IRONWOOD DRIVE BRIDGE

MERIDIAN ROAD BRIDGE

Calcs and
Bid Schedules

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Ironwood Drive Bridge PAGE 1 OF 23

DETAIL Index to Design & Design Check Calcs COMPUTED _____ DATE _____

CHECKED BY NPK DATE 8-86

New Single Span R.C. Bridge, with 32'-0 Clr Rdwy & 2 Swks. Sk 38°58' Rt

	Deck	Abutment
f'_c =	5000 psi	3000 psi
f_c =	2.000	1200
f_y =	60,000	40,000
f_s =	24,000	20,000
n =	7	9

Allow soil Pressure on Cemented S&G = 3.5 TSF

DESIGN CALCS	Pages
Deck Slab	2 – 8
Abutment	9 – 15

DESIGN CHECK CALCS	
Deck Slab	16 – 20
Abutment	21 – 23

S=24.5

$M_{LL+I} = \frac{M_{TABLE}}{2E} \times (1+I)$

$E = 4 + .06S \quad max = 7.0'$

$= 4 + .06(24.5)$

$= 5.5$

$I = \frac{50}{S+125} \quad max = 0.3$

$= \frac{50}{24.5+125} = 0.33 \Rightarrow$ use 0.3 ✓

$M_{TABLE} = \frac{207.4 - 192.7}{25-24} = \frac{207.4 - M_{TABLE}}{25-24.5}$

$M_{TABLE} = 200.05 = 200.1$ k-ft

$\frac{M_{TABLE}}{2} = \frac{200.1}{2} = 100.0$

$\frac{M_{TABLE}}{2E} = \frac{200.1}{2(5.5)} = 18.2$ k-lb ✓

$LLM \cong 900S$ ft lb

$= \frac{900(24.5)}{1000}$

$= 22.1$ k-lb

$M_{LL+I} = \frac{M_{TABLE}}{2E} \times (1+I)$

$= 18.2(1.3)$

$= 23.7$ k-ft ✓

say $d = 11.5" \Rightarrow t = 13" \Rightarrow$ thickness $= 13.5"$

$w = (\text{thickness} \times 150) + 25$

$= \left(\frac{13.5}{12} \times 150\right) + 25$

$= 193.75$ #/ft² per ft width

$= .194$ k/ft

$M_{DL} = \frac{wS^2}{8} = \frac{.194(24.5)^2}{8} = 14.6$ k-ft ✓

$M_{DESIGN} = M_{DL} + M_{LL+I}$

$= 14.6 + 23.7$

$= 38.3$ K-ft 38.7

CHECK:

$d = \sqrt{\frac{M_{DESIGN}}{K}}$ $K = .323$

$= \sqrt{\frac{38.3}{.323}}$

$= 10.9" < 11.5"$ ok

$t = 12\sqrt[3]{\frac{12 \times 104.1 \times 5 \times M_{LL+I}}{4030.509 \times 144}}$

$= 12\sqrt[3]{\frac{12 \times 104.1 \times 24.5 \times 23.7}{4030.509 \times 144}}$

$= 12.9" < 13"$ ok

$\therefore$ use $d = 11.5"$

$A_s = \frac{M_{DESIGN}}{f_s jd}$

$= \frac{38.3 \text{ K-ft}}{24^{ksi}(.877)(11.5"/12^{in/ft})}$

$= 1.90 \text{ in}^2$ 1.54

$\therefore$ use ~~#9 @ 6"~~ ~~# 8 @ 5"~~ spacing $\Rightarrow A_s = $ ~~1.90~~ 2.00 in^2

Distr $A_s = \frac{1.90}{\sqrt{24.5}} = .38 \text{ in}^2$ #5 @ 9 = .41

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

LL+I Deflection

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 4 OF

using entire width with no allowed load reductions for 2 lanes:

$$I_e = \left(\frac{M_{cr}}{M_a}\right)^3 I_g + \left[1-\left(\frac{M_{cr}}{M_a}\right)^3\right] I_{cr} \leq I_g$$

width, b = 46'10" = 46.8'

$M_{cr} = f_r I_g / y_t$

$f_r = 7.5\sqrt{f'_c}$ $f'_c = 5000$ psi $y_t = d/2 = 13/2 = 6.5$ in

$= 7.5\sqrt{5000}$

$= 530$ psi $= .53$ ksi

Revised to 13.5

$$I_g = \frac{bt^3}{12} = \frac{(46.8^{ft} \times 12^{in/ft})(13^{in})^3}{12} = 102820 \text{ in}^4$$

$$M_{cr} = .53^{ksi}\left(\frac{102820 \text{ in}^4}{6.5 \text{ in}}\right) = 8384 \text{ K-in} = 699 \text{ k-ft}$$

$$I_{cr} = \left[\frac{1}{3}b(kd)^3 + nA_s(d-kd)^2\right]b$$

from previous calcs

$= 1005 \text{ in}^4/\text{ft}\ (46.8 \text{ ft})$

$= 47034 \text{ in}^4$

$M_a = M_{DESIGN} \times b$

$= 38.3^{k\text{-ft}} \times 46.8 \text{ ft}$

$= 1792$ k-ft

$$I_e = \left(\frac{699}{1792}\right)^3 102820 + \left[1-\left(\frac{699}{1792}\right)^3\right] 47034 \stackrel{?}{\leq} 102820$$

$= 6102 + 44243$

$= 50345 \text{ in}^4$

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br — COMPUTATION AND DATA SHEET

DETAIL Deck Slab LL+I Deflection — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 5 OF

Using $I_e = 50345\ in^4$ over entire width with no load reductions ($b = 46'10"$)

$$\Delta_t = \frac{CPs^3}{EI_e}$$

$$P = (3.78^{K} \times 2) \overset{\#\text{ of lanes}}{2} \times 5.5 = 83.16^{K}$$

$$= \frac{.0233(83.16)(24.5^{ft} \times 12^{in/ft})^3}{(4030.509\ ksi)(50345\ in^4)}$$

$= .243 < .294$ ok

$$\Delta_{Allow} = \frac{s}{1000} = \frac{24.5}{1000}$$

$= .0245^{ft}$

$= .294\ in$

$$\Delta max = \frac{5ws^4}{384EI} = \frac{L^2}{9.6EIe} M$$

$$M = (M_{LL} \times 2) \overset{\#\text{ of lanes}}{2} \times 5.5$$

$(23.7 \times 2) 2 \times 5.5$

$= 521.4^{k\text{-}ft}$

$$= \frac{(24.5^{ft} \times 12^{in/ft})^2 (521.4^{k\text{-}ft} \times 12^{in/ft})}{9.6(4030.509)(50345\ in^4)}$$

$= .278 < .294$ ok ✓

See Sh # 18 for DL Deflections

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Bridge — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

COMPUTED TAD DATE 7/28/8 CHECKED BY NPK DATE 8-86 PAGE 6 OF

$M_s = A_s f_s j d$

$= 1.90 \text{ in}^2 (24 \text{ ksi})(.8783)(11.5 \text{ in})(\text{ft}/12 \text{ in})$

$= 38.4 \text{ k-ft}$

$\frac{1}{2} A_s = \frac{1}{2}(1.90)$

$= .95 \text{ in}^2$

$p = \frac{A_s}{bd} = \frac{0.95 \text{ in}^2}{(12 \text{ in})(11.5 \text{ in})} = 0.007$

