	.899	.0133	.367	.878	.0183	.414	.862
.0034	.208	.931	.0084	.306	.898	.0134	.368	.877	.0184	.415	.862
.0035	.210	.930	.0085	.307	.898	.0135	.369	.877	.0185	.416	.861
.0036	.213	.929	.0086	.308	.897	.0136	.370	.877	.0186	.417	.861
.0037	.216	.928	.0087	.310	.897	.0137	.371	.876	.0187	.417	.861
.0038	.218	.927	.0088	.311	.896	.0138	.372	.876	.0188	.418	.861
.0039	.221	.926	.0089	.313	.896	.0139	.373	.876	.0189	.419	.860
.0040	.223	.926	.0090	.314	.895	.0140	.374	.875	.0190	.420	.860
.0041	.225	.925	.0091	.316	.895	.0141	.375	.875	.0191	.421	.860
.0042	.228	.924	.0092	.317	.894	.0142	.376	.875	.0192	.422	.859
.0043	.230	.923	.0093	.318	.894	.0143	.377	.874	.0193	.422	.859
.0044	.232	.923	.0094	.320	.893	.0144	.378	.874	.0194	.423	.859
.0045	.235	.922	.0095	.321	.893	.0145	.379	.874	.0195	.424	.859
.0046	.237	.921	.0096	.323	.892	.0146	.380	.873	.0196	.425	.858
.0047	.239	.920	.0097	.324	.892	.0147	.381	.873	.0197	.426	.858
.0048	.241	.920	.0098	.325	.892	.0148	.382	.873	.0198	.426	.858
.0049	.244	.919	.0099	.327	.891	.0149	.383	.872	.0199	.427	.858
.0050	.246	.918	.0100	.328	.891	.0150	.384	.872	.0200	.428	.857

GREINER, INC.

7310 North 16th Street, Suite 160
Phoenix, Arizona 85020
(602) 275-5400

FAX COVER SHEET

☐ FAX: (602) 943-1891
☐ Marketing FAX: (602) 997-2037

DATE: 9/14/95 NUMBER OF PAGES: 3 (Including Cover Sheet)

TO: Kumar

FAX NO.: 506-4601

FROM: Vince Gibbons

REFERENCE: OCC - Phase 1

MESSAGE: Request for joint length change from Sundt. Please review & approve or reject.

Thanks Vince

REPLY NEEDED: ☒ Yes ☐ No
☒ FAX Only ☐ Original to Follow by Mail
☐ Copy & Distribute To: _____
☐ Copied & Distributed (Initials: _____)

If you do not receive all pages clearly, please call (602) 275-5400 as soon as possible.

SundtCorp

September 5, 1995

Peter A. Johnson, P.E.
Engineering Supervisor
Street Transportation Department,
Design and Construction Management Division
City of Phoenix
1034 E. Madison St.
Phoenix AZ 85034

Attention: MariAnn Holder, P.E.
Resident Engineer

Re: Old Cross Cut Canal, Phase I
McDowell Rd to Thomas

Gentlemen/ Ladies,

Sundt Corp. requests a clarification on the Joint Note on page C8.1 of the Contract Plans. It requests a construction joint every 38'-6" on the top deck and walls, and every 50' on the bottom slab. Sundt Corp. proposes to place a 1/4" champher strip every 38'-6" to give a weakened plane joint at that location. This has been used successfully on the following ADOT project AC-stp-053-1(29)-H272901C. On the bottom slab, due to the invert being below the water table, we would like to eliminate the joints every 50'.

If you have any questions, please contact me at 253-2972.

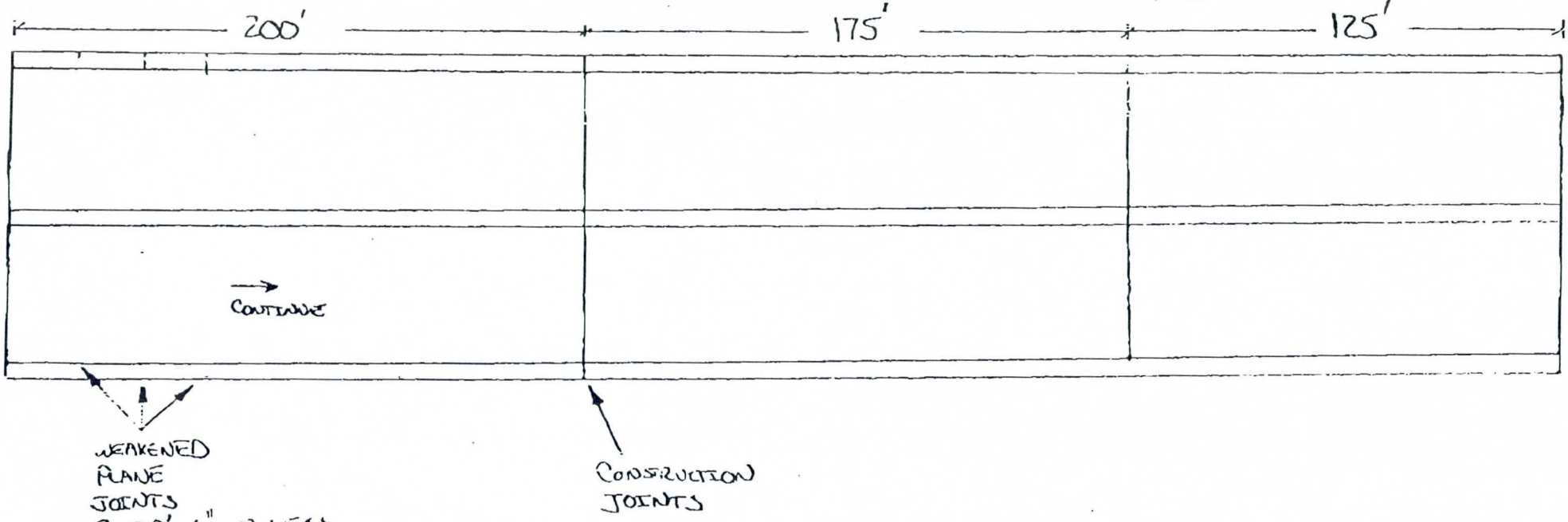
Sincerely,
Sundt Corp, Heavy Group

Marcus Mason
Project Engineer

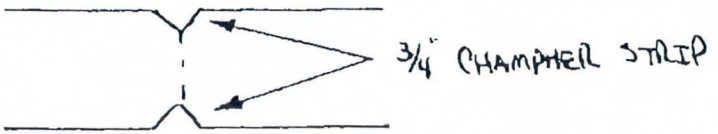
Sundt Corp. 4101 E. IRVINGTON ROAD • TUCSON, AZ (85714) • P.O. BOX 26685 (85726) • 602/748-7551 • FAX 602/747-9673
Arizona Contractor License 068012-A and 066013-B-01 • Nevada Contractor License 0022067-A8 • California Contractor License 453175-A8

NOTES

1. SUNDT WILL PLACE THE INVERT IN 3 SECTIONS (200', 175', 125')
2. WITH THE WATER TABLE BEING ABOVE THE INVERT WE DONT THICK A JOINT EVERY 50' WOULD BE WISE.
3. A 3/4" CHAMPHER STRIP WILL BE PLACED ON THE DECK AND AT THE SAME PLACE ON THE WALLS TO GIVE A WEAKENED PLAN TO CRACK THERE.



WEAKENED PLANE JOINT
DECK



WEAKENED PLANE JOINT
WALLS

To: DJR
MAL
KVH

From: Kumar Hanumaiah:TALOS Host: TALOS
Postmark: 08/30/95 10:24AM Delivered: 08/30/95 10:24AM
Status: Previously read

Subject: Old Cross Cut

Message:

I have a few minor comments on the revised concept of Bill Kantor's.

1) Proposed deep beam has two rows of 6#11 bars,which gives us a 3.5" c.to c. and a clear distance of 2" between the #11 bars. This meets the code requirements, but we may have problems in the field during construction vibrating concrete between the bars. I have to talk to Bill about this clearance.

2) Section D-D shows the Typ.aa bars stopped at the base slab level. It is recommended to extend these bars into the foundation slab and call out as Typ.aa bar length+1'-6"

3) The ELEVATION(LOOKING INTO 8'x6'BOX),shows a note 8'x10'CBC which should be corrected as 8'x6'CBC

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

2801 West Durango Street · Phoenix, Arizona 85009
Telephone: (602) 506-1501
Fax: (602) 506-4601
TT: (602) 506-5897

COVER SHEET

TO: Bill Kantor

Company or Department: Entranco Eng. **Fax #** 943-5068

FROM: Kumar

Number of pages being sent including Cover Sheet: 1

Comments: When you are sending the revised Structural Sct, also send us some Computations in Support of the new Concept. (Code)
Thanks.

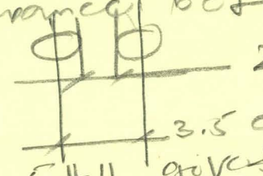
****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

TX/RX NO.	7689
TTI	ADMIN SERVICES
CONNECTION TEL	99435068
CONNECTION ID	
START TIME	08/21 16:01
USAGE TIME	00'39
PAGES	1
RESULT	OK

① Comment

a) 6 #11 used per Row, giving a clearance between the bars

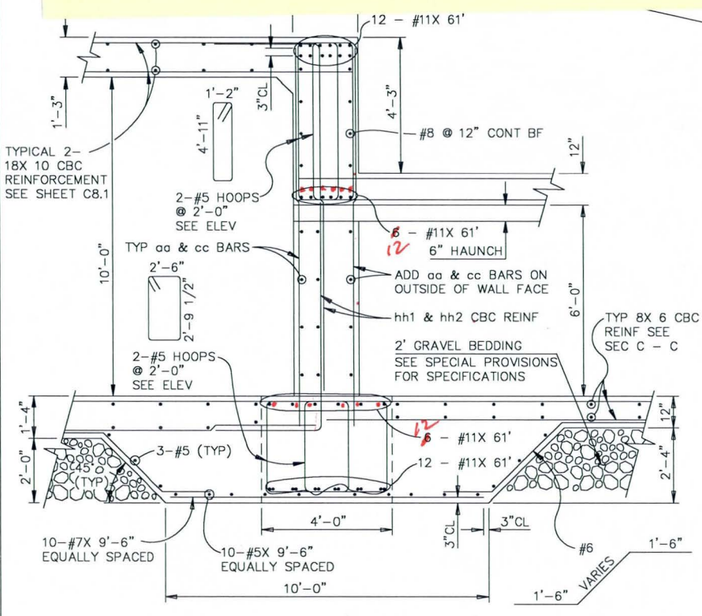


b) using 5 #11 gives a 3" clear

② Box (8'x10') → (8'x6')

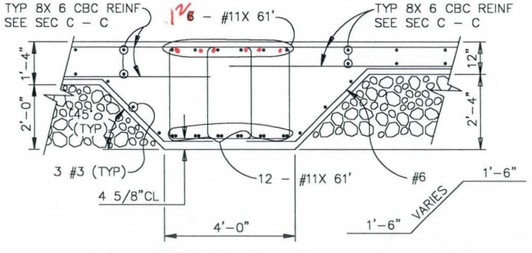
③ Bar Length [Box + ~~2'-0~~ 1'-6]

this detail of Rein will be on C8.3



SECTION D – D (D1 – D1 SIM)

1/2"=1'-0"

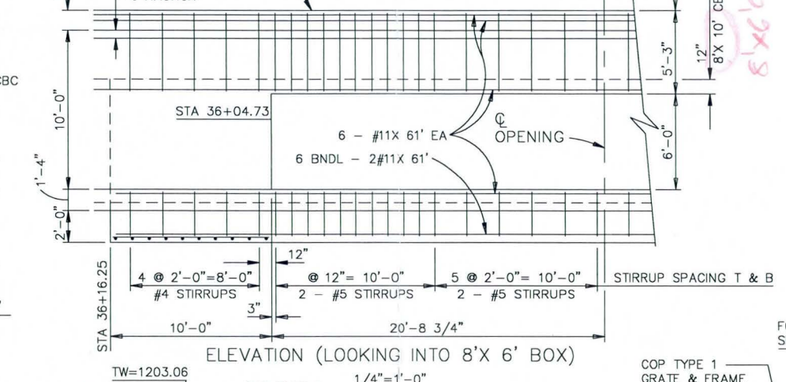


SECTION E – E

1/2"=1'-0"

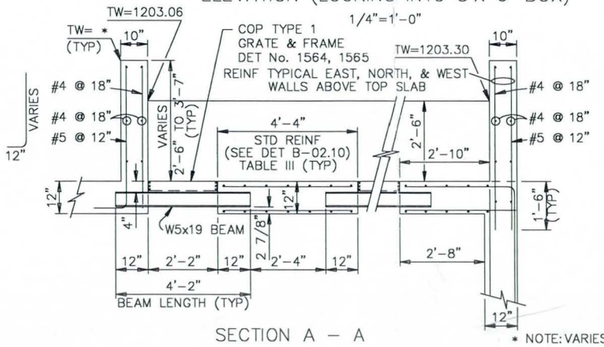
PLAN

1/4"=1'-0"



ELEVATION (LOOKING INTO 8'X 6' BOX)

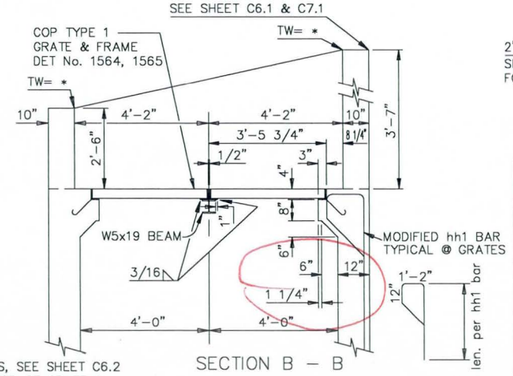
1/4"=1'-0"



SECTION A – A

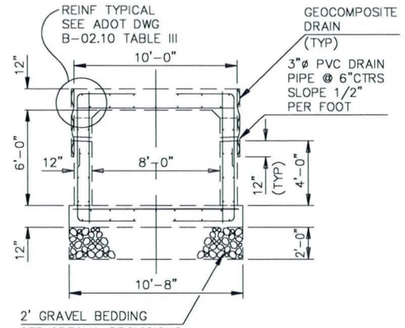
1/2"=1'-0"

* NOTE: VARIES, SEE SHEET C6.2 FOR TOP OF GRATE & WALL ELEVATIONS



SECTION B – B

1/2"=1'-0"



SECTION C – C

1/4"=1'-0"

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

OLD CROSS CUT CANAL
INDIAN SCHOOL RD TO McDOWELL RD
PROJECT NO. FCD 95-08

	BY	DATE
DESIGNED	VA/WSK	08/31/95
DRAWN	TST	08/31/95
CHECKED	WSK	08/31/95

ENTRANCO
CONSULTANTS PLANNERS SURVEYORS
3443 WEST DUNLAP AVENUE, SUITE 100
PHOENIX, ARIZONA 85051 (602) 381-1200

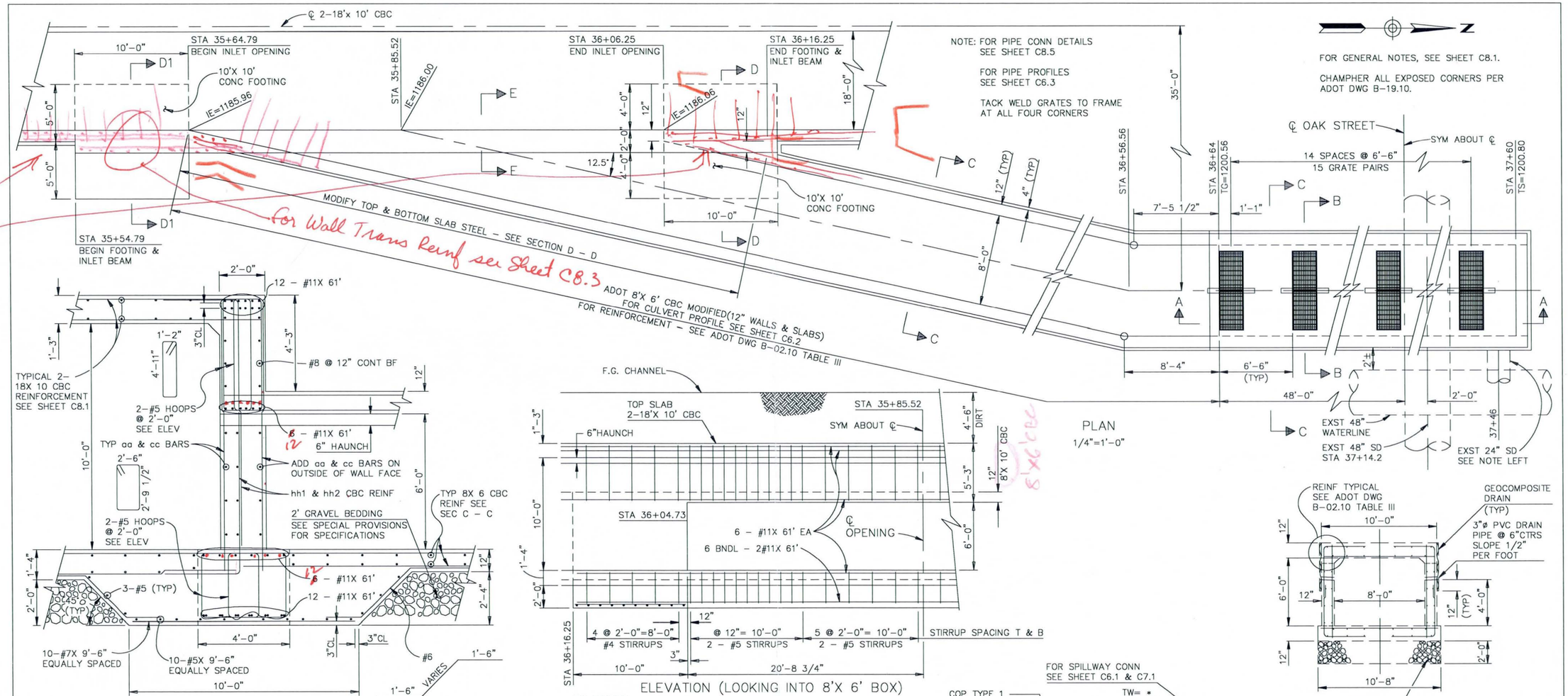
SPECIAL SIDE INLET
STA 35+85.52

SHEET OF C8.7

PLOT DATE: 08.25/95 CADD NAME: 2GRATES2.DWG
SCALE: 1/4"=1'

12" 6" 1 1/4" 1'-7 1/4"

10" 8 1/4" 3 21 1/4" = 1'-9 1/4"



This detail of Reinf will be on C8.3

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION		
OLD CROSS CUT CANAL INDIAN SCHOOL RD TO McDOWELL RD PROJECT NO. FCD 95–08		
	BY	DATE
DESIGNED	VA/WSK	08/31/95
DRAWN	TST	08/31/95
CHECKED	WSK	08/31/95
ENTRANCO		
SPECIAL SIDE INLET STA 35+85.52		SHEET OF C8.7

PLOT DATE: 08.25/95 CADD NAME: 2GRATES2.DWG
SCALE: 1/4"=1'

12" 6" 1 1/4" 1'-7 1/4"

10" 8 1/4" 3 21 1/4" = 1'-9 1/4"

To: Kumar Hanumaiah:TALOS

From: Don Rerick:TALOS Host: TALOS
Postmark: 08/21/95 01:28PM Delivered: 08/21/95 01:28PM
Status: Previously read Certified

Subject: Reply to: OCC

Reply Text:
thanks for the message, but i need more information.

please send me a response indicating that you have reviewed and aproved the revised concept presented by kantor.

also, state whether or not fruther calculations are required.

this should all be included in a message response that can be filed with copies of the sketches the revised concept.

please send me copies of the revised sketches of the concept.

thanks.

Previous Comments:
From: Kumar Hanumaiah:TALOS
Date: 08/21/95 01:22PM

I received a fax from Bill Kantor,showing a section at the beam and a section at the footing which appears to be satisfactory. I also mentioned to Bill to send us a set of structural sheets after making all the changes for a quick review, before the final submittal.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

2801 West Durango Street · Phoenix, Arizona 85009
Telephone: (602) 506-1501
Fax: (602) 506-4601
TT: (602) 506-5897

COVER SHEET

TO: Bill Kantor

Company or Department: Entranco Eng. **Fax #** 943-5068

FROM: Kumar

Number of pages being sent including Cover Sheet: 1

Comments: Please send us a set of Structural Sheets soon after making all the Changes for a quick review, before the final Submittal. Give me a Call if you have any questions.

****
*** ACTIVITY REPORT ***
****

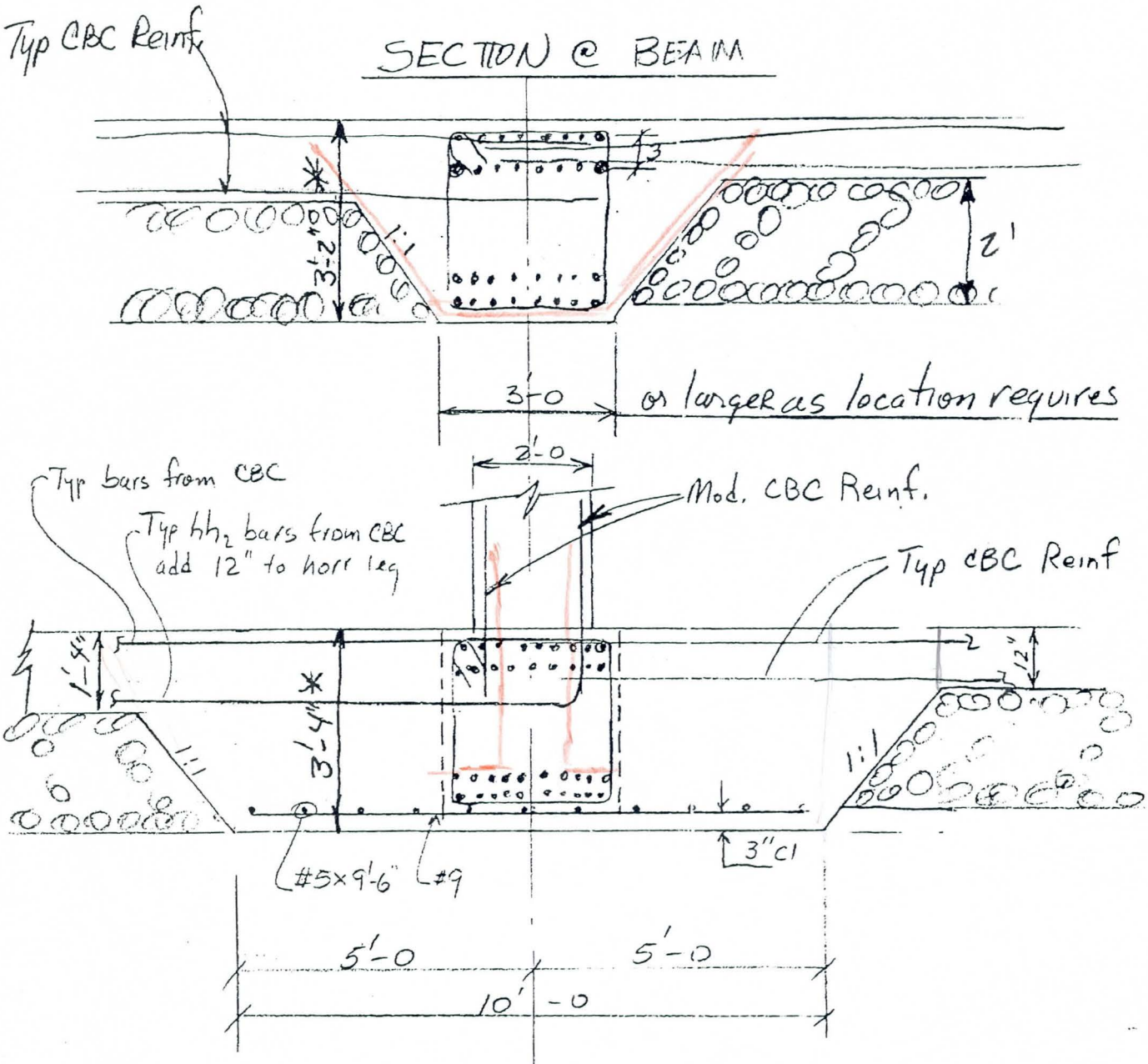
TRANSMISSION OK

TX/RX NO.	7501
CONNECTION TEL	99435068
CONNECTION ID	
START TIME	08/15 14:27
USAGE TIME	00'41
PAGES	1
RESULT	OK

ENTRANCO

SHEET NO 1 OF 1
PROJECT NO

PROJECT X-CUT
SUBJECT INLET OPENING BEAM CONCEPT
MADE BY WSK DATE 8/14/95 CHECKED BY DATE
REVISED BY DATE RECHECKED BY DATE