$pn = .007(7) = .049 \Rightarrow k = .2679 \; j = .9107$

$M_s = 0.95(24)(.9107)(11.5)(1/2)$

$= 19.9 \text{ k-ft}$ ✓

$\frac{1}{20} s = \frac{1}{20}(24.5) = 1.2 \text{ ft} = 14.7 \text{ in}$

15 bar diam $= 15(\#8) = 15(1.0) = 15 \text{ in}$ $* = 1.25$

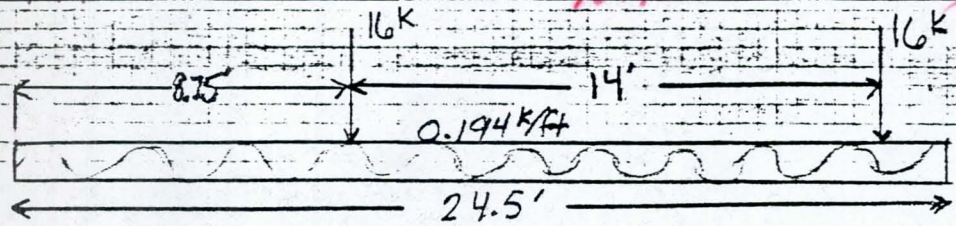
$d = 11.5 \text{ in}$

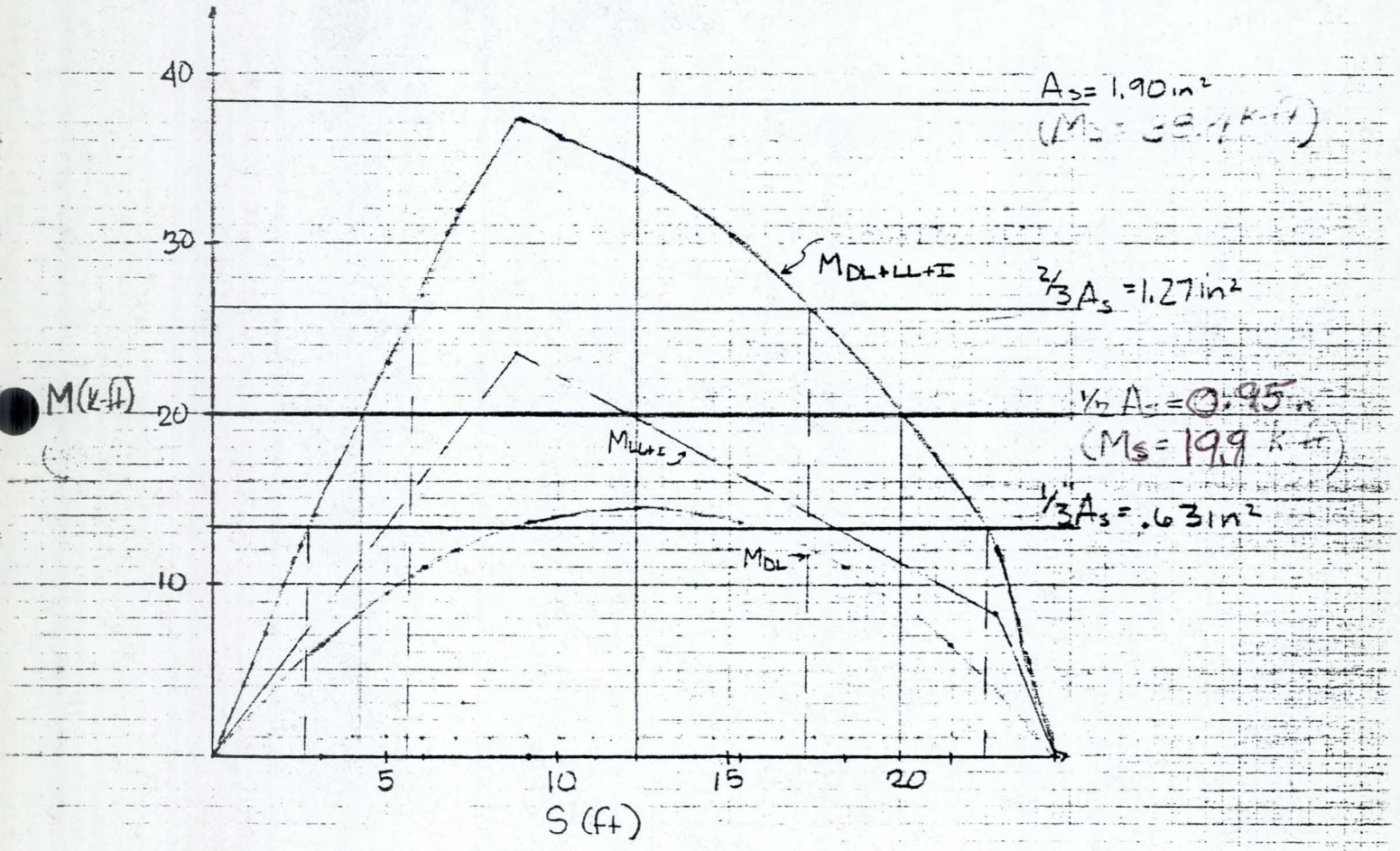
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br. — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 7 OF





± 20 (clear span)

Distance from ℄ for A_s = 12.25 ft

Distance from ℄ for ⅔ A_s = 7 ft + 1.2' = 8.2' ⇒ 8.5 ft

Distance from ℄ for ⅓ A_s = 10.25 + 1.2' = 11.45' ⇒ 11.5 ft

~~Distance from ℄ for ½ A_s = 7.9 ft + 1.25 ft = 9.15 ft ⇒ 9.5 ft~~

USED 10'-9"

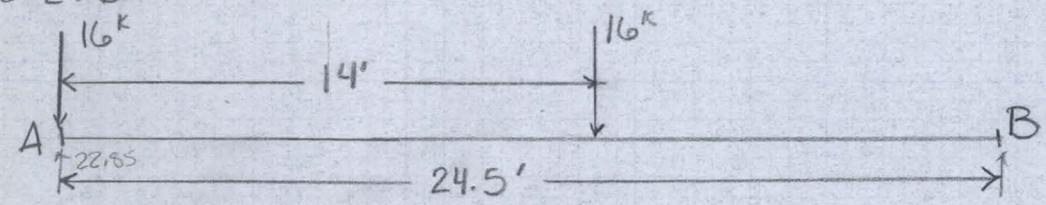
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT IRONWOOD Dr. Br — COMPUTATION AND DATA SHEET

DETAIL Deck Reactions — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-26 — PAGE 8 OF

S=24.5



Live Load @ end A

V_{TABLE}: $\frac{46.1-45.3}{25-24} = \frac{46.1-V_{TABLE}}{25-24.5}$

$V_{TABLE} = 45.7^k$

$I = \frac{50}{L+125}$ $L = 14'$ max = 0.3

$= \frac{50}{14+125} = 0.36$ ∴ use 0.3 ✓

$E = 4 + 0.06S$

$= 4 + 0.06(24.5)$

$= 5.5$ ✓

$V_{LL+I} = \frac{V_{TABLE}}{2E} \times (1+I)$

$= \frac{45.7}{2(5.5)} \times (1.3)$

$= 5.4^k$ per ft of width ✓

Dead Load @ end A

d = 11.5" ⇒ thickness = 13.5"

w = (thickness x 150 #/cuft) + 25 #/sqft

$= \left(\frac{13.5}{12} \times 150\right) + 25$

$= 193.75$ #/ft² per ft width

$= 0.194$ K/ft

$V_{DL} = \frac{0.194(24.5)}{2} = 2.38^k$ per ft width

CHECK ✓

$0.95\sqrt{f'_c} \geq V_{DESIGN}/d \times 12$

$0.95\sqrt{5000} \geq \frac{7.78 \times 1000}{11.5 \times 12}$

$67.2 \geq 56.4$ ok

$V_{DESIGN} = 5.4 + 2.38 = 7.78^k$ per ft width

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. - Bulldog Floodway — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE 6/4/86 CHECKED BY NPK DATE 8-86 PAGE 9 OF

Select Material

Assume ½ way between SW & GW

Using 0.95 Proctor ⇒ 0.54 relative density

$\phi = 36°$ $\gamma_0 = 123$ } fig 7

$k_o = 1 - \sin\phi$

$= 0.4122$

$\gamma k_o = 50.7$

Top of Deck Elev = 52.09

Bottom of Footing Elev = 39.84

12.25 Say 12.0 ft − 2.0 ft footing = 10.0 ft stem

$P = \gamma k_o \frac{H^2}{2} = \frac{0.0507}{2} H^2 = 0.0254 H^2$

$M = \frac{PH}{3} = 0.0254 H^2 \frac{H}{3} = 0.00845 H^3$

Stem: H	H^2	H^3	P	M
2	4	8	0.1016	0.0676
5	25	125	0.635	1.056
7	49	343	1.245	2.898
10	100	1000	2.54	8.45

thickness → span

$R_{DL} = \left[\left(\frac{13.5}{12} \times 150\right) + 25\right] \frac{1}{1000} \times \frac{24.5}{2} = 2.37^k$

APPROACH SLAB $= 1.0 \times .150 \times 10/2 = 0.75^k$

$R_{LL} = 5.4/1.3 = \frac{4.15^k}{7.27 \cos 7.40°} = 7.21$ ~~38.9° 5.65k~~

assume d = 12 in

10 ft stem: $1.0 \times .15 \times 10 =$ 1.5

8.71

7.2

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br. — COMPUTATION AND DATA SHEET

DETAIL Abutment Stem Wall — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-83 — PAGE 10 OF