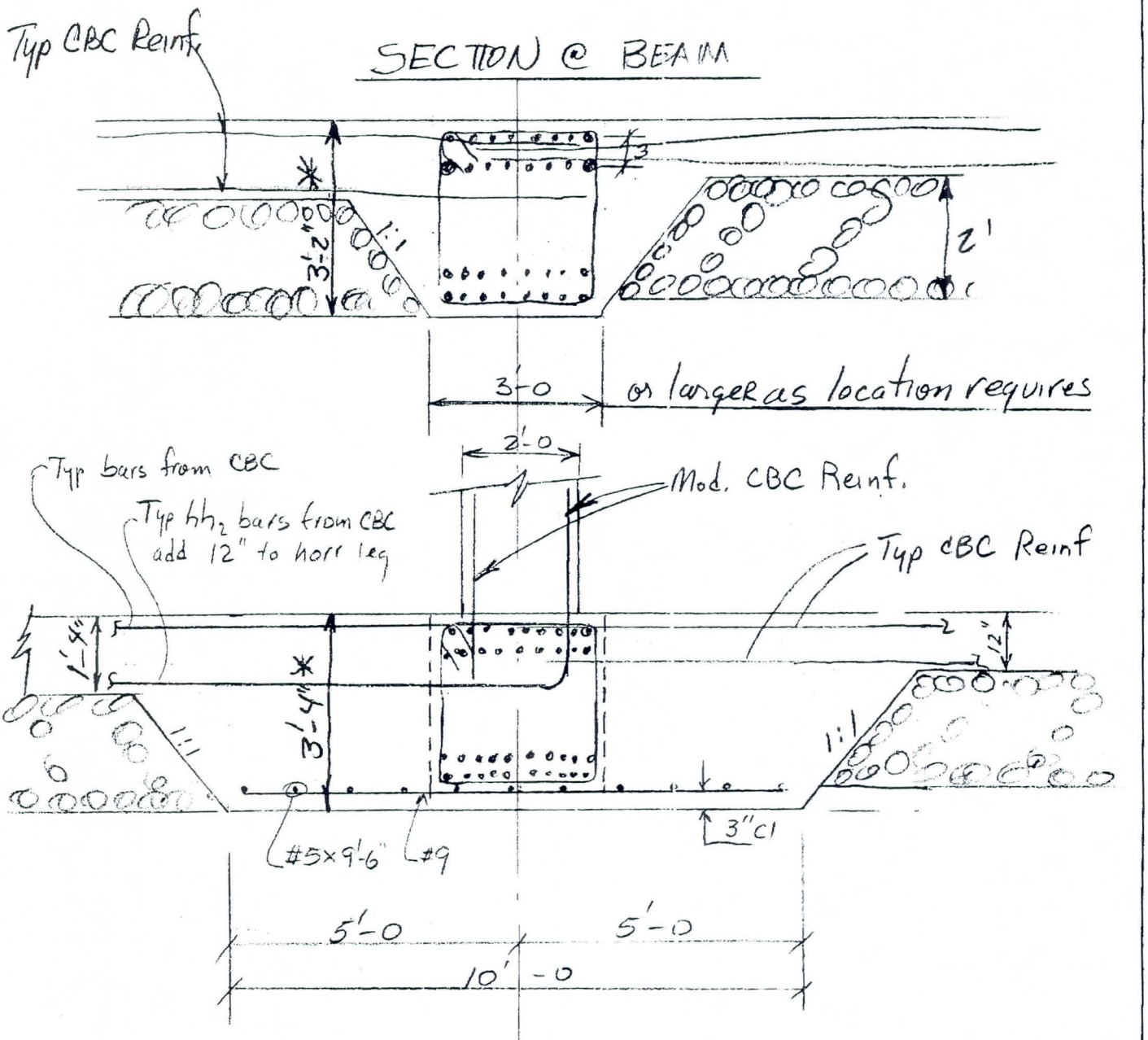


*Depths may need to be 6" deeper to accomodate strength requirements

ENTRANCO

SHEET NO 1 OF 1
PROJECT NO

PROJECT X-CUT
SUBJECT INLET OPENING BEAM CONCEPT
MADE BY WSK DATE 8/14/95 CHECKED BY DATE
REVISED BY DATE RECHECKED BY DATE



*Depths may need to be 6" deeper to accomodate strength requirements

To: DJR
MAL
KVH

From: Kumar Hanumaiah:TALOS
Postmark: 08/03/95 08:48AM
Status: Previously read

Host: TALOS
Delivered: 08/03/95 08:48AM

Subject: Old Cross Cut Canal

Message:

The following are the structural review comments for the Old cross cut canal project.

1) Deep beam proposed at the foundation level running for the entire length of the opening may not be required, as the loads are transferred directly to the spread footings. All that is required is a thickened slab section where the two bottom slabs meet.
Section D-D, should also show the thickened wall reinforcing transferring load to the spread footings.
Dowels #7 @ 24" shown now may not be sufficient to transfer the load from the wall to the foundations.

2) Deep Beam proposed has 12 # 11 bars at the top and 6 # 11 at the bottom. As the full fixity may or may not be developed at the ends, the same 12 # 11 may be used both at the top and bottom to be safe.

3) Side inlet at station 75+82 shows a 24" diameter column at the center. Rectangular column with rounded edges is preferable to avoid any punching shear problems at the foundation level.

To: DJR
MAL
KVH

From: Kumar Hanumaiah:TALOS
Postmark: 08/03/95 08:48AM
Status: Previously read

Host: TALOS
Delivered: 08/03/95 08:48AM

Subject: Old Cross Cut Canal

Message:

The following are the structural review comments for the Old cross cut canal project.

1) Deep beam proposed at the foundation level running for the entire length of the opening may not be required, as the loads are transferred directly to the spread footings. All that is required is a thickened slab section where the two bottom slabs meet.
Section D-D, should also show the thickened wall reinforcing transferring load to the spread footings.
Dowels #7 @ 24" shown now may not be sufficient to transfer the load from the wall to the foundations.

2) Deep Beam proposed has 12 # 11 bars at the top and 6 # 11 at the bottom. As the full fixity may or may not be developed at the ends, the same 12 # 11 may be used both at the top and bottom to be safe.

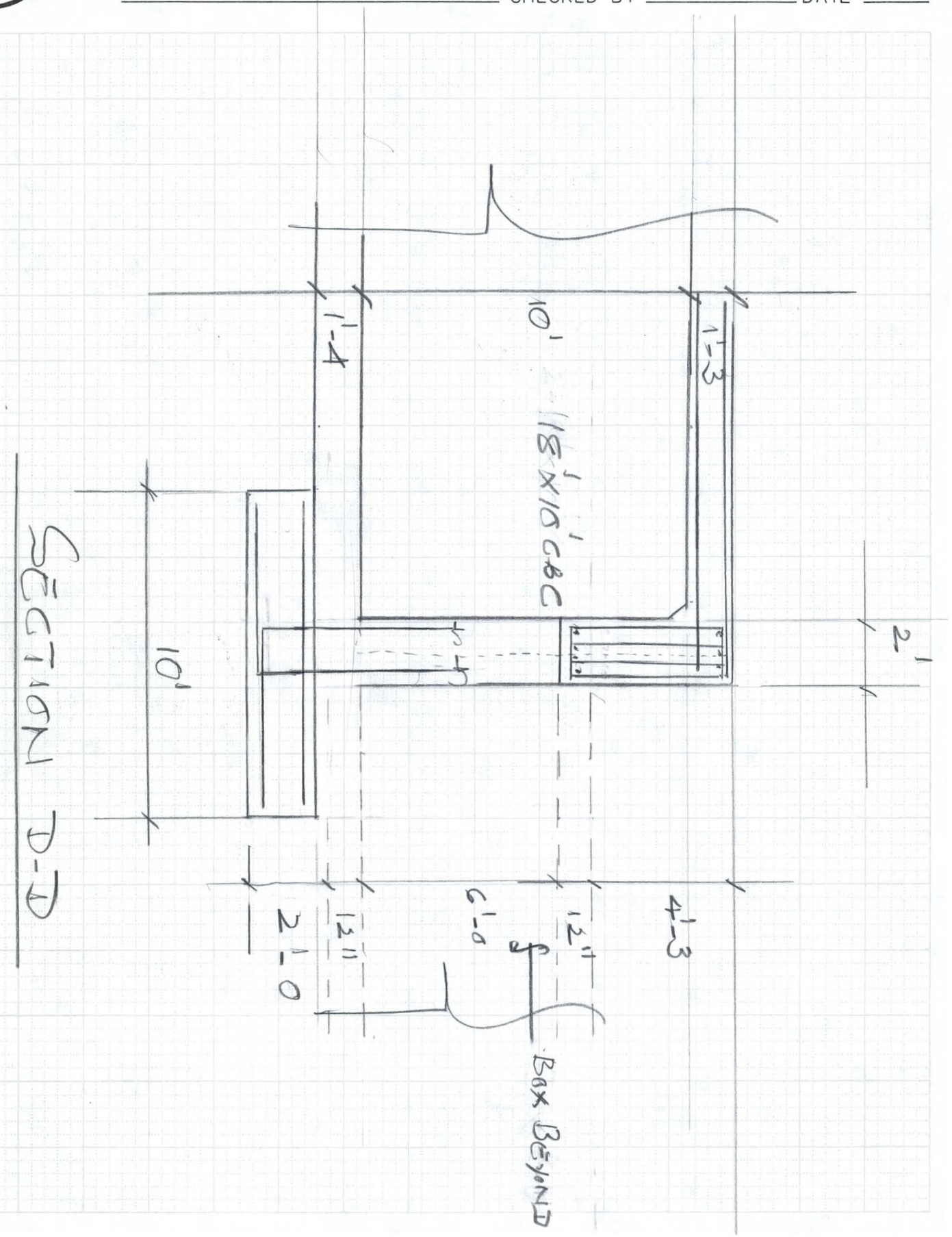
3) Side inlet at station 75+82 shows a 24" diameter column at the center. Rectangular column with rounded edges is preferable to avoid any punching shear problems at the foundation level.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT OCC PAGE 1 OF

DETAIL COMPUTED KPH DATE

CHECKED BY DATE



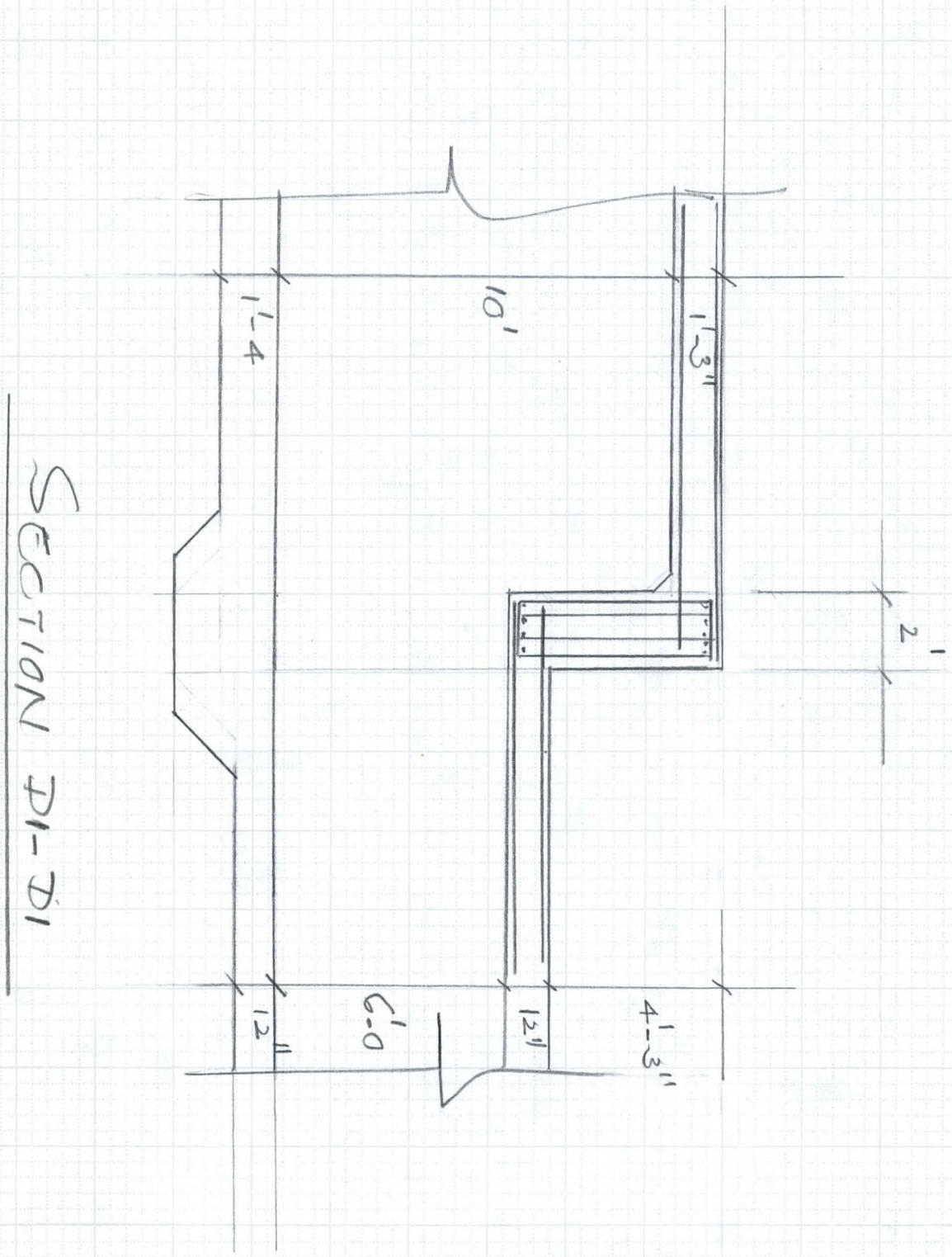
SECTION D-D

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT OCC PAGE 3 OF ____

DETAIL ____ COMPUTED KN/H DATE ____

____ CHECKED BY ____ DATE ____



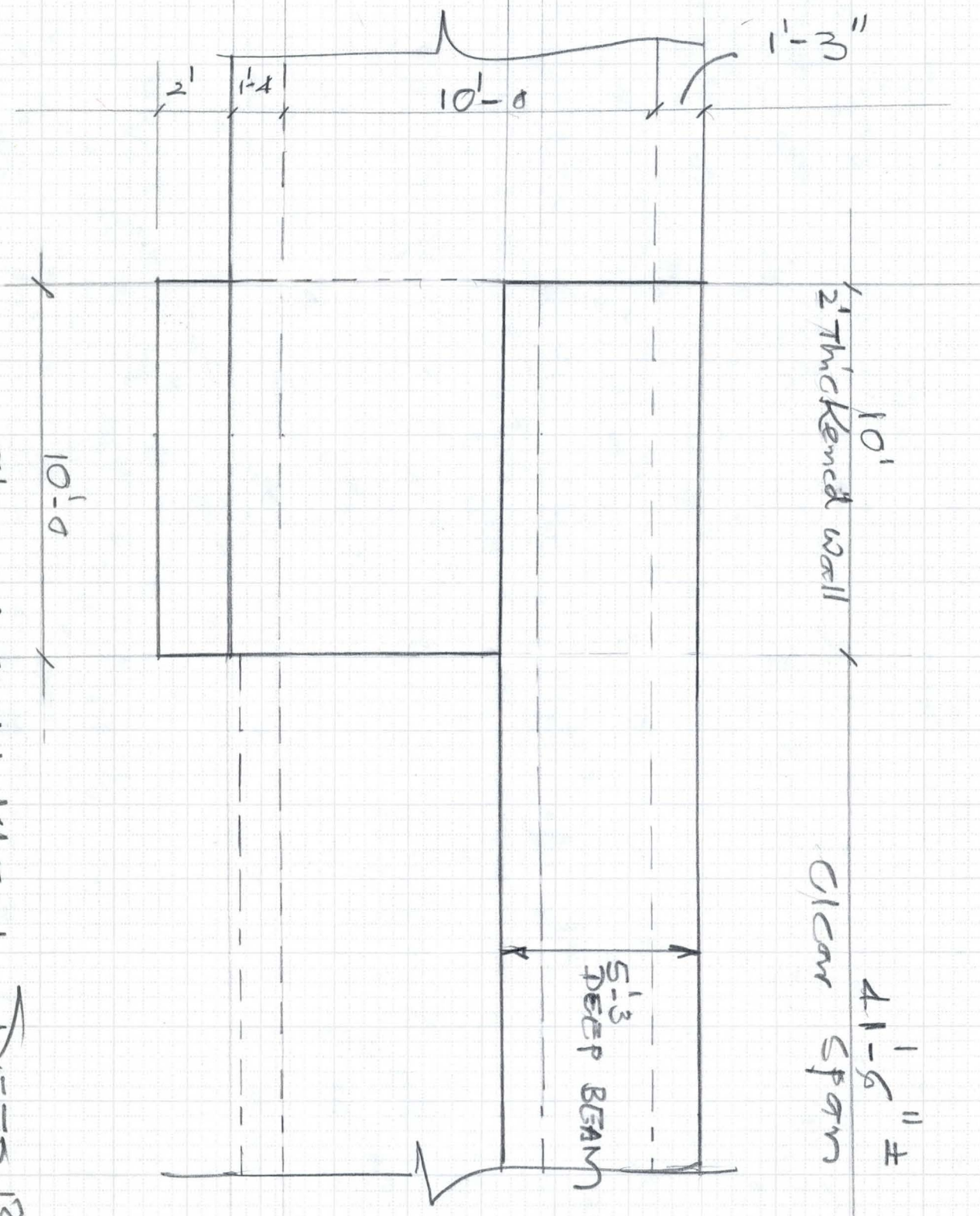
SECTION D1-D1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT OCC. PAGE 2 OF

DETAIL COMPUTED KVH DATE

CHECKED BY DATE



ELEVATION VIEW - DEEP BEAM

6910-153 4-90

MAL

ENTRANCO

July 28, 1995

Maricopa County Department of Transportation
2901 West Durango Street
Phoenix, Arizona 85009

ATTN: Don Rerick
Project Manager

RE: Old Cross Cut Canal
Project 95-09
Large Side Inlets/Openings At Oak Street, Earl Drive and Osborn Road

Dear Mr. Rerick:

In response to you request for information concerning the structural framing scheme used on the intersection of the large side inlet with the main box culvert, the following is an outline of the historical and technical development.

In the original concept (1990) the side inlets would have connected to the box at right angles requiring only 10 or 12 feet openings which could have been framed simply with minimal additional reinforcing and bottom slab thickening. This concept continued through the 1991 60% submittal.

Subsequently, the 1993 60% submittal showed the large side inlet connections at 12½° angle of incidence (a skew angle of 77.5°). This came about from the conclusion of a more rigorous analysis of the hydraulics of the main box culvert. Conceptually, at this time the resulting long spans were braced with columns at their mid-span and at the third points for the Earll Drive inlet. Definitive footing details were not shown at this point since the project was under reanalysis and could have been revised substantially. The presence of long spans and columns always required a foundation of spread footings to meet the maximum allowable soil pressure since the long spans would naturally concentrate high reactions at the beginning and end of the openings.

Subsequently, the project was delayed. The same concepts without detailed spread footing were shown in the 1994 60% submittal. Foundation details were not developed until after this review to avoid redesign, if other review concerns or project changes resulted.

During final design for Phase 2, it was observed that a widening of the main box wall above the inlet intersection could accommodate the spanning of the opening without a intermediate column. The beam only added one-foot of concrete width to the 12-inch main box wall above the opening. Below the opening the same two-foot wide beam could be used here that was designed above providing similar construction requirements. The need for spread footings beneath the beam resulted from the analysis showing high concentrated reaction at the ends of the beams and the need to spread these loads out to meet the available soil bearing capacity of 5000 lbs/ft². Since the main box has uniform bearing under its entire surface, the combination of the beam reactions would exceed the allowable bearing pressure with a thickened slab.

2400 WEST
DUNLAP AVE
SUITE 100
PHOENIX
ARIZONA
85021-2813

TELEFAX
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264 1728

ARIZONA
CALIFORNIA
WASHINGTON

The framing scheme above was continued in Phase 3 to match the design in Phase 2 with similar construction requirements. The resulting design reduced hydraulic losses at the junction of the boxes and improved the maintenance access to the side inlet from the main box.

If you have any questions, need additional information or clarification please contact Vince Gibbons at Greiner, Inc. or myself.

Sincerely,

ENTRANCO

William S. Kantor, Jr., P.E.
Project Manager

WSK/hls

PHASE "2"

MARICOPA COUNTY FLOOD CONTROL DISTRICT

INTEROFFICE MEMORANDUM

SUBJECT:OCCC PRE-FINAL, SHEET 8.2,8.7

TO:DON RERICK FROM:C G WAINWRIGHT DATE:JUN,5,1995
VIA:R SHAH

STRUCTURAL SHEET 8.2

1.TYPICAL SECTION A-A,DETAIL A-
THE WIDTH OF THE WEST SIDE WALL IS 16" NOT 12". EAST SIDE WALL IS 12" WIDE. THE WALLS IN THIS AREA HAVE EXPOSED CORNERS WHICH REQUIRES AN INCLUSION IN THE GENERAL STRUCTURAL NOTES FOR 3/4" CHAMFER.

2.WALL TRANSITION DETAIL-
THE SLAB DEPTH CHANGES FROM 2'-0 FOR THE OPEN CHANNEL TO 1'-4 FOR THE BOX. THE DETAIL SHOULD SHOW THE DEPTH CHANGE AND THE REBAR AT THE CHANGE.

STRUCTURAL SHEET 8.7

1.PLAN VIEW/ELEVATION(LOOKING INTO 8'X6' BOX)-
THERE SHOULD BE A DETAIL SHOWING HOW THE WALL STEEL FROM THE 18X10 AND THE 8X6 BOXES MERGE TOGETHER AT EACH END.

IT IS UNCLEAR FROM THE PLAN VIEW WHETHER THE INTERSECTING WALLS OF THE BOXES HAVE POINTED OR TRUNCATED ENDS.

THE ELEV VIEW SHOWS THE END OF OPENING AS 36+04.73, WHILE THE PLAN VIEW VAGUELY SHOWS THE TRUNCATED END AS 36+08.85. THE APPARENT BEGINNING OF OPENING STA 35+67.38 PLUS THE LENGTH AT 41.47' = 38+08.85. IF THIS IS CORRECT, THE TRUNCATED END OF THE OPENING AT 38+08.85 SHOULD BE INDICATED CLEARLY ON BOTH VIEWS.

THE STATIONING IN THE ELEV VIEW FOR THE END STA 36+04.73 IS APPARENTLY FOR A POINTED END.(BEG STA 35+67.38 PLUS 8'/SIN 12.5DEG = 36.96 EQUALS STA 36+04.34).

2.ELEVATION VIEW-
THE 7-#11X 60' EA CALLOUT SHOULD BE 6-#11X 60' EA
CHECK SECTION D-D

THE BEGINNING AND END OF THE DEEP BEAMS SHOULD BE SHOWN. THE ELEV VIEW SHOWS THE #11 BARS EXTENDING BEYOND THEIR 60' LENGTH.

3.SECTION D-D-
10-#5X 9'-6"@ 12" CALLOUT NEEDS ANOTHER ARROW FOR THE TOP STEEL.

4.SECTION C-C-
A NOTE ON SECTION C-C CALLS FOR ADOT ST'D REINFORCING, BUT THE DRAWING SHOWS MUCH MORE REINF THAN THE ST'D. THERE IS NO REINFORCING IN THE MIDDLE SLABS TOP OF TOP AND BOTT OF BOTT. THE INLET BOX SHOULD HAVE ADDITION REINFORCING SIMILAR TO THAT SHOWN IN SECT C-C, SINCE THE W5X19 BEAMS WOULD BE EMBEDDED INTO AREAS WITH NO TOP REINFORCING IF THE ST'D ADOT SECTION IS USED.

THEREFORE THERE SHOULD PROBABLY BE TWO 8'X6' BOX DETAILS, ONE FOR THE ADOT ST'D COVERED BOX AREA, AND ONE FOR THE INLET BOX WITH EXTRA REINFORCING.

5.SECTION A-A-
SHOULD HAVE REINFORCING ADDED TO ADOT ST'D AS PER ABOVE COMMENTS.

6.SECTION B-B-
CHECK DIMENSIONS. THE 4'-0 DIM FROM THE CL OF THE BOX TO THE 10" WALLS SHOULD BE 4'-2. THE BOX DIM IS 4'-0 FROM THE CL TO THE 12" BOX WALL. THE 6.25" DIM FROM THE WALL TO THE GRATE SHOULD BE 8.25".

MESSAGE DISPLAY FOR DON RERICK

To: mal
rcs
Cc: djr

From: Don Rerick:TALOS Host: TALOS
Postmark: 07/28/95 12:04PM Delivered: 07/28/95 12:04PM
Status: Previously read Urgent

Subject: OCC Phase 2 and 3 - Large Side Inlet Structure Design

---

Message:
We have been discussing the structural design for the three major side inlets in the OCC project -
-- At Oak Street in Phase 2
-- At Earll and Osborn in Phase 3

The major change occured on the 99% submittal for Phase 2 and the 90% submittal for Phase 3. These submittals occured at about the same time.

I am providing you with the 90% red-lined plan sheets and CGW's 90% review comments memo. I am also providing you with the 99% revised plan sheets which should incorporate all of the District's review comments. (These are the only copies of the 99% plan sheets, so don't loose them).

The 99% Phase 2 Oak Street inlet sheet has already been reviewed and red-lined by RCS and CGW.

Please have someone in Engineering review the 99% submittal sheets for all three inlets to ensure all comments from the red-lined set and the CGW comments have been incorporated to Engineering Division satisfaction.

Based on RCS and CGW red-line comments on the 99% Phase 2 Oak Street inlet, it appears we need to invite Bill Kantor from Entranco to come down here for a meeting. We shouldn't do this until we agree with the design concept.

Given the time frame in the design contract, we cannot make any major changes to the design or plans now. We need to get this thing done ASAP!!!

Lets plan to complete our review and meet with Bill NLT August 7.

Thanks!!!!!

MARICOPA COUNTY FLOOD CONTROL DISTRICT

INTEROFFICE MEMORANDUM

SUBJECT:REVIEW OF OCCC PHASE III 90% PLANS & CALCS

TO:DON RERICK FROM:C G WAINWRIGHT DATE:MAY 4,1995

CALCULATIONS: I REVIEWED THE CALCS AND THEY APPEAR TO BE SATISFACTORY

PLANS:

SHEET C1.2- SHEET INDEX
C2.5 INDEX CALL OUT AS 'TYP RDWY SECTIONS' BUT THE SHT C2.5 TITLE BLOCK CALLS OUT 'DRIVEWAYS/MODIFIED SCUPPER'
C8.10 STA ON INDEX IS 75+82.5 WHILE ON SHT C8.10 IT'S 75+82.0
C8.11 STA ON INDEX IS 89+.005 WHILE ON SHT C8.11 IT'S 88+76.28

SHEET C2.4- SHOULD THERE BE GUARDRAIL SHOWN NEXT TO THE CANAL SLOPE X-SECTION STA 305+52.42 TO 307+68.15.

SHEET C3.2- SHOULD THE G AND TC ELEVATIONS BE GIVEN FOR THE EAST CURB LINE AT THE BEGINNING AND END STATIONS ON EACH ROADWAY PLAN SHEET SAME AS THE WEST CURB LINE? TYP ALL ROADWAY SHEETS.

SHEET C3.4- OVERHEAD ELECT LINE CALL OUTS SHOULD BE BOLD. TYP ALL SHEETS. THE TITLE BLOCK SHOULD HAVE THE SAME BOLD PRINT ON ALL SHEETS.

SHEET C3.7,& C3.6- ON C3.7 THE WEST SIDE ROAD IS TO BE REMOVED. DOES THIS WEST SIDE ROAD REMOVAL CARRY OVER TO C3.6? IT'S NOT CALLED OUT ON C3.6.

SHEET C3.8- ELEVATION AT WEST SIDE OF ROADWAY NOT COMPLETE AT STA 289+00.
DOES ROADWAY PAVEMENT END ON EAST SIDE STA 286+30+/-?

SHEET C3.9- NO WEST GUTTER LINE CALL OUT ON PROFILE.
NO 'W' CALL OUT IN RDWY CONST NOTES. TWO 'W'S AT 289+.

SHEET C3.11- CURB OPENINGS AT STA 301+92, 302+63, AND 303+70 FOR DRIVEWAYS?

SHEET C3.12- NO 'E1' CALL OUT IN RDWY CONST NOTES. STA 116+00+/-.

SHEET C4.2- TITLE BLOCK STA 67+00 TO 73+00, NOT 58+00 TO 62+00.

SHEET C4.11- SECTION A. ARROW FOR 0.86% SLOPE POINTS THE WRONG WAY.
SECTIONS B&D. A 1'6" TOE DOWN FOR SLOPE PAVING WOULD BE PREFERABLE INSTEAD OF THE 1"0 AS SHOWN.

SHEET C5.1- IT APPEARS THAT THOMAS RD ACTS AS A DAM FOR THE SURFACE FEATURE ON THE PROFILE SHEET AT STA 63+50+/-.

SHEET C5.11- PROFILE SHEET. 'FINISHED GRADE AND SWALE' ARROW POINTS TO NOTHING.
PLANS SHEET. THE 4 ARROW SHOULD POINT TO THE INLET AT STA 114+40+/-.

SHEET C5.12- NOTE 16 NOT COMPLETE. 16 ON PLAN SHEET HAS NO ARROW. NOTE 20 NEEDS A + IN THE STATION CALL OUT.

SHEET C7.1- SECTION 2. 'SEE SHEET 8.11' SHOULD BE 'SEE SHEET C8.12'.

SHEET C7.2- SECTION B. ADD REINF TO THE SAWTOOTH. 1'-0 VERTICAL BY 1'-6 ON SLOPING SIDE. #3 BARS @12". N/A

SHEET C8.1- TYPICAL ALL ENTRANCO SHEETS, TITLE BLOCKS NEED TO BE CHANGED.
TYPICAL SECTION. GEO DRAIN SHOULD EXTEND 12" BELOW WEEP HOLE.
CONST JOINT BETWEEN WALLS AND TOP SLAB SHOULD BE LABELED.
SECTION A-A. C5.1,C5.2 SHOULD BE C5.9 TO C5.12.

SHEET C8.2- TYPICAL SECTION. GEO DRAIN SHOULD EXTEND 12" BELOW WEEP HOLE.
CONST JOINT BETWEEN WALLS AND TOP SLAB SHOULD BE LABELED.
SECTION A-A. C5.1,C5.2 SHOULD BE C5.4 TO C5.8.
BENDS. bbBARS VERTICAL HEIGHT SHOULD BE 12'-8 NOT 11'-101/2.
TABLE. aa BAR LENGTH SHOULD BE 12'-8 NOT 15'-8.
bb BAR LENGTH SHOULD BE 15'-8 NOT 12'-8.

SHEET C8.3- TYPICAL SECTION. IS THE NOTE 'INSTALL REMOVABLE PLUG...' NEEDED THIS PHASE?
IS THE NOTE 'FOR FLOOR AND FILL...' NEEDED THIS PHASE?
SECTION A-A. C5.1,C5.2 SHOULD BE C5.1 TO C5.3.

SHEET C8.4- SECTION A-A, SECTION B-B- GEO DRAIN SHOULD EXTEND 12" BELOW WEEP HOLE.
GEOCOMPOSITE DRAIN SEE SHEET C8.3.
PLANS TRANSITION 18X10 TO 12X10. WERE DOES THE WALL THICKNESS CHANGE FROM 12" TO 13"? DETAIL POSSIBLY NEEDED.

SHEET C8.6-
TYPICAL SECTION WITH MANHOLE. THE RISER TO BOX CONNECTION DOESN'T APPEAR TO MATCH THE MAG STANDARD FOR THE RISER. THE ROOF AND FLOOR THICKNESSES WILL VARY.
SECTION A-A. THE WALL THICKNESSES WILL VARY.
SECTIONS B-B,& C-C. THE ROOF THICKNESSES WILL VARY.

SHEET C8.7- PLAN. SHOULD THE 'ADD 4#8 X 38'-6 ' BE TYPICAL EACH BLOCKOUT?

SHEET C8.8- NORMAL CONNECTION. WALL THICKNESSES WILL VARY.
SKEWED CONNECTION. WALL THICKNESS SHOULD BE 1'-1.

SHEET C8.10-
PLAN VIEW. SIZE OF INLET BOX NEEDS TO BE CALL OUT, AND WHETHER IT'S AN ADOT STD BOX.
IS A DETAIL NEEDED AT THE INTERSECTION OF THE WALLS OF THE MAIN BOX AND THE INLET BOX SHOWING THE MERGING REBAR OF THE WALLS AND THE FOOTINGS AND ROOFS. (TYP EACH INLET)?
SECTION C-C. PLANS SHOW 4#8 VERTICAL BARS BUT THE CALCS SHOW 6#10 BARS. THERE SHOULD BE A DETAIL SHOWING THE COLUMN REBAR INTERSECTING INTO THE HORIZONTAL TOP AND BOTTOM BEAMS, WITH REBAR LENGTHS.
SECTION A-A. TWO CALL OUTS ON EACH END 'FL 2-8X10 CBC' SHOULD PROBABLY BE 'FL 2 18X10 CBC'. SHOULD FLOOR THICKNESS OF THE 18X10 BOX BE 1'-4 AT THE DETAIL'S FAR LEFT SIDE?
DETAIL A. LOCATED IN THE WRONG PLACE IN SECTION B-B. W8X28 BEAM SHOULD BE W8X58.
SECTION D-D. SHOULD THE FOOTING TOP STEEL BE #5@12 EACH WAY?
#5 HOOPS IN BOTTOM BEAM SHOULD PROBABLY BE 4'-5 NOT 5'-7.
THE LOCATION OF THE BEGINNING AND END OF THE TOP AND BOTTOM BEAMS SHOULD BE SHOWN.
THE TWO SPAN BEAM LENGTH OF 60'-4 (2X30'-2) PLUS THE END DEVELOPMENT LENGTH OF THE #11 BARS WILL PROBABLY REQUIRE BAR SPLICES. THE SPLICE LOCATIONS SHOULD BE CALLED OUT. IS THERE ENOUGH ROOM FOR THE SPLICES IN THE REINF AREA OR WILL BUTT SPLICES BE REQUIRED?

SHEET C8.11-
PLAN. DETAIL OF MERGING BOX WALL STEEL NEEDED?
SECTION D-D. TOP FOOTING STEEL #5@12 EACH WAY.
THE BEGINING AND END LOCATION OF THE TOP AND BOTTOM BEAMS SHOULD BE NOTED.

SHEET C8.12-
SECTION B-B. CALCS CALL FOR GROUTING OF ALL CELLS, NOTE NOT FOUND ON PLANS.
SECTION C-C. CALCS ITEM 7b CALLS FOR #8@8" VERTICAL STEEL WHILE THE PLANS SHOW #7@8" STEEL. CALCS SHEET 7b 2 OF 2 SHOWS #9@12" FOOTING STEEL WHILE THE PLANS SHOW #5@12".
SECTION A-A. SHOULD THE #7@8" VERTICAL WALL STEEL BE #8@8"? THE HORIZONTAL LENGTH OF THE SAME BARS SHOULD BE SHOWN.

FLOOD CONTROL DISTRICT
of
MARICOPA COUNTY

Interoffice memorandum

DATE: OCT. 1, 1996

TO: FBF

FROM: KVH

SUB: OLD CROSS CUT CANAL

Removal of traveling forms from Ames construction, Inc., has been reviewed and we recommend Ames should stay with Section 505 of MAG Specifications.

The forms shall stay in place for at least 24 hours and concrete shall reach a minimum strength of 3200 psi. Curing of the concrete shall be as per sect.505.8 and immediately after the removal of the forms. The structure shall not be subjected to any type of loading for at least 28 days and the concrete has reached the full design strength of 4000 psi.

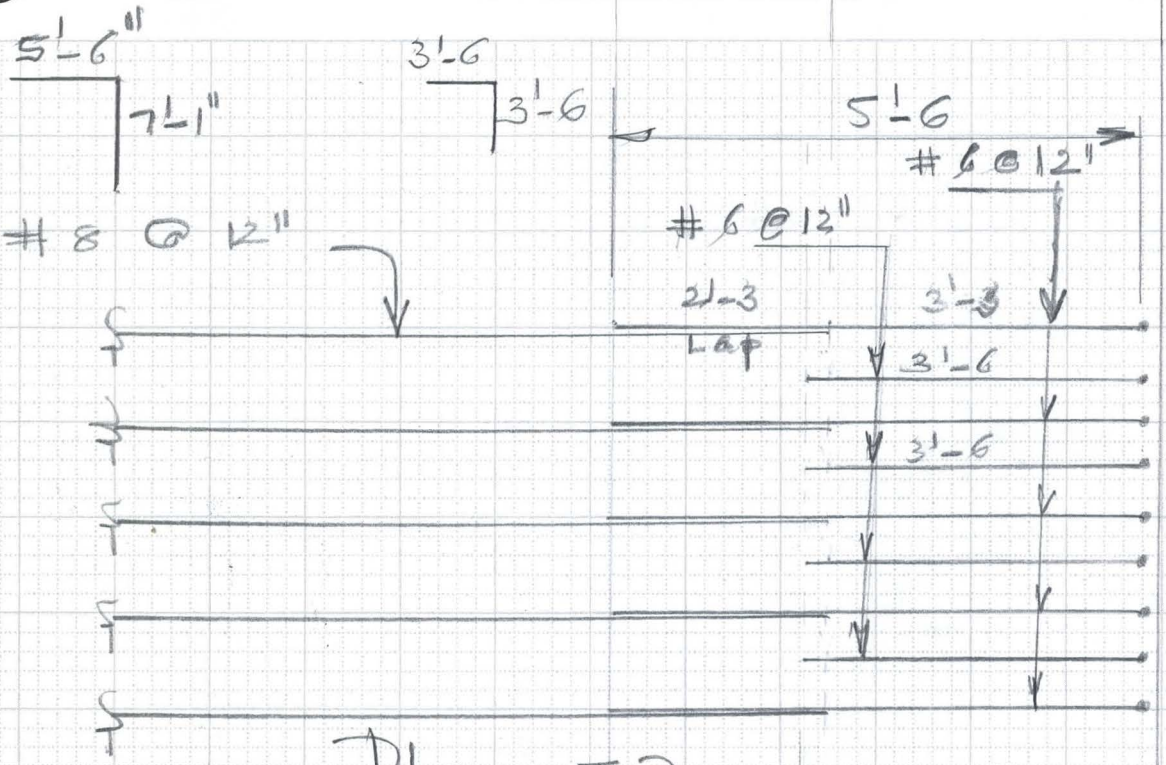
As this is a continuous structure, the requirement of at least 24 hours and a minimum strength of 3200 psi. shall apply to both walls and slabs.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

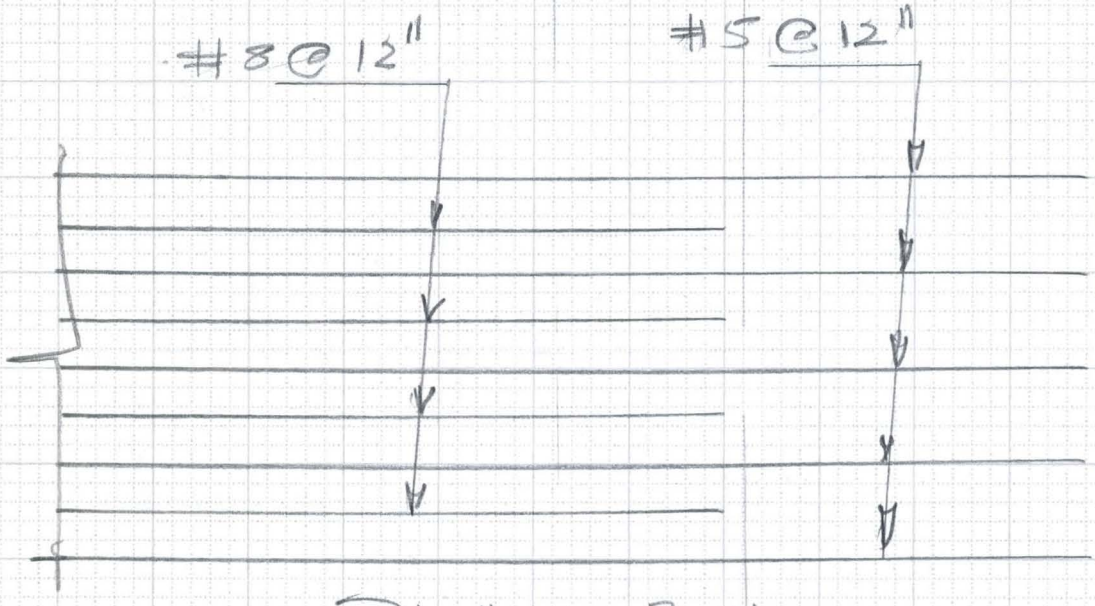
PROJECT _____ PAGE ____ OF ____

DETAIL _____ COMPUTED _____ DATE ____

_____ CHECKED BY _____ DATE ____



Plan - Top



PLAN - Bottom

AMES CONSTRUCTION, INC.
1801 SOUTH 51ST AVE.
PHOENIX, ARIZONA 85043
TELEPHONE: (602) 995-0622
FAX: (602) 995-8137
AZ. LIC. # 074995-002 CLASS A

September 25, 1996

Maricopa County Flood Control District
2801 West Durango Street
Phoenix, Arizona 85009

Attn: Tom Johnson, P.E.
Manager - Construction Operations

Re: Contract FCD 95-08
Old Cross Cut Canal Project, Phase II
Box Culvert - Stripping Falsework

Gentlemen,

The nature of this project lends itself to the use of traveling forms to form and pour the double barrel box culvert. The length and duration of the project does not leave many alternatives to the traveling form system. From our conversations with the unsuccessful bidders, a traveling system was the system of choice to every contractor bidding the project. One of the advantages of using the traveling forms is that they lend themselves to quick stripping and reuse.

In order for our pour sequence to work properly and to optimize the efficiency of our form system, it is imperative that Ames be allowed to strip the forms/falsework as early as possible. Ames requests that we be allowed to strip forms and falsework as soon as the concrete achieves a compressive strength of 1400 p.s.i. (approximately 20 hrs. after pour time) This is contrary to MAG which is why the design calculations verifying the 1400 p.s.i. are attached.

Ames understands that we are ultimately responsible for the ramifications should early removal of falsework cause structural damage. By allowing Ames to pull falsework when the concrete reaches 1400 p.s.i., neither MCFCD nor the Engineer of record will be held in any way responsible for our actions.

Ames plans on preparing four field cure cylinders during each pour of the box culvert. The cylinders will be placed on the box deck under the curing blankets to best duplicate field curing conditions of the concrete. One of the cylinders will be broken using proper specifications by an accredited lab the following morning to verify compressive strength. If the cylinder breaks at 1400 p.s.i. or greater, Ames will pull the forms and falsework to advance them for the next pour. Should the cylinder break at less than 1400 p.s.i., another cylinder will be broke 1 hour later. This series of breaks will continue until the 1400 p.s.i. is achieved. Ames will under no circumstances

pull falsework without verification of the concrete compressive strength through the breaking of concrete cylinders.

Please review the enclosed Engineering calculations and allow Ames to strip forms and falsework when the box culvert concrete has achieved a compressive strength of 1400 p.s.i.

We apologize for the late submittal of this information. Our first box culvert pour is scheduled for September 26th (tomorrow).

Please call me if you require any additional information at 995-0622.

Sincerely,

David M. Reeg, P.E.
Division Engineer

cc: Brad Hill
Bill Spies
Jack VanMarter
File

on the plans or approved by the Engineer. Prior to the use of such forms the Contractor shall provide a complete set of details to the Engineer for review and approval. The detailed plans for structures, unless otherwise noted, are dimensioned for the use of removable forms and any changes necessary to accommodate stay-in-place forms, if approved, shall be at the expense of the Contractor.

3.2.4 Removal of Falsework and Forms

3.2.4.1 General

Falsework or forms shall not be removed without approval of the Engineer. In the determination of the time for the removal of falsework and forms, consideration shall be given to the location and character of the structure, the weather, the materials used in the mix, and other conditions influencing the early strength of the concrete.

Methods of removal likely to cause overstressing of the concrete or damage to its surface shall not be used. Supports shall be removed in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own weight. For arch structures of two or more spans, the sequence of falsework release shall be as specified or approved.

3.2.4.2 Time of Removal

If field operations are not controlled by beam or cylinder tests, the following minimum periods of time, exclusive of days when the temperature is below 40F, shall have elapsed after placement of concrete before falsework is released or forms are removed:

Falsework for:	
Spans over 14 feet	14 days
Spans of 14 feet or less	10 days
Bent caps not yet supporting girders	10 days
Forms:	
Not supporting the dead weight of the concrete	24 hours
For interior cells of box girders and for railings	12 hours

If high early strength is obtained with Type III cement or by the use of additional cement, these periods may be reduced as directed.

When field operations are controlled by cylinder tests, the removal of supporting forms or falsework shall not begin until the concrete is found to have the specified compressive strength, provided further that in no case shall supports be removed in less than 7 days after placing the concrete.

In addition to the above time requirements:

Forms shall not be removed until the concrete has sufficient strength to prevent damage to the surface.

Falsework for post-tensioned portions of structures shall not be released until the prestressing steel has been tensioned.

Falsework supporting any span of a continuous or rigid frame bridge shall not be released until the aforementioned requirements have been satisfied for all of the structural concrete in that span and in the adjacent portions of each adjoining span for a length equal to at least one-half the length of the span where falsework is to be released.

Unless otherwise specified or approved, falsework shall be released before the railings, copings or barriers are placed for all types of bridges. For arch bridges, the time of falsework release relative to the construction of elements of the bridge above the arch shall be as shown on the plans or directed by the Engineer.

3.2.4.3 Extent of Removal

All falsework and forms shall be removed except:

Portions of driven falsework piles more than one foot below subgrade within roadbeds, or 2 feet below the original ground or finished grade outside of roadbeds, or 2 feet below the established limits of any navigation channel.

Footing forms where their removal would endanger the safety of cofferdams or other work.

Forms from enclosed cells where access is not provided.

Deck forms in the cells of box girder bridges that do not interfere with the future installation of utilities shown on the plans.

3.3 COFFERDAMS AND SHORING

3.3.1 General

Cofferdams and shoring consist of those structures used to temporarily hold the surrounding earth and water out of excavations and to protect adjacent property and facilities during construction of the permanent work.

(3) Metal, Fiberglass and Other Forms:
The same provisions as specified under wood forms shall apply to metal and fiberglass forms and in addition, the following shall apply:

All bolts and rivet heads shall be countersunk. Clamps, rods, pins or other connecting devices shall be designed to hold the forms rigidly together and allow removal without injury to the concrete. Forms which do not present a smooth surface or are not properly aligned shall not be used.

Care shall be exercised to keep the forms free of dust, grease or other foreign matter which will tend to discolor the concrete.

Metal forms shall be used for the casting of precast I-beams, box beams and flat slabs.

Waste slabs used as a part of the forms shall be finished to the appropriate grade including any camber. The finished slab shall not vary more than 1/4 inch from the theoretical grade nor more than 1/4 inch from a 10 foot straight edge in any direction.

(D) Removal of Falsework and Forms:
No falsework or forms shall be relieved of load and no forms shall be removed without approval of the Engineer.

Falsework, excluding bridge deck cantilevered overhangs for cast-in-place prestressed structures, shall not be removed until after the prestressing steel has been tensioned. Falsework for the cantilevered bridge deck overhang shall be removed prior to prestressing but shall not be removed within seven days of concrete placement unless the concrete has attained a minimum compressive strength of 3,000 pounds per square inch. In no case shall falsework be removed within five days of concrete placement. On bridges with both transverse and longitudinal stressing, falsework shall not be removed until after the transverse prestressing has been completed. The deck overhang falsework shall then be removed prior to performing the longitudinal prestressing.

Falsework for cast-in-place non-prestressed structures or composite superstructures, excluding concrete above the bridge deck, shall not be removed until either:

(1) At least ten days after the last concrete has been placed in each continuous span and until the compressive strength of all placed concrete has attained at least 70 percent of the required 28-day compressive strength.

(2) At least five days after the last concrete has been placed in each continuous span and until the concrete has attained the required 28-day compressive strength.

Side forms for footings, beams, girders, box culverts, columns, railings, curbs or other members wherein the forms do not resist dead load bending may be removed after the concrete has set and the contractor shall cure and protect the concrete thus exposed in accordance with the requirements of Section 1006. The contractor shall assume all risks and responsibility resulting from such removals. Forms for cast-in-place concrete, unless otherwise specified herein, shall not be removed until at least seven days after concrete has been placed in the forms, without the approval of the Engineer.

Backfilling shall not be done against walls and columns for a minimum period of seven days after placement of concrete and until the concrete has acquired the strength required for the intended loading.

Forms for precast concrete shall stay in place a minimum of fifteen hours.

The period of time between the placement of concrete in the top slab of a standard concrete box culvert (12 foot span or less) and the removal of the slab support forms may be reduced to 48 hours if the top slab remains supported along the center line of the culvert span by a continuous beam and line of posts erected as a part of the original slab form, and which will remain in place, undisturbed, a minimum of seven days.

If the Engineer allows the removal of forms before the specified curing period has elapsed, the contractor shall cure the concrete for the remaining required curing time by one of the methods specified in Section 1006.