$e = 0.6 + 0.03h$
$= 0.6 + 0.03(12)$
$= 0.96$ in
$= 0.08$ ft

$M = 0.08 \times 8.71$ (eR)
$= 0.70$

$f'_c = 3000 \quad n = 9 \quad f_s = 20000 \quad f_c = 1200$

$M = 8.45 + .70 = 9.15$ (δ)
$\times 1.13 = 10.3$ -

$d^2 = \frac{M}{Kb}$

$= \frac{10.3}{0.186 \times 1} = 55.4$

$1.2 M_{CR} = 1.2 \times 1.41 \times 1.0 \times \frac{12^2}{6} = 11.8$ k-ft

$\text{Min } A_s = \frac{11.8 \times 12}{60 \times .9 \times 9.15} = .28$

$d = 7.4$
2.5
9.9
1.9
11.8
Use 12 in $\Rightarrow d = 9.5$

$\frac{\text{direct load}}{f_A \times b} = \frac{8.71}{(.389)(12)} = 1.9$

$A_s = \frac{M}{f_s j d}$
$= \frac{10.3 \times 12}{(20)(.883)(9.5)}$
$= 0.74$ -

$k = \frac{1}{1 + \frac{20}{9 \times 1.2}} = 0.351$

$j = 1 - \frac{.351}{3} = 0.883$

$K = \frac{1.2}{2} \times .351 \times .883$
$= 0.186$

Use bars @ 6" ctr
#5 & #6 $\Rightarrow A_s = 0.75$ -

$p_n = \frac{0.75(9)}{12(9.15)} = 0.059$

$k = 0.2894$
$j = 0.9036$

$f_s = \frac{10.3 \times 12}{0.75(.9036)(9.5)} = 19.2$

Bending $f_B = \frac{19.2}{9} \times \frac{.2894}{.7106} = .87$

direct load $f_A = \frac{8.71}{12 \times 12} = 0.06$

$\frac{.73}{.87} + \frac{.15}{.06} = \frac{.06}{.389} = 0.88$ ok.

3000(.4)

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br. — COMPUTATION AND DATA SHEET

DETAIL Abutment Stem Wall — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 11 OF

$$EI = \frac{\frac{E_c I_g}{2.5}}{1+\beta_d}$$

$$= \frac{\frac{3122(1728)}{2.5}}{1+1}$$

$$= 1078963$$

$$E_c = 57000\sqrt{f'_c}$$

$$= 57000\sqrt{3000}$$

$$= 3122019 \text{ psi}$$

$$= 3122 \text{ ksi}$$

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

$$= 1728$$

$$\beta_d = 1$$

$$P_c = \frac{\pi^2 EI}{(K_u l)^2}$$

$$= \frac{\pi^2(1078963)}{(2\times10\times12)^2} = 184.9$$

$$P_c = f_a \times F.S. \times A \Rightarrow f_a = \frac{P_c}{F.S. \times A} = \frac{184.9}{2.5\times(1.32\times12\times12)} = 0.389$$

$$\frac{1+(n-1).041bd}{1+8(.04)bd}$$

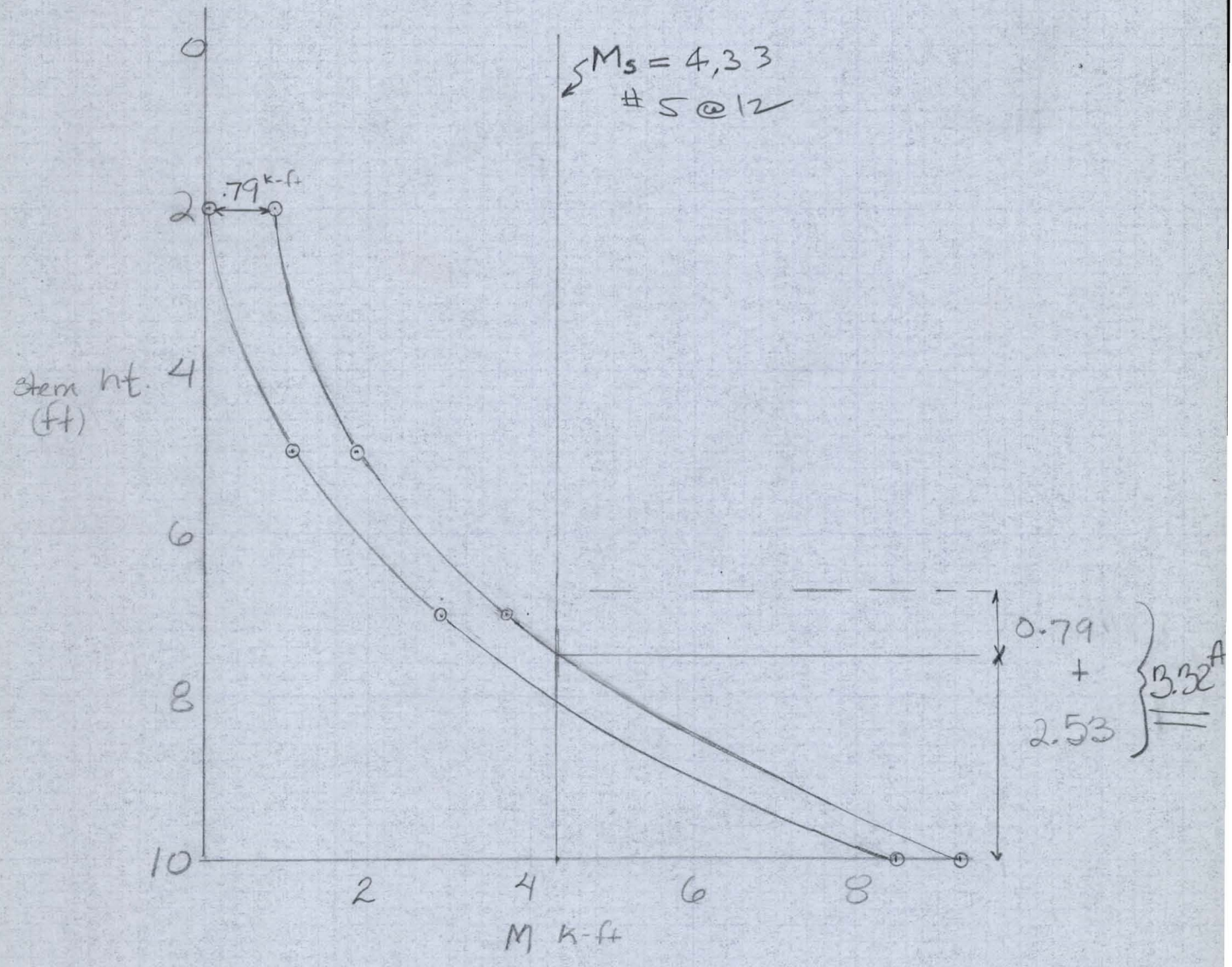
$$\delta = \frac{C_m}{1-\frac{2.5P}{\phi P_c}} = \frac{1}{1-\frac{2.5(8.71)}{(1)(184.9)}} = 1.13$$

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br — COMPUTATION AND DATA SHEET

DETAIL Abutment Stem Wall — FILE NO.

COMPUTED TAD DATE 8/4/86 CHECKED BY NPK DATE 8-86 PAGE 12 OF



Light bar: #5 @12" ctr $\Rightarrow A_s = 0.31\ in^2$

#5 @12 $M_s = A_s f_s j d = \frac{0.31\ in^2}{12}(20\ ksi)(.883)(9.5\ in) = 4.33\ k\text{-}ft$

Offset = $O_{ET} + M_{min}$ (due to eccentricity) $+ M_{magnet.}$

$= 0 + (0.7)(1.13) = 0.79\ k\text{-}ft$

$\frac{\ell}{20} = \frac{10}{20} = 0.5\ ft$ 15 bar diam $= 15(45) = 15(.625) = .78\ ft$

$d = 9.5\ in \approx .79\ ft$

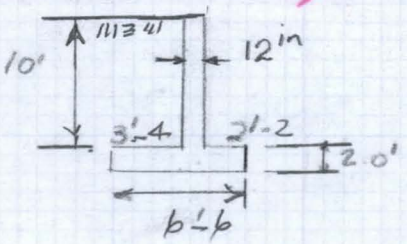
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br. — COMPUTATION AND DATA SHEET

DETAIL Abutment (Will use Shear Key) — FILE NO.

COMPUTED TAD DATE 8/5/86 CHECKED BY NPK DATE 8-86 PAGE 13 OF

Wingwall: stability



		P_v		ΣM_{toe}
stem	$1.0' \times 10.0' \times .15 =$	1.5 K	$\times$ 2.67 =	4.0
Ftg	$6.5 \times 2.0 \times .15 =$	2.0	$\times$ 3.25 =	6.5 K-ft
Fill	$3.33 \times 10' \times .12 =$	4.0	$\times$ 4.83 =	19.3
		7.5		29.8

$\gamma k_a \frac{h^2}{2} = P_H = .0254 \times 12^2 = 3.66 \times \frac{12}{3} = \frac{14.63}{15.2}$ $\quad a = \frac{15.2}{7.5} = 2.03$

Overturn F.S. $= \frac{29.8}{14.63} = 2.03$

Sliding F.S $= \frac{7.5 \times .67}{3.66} = 1.28$ Will use shear key. See next sheet

Soil P $= \frac{7.5 \times 2}{3 \times 2.03} = 2.46$ K/ft² max

.24 (2' fill x .12 on top of toe)

2.7 K/ft² for wingwall

2.0 / 4.7 K/FT for Abutment OK.