Forms for cast-in-place concrete above the bridge decks that require a Class II finish may be removed after the concrete has set, providing the required surface finishing of the concrete is completed within four days. If finishing cannot be completed within four days, the forms shall remain in place for seven days.

All forms shall be removed, except forms used to support the deck of box girders when no permanent access to the cells is available.

Care shall be taken in removing falsework and forms so as not to deface or damage the structure. Methods of removal likely to damage or cause overstressing of the concrete shall not be used.

(2) At least five days after the last concrete has been placed in each continuous span and until the concrete has attained the required 28-day compressive strength.

Side forms for footings, beams, girders, box culverts, columns, railings, curbs or other members wherein the forms do not resist dead load bending may be removed after the concrete has set and the contractor shall cure and protect the concrete thus exposed in accordance with the requirements of Section 1006. The contractor shall assume all risks and responsibility resulting from such removals. Forms for cast-in-place concrete, unless otherwise specified herein, shall not be removed until at least seven days after concrete has been placed in the forms, without the approval of the Engineer.

Placement of backfill material shall be in accordance with Subsection 203-5.03. Where backfill is to be placed against both sides of a structural element, the backfill elevations on one side of the element shall not exceed the backfill elevations on the opposite side of the element by more than five feet.

Forms for precast concrete shall stay in place a minimum of fifteen hours.

The period of time between the placement of concrete in the top slab of a standard concrete box culvert (12 foot span or less) and the removal of the slab support forms may be reduced to 48 hours if the top slab remains supported along the center line of the culvert span by a continuous beam and line of posts erected as a part of the original slab form, and which will remain in place, undisturbed, a minimum of seven days.

If the Engineer allows the removal of forms before the specified curing period has elapsed, the contractor shall cure the concrete for the remaining required curing time by one of the methods specified in Section 1006.

Forms for cast-in-place concrete above the bridge decks that require a Class II finish may be removed after the concrete has set, providing the required surface finishing of the concrete is completed within four days. If finishing cannot be completed within four days, the forms shall remain in place for seven days.

All forms shall be removed, except forms used to support the deck of box girders when no permanent access to the cells is available.

Care shall be taken in removing falsework and forms so as not to deface or damage the structure. Methods of removal likely to damage or cause overstressing of the concrete shall not be used.

All falsework shall be removed from under bridge superstructures prior to opening the structure to traffic. Falsework shall be removed in such a manner that excessive stresses are not induced into the structure. Holes or blockouts shall not be drilled or cast into the structure to facilitate removal of the falsework.

601-3.03 **Placing Concrete:**

(A) **General Requirements:**

No concrete shall be placed in any structur reinforcing steel and the adequacy of the been approved by the Engineer.

Adequate time shall be given to the Engi dimensions, embedded items, and placement Concrete shall not be placed until all ne been made by the contractor and all work re pour has been completed.

Reinforcing steel shall be placed in accorda of Section 605 and the plans.

The sequence of concrete placement shall be plans or as approved by the Engineer when n plans.

Concrete shall be placed and consolidated by cause harmful segregation and will result concrete free of honeycomb or voids.

Concrete shall be placed in horizontal layers depth unless otherwise approved by the Enginee

Concrete shall be placed as nearly as possibl and the use of vibrators for shifting the mass not be permitted. Dropping the concrete more the use of approved pipes or tubes will not be

Care shall be taken to fill all areas within the concrete under and around the reinforcem the reinforcement or other embedded items.

Conveying equipment shall be capable of pr concrete to the point of placement with interruptions sufficient to permit loss o successive increments.

Concrete placed in slabs and floors other than struck off by means of a screed. The screed screed equipment or the type specified under Su Fixed Form-Manual Methods.

No concrete that has partially hardened or foreign materials shall be deposited in the stru

The rate of concrete placement and consolidati the formation of cold joints within monolit structure will not occur. Any portion of an apparent cold joints will be rejected, unless expense, can submit evidence that will indica joint does not exist or that a cold joint is structure. The Engineer shall be the sole ju

l not be used unless specified on the plans
r. Expanded metal meshes may be used to
providing: (1) three inch edge cover is
ridge decks is prohibited.

ained at all times in good condition as to
h, rigidity, watertightness and smoothness
lumber unsatisfactory in any respect shall

d so that portions may be removed without
to remain. Forms to be used when a Class
work is required shall be constructed of
anels, or plywood. All form joints shall
n acceptable manner. Forms for this work
st class pattern work.

4 inch at all exposed, sharp corners of the

d with an approved form release agent before
material which will adhere to or discolor
used.

all dirt, sawdust, water and other foreign
concrete in the forms.

lum where the bottom of the form is
shall be made for cleaning out extraneous
re placing the concrete. The cells of box
d of all loose materials prior to the
g when such forming is to remain in place.
to be removed, the cells of the box girders
ose materials after removal of the forms.

:

s shall be free from defects affecting the
gth, rigidity, watertightness and smoothness
mber for forms above stream bed shall be
- shall be securely fastened to the studding
ccur. Chamfer strips shall be of selected
line and uniform dimensions. The interior
contact with concrete surfaces which will be
work shall be smooth and even. No uneven or
boards projecting so that their impressions
ete will be allowed. Forms, as far as
constructed that the form marks will conform
f the structure. In general, grain of the
ide joints shall be horizontal on wide faces
n narrow faces. If varying widths of panels
els shall be placed on the bottom and the
op. Panel end joints shall be staggered not
spreaders made of wood shall not be left in

(3) **Metal, Fiberglass and Other Forms:**

The same provisions as specified under wood forms shall apply to metal and fiberglass forms and in addition, the following shall apply:

All bolts and rivet heads shall be countersunk. Clamps, rods, pins or other connecting devices shall be designed to hold the forms rigidly together and allow removal without injury to the concrete. Forms which do not present a smooth surface or are not properly aligned shall not be used.

Care shall be exercised to keep the forms free of dust, grease or other foreign matter which will tend to discolor the concrete.

Metal forms shall be used for the casting of precast I-beams, box beams, and voided or flat slabs where the contract number of units combined dictates production runs equal to or longer than the precasting bed length. A limited number of units, having a total combined length at least one unit length less than bed length, may be cast with alternate forms, as approved by the Engineer. Dimensional tolerances using alternate forms shall conform with 601-4.02(B).

Waste slabs used as a part of the forms shall be finished to the appropriate grade including any camber. The finished slab shall not vary more than 1/4 inch from the theoretical grade nor more than 1/4 inch from a 10 foot straight edge in any direction.

(D) **Removal of Falsework and Forms:**

No falsework or forms shall be relieved of load and no forms shall be removed without approval of the Engineer.

Falsework, excluding bridge deck cantilevered overhangs for cast-in-place prestressed structures, shall not be removed until after the prestressing steel has been tensioned and a minimum of 72 hours after the prestressing steel has been grouted. Falsework for the cantilevered bridge deck overhang shall be removed prior to prestressing but shall not be removed within seven days of concrete placement unless the concrete has attained a minimum compressive strength of 3,000 pounds per square inch. In no case shall falsework be removed within five days of concrete placement. On bridges with both transverse and longitudinal stressing, the deck or overhang falsework shall not be removed until after the transverse prestressing has been completed unless shown otherwise on the plans. The deck overhang falsework shall then be removed prior to performing the longitudinal prestressing.

Falsework for cast-in-place non-prestressed structures or composite superstructures, excluding concrete above the bridge deck, shall not be removed until either:

(1) At least ten days after the last concrete has been placed in each continuous span and until the compressive strength of all placed concrete has attained at least 70 percent of the required 28-day compressive strength.

Since hot weather leads to more rapid drying of concrete, protection and curing are far more critical than in cool weather. Water curing should be used wherever it is practical and should be continuous to avoid volume changes due to alternation of wetting and drying. The need for adequate continuous curing is greatest during the first few hours after placement of concrete in hot weather.

505.9 FINISHING CONCRETE:

Immediately after the removal of forms as provided above, all concrete surfaces shall be finished in accordance with the requirements specified below.

All surfaces scheduled to be covered with backfill shall be finished so as to be free of open and rough spaces.

All surfaces that will remain exposed in the completed work shall be finished so as to be free of open and rough spaces, depressions or projections. All angles and fillets shall be sharp and true and the finished surface shall present a pleasing appearance of uniform color.

All top surfaces of walls, abutments, piers, etc., shall be finished to a smooth surface and shall be cured by an approved method.

If rock pockets or honeycomb are of such an extent and character as to affect materially the strength of the structure and to endanger the steel reinforcement the Engineer may declare the concrete defective and require the removal and replacement of that portion of the structure affected by the Contractor at no additional cost to the Contracting Agency.

If finishing operations are not carried out as set forth below, all placing of concrete shall stop until satisfactory arrangements are made by the Contractor to promptly correct defective finishing work and to carry out finishing operations as specified.

One of the classes of finish as specified shall be applied to the various surfaces as set forth under applicability of finishes.

No finishing or patching shall be permitted until the surface has been inspected by the Engineer.

505.9.1 Finishing Fresh Concrete in Bridge Decks: Upon placing the deck to a uniform and true surface, screed supports shall promptly be removed from the surface and any necessary hand finishing shall be promptly accomplished in the areas where the screed supports have been removed.

After the floating, as specified above, is completed, the concrete surface shall be textured with a burlap drag or a drag boom, as required by the Contracting Agency.

The finished surface will be tested with a 10 foot straightedge furnished by the Contractor. The testing will be accomplished by holding the straightedge in contact with the deck surface and parallel to the centerline. The surface shall not vary more than $^1/_8$ inch from the lower edge of the straightedge. Areas showing high spots of more than $^1/_8$ inch shall be corrected by cutting or planing. The cutting or planing machine shall be a rotary type, equipped with an adjustable cutter and having a minimum wheel base of 10 feet. Areas showing low spots of more than $^1/_8$ inch shall be filled with an approved mixture of sand, cement and epoxy. The mixture shall firmly adhere to the surface and shall match the surrounding concrete. All areas corrected shall not show deviations in excess of $^1/_8$ inch when tested with a 10 foot straightedge.

505.9.2 Finishing Fresh Concrete in Sidewalks and Bridge Sidewalks: After the concrete has been placed and spread between the forms, it shall be thoroughly worked until all the coarse aggregate is below the surface and the mortar comes to the top. Concrete may be consolidated by means of mechanical vibrators approved by the Engineer.

The surface shall then be struck off and worked to grade and cross section with a wood float.

Regardless of the method used in pouring concrete without outside forms the following stipulations shall hold:

(A) The reinforcing steel shall be accurately set and held firmly in place, to the satisfaction of the Engineer.

(B) No direct payment will be made for building paper, sheeting, gunite or concrete placed outside of concrete lines shown on the plans. The cost thereof shall be absorbed in the prices bid for the various items of work.

(C) The Contractor shall assume all risks of damage to the work or to existing improvements due to any reason whatsoever that may be attributable to the method of construction outlined above.

505.3.1 Removal of Forms: The falsework supporting any span of a continuous or rigid frame structure subject to bending stress shall not be released until after the last concrete placed in the span and in the adjoining spans, excluding concrete above the deck slab, has attained a compressive strength of not less than twice the design unit stress, or 21 days after the concrete is placed, whichever occurs first.

Stairway riser forms shall be removed and the finish of the steps completed on the day the concrete is placed. Metal stairway treads, if required by the plans, shall be installed immediately after the steps have been placed.

Side forms for beams, girders, columns, railings, or other members wherein the forms do not resist dead load bending shall be removed not more than 24 hours after placing concrete, where finishing is required, unless otherwise directed by the Engineer, provided that satisfactory arrangements are made to cure and protect the concrete thus exposed.

Side forms for arch rings, columns, and piers shall be removed before the members of the structure which they support are poured or placed so that the quality of the concrete may be inspected. Such forms shall be so constructed that they may be removed without disturbing other forms which resist direct load or bending stress.

Forms and shoring for box and arch sections of sewers and storm drains may be removed as follows:

(A) Forms for open channel walls — 16 hours.

(B) Outside forms of box sections and inside wall forms of box sections which do not support the slab forms — 16 hours.

(C) Arch sections in open cut — 12 hours.

(D) Slab forms for box sections:

(1) Type II Cement — 48 hours or 6 hours per foot of span between supports, whichever is greater.

(2) Type III Cement — 24 hours or 3 hours per foot of span between supports, whichever is greater.

(3) Type V Cement — 56 hours or 7 hours per foot of span between supports, whichever is greater.

The periods of time at which the Contractor may remove forms, as set forth above, are permissive only and subject to the Contractor's assuming all risks that may be involved in such removals. At his option, except for surfaces to be finished, the Contractor may leave the forms in place for such longer periods as are, in his opinion, required.

charging the tube with concrete. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering, when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of the work to prevent water entering the tube and shall be entirely sealed at all times, except when concrete is being placed. The tremie tube shall be kept full of concrete. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous.

The underwater bucket shall have an open top and the bottom doors shall open freely and outward when tripped. The bucket shall be completely filled and slowly lowered to avoid back wash and shall not be dumped until it rests on the surface upon which the concrete is to be deposited. After discharge, the bucket shall be raised slowly until well above the concrete.

Concrete deposited in water shall have 10 percent extra cement added.

505.8 CURING:

As soon after the completion of the specified finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surface shall either be sprinkled with water, covered with earth, sand or burlap; sprayed with a curing compound or sealed with a material conforming with Section 726. All concrete for bridge structures shall be water cured unless otherwise permitted by the Engineer.

Concrete that is water cured must be kept continuously wet for at least 10 days after being placed; preferably being covered, if possible, with at least 2 layers of not lighter than 7 ounce burlap, except that handrail, baserail, railing posts, tops of walls, and similar parts of the structure, if water cured, must be covered with burlap as above prescribed, immediately following the finishing treatment specified therefor, and such covering shall not be removed in less than 4 days. Roadway areas, floors, slabs, curbs, walks, and the like, that are water cured may be covered with sand to a depth of at least 2 inches, in lieu of the burlap as specified above, as soon as the condition of the concrete will properly permit, and such covering must remain wet and in place until the concrete so covered is at least 10 days old unless otherwise directed by the Engineer or provided by special provisions.

When a sprayed impervious membrane is used it shall be applied under pressure through a spray nozzle in such manner and quantity as to entirely cover and seal all exposed surfaces of the concrete with a uniform film. To insure complete coverage, membrane shall be applied in two applications for a total coverage of 150 square feet per gallon. The membrane, however, shall not be applied to any surface until all of the finishing operations have been completed; such surfaces being kept damp, until the membrane is applied. All surfaces on which a bond is required, such as construction joints, shear planes, reinforcing steel, and the like, shall be adequately covered and protected before starting the application of the sealing medium in order to prevent any of the membrane from being deposited thereon; and any such surface with which the seal may have come in contact shall immediately thereafter be cleaned. Care shall be exercised to avoid and prevent any damage to the membrane seal during the curing period. Should the seal be broken or damaged before the expiration of 10 days after the placing of the concrete, the break shall be immediately repaired by the application of additional impervious membrane over the damaged area.

Should any forms be removed sooner than 10 days after the placing of the concrete, the surface so exposed shall either be immediately sprayed with a coating of the membrane seal, or kept continuously wet by the use of burlap or other suitable means until such concrete has cured for at least 10 days.

When tops of walls are cured by the membrane sealing method the side forms, except metal forms, must be kept continuously wet for the 10 days following the placing of the concrete.

If due to weather conditions, materials used, or for any other reason, there is any likelihood of the fresh concrete checking or cracking prior to the commencement of the curing operations, it shall be kept damp, but not wet, by means of an indirect fine spray of water until all danger of such checking or cracking is past, or until the curing operations are started in the particular area affected.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT _____ PAGE ____ OF ____

DETAIL _____ COMPUTED _____ DATE ____

_____ CHECKED BY _____ DATE ____

8.15.2.11, $f_r = 7.5\sqrt{f'c} = 7.5\sqrt{4000}$

$= 474$ psi

8.7; $E_c = 57000\sqrt{4000} = 3604996$

$M_{cr} = f_r I_g / y$

$I_g = \frac{12 \times 15^3}{12} = 3375$

$M_{cr} = \frac{474 \times 3375}{7.5}$

$= 213{,}300$ lb-in $= 17.8$ k-ft

$\Delta = \frac{5}{384} \frac{wl^4}{EI} = \frac{5}{384} \times \frac{188 \times (18 \times 12)^3}{3604996 \times 3375}$

$= 0.002$"

$w_L = \left(\frac{15}{12} \times 150\right) = 188$

$D_L = (1.25)\,150 = 188$ lb/ft

$M_{DL} = \frac{wl^2}{9} = \left(\frac{188 \times 18^2}{9}\right) = 6.77$ k-ft

$f_r = 7.5\sqrt{1400} = 280$ psi

$M_{cr} = \frac{280 \times 3375}{7.5} = 126000$ lb-in

$= 10.5$ k-ft

PROGRAM:SAP90/FILE:DCBC-4.SOL

MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)

JOINT DISPLACEMENTS

LOAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	R(Z)
1	0.000000	-0.008255	-0.000094
2	0.000000	-0.010419	-0.000064
3	0.000000	-0.010576	0.000060
4	0.000048	-0.008196	0.000119
5	0.000095	-0.005332	0.000100
6	0.000143	-0.003346	0.000056
7	0.000191	-0.002514	0.000010
8	0.000239	-0.002899	-0.000042
9	0.000286	-0.004746	-0.000107
10	0.000334	-0.008274	-0.000170
11	0.000382	-0.012803	-0.000170
12	0.000429	-0.015188	0.000000
13	0.000477	-0.012803	0.000170
14	0.000525	-0.008275	0.000170
15	0.000573	-0.004746	0.000107
16	0.000620	-0.002899	0.000042
17	0.000668	-0.002513	-0.000010
18	0.000716	-0.003345	-0.000056
19	0.000763	-0.005329	-0.000100
20	0.000811	-0.008193	-0.000119
21	0.000859	-0.010573	-0.000060
22	0.000859	-0.010424	0.000064
23	0.000859	-0.008264	0.000094
24	-0.002837	-0.011054	0.000180
25	-0.007853	-0.011488	0.000210
26	-0.012052	-0.011876	0.000113
27	-0.012374	-0.012219	-0.000108
28	-0.005760	-0.012517	-0.000455
29	0.000430	-0.016046	0.000000
30	0.000431	-0.016860	0.000000
31	0.000431	-0.017630	0.000000
32	0.000432	-0.018354	0.000000
33	0.000432	-0.019033	0.000000
34	0.003697	-0.011051	-0.000180
35	0.008714	-0.011485	-0.000210
36	0.012914	-0.011874	-0.000114
37	0.013237	-0.012217	0.000108
38	0.006623	-0.012514	0.000455
39	0.000890	-0.012609	-0.000509
40	0.000839	-0.026387	-0.000585
41	0.000788	-0.040591	-0.000513
42	0.000737	-0.051153	-0.000308
43	0.000686	-0.055580	-0.000038
44	0.000635	-0.053112	0.000227
45	0.000584	-0.044716	0.000420

46	0.000533	-0.033091	0.000472
47	0.000483	-0.022663	0.000314
48	0.000432	-0.019258	0.000000
49	0.000381	-0.022662	-0.000314
50	0.000330	-0.033090	-0.000472

JOINT DISPLACEMENTS

LOAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	R(Z)
51	0.000279	-0.044715	-0.000420
52	0.000228	-0.053110	-0.000227
53	0.000177	-0.055578	0.000038
54	0.000126	-0.051150	0.000308
55	0.000075	-0.040589	0.000513
56	0.000025	-0.026384	0.000585
57	-0.000026	-0.012606	0.000509

PROGRAM:SAP90/FILE:DCBC-4.F3F

MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)

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

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	AXIAL MOMENT	1-3 PLANE FORCE	AXIAL SHEAR	MOMENT	TORQ
1								
	1	0.000					0.000	
		0.000	561.653				0.000	
		25.980	127.787				8955.819	
		25.980					0.000	
2								
	1	0.000					0.000	
		0.000	1545.764				8955.819	
		19.980	1212.098				36506.852	
		25.980					0.000	
3								
	1	0.000					413.957	
		6.000	-922.581				20748.252	
		25.224	-1243.622				-73.286	
		25.224					413.957	
4								
	1	0.000					413.957	
		0.000	-128.085				-73.286	
		25.227	-549.373				-8618.349	
		25.227					413.957	
5								
	1	0.000					413.957	
		0.000	176.267				-8618.349	
		10.555	-0.001				-7688.105	
		25.227	-245.021				-9485.564	
		25.227					413.957	
6								
	1	0.000					413.957	
		0.000	210.421				-9485.564	
		12.600	-0.001				-8159.902	
		25.227	-210.867				-9491.183	
		25.227					413.957	
7								
	1	0.000					413.957	
		0.000	131.232				-9491.183	
		7.858	-0.001				-8975.557	
		25.227	-290.056				-11494.491	
		25.227					413.957	
8								
	1	0.000					413.957	
		0.000	104.499				-11494.491	
		6.257	-0.001				-11167.543	
		25.227	-316.789				-14172.188	

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		25.227		413.957				
9								
	1	0.000		413.957				
		0.000	329.090	-14172.188				
		19.706	-0.001	-10929.675				
		25.227	-92.198	-11184.182				
		25.227		413.957				
10								
	1	0.000		413.957				
		0.000	1033.939	-11184.182				
		25.227	612.651	9584.937				
		25.227		413.957				
11								
	1	0.000		413.957				
		0.000	2355.104	9584.937				
		20.227	2017.316	53805.020				
		25.227		413.957				
12								
	1	0.000		413.960				
		5.000	-2017.472	53811.310				
		25.227	-2355.260	9588.075				
		25.227		413.960				
13								
	1	0.000		413.960				
		0.000	-612.739	9588.075				
		25.227	-1034.027	-11183.266				
		25.227		413.960				
14								
	1	0.000		413.960				
		0.000	92.183	-11183.266				
		5.520	-0.001	-10928.845				
		25.227	-329.105	-14171.665				
		25.227		413.960				
15								
	1	0.000		413.960				
		0.000	316.828	-14171.665				
		18.972	-0.001	-11166.276				
		25.227	-104.460	-11492.979				
		25.227		413.960				
16								
	1	0.000		413.960				
		0.000	290.118	-11492.979				
		17.372	-0.001	-8972.966				

Max Moment in Base Slab (lb-in)

Max Shear in Base Slab (lb)

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	MOMENT	AXIAL TORQ
		25.227	-131.170	-9488.103				
		25.227		413.960				
17								
	1	0.000		413.960				
		0.000	210.890	-9488.103				
		12.628	-0.001	-8156.527				
		25.227	-210.398	-9481.893				
		25.227		413.960				
18								
	1	0.000		413.960				
		0.000	244.890	-9481.893				
		14.664	-0.001	-7686.354				
		25.227	-176.398	-8617.980				
		25.227		413.960				
19								
	1	0.000		413.960				
		0.000	548.916	-8617.980				
		25.227	127.628	-84.447				
		25.227		413.960				
20								
	1	0.000		413.960				
		0.000	1242.685	-84.447				
		19.227	921.597	20721.692				
		25.227		413.960				
21								
	1	0.000		0.000				
		6.000	-1213.465	36465.378				
		25.920	-1546.129	8979.830				
		25.920		0.000				
22								
	1	0.000		0.000				
		0.000	-127.414	8979.830				
		26.040	-562.282	0.000				
		26.040		0.000				
25								
	1	0.000		-3373.669				
		8.000	-413.957	14184.046				
		24.360	-413.957	7411.711				
		24.360		-3069.169				
26								
	1	0.000		-3069.169				
		0.000	-413.957	7411.711				
		24.420	-413.957	-2697.116				

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		24.420		-2763.919				
27								
	1	0.000		-2763.919				
		0.000	-413.957	-2697.116				
		24.420	-413.957	-12805.944				
		24.420		-2458.669				
28								
	1	0.000		-2458.669				
		0.000	-413.957	-12805.944				
		24.420	-413.957	-22914.771				
		24.420		-2153.419				
29								
	1	0.000		-2153.419				
		0.000	-413.957	-22914.771				
		24.420	-413.957	-33023.598				
		24.420	-	-1848.169				
30								
	1	0.000		-1848.169				
		0.000	-413.957	-33023.598				
		5.940	-413.957	-35482.502	——— Max M in Ext Wall			
		13.440		-1633.129	——— Max V in Ext Wall			
31								
	1	0.000		-5934.808				
		8.000	0.335	-4.363				
		24.360	0.323	1.026				
		24.360		-5630.308				
32								
	1	0.000		-5630.308				
		0.000	-0.003	1.026				
		24.420	-0.003	0.957				
		24.420		-5325.058				
33								
	1	0.000		-5325.058				
		0.000	-0.003	0.957				
		24.420	-0.003	0.889				
		24.420		-5019.808				
34								
	1	0.000		-5019.808				
		0.000	-0.003	0.889				
		24.420	-0.003	0.820				
		24.420		-4714.558				