Deck Lds, $e = 3.50 - 2.17 - .5 = .83'$

Soil P $= \frac{5.6}{6.5}\left[1 \pm \frac{6 \times 0.83}{6.5}\right] = 2.0$ KSF Max

$= 0.3$ Min

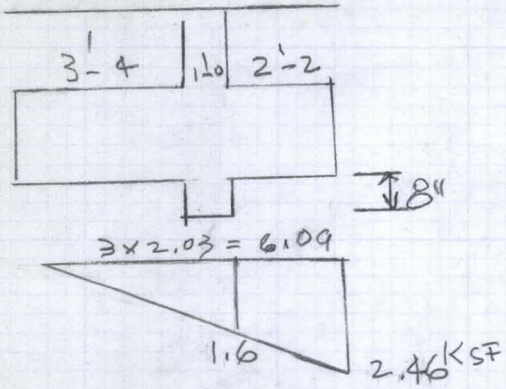
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr Br — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED IAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 14 OF

SHEAR KEY



Wingwall Soil press.

$p = 1.6$ KSF

$K_p = 3.0$

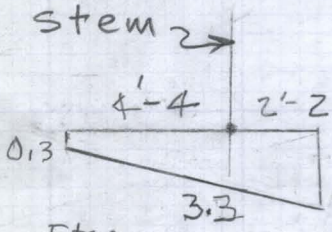
Resist. offered by key = $1.6 \times 3.0 \times .67 = 3.2$ K/FT (p, K_p, h)

Total Resist $= (7.5 \times .67) + 3.2 = 8.2$ K/FT (5.0)

Sliding FS $= \frac{8.2}{3.66} = 2.24$ for Wingwall

will be considerably higher for Abut.

TOE



$1.2 M_{CR} = 1.2 \times .410 \times 1 \times \frac{24^2}{6} = 47.5$ K-Ft

Ftg

$(3.3 - 0.3) \times 2.17 = \frac{V}{6.5} \times 1.08 = \frac{M}{7.0}$

$1.4 \sim \frac{2.17}{2} = \frac{1.5}{8.0\,K} \times \frac{2.17}{3} = \frac{1.1}{8.1}$ K-ft

$d^2 = \frac{8.1}{.186 \times 1} = 43.5 \Rightarrow d = 6.6"$

$d = \frac{8.1 \times 1000}{\sqrt{3000} \times .9 \times 12} = 13.7$ in

Used 2' footing $d = 24 - 3.5 = 20.5$"

$A_s = \frac{8.1 \times 12}{(20 \times .383)(20.5)} = .27\,in^2 \times 1.33 = .35$

$\Sigma_o = \frac{8.0}{.3 \times .9 \times 20.5} = 1.45$ in

Used # 6 @ 12 from stem & # 5 @ 12 Str

A_s	Σ_o
.44	2.4
.31	2.0
.75	4.4

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Ironwood Dr. Br. — COMPUTATION AND DATA SHEET

DETAIL Wingwall — FILE NO.

COMPUTED TAD DATE 8/5/86 CHECKED BY NPK DATE 8-86 PAGE 15 OF

Wingwall
Heel

1. Top steel

10' fill = 10 x .12 = 1.2 K/ft

	V		M
ftg = 2.0x.15 =	.3	K x 3.33 =	5.0 K x 1.67 = 8.3 K-ft
	1.5		

$d^2 = \frac{M}{Kb} = \frac{8.3}{.186(1.0)} = 44.8 \Rightarrow d = 6.7$ in

$1.2 M_{CR} = 47.5$ K-FT

$d = \frac{V}{\sqrt{f'_c}\, jb} = \frac{5.0}{\frac{\sqrt{3000}}{1000} \times .9 \times 12} = 8.5$ in

$A_s = \frac{M}{f_s j d} = \frac{8.3 \text{ K-ft} \times 12 \text{ in/ft}}{(20)(.883)(20.5)} = 0.27 \text{ in}^2$

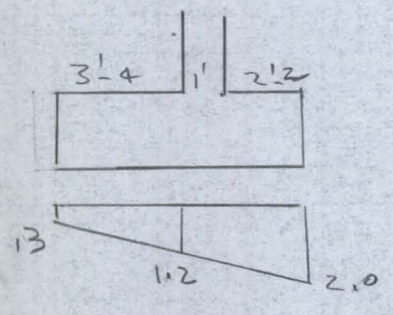
$\times 1.33 = .36$

$\ell_o = \frac{V}{.06 f'_c \times j \times d} = \frac{5.0}{.06(3) \times .9 \times 20.5} = 1.50$ in

top of ftg

Used #6 @ 12 $A_s = .44$, $\ell_o = 2.4$

2. Bot. steel



Assume No EP THRUST
Deck Ld & Stem 7.2 K e = .83'

Soil $P = \frac{7.2}{6.5}\left[1 \pm \frac{6 \times .83}{6.5}\right] = 2.0$ KSF Max, 0.3 Min

	V		M
0.3 x 3.33 =	1.0	x 1.67 =	1.7 K-Ft
0.9 x 3.33/2 =	1.5/2.5	x 1.11 =	1.7/3.4

$A_s = \frac{3.4 \times 12}{20 \times .88 \times 20.5} = .11 \text{ in}^2$

$\times 1.33 = .15 \text{ in}^2$

Used #5 @ 12 in bot of Heel $A_s = .31$

PROJECT Ironwood Dr
SHEET 16 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86

Ironwood Rd Bridge

Span = 24.5 FT

Slab thickness = t = 13.5", main steel use #9 φ = 1.128", Slab clearance 1.5"

effective depth = $d = 13.5 - 1.5 - 1.128/2 = 11.44$

1) Dead load per foot of Width:

a) due to concrete $\left(\frac{13.5}{12}\right)$ FT x 1 Ft x .15 $\frac{K}{FT^3}$ = .169 K/FT

b) due to asphalt $\left(\frac{2}{12}\right)$ FT x 1 FT x .15 $\frac{K}{FT^3}$ = .025 K/FT

c) Moment due to dead Load = $(.169 + .025) \times (24.5)^2/8 = 14.5$ K-FT
.194 K/FT

2) Live load per foot of Width:

a) AASHTO (3.24.3.2)

$E = 4 + .06 \times 24.5 = 5.47 < 7 \Rightarrow$ OK//

ONE LANE LOAD (HS 20-44) = 200.05 K-F Maximun moment

Impact $I = 50/(24.5 + 125) = .33 > .3$ use 30%

ONE LANE LOAD (HS 20-44) = 45.7 Kips Maximum Shear

Assuming a maximum of 2 wheels per lane

Maximum moment per foot + Impact = $\frac{200.05 \times 1.3}{2 \times 5.47}$ = 23.77 K-FT

Maximum Shear per foot + Impact = $\frac{45.7 \times 1.3}{2 \times 5.47}$ = 5.43 K

3) Slab Design using $f'_c = 5000$, $fc = 2000$, $fs = 24000$ $E_c = 4030509 \frac{lb}{IN^2}$

Assuming As = #9 @6 = 2 IN^2 $M_{Design} = 14.5 + 23.77 = 38.33$

$n = 7$, $b = 12$, $d = 11.44$, $np = \frac{7 \times 2}{12 \times 11.44} = .102$

$k = \sqrt{2np + (np)^2} - np = .361$ $j = 1 - \frac{k}{3} = .879$

$fs = \frac{M}{As\,Jd} = \frac{38.33 \times 12000}{2 \times .879 \times 11.44} = 22868 < 24000 \Rightarrow$ OK//

$fc = \frac{fs\,k}{n(1-k)} = \frac{22868 \times .361}{7(1 - .361)} = 1845.6 < 2000 \Rightarrow$ OK//

$As_{MIN} = \frac{1.5\sqrt{fc'}\,bt^2}{Jd\,fy} = \frac{1.5 \times \sqrt{5000} \times 12 \times (13.5)^2}{.879 \times 11.44 \times 60000} = .38\ IN^2 < 2\ IN^2$

$\Rightarrow$ OK//

See Sh #4 for LL+I Deflections.

PROJECT Ironwood Dr
SHEET 17 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86

Distribution Reinforcement

a) for main Reinforcemet porallel to traffic

$$\% = 100/\sqrt{S} = 100/\sqrt{24.5} = 20.2\% \text{ of Steel Required}$$

$$A_{s\,req} = \frac{M_s}{f_s J d} = \frac{38.33 \times 12000}{24000 \times .879 \times 11.44} = 1.9\ in^2$$

A_s for distribution $= .202 \times 1.9 = .38\ in^2$

#5 @ 9 => .41 >> .38 => OK// ✓

Shear & Bond

Per AASHTO (3.24.4) Slabs designed for bending Moment in accordance with 3.24.3 shall be considered Satisfactory in bond & Shear. ✓

Computation for deflections

for slab $n=7$, $t = 13.5" = 1.125'$, $b = 1'$, $k = .361$

$kd = .361 \times (\frac{11.44}{12}) = .344$ FT, $d = \frac{11.44}{12} = .953'$, $j = .879$, , $A_s = 2in^2 = .0138\ FT^2$

$$I_{cr}|_{FT} = b(kd)^3/3 + nA_s(d-kd)^2$$

$$= 1(.344)^3/3 + 7 \times .0138(.953 - .344)^2 = .049\ FT^4$$

$$I_g/_t = bt^3/12$$

$$= 1(1.125)^3/12 = .1186\ FT^4$$

$$y_T = t/2$$

$$= 1.125/2 = .5625\ FT$$

$$fr = 7.5\sqrt{f'c}$$

$$= 7.5\sqrt{5000} = 530\ \frac{Lb}{IN^2} = 76.36\ \frac{K}{FT^2}$$

$$M_{cr/FT} = fr\, I_{g/FT}/y_T = 76.36 \times .1186 \div .5625 = 16.10\ K\text{-FT}$$ ✓

Used 14.84 K-Ft

See next sheet

See Sh #4 for LL+I Deflections

PROJECT Ironwood Rd
SHEET 13 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8.86

7) Computation of Deflections

$n=7$, $t=13\text{ IN}=1.083\text{ FT}$

$k=.3599$, $J=.880$, $d=11"=.9167\text{ FT}$ $b=1\text{ FT}$, $A_S=1.9\text{ in}^2=.013\text{ FT}^2$

$$I_{CR/F}=\frac{1(kd)^3}{3}+nA_s(d-kd)^2 \qquad kd=.3599\times.9167=.3299$$

$$=1\times(.3299)^3/3+7\times.013\times(.9167-.3299)^2=.04330\text{ FT}^4$$

$$I_{g/F}=\frac{bt^3}{12}=1(1.083)^3/12=.1058\text{ FT}^4$$

$$y_T=t/2=1.083/2=.5415\text{ FT}$$

$$f_r=7.5\sqrt{f'c}=7.5\sqrt{5000}=530\frac{lb}{IN^2}=76.32\frac{K}{FT^2}$$

$$M_{CR/F}=\frac{f_rI_g}{y_T}=\frac{76.32\times.106}{.5415}=14.84\text{ K-FT/F}$$

7-1) Immediate deflection due to dead load

$$M_a=M_{DL}=14.1\text{ K-FT/F}$$

$$\left(\frac{Ma}{MCR}\right)^3_{/F}=\left(\frac{14.1}{14.84}\right)^3=(.9498)^3=.857$$

$$\boxed{I_e=\left(\frac{Ma}{Mcr}\right)^3I_g+\left(1-\left(\frac{Ma}{Mcr}\right)^3\right)I_{CR}\leq I_g}$$

$$I_{e/F}=.8568\cdot.1058+(1-.8568).0433=$$

$$I_{e/F}=.0906+.14316\times.0433=$$

$$I_{e/F}=.0906+.006199=.0967<.1058\text{ OK}$$

$$I_{e/F}=.0967\text{ FT}^4$$

$E_c = 580393\ K/FT^2$

$$\delta_{\text{¢}} = \frac{5 W_{eq} S^4}{384 E I_{eq}} = \frac{W_{eq} S^2}{8} \times \frac{5S^2}{48 E I_{eq}} = \frac{M_{eq} \times 5S^2}{48 E I_{eq}} = \delta_{\text{¢}}$$

$$\delta_{\text{¢ Inmediate}} = \frac{14.1 \times 5 \times (24.5)^2}{48 \times 580393 \times .0967} = .0157\ FT = .188'' \approx 3/16$$

7-2) Additional long term deflexion factor ADF

$$ADF = \left[2 - 1.2\left(\frac{A'_s}{A_s}\right)\right] \geq .6$$ AASHTO (8.13.4)

PROJECT Ironwood Dr
SHEET 19 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86

If $A'_s \geq .1 A_s$ $\quad \frac{A'_s}{A_s} = .1$

$$ADF = 2 - 1.2 \times .1 = 1.88$$

$.0157 + .0157 \times 1.88 = .0452'$

$$\delta_{\text{¢ long term}} = .188'' + .188'' \times 1.88 = .541'' \approx 9/16$$ ✓

7-3 Deflected Shape $\quad \delta_x = 5 W_e S^4 / 384 EI$

$$W_e = \delta \times 384 EI / 5S^4 = \frac{.0452\ FT \times 384 \times 580393 \times .0967}{5 \times (24.5)^4}$$

$W_e = .5407\ K/FT$

$$\delta(x) = \frac{W_e x}{24 EI}\left(S^3 - 2Sx^2 + x^3\right) = \frac{.5407\ x}{24 \times 58893 \times .0967}\left(24.5^3 - 2 \times 24.5\, x^2 + x^3\right)$$

$$\delta(x) = 4.014 \times 10^{-7}\, x\left(14706 - 49x^2 + x^3\right)$$

$$\delta(12.25) = 4.014 \times 10^{-7} \times 12.25\left(14706 - 49(12.25)^2 + (12.25)^3\right) = .045' = .54''$$

IRONWOOD DRIVE BRIDGE

PROJECT Ironwood Dr
SHEET 20 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86

Development length of bars of the deck

$A_{s\,req} = 1.96$

$A_s = \#9 @ 6 \quad A_s = 2.0\ in^2$

$A_b = 1 in^2$

$D_b = 1.128$

$$Ld = MAX(.04 A_b f_y / \sqrt{f'_c}\ ,\ .0004 d_b f_y\ ,\ 12")$$

$$Ld = MAX\left(\frac{.04 \times 1 \times 60000}{\sqrt{5000}}\ ,\ .0004 \times 1.128 \times 60000\ ,\ 12\right)$$

$Ld = MAX(34", 27", 12") = 34 in \times 1.2 = 40.8 in$ ← Avg $(1 + 1.4)$

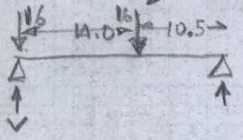
$$Ld \le \frac{M}{V} + La \Rightarrow La \ge Ld - \frac{M}{V}$$

$M = A_s(\text{at the section}) \times f_s \times J \times d$ (at point where only half of the steel is needed)

$$M = .5 \times 2.0 \times 24000 \times .88 \times \frac{11.4}{12{,}000} = 20.06\ K\text{-}FT$$

$N = 7 \quad b = 12 \quad d = 11 \Rightarrow J = .88$

$$V = .194 \times \frac{24.5}{2} + \frac{16 \times 1.3}{5.47}\left[1 + \frac{10.5}{24.5}\right] = 7.81\ K$$



$$La \ge 40.8 - \frac{20.06}{7.81} \times 12 = 9.97"$$

$La = 16" > 9.97$ OK!!

Where to cut to half of the Required Steel

Location of maximum moment (HS-20-44)