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
35								
	1	0.000		-4714.558				
		0.000	-0.003	0.820				
		24.420	-0.003	0.751				
		24.420		-4409.308				
36								
	1	0.000		-4409.308				
		0.000	-0.003	0.751				
		5.940	-0.003	0.734				
		13.440		-4194.268				
37								
	1	0.000		-3373.678				
		8.000	413.960	-14183.212				
		24.360	413.960	-7410.831				
		24.360		-3069.178				
38								
	1	0.000		-3069.178				
		0.000	413.960	-7410.831				
		24.420	413.960	2698.065				
		24.420		-2763.928				
39								
	1	0.000		-2763.928				
		0.000	413.960	2698.065				
		24.420	413.960	12806.961				
		24.420		-2458.678				
40								
	1	0.000		-2458.678				
		0.000	413.960	12806.961				
		24.420	413.960	22915.857				
		24.420		-2153.428				
41								
	1	0.000		-2153.428				
		0.000	413.960	22915.857				
		24.420	413.960	33024.753				
		24.420		-1848.178				
42								
	1	0.000		-1848.178				
		0.000	413.960	33024.753				
		5.940	413.960	35483.674				
		13.440		-1633.138				
43								
	1	0.000		-413.957				

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		12.000	1435.969	-20172.587				
		25.227	1218.655	-2616.671				
		25.227		-413.957				
44								
	1	0.000		-413.957				
		0.000	1218.655	-2616.671				
		25.227	804.181	22898.037				
		25.227		-413.957				
45								
	1	0.000		-413.957				
		0.000	804.181	22898.037				
		25.227	389.707	37956.943				
		25.227		-413.957				
46								
	1	0.000		-413.957				
		0.000	389.707	37956.943				
		23.719	-0.001	42578.717	— Max top slab positive Moment			
		25.227	-24.767	42560.049				
		25.227		-413.957				
47								
	1	0.000		-413.957				
		0.000	-24.767	42560.049				
		25.227	-439.241	36707.354				
		25.227		-413.957				
48								
	1	0.000		-413.957				
		0.000	-439.241	36707.354				
		25.227	-853.715	20398.858				
		25.227		-413.957				
49								
	1	0.000		-413.957				
		0.000	-853.715	20398.858				
		25.227	-1268.190	-6365.439				
		25.227		-413.957				
50								
	1	0.000		-413.957				
		0.000	-1268.190	-6365.439				
		25.227	-1682.664	-43585.536				
		25.227		-413.957				
51								
	1	0.000		-413.957				
		0.000	-1682.664	-43585.536				
		14.227	-1916.408	-69186.933	— Max top slab positive Moment			

Max Shear top slab

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	MOMENT	AXIAL TORQ
		25.227		-413.957				
52								
	1	0.000		-413.960				
		11.000	1916.400	-69186.312				
		25.227	1682.655	-43585.035				
		25.227		-413.960				
53								
	1	0.000		-413.960				
		0.000	1682.655	-43585.035				
		25.227	1268.181	-6365.149				
		25.227		-413.960				
54								
	1	0.000		-413.960				
		0.000	1268.181	-6365.149				
		25.227	853.707	20398.936				
		25.227		-413.960				
55								
	1	0.000		-413.960				
		0.000	853.707	20398.936				
		25.227	439.233	36707.220				
		25.227		-413.960				
56								
	1	0.000		-413.960				
		0.000	439.233	36707.220				
		25.227	24.759	42559.703				
		25.227		-413.960				
57								
	1	0.000		-413.960				
		0.000	24.759	42559.703				
		1.507	-0.001	42578.358				
		25.227	-389.715	37956.386				
		25.227		-413.960				
58								
	1	0.000		-413.960				
		0.000	-389.715	37956.386				
		25.227	-804.189	22897.267				
		25.227		-413.960				
59								
	1	0.000		-413.960				
		0.000	-804.189	22897.267				
		25.227	-1218.664	-2617.652				
		25.227		-413.960				

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

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	AXIAL MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	AXIAL MOMENT	TORQ
60								
1		0.000		-413.960				
		0.000	-1218.664	-2617.652				
		13.227	-1435.978	-20173.679				
		25.227		-413.960				

MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)

S Y S T E M D A T A

EXECUTION CODE - - - - - - - - - - - - - - - 0

NUMBER OF LOAD CONDITIONS - - - - - - - - - - 2

STEADY STATE LOAD FREQUENCY - - - - - - - - -0.0000E+00

NUMBER OF EIGENVALUES - - - - - - - - - - - - 0

EIGEN CONVERGENCE TOLERANCE - - - - - - - - -0.1000E-03

EIGEN CUTOFF TIME PERIOD - - - - - - - - - -0.0000E+00

GENERATED JOINT COORDINATES

JOINT	X	Y	Z
1	0.000	0.000	0.000
2	25.980	0.000	0.000
3	51.960	0.000	0.000
4	77.184	0.000	0.000
5	102.411	0.000	0.000
6	127.638	0.000	0.000
7	152.864	0.000	0.000
8	178.091	0.000	0.000
9	203.318	0.000	0.000
10	228.545	0.000	0.000
11	253.772	0.000	0.000
12	278.999	0.000	0.000
13	304.225	0.000	0.000
14	329.452	0.000	0.000
15	354.679	0.000	0.000
16	379.906	0.000	0.000
17	405.133	0.000	0.000
18	430.360	0.000	0.000
19	455.586	0.000	0.000
20	480.813	0.000	0.000
21	506.040	0.000	0.000
22	531.960	0.000	0.000
23	558.000	0.000	0.000
24	51.960	24.360	0.000
25	51.960	48.780	0.000
26	51.960	73.200	0.000
27	51.960	97.620	0.000
28	51.960	122.040	0.000
29	279.000	24.360	0.000
30	279.000	48.780	0.000
31	279.000	73.200	0.000
32	279.000	97.620	0.000
33	279.000	122.040	0.000
34	506.040	24.360	0.000
35	506.040	48.780	0.000
36	506.040	73.200	0.000
37	506.040	97.620	0.000
38	506.040	122.040	0.000
39	51.960	135.480	0.000
40	77.187	135.480	0.000
41	102.413	135.480	0.000
42	127.640	135.480	0.000
43	152.867	135.480	0.000
44	178.093	135.480	0.000
45	203.320	135.480	0.000
46	228.547	135.480	0.000
47	253.773	135.480	0.000

48	279.000	135.480	0.000
49	304.227	135.480	0.000
50	329.453	135.480	0.000
51	354.680	135.480	0.000
52	379.907	135.480	0.000

GENERATED JOINT COORDINATES

JOINT	X	Y	Z
53	405.133	135.480	0.000
54	430.360	135.480	0.000
55	455.587	135.480	0.000
56	480.813	135.480	0.000
57	506.040	135.480	0.000

RESTRAINT DATA

JOINT	RX	RY	RZ	RXX	RYY	RZZ
1	1	0	1	1	1	0
2	0	0	1	1	1	0
3	0	0	1	1	1	0
4	0	0	1	1	1	0
5	0	0	1	1	1	0
6	0	0	1	1	1	0
7	0	0	1	1	1	0
8	0	0	1	1	1	0
9	0	0	1	1	1	0
10	0	0	1	1	1	0
11	0	0	1	1	1	0
12	0	0	1	1	1	0
13	0	0	1	1	1	0
14	0	0	1	1	1	0
15	0	0	1	1	1	0
16	0	0	1	1	1	0
17	0	0	1	1	1	0
18	0	0	1	1	1	0
19	0	0	1	1	1	0
20	0	0	1	1	1	0
21	0	0	1	1	1	0
22	0	0	1	1	1	0
23	0	0	1	1	1	0
24	0	0	1	1	1	0
25	0	0	1	1	1	0
26	0	0	1	1	1	0
27	0	0	1	1	1	0
28	0	0	1	1	1	0
29	0	0	1	1	1	0
30	0	0	1	1	1	0
31	0	0	1	1	1	0
32	0	0	1	1	1	0
33	0	0	1	1	1	0
34	0	0	1	1	1	0
35	0	0	1	1	1	0
36	0	0	1	1	1	0
37	0	0	1	1	1	0
38	0	0	1	1	1	0
39	0	0	1	1	1	0
40	0	0	1	1	1	0
41	0	0	1	1	1	0
42	0	0	1	1	1	0
43	0	0	1	1	1	0
44	0	0	1	1	1	0
45	0	0	1	1	1	0
46	0	0	1	1	1	0
47	0	0	1	1	1	0

48	0	0	1	1	1	0
49	0	0	1	1	1	0
50	0	0	1	1	1	0
51	0	0	1	1	1	0
52	0	0	1	1	1	0

RESTRAINT DATA

JOINT	RX	RY	RZ	RXX	RYY	RZZ
53	0	0	1	1	1	0
54	0	0	1	1	1	0
55	0	0	1	1	1	0
56	0	0	1	1	1	0
57	0	0	1	1	1	0

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

NUMBER OF MEMBER SECTION PROPERTIES 6
NUMBER OF SPAN LOADING PATTERNS 1

LOAD COND	GRAVITATIONAL MULTIPLIERS X	Y	Z	TEMPERATURE MULTIPLIERS	PRESTRESS MULTIPLIERS
1	0.000	-1.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000

SECTION PROPERTY DATA

PROP ID	AREA	TORSIONAL INERTIA	MOMENTS OF INERTIA I33	I22	SHEAR AREAS A2	A3
1	0.192E+03	0.00000E+00	0.40960E+04	0.00000E+00	0.000E+00	0.000E+00
2	0.180E+03	0.00000E+00	0.33750E+04	0.00000E+00	0.000E+00	0.000E+00
3	0.144E+03	0.00000E+00	0.17280E+04	0.00000E+00	0.000E+00	0.000E+00
4	0.306E+03	0.00000E+00	0.16581E+05	0.00000E+00	0.000E+00	0.000E+00
5	0.120E+03	0.00000E+00	0.10000E+04	0.00000E+00	0.000E+00	0.000E+00
6	0.444E+03	0.00000E+00	0.50653E+05	0.00000E+00	0.000E+00	0.000E+00

M A T E R I A L P R O P E R T Y D A T A

PROP ID	MODULUS OF ELASTICITY	SHEAR MODULUS	WEIGHT PER UNIT LEN	MASS PER UNIT LEN	THERMAL EXPANSION
1	0.1140E+07	0.4385E+06	0.1670E+02	0.0000E+00	0.0000E+00
2	0.1140E+07	0.4385E+06	0.1560E+02	0.0000E+00	0.0000E+00
3	0.1140E+07	0.4385E+06	0.1250E+02	0.0000E+00	0.0000E+00
4	0.1140E+07	0.4385E+06	0.1950E+02	0.0000E+00	0.0000E+00
5	0.1140E+07	0.4385E+06	0.1040E+02	0.0000E+00	0.0000E+00
6	0.1140E+07	0.4385E+06	0.2450E+02	0.0000E+00	0.0000E+00

MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)

S P A N L O A D I N G D A T A

UNIFORM LOAD DATA

PATTERN ID	1-DIR	2-DIR	3-DIR	X-DIR	Y-DIR	Z-DIR
1	0.0000	-0.8300	0.0000	0.0000	0.0000	0.0000

FRAME ELEMENT DATA

ELT ID	JOINT END-I	JOINT END-J	LOCAL-AXIS N1	LOCAL-AXIS N2	PROPERTY-ID END-I	PROPERTY-ID END-J	REL VAR	REF ELEMENT CODES	TEMP	LENGTH
1	1	2	1	0	1	1	0	000000	0.00	25.98
2	2	3	1	0	1	1	0	000000	0.00	25.98
3	3	4	1	0	1	1	0	000000	0.00	25.22
4	4	5	1	0	1	1	0	000000	0.00	25.23
5	5	6	1	0	1	1	0	000000	0.00	25.23
6	6	7	1	0	1	1	0	000000	0.00	25.23
7	7	8	1	0	1	1	0	000000	0.00	25.23
8	8	9	1	0	1	1	0	000000	0.00	25.23
9	9	10	1	0	1	1	0	000000	0.00	25.23
10	10	11	1	0	1	1	0	000000	0.00	25.23
11	11	12	1	0	1	1	0	000000	0.00	25.23
12	12	13	1	0	1	1	0	000000	0.00	25.23
13	13	14	1	0	1	1	0	000000	0.00	25.23
14	14	15	1	0	1	1	0	000000	0.00	25.23
15	15	16	1	0	1	1	0	000000	0.00	25.23
16	16	17	1	0	1	1	0	000000	0.00	25.23
17	17	18	1	0	1	1	0	000000	0.00	25.23
18	18	19	1	0	1	1	0	000000	0.00	25.23
19	19	20	1	0	1	1	0	000000	0.00	25.23
20	20	21	1	0	1	1	0	000000	0.00	25.23
21	21	22	1	0	1	1	0	000000	0.00	25.92
22	22	23	1	0	1	1	0	000000	0.00	26.04
25	3	24	1	0	3	3	0	000000	0.00	24.36
26	24	25	1	0	3	3	0	000000	0.00	24.42
27	25	26	1	0	3	3	0	000000	0.00	24.42
28	26	27	1	0	3	3	0	000000	0.00	24.42
29	27	28	1	0	3	3	0	000000	0.00	24.42
30	28	39	1	0	3	4	1	000000	0.00	13.44
31	12	29	1	0	3	3	0	000000	0.00	24.36
32	29	30	1	0	3	3	0	000000	0.00	24.42
33	30	31	1	0	3	3	0	000000	0.00	24.42
34	31	32	1	0	3	3	0	000000	0.00	24.42
35	32	33	1	0	3	3	0	000000	0.00	24.42
36	33	48	1	0	3	4	1	000000	0.00	13.44
37	21	34	1	0	3	3	0	000000	0.00	24.36
38	34	35	1	0	3	3	0	000000	0.00	24.42
39	35	36	1	0	3	3	0	000000	0.00	24.42
40	36	37	1	0	3	3	0	000000	0.00	24.42
41	37	38	1	0	3	3	0	000000	0.00	24.42
42	38	57	1	0	3	4	1	000000	0.00	13.44
43	39	40	1	0	2	2	0	000000	0.00	25.23
44	40	41	1	0	2	2	0	000000	0.00	25.23
45	41	42	1	0	2	2	0	000000	0.00	25.23
46	42	43	1	0	2	2	0	000000	0.00	25.23
47	43	44	1	0	2	2	0	000000	0.00	25.23

48	44	45	1	0	2	2	0	000000	0.00	25.23
49	45	46	1	0	2	2	0	000000	0.00	25.23
50	46	47	1	0	2	2	0	000000	0.00	25.23
51	47	48	1	0	2	2	0	000000	0.00	25.23
52	48	49	1	0	2	2	0	000000	0.00	25.23
53	49	50	1	0	2	2	0	000000	0.00	25.23

FRAME ELEMENT DATA

ELT ID	JOINT END-I	JOINT END-J	LOCAL-AXIS N1	N2	PROPERTY-ID END-I	END-J	REL VAR	CODES	REF TEMP	ELEMENT LENGTH
54	50	51	1	0	2	2	0	000000	0.00	25.23
55	51	52	1	0	2	2	0	000000	0.00	25.23
56	52	53	1	0	2	2	0	000000	0.00	25.23
57	53	54	1	0	2	2	0	000000	0.00	25.23
58	54	55	1	0	2	2	0	000000	0.00	25.23
59	55	56	1	0	2	2	0	000000	0.00	25.23
60	56	57	1	0	2	2	0	000000	0.00	25.23

FRAME ELEMENT DATA

ELT ID	MASTER-JOINTS END-I	END-J	RIGID-OFFSETS END-I	END-J	REDUCTION FACTOR
2	0	0	0.00	6.00	0.50
3	0	0	6.00	0.00	0.50
4	0	0	0.00	0.00	0.50
5	0	0	0.00	0.00	0.50
6	0	0	0.00	0.00	0.50
7	0	0	0.00	0.00	0.50
8	0	0	0.00	0.00	0.50
9	0	0	0.00	0.00	0.50
10	0	0	0.00	0.00	0.50
11	0	0	0.00	5.00	0.50
12	0	0	5.00	0.00	0.50
13	0	0	0.00	0.00	0.50
14	0	0	0.00	0.00	0.50
15	0	0	0.00	0.00	0.50
16	0	0	0.00	0.00	0.50
17	0	0	0.00	0.00	0.50
18	0	0	0.00	0.00	0.50
19	0	0	0.00	0.00	0.50
20	0	0	0.00	6.00	0.50
21	0	0	6.00	0.00	0.50
22	0	0	0.00	0.00	0.50
25	0	0	8.00	0.00	0.50
26	0	0	0.00	0.00	0.50
27	0	0	0.00	0.00	0.50
28	0	0	0.00	0.00	0.50
29	0	0	0.00	0.00	0.50
30	0	0	0.00	7.50	0.50
31	0	0	8.00	0.00	0.50
32	0	0	0.00	0.00	0.50
33	0	0	0.00	0.00	0.50
34	0	0	0.00	0.00	0.50
35	0	0	0.00	0.00	0.50
36	0	0	0.00	7.50	0.50
37	0	0	8.00	0.00	0.50
38	0	0	0.00	0.00	0.50
39	0	0	0.00	0.00	0.50
40	0	0	0.00	0.00	0.50
41	0	0	0.00	0.00	0.50
42	0	0	0.00	7.50	0.50
43	0	0	12.00	0.00	0.50
44	0	0	0.00	0.00	0.50
45	0	0	0.00	0.00	0.50
46	0	0	0.00	0.00	0.50
47	0	0	0.00	0.00	0.50
48	0	0	0.00	0.00	0.50

49	0	0	0.00	0.00	0.50
50	0	0	0.00	0.00	0.50
51	0	0	0.00	11.00	0.50
52	0	0	11.00	0.00	0.50
53	0	0	0.00	0.00	0.50
54	0	0	0.00	0.00	0.50

FRAME ELEMENT DATA

ELT ID	MASTER-JOINTS END-I	END-J	RIGID-OFFSETS END-I	END-J	REDUCTION FACTOR
55	0	0	0.00	0.00	0.50
56	0	0	0.00	0.00	0.50
57	0	0	0.00	0.00	0.50
58	0	0	0.00	0.00	0.50
59	0	0	0.00	0.00	0.50
60	0	0	0.00	12.00	0.50

BEAM SPAN LOADING PATTERNS

ELT ID	LOAD 1	LOAD 2
43	0	1
44	0	1
45	0	1
46	0	1
47	0	1
48	0	1
49	0	1
50	0	1
51	0	1
52	0	1
53	0	1
54	0	1
55	0	1
56	0	1
57	0	1
58	0	1
59	0	1
60	0	1

TOTAL WEIGHTS AND MASSES

PROP	WEIGHT	MASS
1	9318.6000	0.0000
2	7083.6480	0.0000
3	4828.5000	0.0000
4	393.1200	0.0000
5	0.0000	0.0000
6	0.0000	0.0000
TOTAL	21623.8680	0.0000

L O A D C O N D I T I O N C O M B I N A T I O N M U L T I P L I E R S

COMBINATION	CONDITION	FACTOR
1		
	1	1.000
	2	1.000

OUTPUT FILES CREATED BY PROGRAM

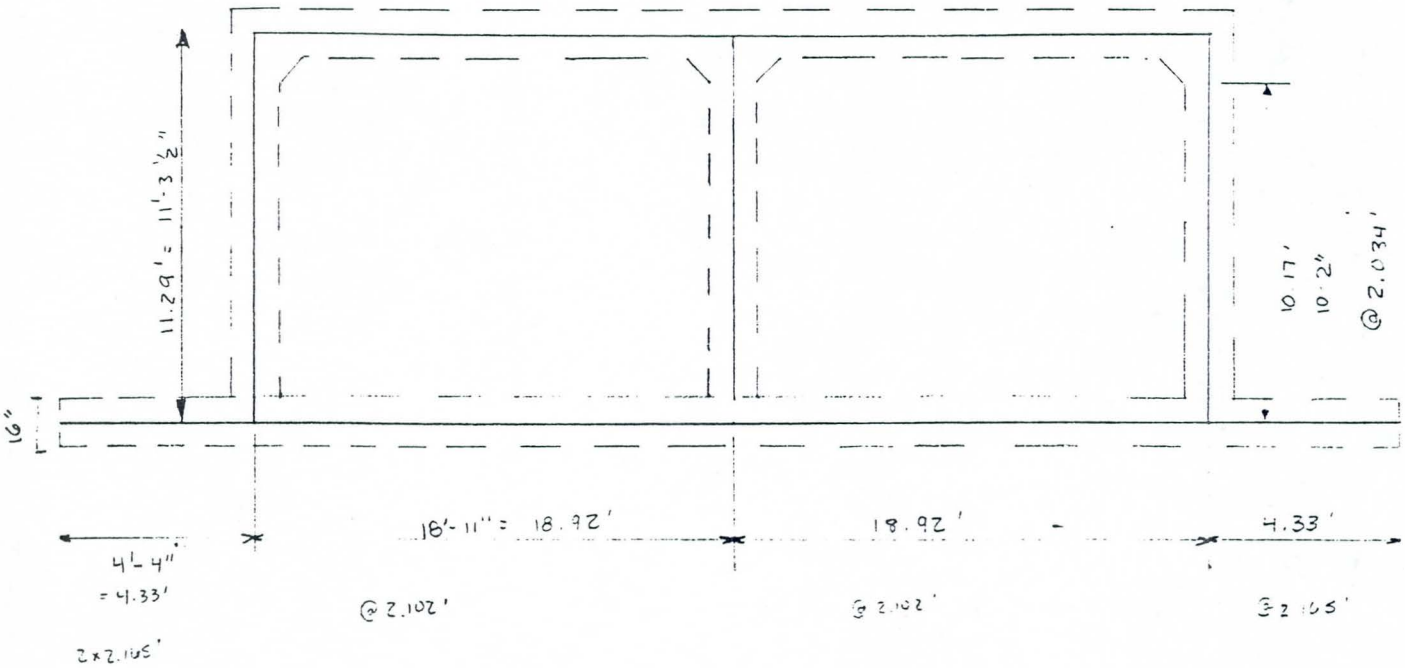
INPUT DATA ECHO	DCBC-4.SAP
SOLUTION ERRORS AND WARNINGS	DCBC-4.ERR
EQUATION NUMBERING	DCBC-4.EQN
DISPLACEMENTS AND REACTIONS	DCBC-4.SOL
FRAME ELEMENT FORCES	DCBC-4.F3F

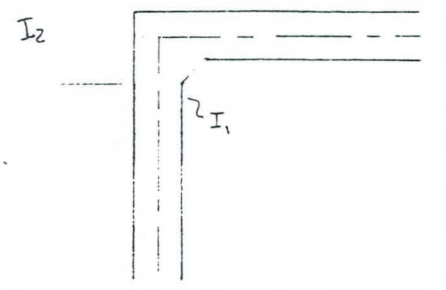
Project No. 96.122 Project Title: DCBC - Fc Analysis

Client: AMES CONST. Activity: SAP 90 INPUT DATA (X-SECT PROPERTIES)

Computations by: MH Date: 9/19 Sheet: ____ of ____

Bates Engineering Incorporated



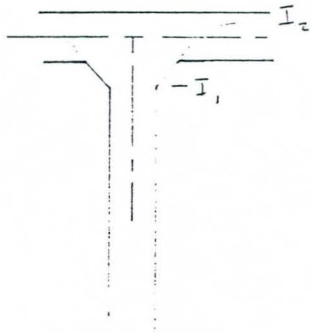


$I_1 = 1728$

$I_2 = (12" + 6" + 7.5)^3$

$= 16,581 \text{ in}^4$

$A = 360$



$I_1 = 1000 \text{ in}^4$

$I_2 = [10" - 2(6) + 2(7.5)]^3 = 50,653 \text{ in}^4$

$A = 444$

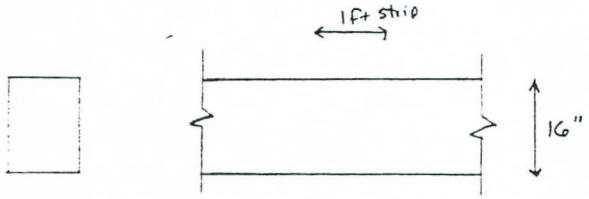
Project No. 96.122 Project Title: DCBC fi analysis

Client: AMES CONST. Activity: X-SECTION PROPERTIES

Computations by: MH Date: 9/19 Sheet: ____ of ____

Bates Engineering Incorporated

EIEMENT 1 CBC base SLAB



$I = 16^3 = 4096\ in^4$

$AS = 192\ in^2$

$W = \frac{150}{1728}\ lb/in^3 (16 \times 12) = 16.7\ lb/in$

ELEMENT 2 CBC TOP SLAB

b = 12"

h = 15"

$I = 3375\ in^4$

$A = AS = 180\ in^2$

$W = 15.6\ lb/in$

Element 3 CBC EXT Side Walls

b = 12"

h = 12"

$I = 1728\ in^4$

$A = AS = 144\ in^2$

$W = 12.5\ lb/in$

EIEMENT 4 CBC INT SIDE WALL

b = 12

h = 10

$I = 1000\ in^4$

$A = 120\ in^2$

$W = 10.42$

Project No. 96.122 Project Title: Double Concrete Box Culvert Concrete Strength Anal.

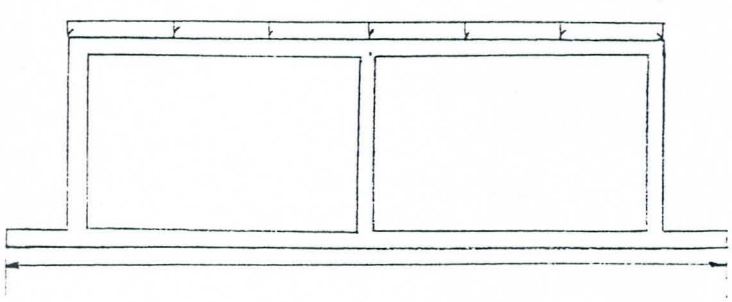
Client: AMES CONST. Activity: INPUT DATA (SAP90)

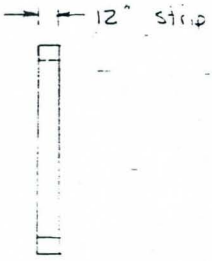
Computations by: MH Date: 9/19 Sheet: ____ of ____

Bates Engineering Incorporated

SLAB = 150 pcf = $.087 \frac{lb}{in^3}$ = 15.6 lb/in

10 psf = $.07 \frac{lb}{in^2}$ = .83 $\frac{lb}{in}$





Project No. 96.122 Project Title: DCBC f'_c Analysis

Client: AMES CONST. Activity: SAP90 INPUT DATA

Computations by: MH Date: 9/19/96 Sheet: ____ of ____

Bates Engineering Incorporated

IF f'_c = 1000 psi $E = 57{,}000\sqrt{1000} = 1{,}802{,}498$ psi

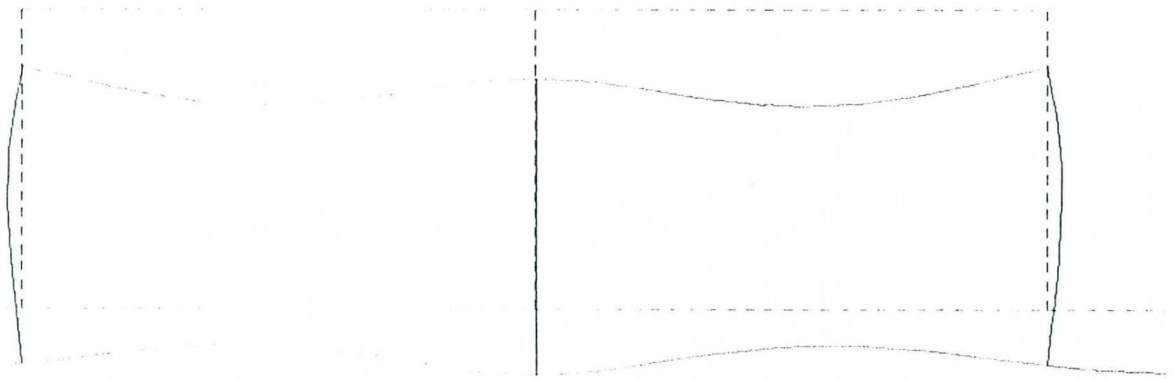
500 psi $E =$ $= 1{,}274{,}558$ psi

400 psi $= 1{,}140.000$ psi

Load 10 psf Line load = 10 lb/Lf = .83 lb/in

```
MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)
BATES ENGINEERING, INC. - 96.119 - SEPT., 1996
MARK HEFFRON FILE: DCBC-5  (Soil as 50pci)
SYSTEM
L=2
JOINTS
1     X=0.00  Y=0.00  S=12
3     X=4.33  Y=0.0   G=1,3,1
4     X=6.432 Y=0.0
21    X=42.17 Y=0.0   G=4,21,1
22    X=44.33 Y=0.0
23    X=46.5  Y=0.0
24    X=4.33  Y=2.03
28    X=4.33  Y=10.17 G=24,28,1
29    X=23.25 Y=2.03
33    X=23.25 Y=10.17 G=29,33,1
34    X=42.17 Y=2.03
38    X=42.17 Y=10.17 G=34,38,1
39    X=4.33  Y=11.29
57    X=42.17 Y=11.29 G=39,57,1

RESTRAINTS
1     R=1,0,1,1,1,0
2 57 1 R=0,0,1,1,1,0

SPRINGS
1     23    22    K=0,7560.0,0.0,0.0  :MOD = 50 PCI
2     22    1     K=0,15120.0,0.0,0.0 :MOD = 50 PCI

FRAME
NL=1 Y=-1.0 NM=6
1 A=192.0     I=4096.0     E=1.14E6     W=16.7  :BOTTOM SLAB
2 A=180.0     I=3375.0     E=1.14E6     W=15.6  :TOP SLAB
3 A=144.0     I=1728.0     E=1.14E6     W=12.5  :EXT SIDE WALLS
4 A=306.0     I=16581.0    E=1.14E6     W=19.5  :VARIABLE SECT
5 A=120.0     I=1000.0     E=1.14E6     W=10.4  :INT SIDE WALLS
6 A=444.0     I=50653.0    E=1.14E6     W=24.5  :VARIABLE SECT
1 WL=0,-0.83.0
1     1     2     M=1                    :BOTTOM SLAB
2     2     3     M=1    RE=0.6  RZ=0.5
3     3     4     M=1    RE=6.0  RZ=0.5
4     4     5     M=1    G=6,1,1,1
11    11    12    M=1    RE=0.5  RZ=0.5
12    12    13    M=1    RE=5.0  RZ=0.5
13    13    14    M=1    G=6,1,1,1
20    20    21    M=1    RE=0.6  RZ=0.5
21    21    22    M=1    RE=6.0  RZ=0.5
22    22    23    M=1                   :EXT WALL
25    3     24    M=3    RE=8.0  RZ=0.5
26    24    25    M=3    G=3,1,1,1
30    28    39    M=3,4,1 RE=0.7.5 RZ=0.5      :VARIABLE SECT
31    12    29    M=3    RE=8.0  RZ=0.5       :INT WALL
32    29    30    M=3    G=3,1,1,1
33    31    48    M=3,4,1 RE=0.7.5 RZ=0.5      :VARIABLE SECT
```

```
37    21    34    M=3    RE=8,0  RZ=0.5       :EXT WALL
38    34    35    M=3    G=3,1,1,1
42    38    57    M=3,4,1 RE=0,7.5 RZ=0.5      :VARIABLE SECT
43    39    40    M=2    RE=12,0  RZ=0.5 NSL=0,1 :TOP SLAB
44    40    41    M=2    G=6,1,1,1      NSL=0,1
51    47    48    M=2    RE=0,11  RZ=0.5 NSL=0,1
52    48    49    M=2    RE=11,0  RZ=0.5 NSL=0,1
53    49    50    M=2    G=6,1,1,1      NSL=0,1
60    56    57    M=2    RE=0,12  RZ=0.5 NSL=0,1

COMBO
1 C=1.1
```



Y

X

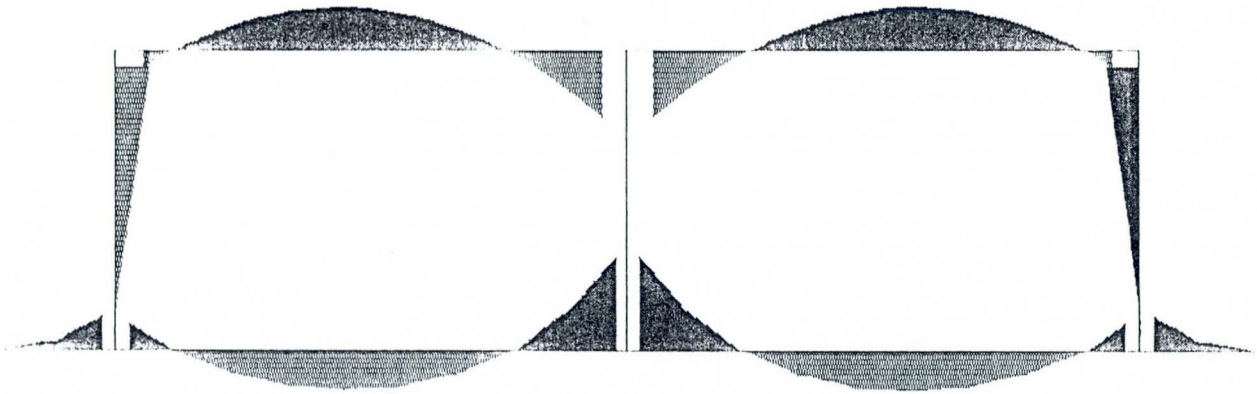
DCBC-5

DEFORMED
SHAPE

LOAD 1

MINIMA
X-0.1785E-01
Y-0.1259E+00
Z 0.0000E+00
MAXIMA
X 0.1850E-01
Y-0.4837E-01
Z 0.0000E+00

SAP90



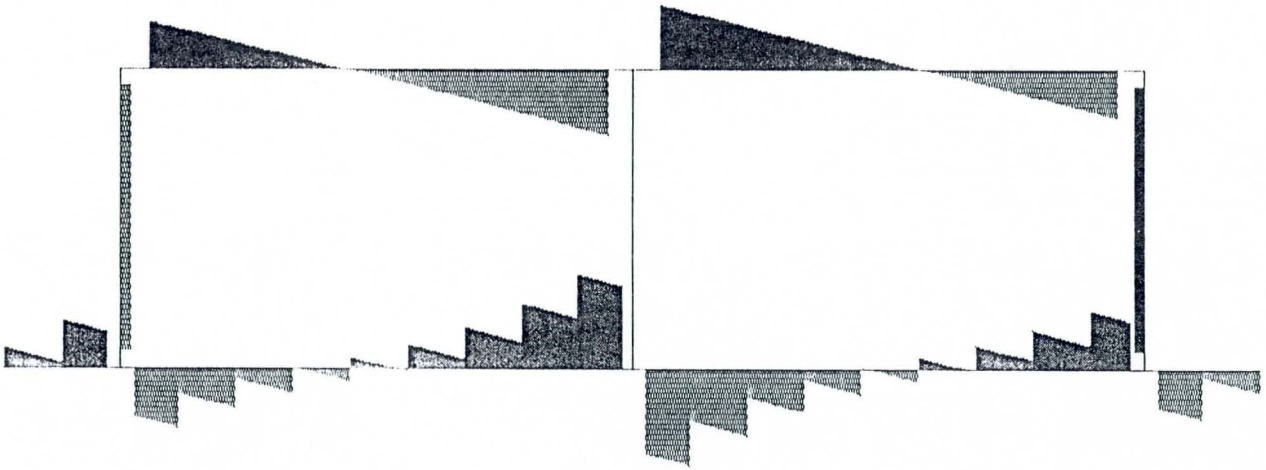
Y
X

DCBC-5

FRAME
OUTPUT M33
LOAD 1

MIN < 51>
-0.6813E+05
AT 14.23
MAX < 12>
0.9495E+05
AT 5.00

SAP90



Y

X

DCBC-5

FRAME

OUTPUT V22

LOAD 1

MIN < 12>
-0.2730E+04
AT 25.23
MAX < 11>
0.2730E+04
AT 0.00

SAP90

PROGRAM:SAP90/FILE:dcbc-5.F3F

MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	AXIAL MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	AXIAL MOMENT	TORQ
1								
	1	0.000		0.000				
		0.000	633.395	0.000				
		25.980	199.529	10819.672				
		25.980		0.000				
2								
	1	0.000		0.000				
		0.000	1406.905	10819.672				
		19.980	1073.239	35596.317				
		25.980		0.000				
3								
	1	0.000		302.485				
		6.000	-1378.894	28924.331				
		25.224	-1699.935	-669.379				
		25.224		302.485				
4								
	1	0.000		302.485				
		0.000	-716.592	-669.379				
		25.227	-1137.880	-24060.595				
		25.227		302.485				
5								
	1	0.000		302.485				
		0.000	-291.544	-24060.595				
		25.227	-712.832	-36729.197				
		25.227		302.485				
6								
	1	0.000		302.485				
		0.000	40.571	-36729.197				
		2.429	-0.001	-36679.916				
		25.227	-380.717	-41019.605				
		25.227		302.485				
7								
	1	0.000		302.485				
		0.000	350.737	-41019.605				
		21.002	-0.001	-37336.487				
		25.227	-70.551	-37485.514				
		25.227		302.485				
8								
	1	0.000		302.485				
		0.000	718.970	-37485.514				
		25.227	297.682	-24662.064				
		25.227		302.485				

Moment @ base slab / Ext Wall

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
9								
	1	0.000			302.485			
		0.000	1217.501	-24662.064				
		25.227	796.213	737.750				
		25.227			302.485			
10								
	1	0.000			302.485			
		0.000	1891.007	737.750				
		25.227	1469.719	43127.980				
		25.227			302.485			
11								
	1	0.000			302.485			
		0.000	2730.307	43127.980				
		20.227	2392.519	94937.231				
		25.227			302.485			
12								
	1	0.000			302.423			
		5.000	-2392.642	94948.655				
		25.227	-2730.430	43136.919				
		25.227			302.423			
13								
	1	0.000			302.423			
		0.000	-1469.834	43136.919				
		25.227	-1891.122	743.785				
		25.227			302.423			
14								
	1	0.000			302.423			
		0.000	-796.331	743.785				
		25.227	-1217.619	-24659.007				
		25.227			302.423			
15								
	1	0.000			302.423			
		0.000	-297.826	-24659.007				
		25.227	-719.114	-37486.089				
		25.227			302.423			
16								
	1	0.000			302.423			
		0.000	70.352	-37486.089				
		4.213	-0.001	-37337.901				
		25.227	-350.936	-41025.200				
		25.227			302.423			

Moment @ base slab / int wall (max in structure)

Shear @ base int wall (max in structure)

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
17								
	1	0.000			302.423			
		0.000	380.436	-41025.200				
		22.781	-0.001	-36691.926				
		25.227	-40.852	-36741.893				
		25.227			302.423			
18								
	1	0.000			302.423			
		0.000	712.453	-36741.893				
		25.227	291.165	-24082.857				
		25.227			302.423			
19								
	1	0.000			302.423			
		0.000	1137.415	-24082.857				
		25.227	716.127	-703.375				
		25.227			302.423			
20								
	1	0.000			302.423			
		0.000	1699.443	-703.375				
		19.227	1378.355	28884.756				
		25.227			302.423			
21								
	1	0.000			0.000			
		6.000	-1073.694	35540.591				
		25.920	-1406.358	10839.263				
		25.920			0.000			
22								
	1	0.000			0.000			
		0.000	-198.820	10839.263				
		26.040	-633.688	0.000				
		26.040			0.000			
25								
	1	0.000			-3367.257			
		8.000	-302.485	2418.179				
		24.360	-302.485	-2530.470				
		24.360			-3062.757			
26								
	1	0.000			-3062.757			
		0.000	-302.485	-2530.470				
		24.420	-302.485	-9917.144				
		24.420			-2757.507			

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
27								
	1	0.000			-2757.507			
		0.000		-302.485	-9917.144			
		24.420		-302.485	-17303.818			
		24.420			-2452.257			
28								
	1	0.000			-2452.257			
		0.000		-302.485	-17303.818			
		24.420		-302.485	-24690.492			
		24.420			-2147.007			
29								
	1	0.000			-2147.007			
		0.000		-302.485	-24690.492			
		24.420		-302.485	-32077.167			
		24.420			-1841.757			
30								
	1	0.000			-1841.757			
		0.000		-302.485	-32077.167			
		5.940		-302.485	-33873.925			
		13.440			-1626.717			
31								
	1	0.000			-5947.613			
		8.000		0.401	-8.810			
		24.360		0.389	-2.352			
		24.360			-5643.113			
32								
	1	0.000			-5643.113			
		0.000		0.062	-2.352			
		24.420		0.062	-0.844			
		24.420			-5337.863			
33								
	1	0.000			-5337.863			
		0.000		0.062	-0.844			
		24.420		0.062	0.663			
		24.420			-5032.613			
34								
	1	0.000			-5032.613			
		0.000		0.062	0.663			
		24.420		0.062	2.171			
		24.420			-4727.363			
35								
	1	0.000			-4727.363			

Max M in Ext wall

Max V in Ext wall

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
27								
	1	0.000		-2757.507				
		0.000	-302.485	-9917.144				
		24.420	-302.485	-17303.818				
		24.420		-2452.257				
28								
	1	0.000		-2452.257				
		0.000	-302.485	-17303.818				
		24.420	-302.485	-24690.492				
		24.420		-2147.007				
29								
	1	0.000		-2147.007				
		0.000	-302.485	-24690.492				
		24.420	-302.485	-32077.167				
		24.420		-1841.757				
30								
	1	0.000		-1841.757				
		0.000	-302.485	-32077.167				
		5.940	-302.485	-33873.925				
		13.440		-1626.717				
31								
	1	0.000		-5947.613				
		8.000	0.401	-8.810				
		24.360	0.389	-2.352				
		24.360		-5643.113				
32								
	1	0.000		-5643.113				
		0.000	0.062	-2.352				
		24.420	0.062	-0.844				
		24.420		-5337.863				
33								
	1	0.000		-5337.863				
		0.000	0.062	-0.844				
		24.420	0.062	0.663				
		24.420		-5032.613				
34								
	1	0.000		-5032.613				
		0.000	0.062	0.663				
		24.420	0.062	2.171				
		24.420		-4727.363				
35								
	1	0.000		-4727.363				

Max M in Ext wall

Max V in Ext wall

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
44								
	1	0.000			-302.485			
		0.000	1212.243	-333.818				
		25.227	797.769	25019.123				
		25.227			-302.485			
45								
	1	0.000			-302.485			
		0.000	797.769	25019.123				
		25.227	383.294	39916.264				
		25.227			-302.485			
46								
	1	0.000			-302.485			
		0.000	383.294	39916.264				
		23.329	-0.001	44387.189	– Max for SIAE Positive Moment			
		25.227	-31.180	44357.603				
		25.227			-302.485			
47								
	1	0.000			-302.485			
		0.000	-31.180	44357.603				
		25.227	-445.654	38343.142				
		25.227			-302.485			
48								
	1	0.000			-302.485			
		0.000	-445.654	38343.142				
		25.227	-860.128	21872.880				
		25.227			-302.485			
49								
	1	0.000			-302.485			
		0.000	-860.128	21872.880				
		25.227	-1274.602	-5053.183				
		25.227			-302.485			
50								
	1	0.000			-302.485			
		0.000	-1274.602	-5053.183				
		25.227	-1689.076	-42435.046				
		25.227			-302.485			
51								
	1	0.000			-302.485			
		0.000	-1689.076	-42435.046				
		14.227	-1922.820	-68127.671	– Max for SIAE Negative Moment			
		25.227	|		-302.485			

\| — Max for SIAE Shear

FRAME ELEMENT FORCES

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	AXIAL MOMENT	1-3 PLANE FORCE	AXIAL SHEAR	MOMENT	TORQ
60								
1		0.000		-302.423				
		0.000	-1212.271	-334.931				
		13.227	-1429.585	-17806.400				
		25.227		-302.423				

OLD CROSS CUT CANAL PROJECT

MCDOWWEL ROAD TO THOMAS ROAD

PROJECT NO. 95-08

CONCRETE BOX CULVERT

FORMWORK REMOVAL CONCRETE STRENGTH ANALYSES

PREPARED FOR

AMES CONSTRUCTION

SEPTEMBER 23,1996

BATES ENGINEERING INC.

7333 West Jefferson Avenue, Suite 150
Lakewood, CO 80235-2017
(303) 980-1212
(303) 980-6300 FAX

Bates Engineering, Inc.
RECTANGULAR CONCRETE SECTION STRESS ANALYSIS
WORKING STRESS DESIGN
FILE = STRESS.WQ1

DATE:	20-Sep-96	TIME:	10:45:15 AM
CLIENT:	AMES CONSTRUCTION, INC. - 96.122		
PROJECT:	DOUBLE BOX CULVERT FORMWORK REMOVAL CONCRETE STRENGTH ANALYSI		
SECTION:	TOP SLAB STRESS ANALYSIS (MAX M- & V AT INT WALL)		

BEAM WIDTH =	12	inches	input	
BEAM DEPTH =	15	inches	input	
F'c =	500	psi	input	
Ec =	1.27E+06	psi		
Es =	29000000	psi	input	
BAR SIZE =	8		input	
NO. OF BARS =	2		input	
Ast =	1.58	in^2		
REINF. DIA. =	1.00	inches		
Moment =	5.770	kip-ft	input	(Max. from analysis)
n =	22.75			
CLR =	2.00	inches	input	

d =	12.5	inches
rho =	0.0105333	(As/area of concrete)
Rho*n =	0.2396646	
(Rho*n) ^ 2 =	0.0574391	
2*Rho*n =	0.4793293	
k =	0.4929802	(See Ferguson 2nd edition, page 126)
kd =	6.1622522	
j =	0.8356733	
jd =	10.445916	inches

fc =	179	psi	Allowable =	200	psi	0.4(F'c)
fs =	4195	psi	Allowable =	20000	psi	

SHEAR ANALYSIS

V =	2730	lbs/ft.	(max. from analysis)
Av =	150	in ^ 2	
v =	18.20	psi	
v allow. =	24.60	psi	

Bates Engineering, Inc.
RECTANGULAR CONCRETE SECTION STRESS ANALYSIS
WORKING STRESS DESIGN
FILE = STRESS.WQ1

DATE:	20-Sep-96	TIME:	09:53:07 AM
CLIENT:	AMES CONSTRUCTION, INC. - 96.122		
PROJECT:	DOUBLE BOX CULVERT FORMWORK REMOVAL CONCRETE STRENGTH ANALYSI		
SECTION:	TOP SLAB STRESS ANALYSIS (MAX M+ AT MIDSPAN)		

BEAM WIDTH =	12	inches	input	
BEAM DEPTH =	15	inches	input	
F'c =	400	psi	input	
Ec =	1.14E+06	psi		
Es =	29000000	psi	input	
BAR SIZE =	9		input	
NO. OF BARS =	1		input	
Ast =	1.00	in ^ 2		
REINF. DIA. =	1.13	inches		
Moment =	3.500	kip-ft	input	(Max. from analysis)
n =	25.44			
CLR =	1.00	inches	input	

Actual Conditions: # 5 @ # 8 @ 1'-0"
$A_s = 1.1\ in^2/ft$ ∴ OK

d =	13.436	inches			
rho =	0.0062022	(As/area of concrete)			
Rho*n =	0.1577764				
(Rho*n) ^ 2 =	0.0248934				
2*Rho*n =	0.3155527				
k =	0.4257012	(See Ferguson 2nd edition, page 126)			
kd =	5.7197216				
j =	0.8580996				
jd =	11.529426	inches			
fc =	106	psi	Allowable =	~~180~~ 160	psi
fs =	3643	psi	Allowable =	20000	psi

SHEAR ANALYSIS

V =	0	lbs/ft.	(max. from analysis)
Av =	161.232	in ^ 2	
v =	0.00	psi	
v allow. =	22.00	psi	

Bates Engineering, Inc.
RECTANGULAR CONCRETE SECTION STRESS ANALYSIS
WORKING STRESS DESIGN
FILE = STRESS.WQ1

DATE:	20-Sep-96	TIME:	10:42:47 AM
CLIENT:	AMES CONSTRUCTION, INC. - 96.122		
PROJECT:	DOUBLE BOX CULVERT FORMWORK REMOVAL CONCRETE STRENGTH ANALYSI		
SECTION:	BOTTOM SLAB STRESS ANALYSIS (MAX M- & V AT INT WALL)		

BEAM WIDTH =	12	inches	input	
BEAM DEPTH =	16	inches	input	
F'c =	700	psi	input	
Ec =	1.51E+06	psi		
Es =	29000000	psi	input	
BAR SIZE =	7		input	
NO. OF BARS =	2		input	
Ast =	1.20	in^2		
REINF. DIA. =	0.88	inches		
Moment =	7.900	kip-ft	input	(Max. from analysis)
n =	19.23			
CLR =	3.00	inches	input	

d =	12.5625	inches
rho =	0.0079602	(As/area of concrete)
Rho*n =	0.1530728	
(Rho*n) ^ 2 =	0.0234313	
2*Rho*n =	0.3061456	
k =	0.4210151	(See Ferguson 2nd edition, page 126)
kd =	5.2890019	
j =	0.8596616	
jd =	10.799499	inches

fc =	277	psi	Allowable =	280	psi	0.4(F'c)
fs =	7315	psi	Allowable =	20000	psi	

SHEAR ANALYSIS

V =	2730	lbs/ft.	(max. from analysis)
Av =	150.75	in ^ 2	
v =	18.11	psi	
v allow. =	29.10	psi	