$x = \frac{L}{2} - \frac{d}{2} \quad L = 24.5\ FT \quad d = 4.66$

$x = \frac{24.5}{2} - \frac{4.66}{2} = 9.92\ FT$

$(9.92)^2 \rightarrow 100\%$ Steel $\qquad x^2 = (9.92)^2 \times .5$

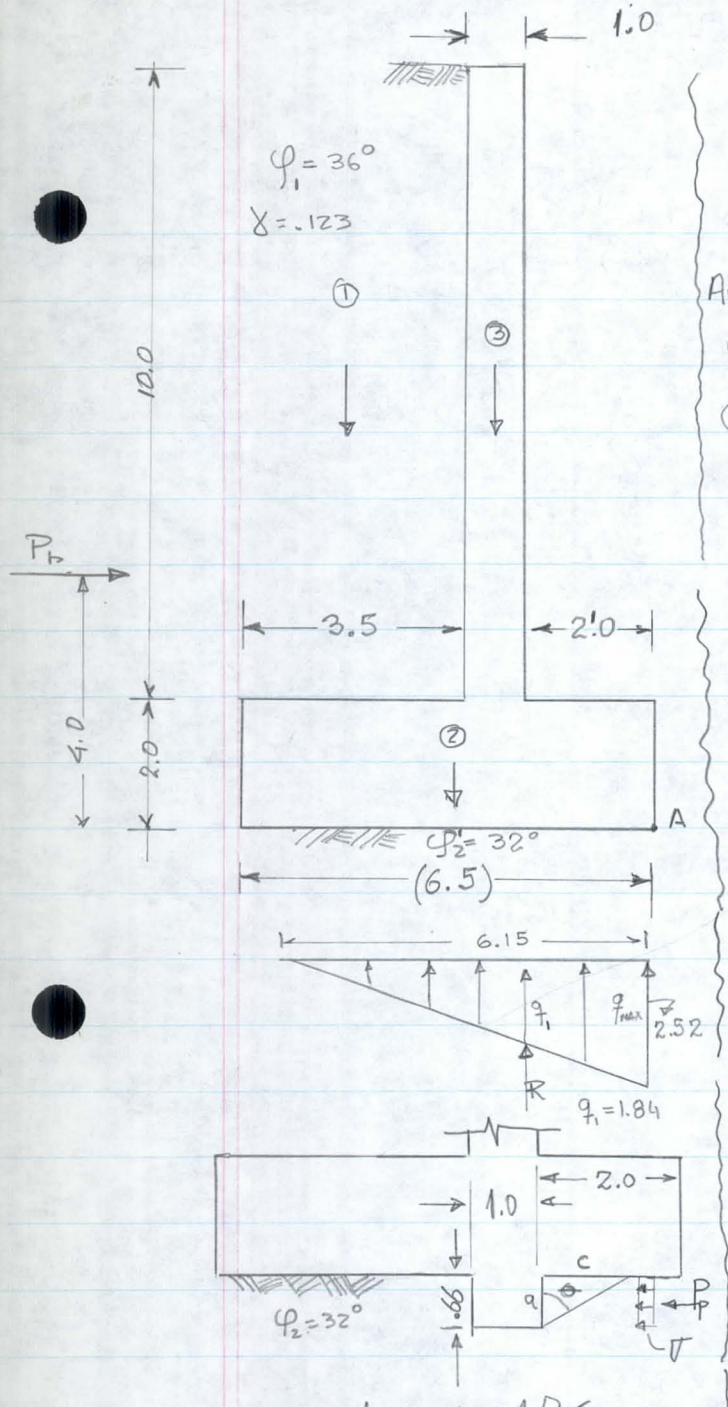
$x^2 \leftarrow 50\%$ Steel $\qquad x = 7.014$

$$\text{length of short bars} = \left[(7.014 + 2.33) + MAX\left(\frac{24.5\ FT}{20} + 15 \times \frac{1.128}{12}\right)\right] \times 2$$

$$= [9.344_{FT} + MAX(1.225\ FT, 1.41)] \times 2 = 21.5\ FT$$

$= 10.75\ FT = 10'\text{-}9$ from ℄ of Span

Wing Wall Stability Computations



$\varphi_1 = 36°$ for backFill $\gamma = .123$

$P_h = .5 \times .123 \times (12)^2 \times (1 - \sin(36)) = 3.65$ k

$\circlearrowright M_o = 3.65 \times 4.0 = 14.6$ k-FT, taken moments about A

Area		γ	Force	Arm	Moment
①	$3.5 \times 10 \times .123$	=	4.3	$2+1+3.5/2$ = 4.75	20.42
②	$6.5 \times 2 \times .150$	=	1.95	$6.5/2$ = 3.25	6.34
③	$1.0 \times 10.0 \times .150$	=	1.5	$2 + 1.0/2$ = 2.5	3.75

$+\downarrow \Sigma F_V = 7.75$ $\quad \circlearrowleft \Sigma M_R = 30.51$

Overturning factor of Safety $= \frac{30.51}{14.6} = 2.09 \Rightarrow$ OK

Safety factor against Sliding $= \frac{\Sigma F_V \times \tan \varphi_2}{\Sigma F_h} =$

$= \frac{7.75 \times \tan(32)}{3.65} = 1.32 \Rightarrow$ Requires a key

Location of the Resultant

$$\frac{\Sigma M_r - \Sigma M_o}{\Sigma F_V} = \frac{30.51 - 14.6}{7.75} = 2.05 = a$$

$3a = 6.15 < 6.5 \Rightarrow \frac{q_{max} \times 3a}{2} = \Sigma F_V$

$q_{max} = \frac{7.75 \times 2}{6.15} = 2.52 < 10 \frac{k}{Ft^2} =$ OK//

$q_1 = \frac{2.52}{6.15} \times 4.5 = 1.84$

Design of the Key

$\theta = 45 + \varphi_2/2 = 45 + \frac{32}{2} = 61°$

$a = .66$

$c = a \tan\theta \Rightarrow c = .66 \tan(61) = 1.2 < 2.0 \Rightarrow$ OK

$\nabla = 1.84 \times (1 + \sin(32)) / (1 - \sin(32)) = 6.0$

$P_p = \nabla \times a = 6 \times .66 = 3.96$ kips

Factor of Safety Against Sliding With Key ✓

$$F_s = \frac{7.75 \times \tan(32) + 3.96}{3.65} = 2.4 \Rightarrow \text{OK//}$$

for Wingwall

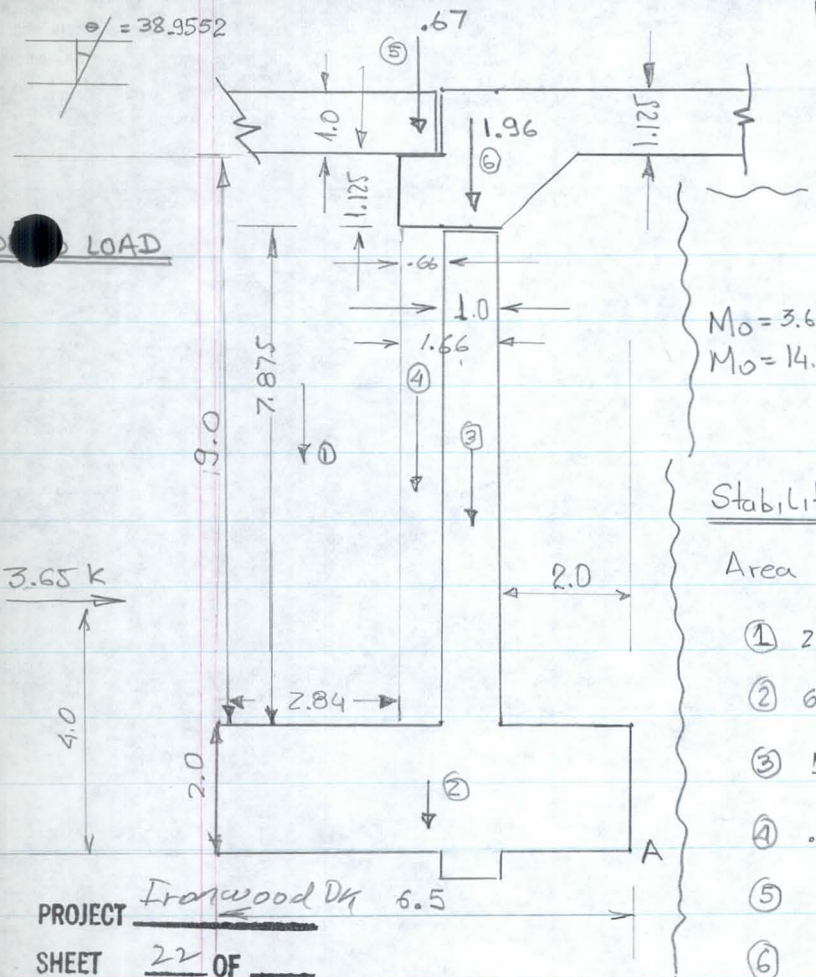
PROJECT Ironwood Dr

SHEET 21 OF ____

DESIGNED EDM

DRAWN ____

CHECKED NPK 8-86



PROJECT Ironwood Dr

SHEET 22 OF

DESIGNED EOM

DRAWN

CHECKED NPK 8-86

DEAD LOAD

$M_o = 3.65 \times 4$

$M_o = 14.6$ K-FT

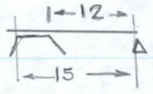
SOIL PRESSURE UNDER DEAD LOAD ONLY

Weight of Deck + Asphalt

$\left(\frac{13.5}{12}\right) \times 1 \times (26/2) \times .15 + \left(\frac{2}{12}\right) \times 1 \times (26/2) \times .15$

$= 2.52$ k $\Rightarrow 1.96$ K/Foot of Abutment

Weight of Aproach Slab



$\left(\frac{12}{12}\right) \times 1 \times (12/2) \times .15 = .9$ k

$= .67$ K/Foot of Abutment

Stability Computations (taken moments about A)

Area	Force	Arm	Moment
①	$2.84 \times 9.0 \times .123 = 3.14$	5.08	15.95
②	$6.5 \times 2 \times .150 = 1.95$	3.25	6.33
③	$1.0 \times 7.875 \times .150 = 1.18$	2.50	2.95
④	$.66 \times 7.875 \times .123 = 0.64$	3.33	2.13
⑤	0.67	3.33	2.23
⑥	1.96	2.50	4.90
	$+\downarrow \Sigma F_v = 9.54$		$+\circlearrowleft \Sigma M_R = 34.49$

Overturning Factor of Safety $= \frac{M_r}{M_o} = \frac{34.49}{14.6} = 2.36$ OK//

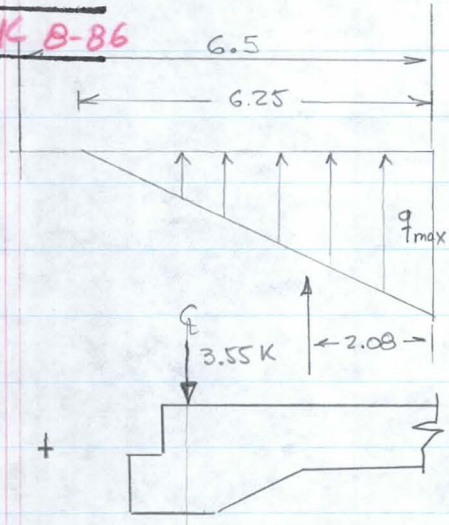
Factor of Safety against Sliding $= \frac{9.54 \tan(32) + 3.96}{3.65} = 2.71$ OK//

Location of the Resultant & Maximum Soil Pressure

$\frac{\Sigma M_r - \Sigma M_o}{\Sigma F_v} = \frac{34.49 - 14.6}{9.54} = 2.08 = a, \; 3a = 6.25$

$q_{max} = \frac{9.54 \times 2}{6.25} = 3.05 \frac{K}{FT^2} < 10 \frac{K}{FT^2} \Rightarrow$ OK//

+ LIVE LOAD



Soil Pressure UNDER DEAD LOAD + LIVE LOAD

Span = 24.427 FT $\Rightarrow$ 3.55 K/Foot of Abutment

$\downarrow \Sigma F_v = 13.09$ $\quad +\circlearrowleft \Sigma M_R = 43.36$ $\quad M_o = 14.6$

Overturning factor of Safety $= \frac{\Sigma M_r}{\Sigma M_o} = \frac{43.36}{14.6} = 2.97$ OK//

Factor of Safety against Sliding $= \frac{13.09 \tan(32) + 3.96}{3.65} = 3.32$ OK//

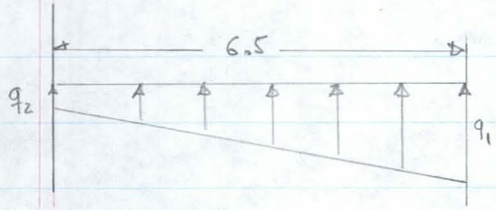
Location of the Resultant & MAXIMUM Soil Pressure

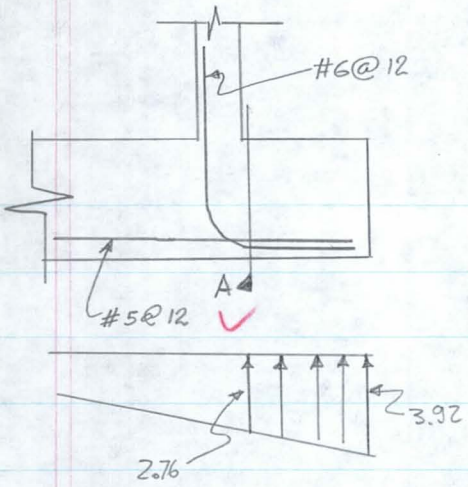
$\frac{\Sigma M_r - \Sigma M_o}{\Sigma F_v} = \frac{43.36 - 14.6}{13.09} = 2.19 = a, \; 3a = 6.6 > 6.5$

$q_{max} = \frac{\Sigma F_v}{b}\left(1 + \frac{6e}{b}\right), \; e = b/2 - a = \frac{6.5}{2} - 2.19 = 1.06$

$q_1 = \frac{13.09}{6.5}\left(1 + \frac{6 \times 1.06}{6.5}\right) = 3.98 < 10 \frac{K}{FT^2} \Rightarrow$ OK// ✓

$q_2 = \frac{13.09}{6.5}\left(1 - \frac{6 \times 1.06}{6.5}\right) = .043 < 10 \; K/FT^2 \Rightarrow$ OK//





toe Design

$f'_c = 3000$ $f_y = 60000$ $t = 24$

at section A $A_s = .44 + .31 = .75$, $d = 24 - 3 - \frac{1}{2} = 20.5$

$$M_A = \frac{2.76(2)^2}{2} + \frac{2}{3} \times 2 \times \left(\frac{1.22 \times 2}{2}\right) = 7.16, \quad n = 9$$

$$np = \frac{.75 \times 9}{12 \times 20.5} = .027, \quad k = \sqrt{2np + (np)^2} - np$$

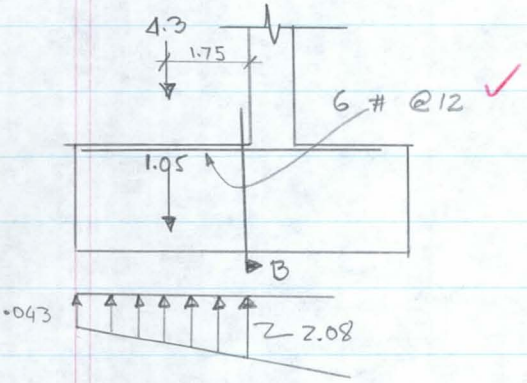
$k = .207$ $\quad J = 1 - k/3 = .931$

$$A_{s\,min} = \frac{1.5\sqrt{f'_c} \times bt^2}{Jd f_y} = \frac{1.5\sqrt{3000} \times 12 \times (24)^2}{.931 \times 20.5 \times 60000}$$

$A_{s\,min} = .49 < .75 \Rightarrow$ OK //

$$f_s = \frac{7.16 \times 12000}{.75 \times .931 \times 20.5} = 6002 < 20000 \Rightarrow \text{OK //}$$

$$f_c = \frac{6002 \times .207}{9 \times (1 - .207)} = 174 < 1200 \Rightarrow \text{OK //}$$



Heel Design

$n = 9$, $f'_c = 3000$, $f_y = 60000$, $t = 24$

$$\circlearrowright M_B = 4.3 \times 1.75 + 1.05 \times 1.75 - .043 \frac{(3.5)^2}{2} - \frac{1}{3} \times 2.04 \frac{(3.5)^2}{2}$$

$$\circlearrowleft = 4.93 \text{ K-FT}$$

$A_s = .44$, $d = 20.5$, $np = \frac{.44 \times 9}{12 \times 20.5} = .0161$

$k = \sqrt{2np + (np)^2} - np = .164$ $\quad J = 1 - \frac{k}{3} = .945$

$$f_s = \frac{M}{A_s Jd} = \frac{4.93 \times 12000}{.44 \times .945 \times 20.5} = 6938 < 20000 \Rightarrow \text{OK //}$$

$$f_c = \frac{f_s \times k}{n(1-k)} = \frac{6938 \times .164}{9(1 - .164)} = 151 < 1200 \Rightarrow \text{OK //}$$

$$A_{s\,min} = \frac{1.5\sqrt{f'_c} \times bt^2}{Jd f_y} = \frac{1.5\sqrt{3000} \times 12 \times (24)^2}{.945 \times 20.5 \times 60000} = .48$$

$.48 \approx .44$ OK //

PROJECT Ironwood Dr

SHEET 23 OF ____

DESIGNED EOM

DRAWN ____

CHECKED NPK 8-86

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT Meridian Road Bridge PAGE 1 OF 32

DETAIL Index to Design & Design Check Calcs. COMPUTED _____ DATE _____

CHECKED BY NPK DATE 8-86

New Single Span R.C. Bridge, with 68'-0 Clr Rdwy & 2 swks. 7°24' sk. Rt.