Bates Engineering, Inc.
RECTANGULAR CONCRETE SECTION STRESS ANALYSIS
WORKING STRESS DESIGN
FILE = STRESS.WQ1

DATE:	20-Sep-96	TIME:	10:38:57 AM
CLIENT:	AMES CONSTRUCTION, INC. - 96.122		
PROJECT:	DOUBLE BOX CULVERT FORMWORK REMOVAL CONCRETE STRENGTH ANALYSI		
SECTION:	EXTERIOR WALL STRESS ANALYSIS (MAX M & V AT TOP SLAB)		

BEAM WIDTH =	12	inches	input	
BEAM DEPTH =	12	inches	input	
F'c =	500	psi	input	
Ec =	1.27E+06	psi		
Es =	29000000	psi	input	
BAR SIZE =	6		input	
NO. OF BARS =	2		input	
Ast =	0.88	in ^ 2		
REINF. DIA. =	0.75	inches		
Moment =	2.960	kip-ft	input	(Max. from analysis)
n =	22.75			
CLR =	1.00	inches	input	

d =	10.625	inches
rho =	0.006902	(As/area of concrete)
Rho*n =	0.1570401	
(Rho*n) ^ 2 =	0.0246616	
2*Rho*n =	0.3140802	
k =	0.4249752	(See Ferguson 2nd edition, page 126)
kd =	4.5153616	
j =	0.8583416	
jd =	9.1198795	inches

fc =	144	psi	Allowable =	200	psi	0.4(F'c)
fs =	4426	psi	Allowable =	20000	psi	

SHEAR ANALYSIS

V =	415	lbs/ft.	(max. from analysis)
Av =	127.5	in ^ 2	
v =	3.25	psi	
v allow. =	24.60	psi	

Bates Engineering, Inc.
RECTANGULAR CONCRETE SECTION STRESS ANALYSIS
WORKING STRESS DESIGN
FILE = STRESS.WQ1

DATE:	20-Sep-96	TIME:	01:38:13 PM
CLIENT:	AMES CONSTRUCTION, INC. - 96.122		
PROJECT:	DOUBLE BOX CULVERT FORMWORK REMOVAL CONCRETE STRENGTH ANALYSI		
SECTION:	BOTTOM SLAB STRESS ANALYSIS (MAX M- & V AT EXT WALL)		

BEAM WIDTH =	12	inches	input	
BEAM DEPTH =	16	inches	input	
F'c =	700	psi	input	
Ec =	1.51E+06	psi		
Es =	29000000	psi	input	
BAR SIZE =	5		input	
NO. OF BARS =	1		input	
Ast =	0.31	in ^ 2		
REINF. DIA. =	0.63	inches		
Moment =	3.000	kip-ft	input	(Max. from analysis)
n =	19.23			
CLR =	3.00	inches	input	

d =	12.6875	inches
rho =	0.0020361	(As/area of concrete)
Rho*n =	0.0391542	
(Rho*n) ^ 2 =	0.0015331	
2*Rho*n =	0.0783084	
k =	0.2434081	(See Ferguson 2nd edition, page 126)
kd =	3.0882407	
j =	0.918864	
jd =	11.658086	inches

fc =	167	psi	Allowable =	280	psi	0.4(F'c)
fs =	9961	psi	Allowable =	20000	psi	

SHEAR ANALYSIS

V =	NA	lbs/ft.	(max. from analysis)
Av =	152.25	in ^ 2	
v =	0.00	psi	
v allow. =	29.10	psi	

Project No. 96.122 Project Title: DCBC

Client: AMES CONST. Activity: Cracking MOMENT Analysis

Computations by: MH Date: 9/20/96 Sheet: ____ of ____

Bates Engineering Incorporated

Cracking Moment (due to removal of forms)

$F_r = 7.5\sqrt{f'_c} = 7.5\sqrt{700} = 198$ psi

$= 7.5\sqrt{1400} = 280$ psi

$M_{cr} = \frac{f_r I}{y_t} = \frac{198(3375)}{7.5''} = 7.4$ k-ft (TOP SLAB)

$= 10.5$ k-ft

$M_{cr①} = 8.4$ k-ft (Bottom SLAB)

$M_{u②} = 11.95$

$M_{u①} = 4.75$ (EXT WALL)

$M_{u②} = 6.7$ k-ft

$M_{(TS)} = 5.8$ k-ft $< M_u = 7.4$ k-ft

$M_{(BS)} = 7.9$ k-ft $< M_u = 8.4$ k-ft

$M_{(EW)} = 3$ k-ft $< M_{cr} = 4.7$ k k-ft

M_u (cracking moments are calculated based on AASHTO Provisions w/ a FS = 2.0 applied to F'_c.

Results indicate that the double box culvert will not crack under structure selfweight and 10 psf surface Live load

Project No. 96.122 Project Title: DCBC: f'_c analysis

Client: Ames Const. Activity: Development Length Calc's

Computations by: MH Date: 9/20/96 Sheet: ____ of ____

Bates Engineering Incorporated

Development Length for #6 Wall bars.

$$\frac{l_{dl}}{d_b} = \left(\frac{f_y \alpha \beta \lambda}{25\sqrt{f'_c}}\right) = \left[\frac{60{,}000(1)(1)(1)}{25\sqrt{700}}\right].75 = 68 \text{ in} = 5.7 \text{ ft} < 7'\text{-}6'' \text{ dev. length provided. } \therefore \text{ OK}$$

Project No. 96.122 Project Title: _____

Client: AMES CONST. Activity: _____

Computations by: MH Date: 9/20/96 Sheet: ____ of ____

Bates Engineering Incorporated

Relative Top SLAB DEFLECTION

Joint 39 $\Delta_y = -.0126$ in

Joint 43 $\Delta_y = -.0556$ in (stiff soil DCBC-4)

Joint 44 $\Delta_y = -.0531$ in

Relative Δ @ Midspan = 0.043 in.

Joint 39 $\Delta_y = -0.0758$

Joint 43 $\Delta_y = -0.1259$

Relative Δ = 0.05 in (@ midspan)

Project No. 96.122 Project Title: DCBC - f'c Analysis

Client: AMES CONST Activity: INPUT/OUTPUT HAND CHECK

Computations by: ML Date: 9/19/96 Sheet: ____ of ____

Bates Engineering Incorporated

Check SAP90 INPUT

LOAD => 10 psf (LL)

$$\frac{10\ psf}{144} = .07\ \frac{lb}{in^2}\ (12\ in\ wide) = .83\ lb/linear\ in$$

Spring DATA : $150/in^2/in$

$$150\ (support\ area) \Rightarrow \frac{150\ lb}{\frac{in^2}{in}}\ (2.1\ ft\ b/w\ nodes \times 12\ in \times 12'' wide)$$

$$= 45,360\ lb/in\ of\ deflection\ @\ each\ interior\ node$$

$$\frac{45360}{2}\ @\ edge\ nodes$$

Approximate check of Moment in top slab

$$M = \frac{wl^2}{8} = \frac{(15.4 - .83)(18 \times 12)^2}{8}$$

$$= 95,819\ lb\text{-}in$$

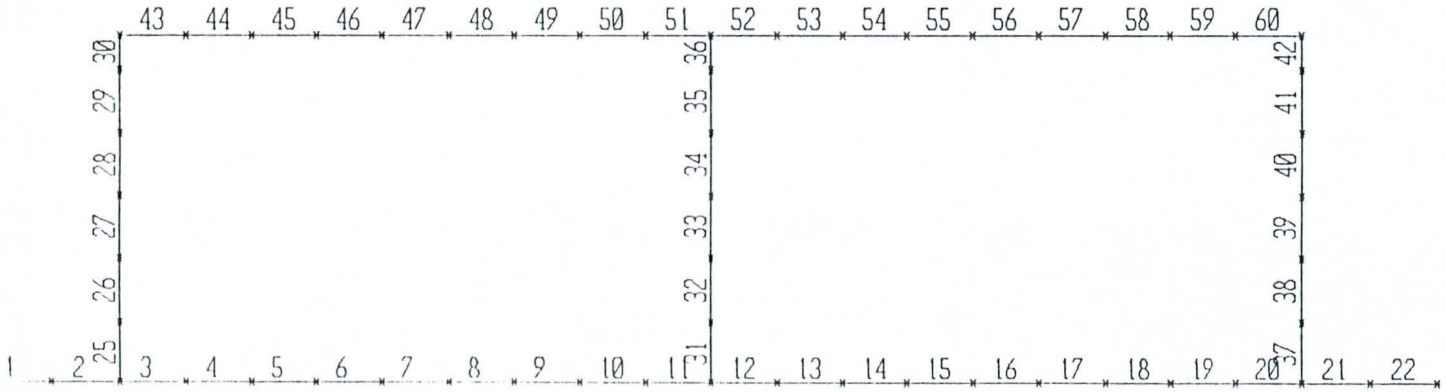
$$= 95,820\ lb\text{-}in$$

$$= 8\text{k-ft}$$

INDICATE USE "Major Errors" IN SAP90 INPUT => SAP90 M= 5.7 k-ft Support moment

```
MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)
BATES ENGINEERING, INC. - 96.119 - SEPT., 1996
MARK HEFFRON FILE: DCBC-4   (Soil 450pci)
SYSTEM
L=2
JOINTS
1     X=0.00  Y=0.00  S=12
3     X=4.33  Y=0.0   G=1,3,1
4     X=6.432 Y=0.0
21    X=42.17 Y=0.0   G=4,21,1
22    X=44.33 Y=0.0
23    X=46.5  Y=0.0
24    X=4.33  Y=2.03
28    X=4.33  Y=10.17 G=24,28,1
29    X=23.25 Y=2.03
33    X=23.25 Y=10.17 G=29,33,1
34    X=42.17 Y=2.03
38    X=42.17 Y=10.17 G=34,38,1
39    X=4.33  Y=11.29
57    X=42.17 Y=11.29 G=39,57,1

RESTRAINTS
1     R=1,0,1,1,1,0
2 57 1 R=0,0,1,1,1,0

SPRINGS
1     23    22     K=0,68040.0,0,0,0,0  :MOD = 450 PCI
2     22    1      K=0,136100.0,0,0,0,0 :MOD = 450 PCI

FRAME
NL=1 Y=-1,0 NM=6
1 A=192.0     I=4096.0      E=1.14E6      W=16.7   :BOTTOM SLAB
2 A=180.0     I=3375.0      E=1.14E6      W=15.6   :TOP SLAB
3 A=144.0     I=1728.0      E=1.14E6      W=12.5   :EXT SIDE WALLS
4 A=306.0     I=16581.0     E=1.14E6      W=19.5   :VARIABLE SECT
5 A=120.0     I=1000.0      E=1.14E6      W=10.4   :INT SIDE WALLS
6 A=444.0     I=50653.0     E=1.14E6      W=24.5   :VARIABLE SECT
1 WL=0,-0.83,0
1     1     2     M=1                          :BOTTOM SLAB
2     2     3     M=1    RE=0.6  RZ=0.5
3     3     4     M=1    RE=6.0  RZ=0.5
4     4     5     M=1    G=6,1,1,1
11    11    12    M=1    RE=0.5  RZ=0.5
12    12    13    M=1    RE=5.0  RZ=0.5
13    13    14    M=1    G=6,1,1,1
20    20    21    M=1    RE=0.6  RZ=0.5
21    21    22    M=1    RE=6.0  RZ=0.5
22    22    23    M=1                         :EXT WALL
25    3     24    M=3    RE=8.0  RZ=0.5
26    24    25    M=3    G=3,1,1,1
30    28    39    M=3,4,1 RE=0.7.5 RZ=0.5      :VARIABLE SECT
31    12    29    M=3    RE=8.0  RZ=0.5        :INT WALL
32    29    30    M=3    G=3,1,1,1
36    33    48    M=3,4,1 RE=0.7.5 RZ=0.5      :VARIABLE SECT
```

```
37    21    34    M=3    RE=8,0  RZ=0.5       :EXT WALL
38    34    35    M=3    G=3,1,1,1
42    38    57    M=3,4,1 RE=0,7.5 RZ=0.5      :VARIABLE SECT
43    39    40    M=2    RE=12,0  RZ=0.5 NSL=0,1 :TOP SLAB
44    40    41    M=2    G=6,1,1,1      NSL=0,1
51    47    48    M=2    RE=0,11  RZ=0.5 NSL=0,1
52    48    49    M=2    RE=11,0  RZ=0.5 NSL=0,1
53    49    50    M=2    G=6,1,1,1      NSL=0,1
60    56    57    M=2    RE=0,12  RZ=0.5 NSL=0,1

COMBO
1 C=1,1
```



X

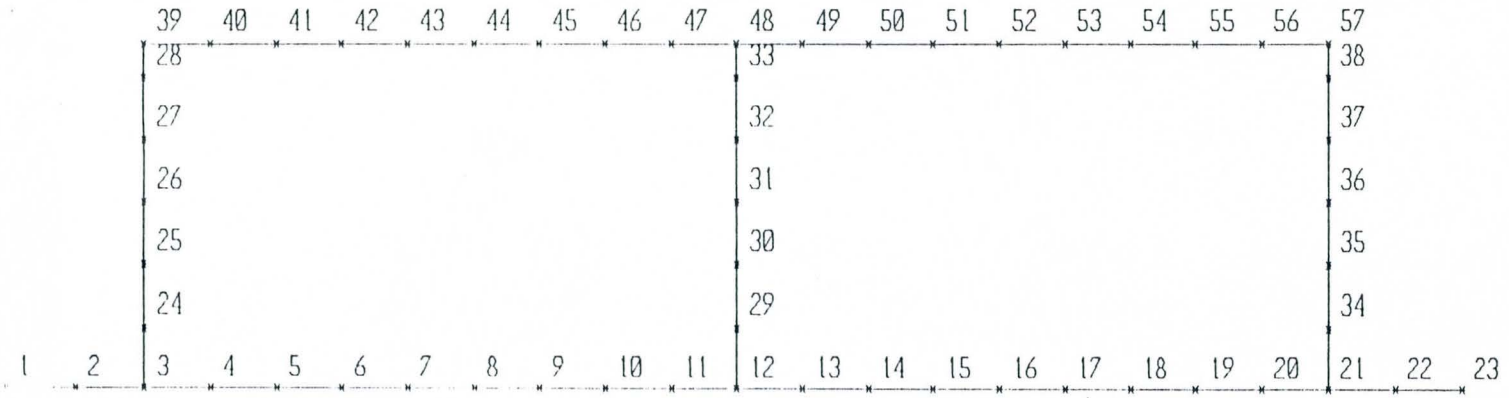
dcbc-4

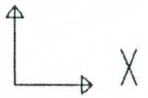
UNDEFORMED SHAPE

OPTIONS

ALL JOINTS
ELEMENT IDS
WIRE FRAME

SAP90





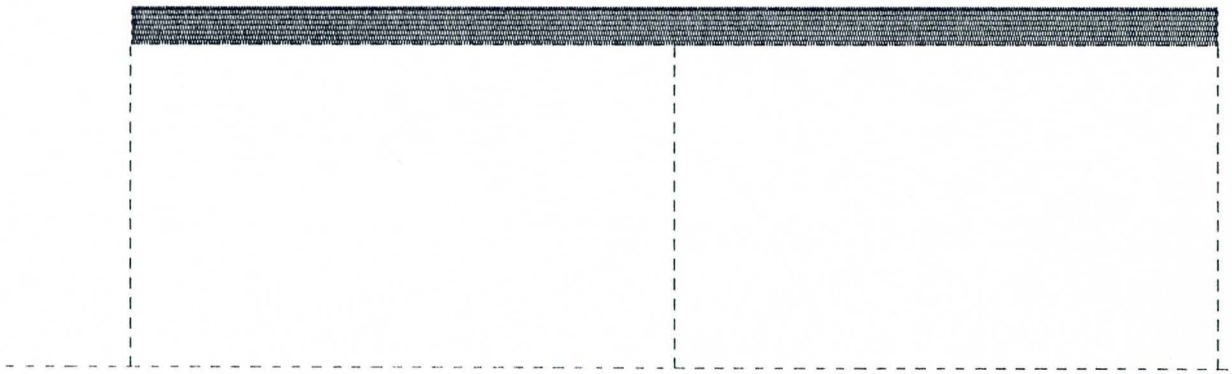
dcbc-4

UNDEFORMED SHAPE

OPTIONS

JOINT IDS
ALL JOINTS
WIRE FRAME

SAP90



Y

X

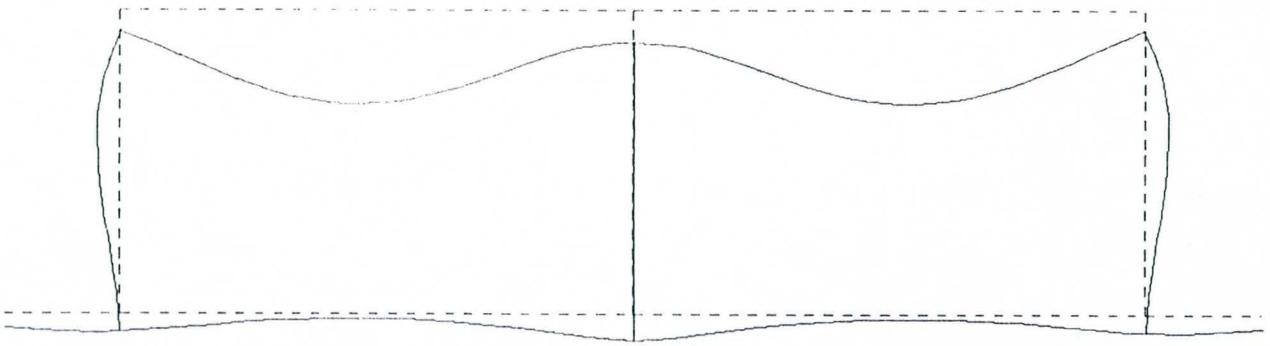
dcbc-4

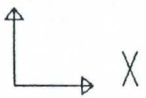
FRAME
LOADS

LOAD 2

MINIMA
w-0.8300E+00
P 0.0000E+00
MAXIMA
w-0.8300E+00
P 0.0000E+00

SAP90





DCBC-4

DEFORMED SHAPE

LOAD 1

MINIMA
X-0.1237E-01
Y-0.5558E-01
Z 0.0000E+00
MAXIMA
X 0.1324E-01
Y-0.2513E-02
Z 0.0000E+00

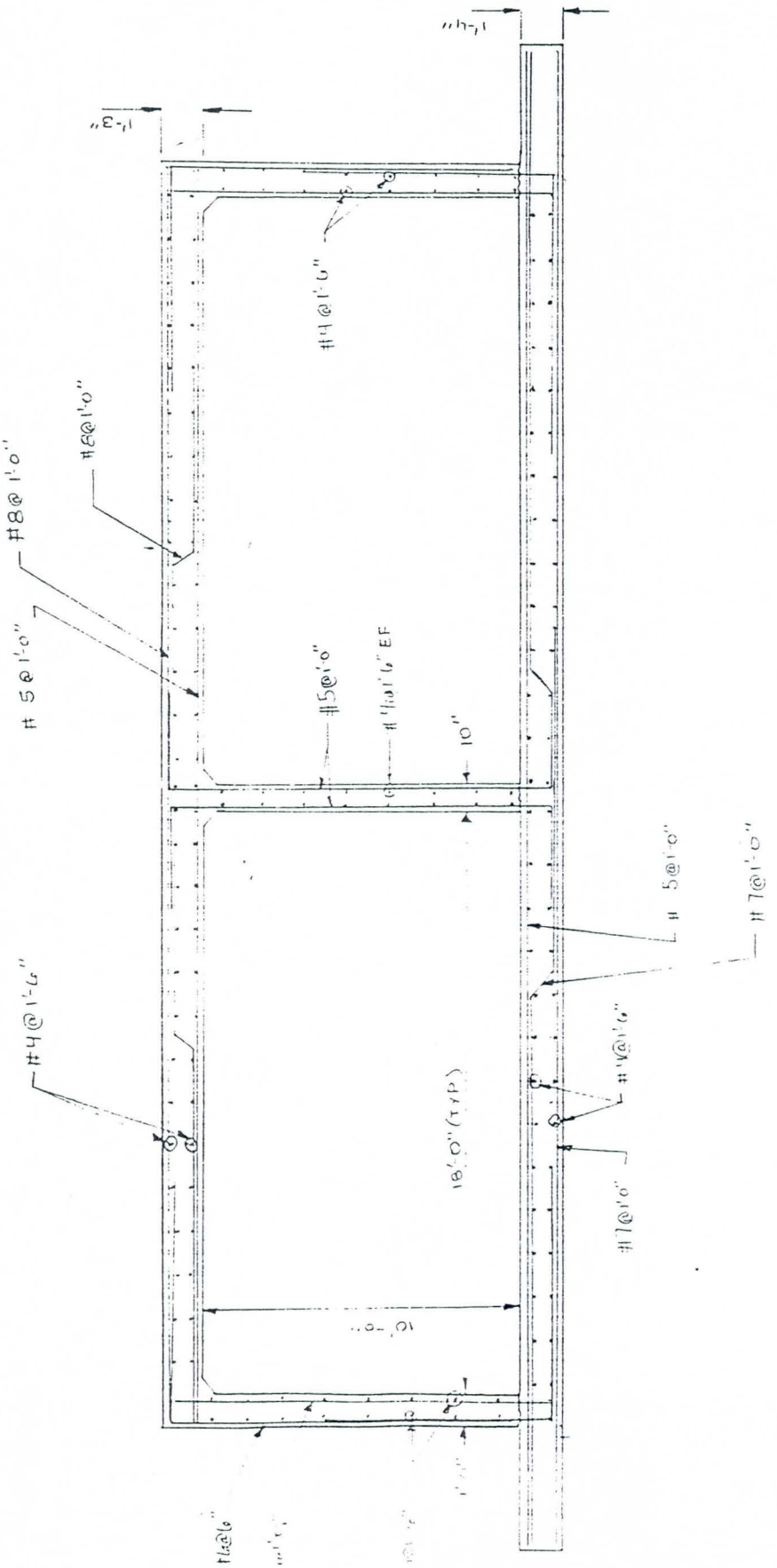
SAP90

Project No. 96.122 Project Title: DOUBLE BOX CULVERT

Client: AMES CONSTRUCTION Activity: Concrete Strength analysis

Computations by: MH Date: 9/19/96 Sheet: ____ of ____

Bates Engineering Incorporated



TYPICAL SECTION

LOADING: 10 psf pedestrian load

46	0.000400	-0.105543	0.000458
47	0.000362	-0.095357	0.000308
48	0.000325	-0.092008	0.000000
49	0.000288	-0.095359	-0.000308
50	0.000251	-0.105547	-0.000458

J O I N T D I S P L A C E M E N T S

LOAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

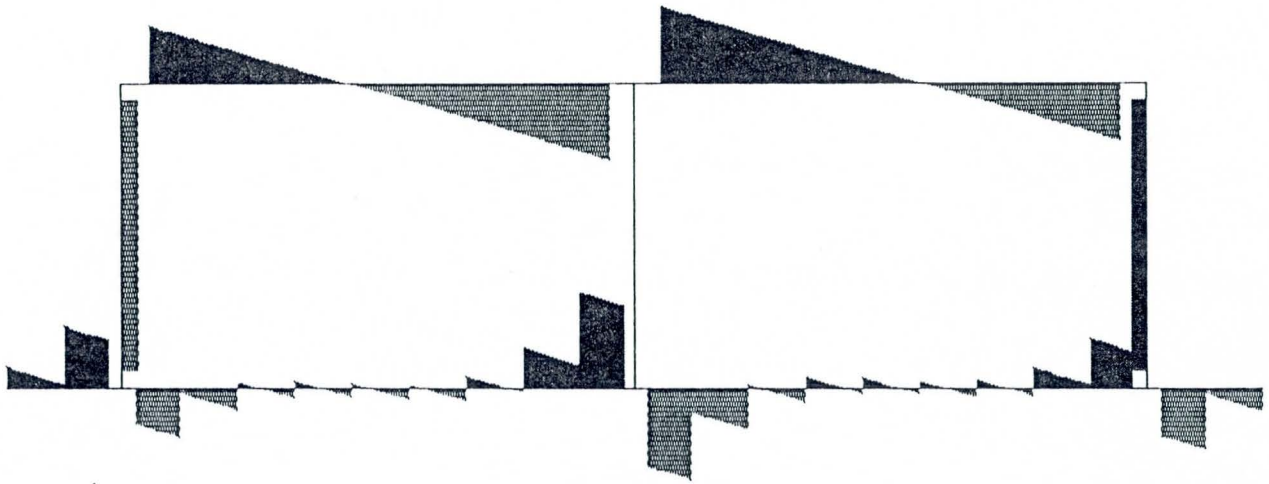
JOINT	U(X)	U(Y)	R(Z)
51	0.000214	-0.116715	-0.000398
52	0.000176	-0.124409	-0.000194
53	0.000139	-0.125905	0.000082
54	0.000102	-0.120207	0.000364
55	0.000065	-0.108052	0.000583
56	0.000028	-0.091902	0.000670
57	-0.000009	-0.075813	0.000605

MARICOPA COUNTY FLOOD CONTROL (DOUBLE BOX CULVERT)

JOINT DISPLACEMENTS

LOAD COMBINATION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	U(Y)	R(Z)
1	0.000000	-0.083782	0.000139
2	0.000000	-0.079853	0.000174
3	0.000000	-0.073778	0.000299
4	0.000035	-0.065036	0.000380
5	0.000070	-0.055975	0.000318
6	0.000105	-0.049828	0.000158
7	0.000139	-0.048377	-0.000047
8	0.000174	-0.052217	-0.000254
9	0.000209	-0.060835	-0.000417
10	0.000244	-0.072407	-0.000477
11	0.000279	-0.083372	-0.000354
12	0.000314	-0.087927	0.000000
13	0.000349	-0.083373	0.000354
14	0.000383	-0.072407	0.000477
15	0.000418	-0.060833	0.000417
16	0.000453	-0.052213	0.000254
17	0.000488	-0.048371	0.000047
18	0.000523	-0.049822	-0.000158
19	0.000558	-0.055969	-0.000318
20	0.000593	-0.065034	-0.000380
21	0.000627	-0.073785	-0.000300
22	0.000627	-0.079864	-0.000175
23	0.000627	-0.083821	-0.000139
24	-0.007461	-0.074255	0.000305
25	-0.014158	-0.074688	0.000228
26	-0.017852	-0.075075	0.000059
27	-0.016309	-0.075418	-0.000201
28	-0.007290	-0.075714	-0.000553
29	0.000315	-0.088787	0.000000
30	0.000317	-0.089603	0.000000
31	0.000320	-0.090375	0.000000
32	0.000323	-0.091101	0.000000
33	0.000324	-0.091781	0.000000
34	0.008098	-0.074263	-0.000305
35	0.014800	-0.074695	-0.000228
36	0.018499	-0.075083	-0.000059
37	0.016957	-0.075425	0.000201
38	0.007940	-0.075722	0.000553
39	0.000660	-0.075806	-0.000605
40	0.000623	-0.091895	-0.000670
41	0.000585	-0.108045	-0.000583
42	0.000548	-0.120201	-0.000364
43	0.000511	-0.125898	-0.000082
44	0.000474	-0.124403	0.000194
45	0.000437	-0.116710	0.000398



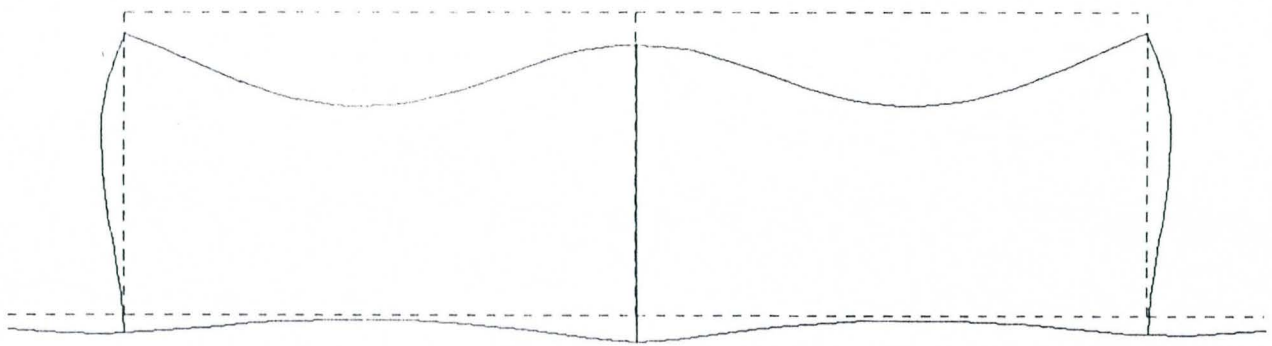
Y
X

DCBC-4

FRAME
OUTPUT V22
LOAD 1

MIN < 12>
-0.2355E+04
AT 25.23
MAX < 11>
0.2355E+04
AT 0.00

SAP90



Y
X

DCBC-4

DEFORMED
SHAPE

LOAD 1

MINIMA
X-0.1237E-01
Y-0.5558E-01
Z 0.0000E+00
MAXIMA
X 0.1324E-01
Y-0.2513E-02
Z 0.0000E+00

SAP90

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut Canal PAGE 1 OF ____

DETAIL Reinf Steel COMPUTED KVH DATE 10/97

Phase IV 10x10' Double BOX CHECKED BY GHS DATE 10/97

Savings

Bar dd1: #6 @12"

Diff: (23'-7") - (19'-7") = 4'

1.502 x 4 = 6.0 → 6.0

Bar ff1: #6 @12"

Diff: (23-8) - (20'-8") = 2'

1.502 x 2 = 3.0

Bar hh1: #5 @6"

Diff: (4'-3") - (0'-9") = 3.5'

No of Bars per ft = 2

Diff: (1.043 x 3.5 x 2) 2 = 14.6

Both Sides

Bar dd2: #6 @12"

Diff: (23-11) - (19'-11") = 4'-0

(1.502 x 4) = 6.0

Bar ff2: #7 @12"

Diff = (23'-2") - (20'-8") = 2.5'

(2.044 x 2.5) = 5.1

34.7 lbs

Say 34 lbs

This Number was wrong.

Revised Steel = (435 - 34) = 401 lbs

Savings: $\frac{34}{435} \approx 8\%$

Actual Savings: $\frac{(480-445)}{480} \approx 7\%$

$\frac{478.5 - 443.6}{478.5} = 7.3\%$

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Crosscut Canal PAGE 2 OF ____

DETAIL Reinf. Steel COMPUTED KNH DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY GHS DATE 10/97

Double Barrel (10'x10')

Bar ff1: #6 @12", L = 20'-8"
(1.502 x 20.67) = 31.0 lbs/ft

Bar dd1: #6 @12", L = 19'-7"
1.502 x 19.58 = 29.4

Bar ee1: #5 @12", L = 22.67
(1.043 x 22.67) = 23.6

Bar hh1: #5 @6" L = 10'-9"
(1.043 x 10.75 x 2) 2 = 44.9
2 Corners & Top
No. of Bars per ft

Bar hh2: #6 @6", L = 10'-9
(1.502 x 10.75 x 2) 2 = ~~65.6~~ 64.6

Bar ff2: #7 @12", L = 20'-8
(2.044 x 20.67) = 42.2

Bar dd2: #6 @12", L = 19'-11"
(1.502 x 19.92) = 29.9

aa Bars: #5 @6", L = 12'-3
(1.043 x 12.25 x 2) 2 = 51.1
Nos per ft — 2 Sides

bb Bars: #5 @12" L = 15'-3
(1.043 x 15.25 x 2) = 31.8
2 Sides

Bar ee2: #5 @12", L = 23'-2"
(1.043 x 23.17) = 24.2

Longitudinal Bars
#4 Bars - Walls: (42 x 1) 0.668 lbs/ft = 28.1
#4 Bars - Slabs: (64 x 1) 0.668 = 42.8
70.9

373.7
70.9
~~444.6~~
443.6

6910-163 4-90

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut Canal PAGE 3 OF ____

DETAIL Reinf. Steel COMPUTED KvH DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY GHS DATE 10/97

Original Qty of Double - 10'x10'

			lbs/ft
Bar-ff1: #6 @12" L = 22'-8			
(1.502 x 22.67)	=		34.1
Bar-dd1: #6 @12" L = 23'-7			
(1.502 x 23.58)	=		35.4
Bar ee1: #5 @12" L = 22.67			
1.043 x 22.67	=		23.6
			93.1
Bar ff2: #7 @12", L = 23.17			
2.044 x 23.17	=		47.4
Bar dd2: #6 @12, L = 23.92			
1.502 x 23.92	=		35.9
Bar ee2: #5 @12" L = 23.17			
1.043 x 23.17	=		24.2
			107.5
Bar hh1: #5 @6" L = 14'-3"			
(1.043 x 14.25 x 2) 2	=		59.5
Nr of Bars / ft — Both sides			
Bar hh2: #6 @6 L = 10'-9			
(1.502 x 10.75 x 2) 2	=		64.6
Bar aa: #5 @6" L = 12'-3			
(1.043 x 12.25 x 2) 2	=		51.1
Bar BB: #5 @12 L = 15-3			
(1.043 x 15.25) 2	=		31.8
			207.0
Longitudinal Steel:			
CC Bars: 42 #4, L = 1.0			
(0.668 x 42 x 1)	=		28.1
64 Bars: 64 #4			
(0.668 x 64 x 1)	=		42.8
			70.9
Total	=		478.5

use 480 lbs

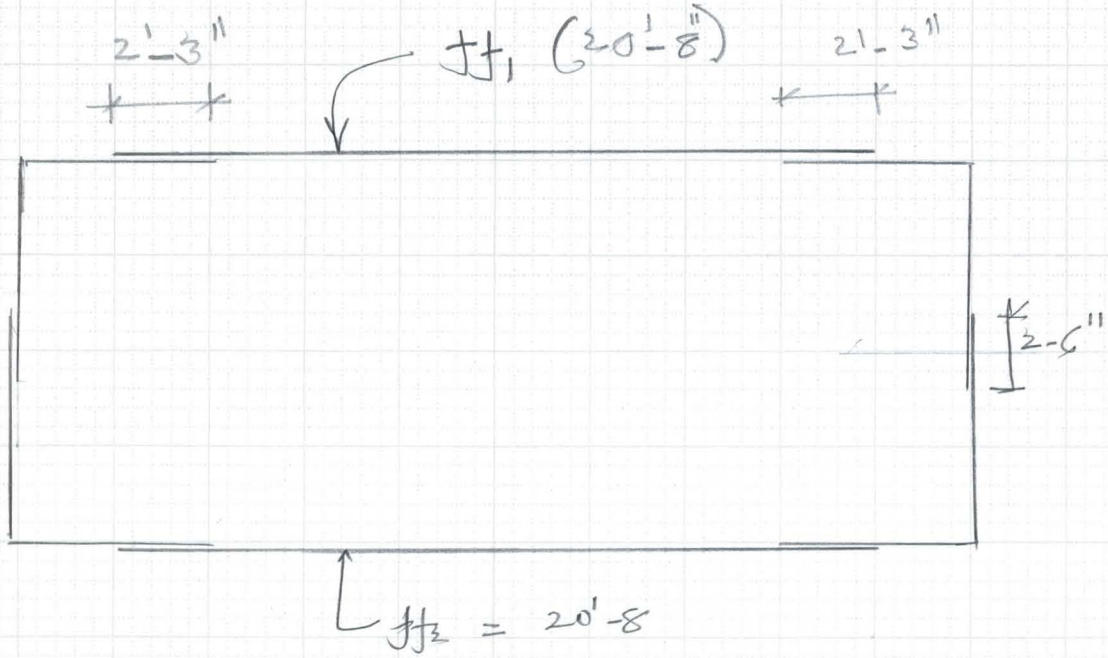
~~480~~
479

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grossel Canal PAGE 4 OF ____

DETAIL Reinf Steel COMPUTED KNH DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY GHS DATE 10/97

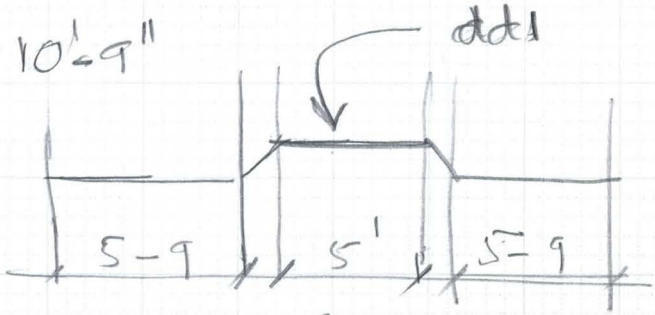


22 -8
2
20 - 8

3'-3

~~7'-3~~ ~~7'-6~~ ok

Length (h_1) = 10'-9"



el_1 → Same as before

el_2 → Same as before

Actual L = (23-7) - 4 = 19-7 ✓

10 — 18
5 — 0
18.4
18.4
55"

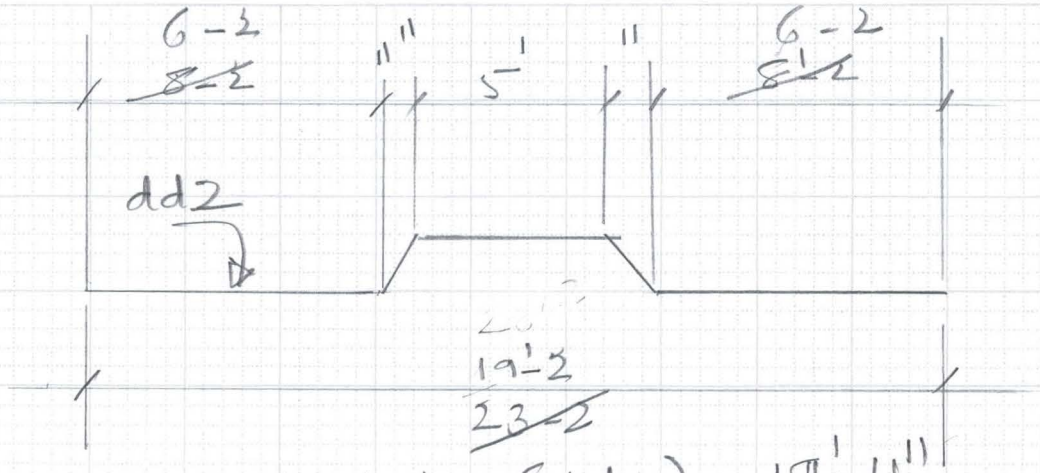
4 - 7
19-7 ✓

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut Canal PAGE 5 OF ____

DETAIL Reinf. Steel COMPUTED KVH DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY CHS DATE 10/97

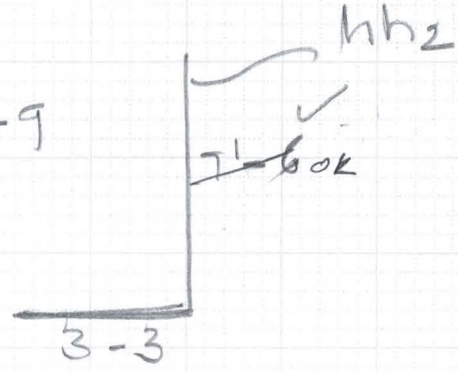


Actual L (dd2) = 19'-11"

18-4
1-10
5
18-14
1-2
19-2

12-4
5-0
15.5
15.5
35
24-11
19-11

Lamp 5 (hh2) = 10'-9



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT 64th Street Outlet Channel PAGE 1 OF ____

DETAIL Reinf Steel COMPUTED KVH DATE 10/97

Phase IV 10x10' Double Box CHECKED BY GHS DATE 10/97

Savings

Bar dd1: #6 @ 12"

Diff: (23'-7") - (19'-7") = 4'

1.502 x 4 = 6.0 — 6.0 ✓

Bar ff1: #6 @ 12"

Diff: (23-8) - (20'-8") = 2'

1.502 x 2 = 3.0 ✓

Bar hh1: #5 @ 6"

Diff: (44'-3") - (40'-9") = 3.5'

No. of Bars per ft = 2

Diff: (1.043 x 3.5 x 2) 2 = 14.6

Both Sides

Bar dd2: #6 @ 12"

Diff: (23-11) - (19'-11") = 4'-0"

(1.502 x 4) = 6.0 ✓

Bar ff2: #7 @ 12"

Diff = (23'-2") - (20'-8") = 2.5'

(2.044 x 2.5) = 5.1 ✓

34.7 lbs say 34 lbs

35

This Number was wrong.

Revised Steel = (435 - 34) = 401 lbs

Savings: (34 / 435) ≈ 8%

Actual Savings (480 - 445) / 480 ≈ 7%

478.5 - 443.6 / 478.5 = 7.3%

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut Canal PAGE 2 OF ____

DETAIL Reinf. Steel COMPUTED KNH DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY GHS DATE 10/97

Double Barrel (10'x10')

Bar ff1: #6 @ 12", L = 20'-8" lbs/ft

(1.502 x 20.67) = 31.0 ✓

Bar dd1: #6 @ 12", L = 19'-7"

1.502 x 19.58 = 29.4 ✓

Bar ee1: #5 @ 12", L = 23.67

(1.043 x 22.67) = 23.6 ✓

Bar hh1: #5 @ 6", L = 10'-9"

(1.043 x 10.75 x 4) 2 = 44.9 ✓

(4 = 2 Corners Top No. of Bars for ft; 2 = 2 Sides)

Bar hh2: #6 @ 6", L = 10'-9"

(1.502 x 10.75 x 2) 2 = ~~65.6~~ 64.6 ✓

Bar ff2: #7 @ 12", L = 20'-8"

(2.044 x 20.67) = 42.2 ✓

Bar dd2: #6 @ 12", L = 19'-11"

(1.502 x 19.92) = 29.9 ✓

aa Bars: #5 @ 6", L = 12'-3"

(1.043 x 12.25 x 4) 2 = 51.1 ✓

(4 = No. of bars for ft; 2 = 2 Sides)

bb Bars: #5 @ 12", L = 15'-3"

(1.043 x 15.25 x 2) = 31.8 ✓

(2 = 2 Sides)

Bar ee2: #5 @ 12", L = 23'-2"

(1.043 x 23.17) = 24.2 ✓

Longitudinal Bars

#4 Bars - Walls: (42 x 1) 0.668 lbs/ft = 28.1 ✓

#4 Bars - Slabs: (64 x 1) 0.668 = 42.8 ✓

70.9 ✓

~~343.7~~ 333.7

370.9 ✓

~~444.6~~ 443.6

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Crosscut Canal PAGE 3 OF ____

DETAIL Reinf. Steel COMPUTED KVH DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY GHS DATE 10/97

Original Qty of Double - 10'x10'

		lbs/ft
Bar #1: # 6 @ 12" L = 22'-8"		
(1.502 x 22.67)	=	34.1
Bar Add: # 6 @ 12" L = 23'-7"		
(1.502 x 23.58)	=	35.4
Bar ee1: # 5 @ 12" L = 22.67		
1.043 x 22.67	=	23.6
		93.1
Bar #2: # 7 @ 12" L = 23.17		
2.044 x 23.17	=	47.4
Bar dd2: # 6 @ 12" L = 23.92		
1.502 x 23.92	=	35.9
Bar ee2: # 5 @ 12" L = 23.17		
1.043 x 23.17	=	24.2
		107.5
Bar hh1: # 5 @ 6" L = 14'-3"		
(1.043 x 14.25 x 2) 2	=	59.5
No of Bars 4 — Both Sides		
Bar hh2: # 6 @ 6" L = 10'-9"		
(1.502 x 10.75 x 2) 2	=	64.6
Bar aa: # 5 @ 6" L = 12'-3"		
(1.043 x 12.25 x 2) 2	=	51.1
Bar BB: # 5 @ 12" L = 15'-3"		
(1.043 x 15.25) 2	=	31.8
		207.0

Longitudinal Steel:

EC Bar 2: 42 # 4 L = 1.0		
(0.668 x 42 x 1)	=	28.1
gf Bar 2: 64 # 4		
(0.668 x 64 x 1)	=	42.8
		70.9

Total = 478.5

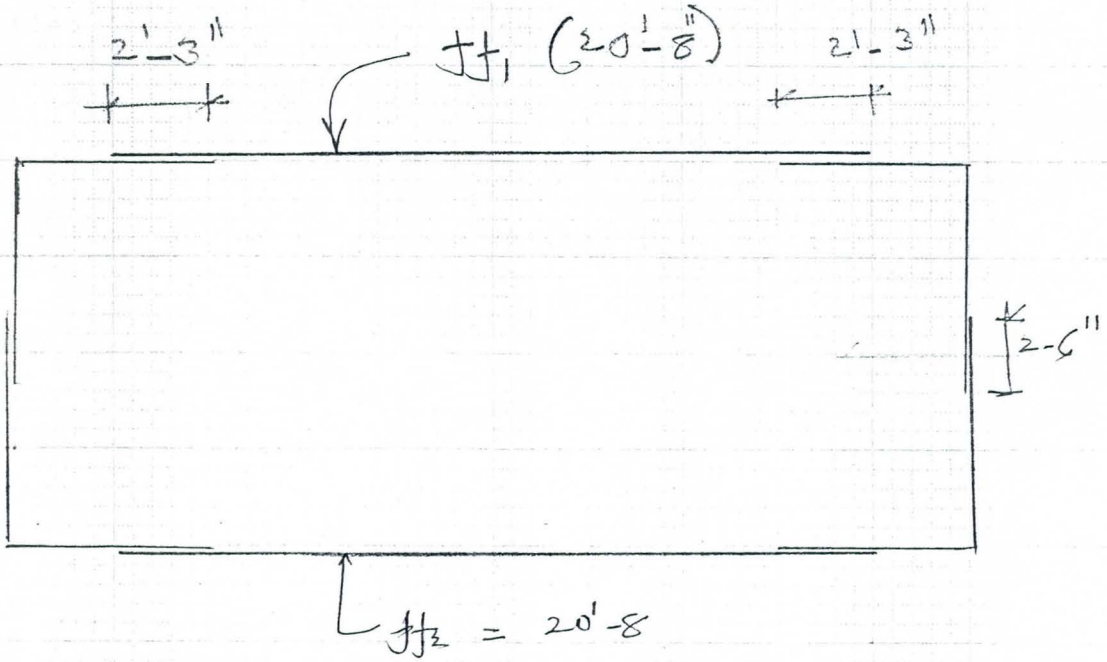
was 480 1b

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Grossman Canal PAGE 4 OF ____

DETAIL Reinf Steel COMPUTED KNH DATE 10/97

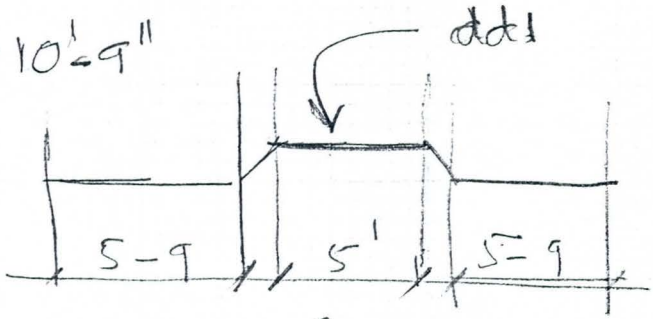
Phase IV 10'x10' Double Box CHECKED BY GHS DATE 10/97



22 - 8
2
20 - 8

3'-3

~~7'-3~~
~~7'-6~~
Length (hh1) = 10'-9"



ee_1 → Same as before

ee_2 → Same as before

Actual L = (23-7) - 4 = 19-7

10 — 18
15 — 0
18.4
18.4
55"

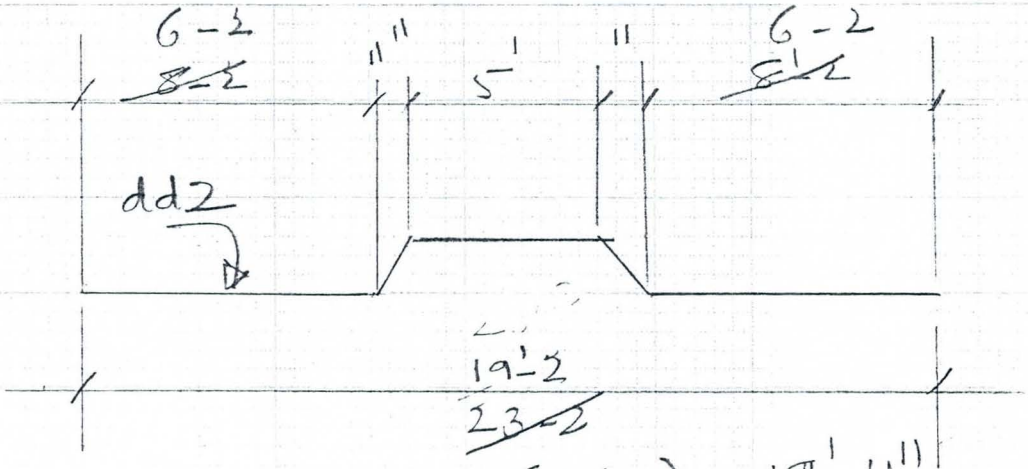
4 - 7
19-7

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Old Cross Cut Canal PAGE 5 OF ____

DETAIL Reinf. Steel COMPUTED Kvtt DATE 10/97

Phase IV 10'x10' Double Box CHECKED BY ____ DATE ____



Actual L (dd2) = 19'-11"

15-4
1-10
5
18-14
1-2
19-2

12-4
5-0
15.5
15.5
35
2-11
19-11

Long15 (hh2) = 10'-9