	Deck	Abutment
f'_c =	5000 psi	3000 psi
f_c =	2000	1200
f_y =	60,000	40,000
f_s =	24,000	20,000
n =	7	9

Allow. Soil press. on Cemented S&G = 3.5 TSF

DESIGN CALCS	Pages
Deck Slab	2 - 8
Abutment	9 - 16

DESIGN CHECK CALCS	
Deck Slab	17 - 24
Abutment	25 - 32

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd span, S = 51.5 ft — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

note: all calcs per ft of width

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 2 OF

S = 51.5 ft

say $d = 23.5'' \Rightarrow t = 25.0'' \Rightarrow$ thickness $= 25.5''$

w = (thickness x 150 #/cu.ft.) + 25 #/sq.ft

$= (\frac{25.5}{12} \times 150) + 25$

$= 343.75$ #/sq.ft per ft of width

$= .344$ k/ft

$M_{DL} = \frac{wS^2}{8}$

$= \frac{.344(51.5)^2}{8} = 114.0$ k-ft

$M_{LL+I} = \frac{M_{TABLE}}{2E} \times (1+I)$

$E = 4 + .06S$ max = 7.0'

$= 4 + .06(51.5)$

$= 7.09'$ use 7.0'

$I = \frac{50}{S+125}$ max = 0.3

$= \frac{50}{51.5+125} = 0.28$ ✓

M_{TABLE}: $\frac{663.6 - 627.9}{52 - 50} = \frac{663.6 - M_{TABLE}}{52 - 51.5}$

$M_{TABLE} = 654.7$ k-ft

$\frac{M_{TABLE}}{2} = \frac{654.7}{2} = 327.4$ ✓

$\frac{M_{TABLE}}{2(E)} = \frac{654.7}{2(7)} = 46.8$ k-ft ✓

$M_{LL+I} = 46.8(1.28)$

$= 59.9$ k-ft ✓

CHECK:

see moment diagram

LLM = $1000(1.3S - 20.0)$ #-ft

$= 1000(1.3(51.5) - 20.0)$

$= 46950$ #-ft

$= 47.0$ k-ft

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Br — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPL DATE 8-86 — PAGE 3 OF 1

$M_{DESIGN} = M_{DL} + M_{LL+I}$

$= 114.0 + 59.9$

$= 173.9$ k-ft

CHECK:

$d = \sqrt[2]{\frac{M_{DESIGN}}{K}}$ $\quad K = .323$ (for $f_s = 24000$)

$= \sqrt{\frac{173.9}{.323}} = 23.2" < 23.5$ ∴ ok

$t = 12\sqrt[3]{\frac{12 \times 104.1 \times S \times M_{LL+I}}{E_c \times 144}}$ $\quad$ (for $\Delta = \frac{L}{1000}$ using I_g)

$= 12\sqrt[3]{\frac{12 \times 104.1 \times 51.5 \times 59.9}{4030.509 \times 144}}$

$= 22.6" < 25.5"$ ∴ ok

∴ use $d = 23.5"$

$d = 26 - 1\frac{1}{2} - \frac{1.4}{2} = 23.8"$

$A_s = \frac{M_{DESIGN}}{f_s j d}$

$= \frac{173.9 \text{ k-ft}}{24^{ksi}(.877)(\frac{23.5"}{12"/ft})}$

$= 4.22 \text{ in}^2$ / ft width

$1.2M_{CR} = 1.2 \times .530 \times 1.0 \times \frac{24^2}{6} = 61.1$ K-Ft

∴ use #11 @ 4½" spacing

$A_s = 4.16 \text{ in}^2$

$p = \frac{A_s}{bd} = \frac{4.16}{12(23.5)} = .015$

$n = 7$

$pn = .105 \Rightarrow j = .8783, \; k = .3651$

$f_s = \frac{M}{A_s j d} = \frac{173.9}{4.16(.8783)(\frac{23.5}{12})}$

$= 24.3$ ksi

$f_c = \frac{f_s}{n} \times \frac{k}{1-k}$

$= \frac{24.3}{7} \times \frac{.3651}{1-.3651}$

$= 2.00$ ksi

distr $A_s = \frac{4.22}{\sqrt{51.5}} = .59 \text{ in}^2$

Use #6 @ 9" $A_s = 0.59$

using entire width with allowed load reductions:

$$I_e = \left(\frac{M_{cr}}{M_a}\right)^3 I_g + \left[1 - \left(\frac{M_{cr}}{M_a}\right)^3\right] I_{cr} \leq I_g$$

$$M_{cr} = f_r I_g / y_t$$

$$f_r = 7.5\sqrt{f'_c} \qquad f'_c = 5000\,psi$$
$$= 7.5\sqrt{5000}$$
$$= 530\,psi = .53\,ksi$$

$$I_g = \frac{bt^3}{12} = \frac{(86' \times 12''/1)(25'')^3}{12} = 1343750\,in^4$$

$$y_t = d/2 = 25/2 = 12.5''$$

$$M_{cr} = .53^{ksi}\,(1343750\,in^4 / 12.5\,in)$$
$$= 56975\,k\text{-}in = 4748\,k\text{-}ft$$

$$I_{cr} = \left[\tfrac{1}{3} b(kd)^3 + nA_s(d - kd)^2\right]$$
$$= 9008\,in^4 \leftarrow \text{from prev. calcs}$$
$$9008\,in^4 \times 86'$$
$$= 774688\,in^4$$

$$M_a = M_{DESIGN} \times 86'$$
$$= 173.9\,k\text{-}ft \times 86'$$
$$= 14955\,k\text{-}ft$$

$$I_e = \left(\frac{4748}{14955}\right)^3 1343750 + \left[1 - (\quad)^3\right] 774688$$
$$= 43002 + 749897$$
$$= 792899\,in^4 \checkmark$$

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Br — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

LL+I Deflections

COMPUTED TAD DATE CHECKED BY NPL DATE 8-86 PAGE 5 OF

using $I_e = 792900$ over entire width w/ load reductions

$$\Delta_\ell = \frac{CPS^3}{EI_e}$$

$$P = (2.93^k \times 2)5 \times .75 \times 7 = 153.8^k$$

$$\Delta_\ell = \frac{.0387(153.8)(51.5\times12)^3}{4030.509(792900)}$$

$$= .440 < .618 \therefore ok$$

$$S/1000 = \frac{51.5}{1000} = .0515' = .618''$$

$$\Delta max = \frac{5ws^4}{384EI} = \frac{C\,\frac{wl^2}{8}L^2}{EI} = \frac{L^2}{9.6EI_e}M$$

$$= \frac{(51.5\times12)^2(37740)}{9.6\,(4030.509)(792900)}$$

$$= .470'' < .618'' \therefore ok$$

$$M = (M_{LL}\times2)5\times.75\times7$$

$$= 59.9(52.5)$$

$$= 3145^{k\text{-}ft}$$

$$= 37740^{k\text{-}in}$$

See Sh #22 for DL Deflections

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Bridge — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

COMPUTED TAD DATE 7/28/86 CHECKED BY NPK DATE 8-86 PAGE 6 OF

$M_s = A_s f_s jd$

$= (4.16\ in^2)(24.3\ ksi)(0.8793)(23.5\ in)(ft/12\ in)$

$= 173.9\ k\text{-}ft$

$\frac{1}{2} A_s = \frac{1}{2}(4.16) = 2.08\ in^2$

$p = \frac{A_s}{bd} = \frac{2.08}{(12)(23.5)} = .007$

$pn = .007(7) = 0.049 \Rightarrow k = .2679,\ j = .9107$

$M_s = (2.08\ in^2)(24)(.9107)(23.5)(1/12)$

$= 89.0\ k\text{-}ft$

$\frac{1}{20} S = \frac{1}{20}(51.5) = 2.6\ ft = 30.9\ in$ * $= 2.6\ ft$

15 bar diam $= 15(\#11) = 15(1.410\ in) = 21.15\ in$

$d = 23.5\ in$

$\ell_d \leq \frac{M}{V} + \ell_a$ (ℓ_a: dist beyond ℄ Brg.)

$50.8 \leq \frac{89.0 \times 12}{14.33} + 12$ (74.5 ≈ $V_{DL+LL+I}$ from sheet #8)

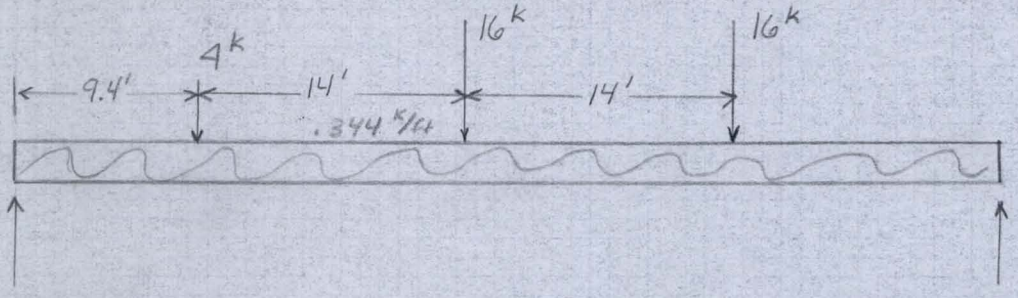
≤ 86.5 OK

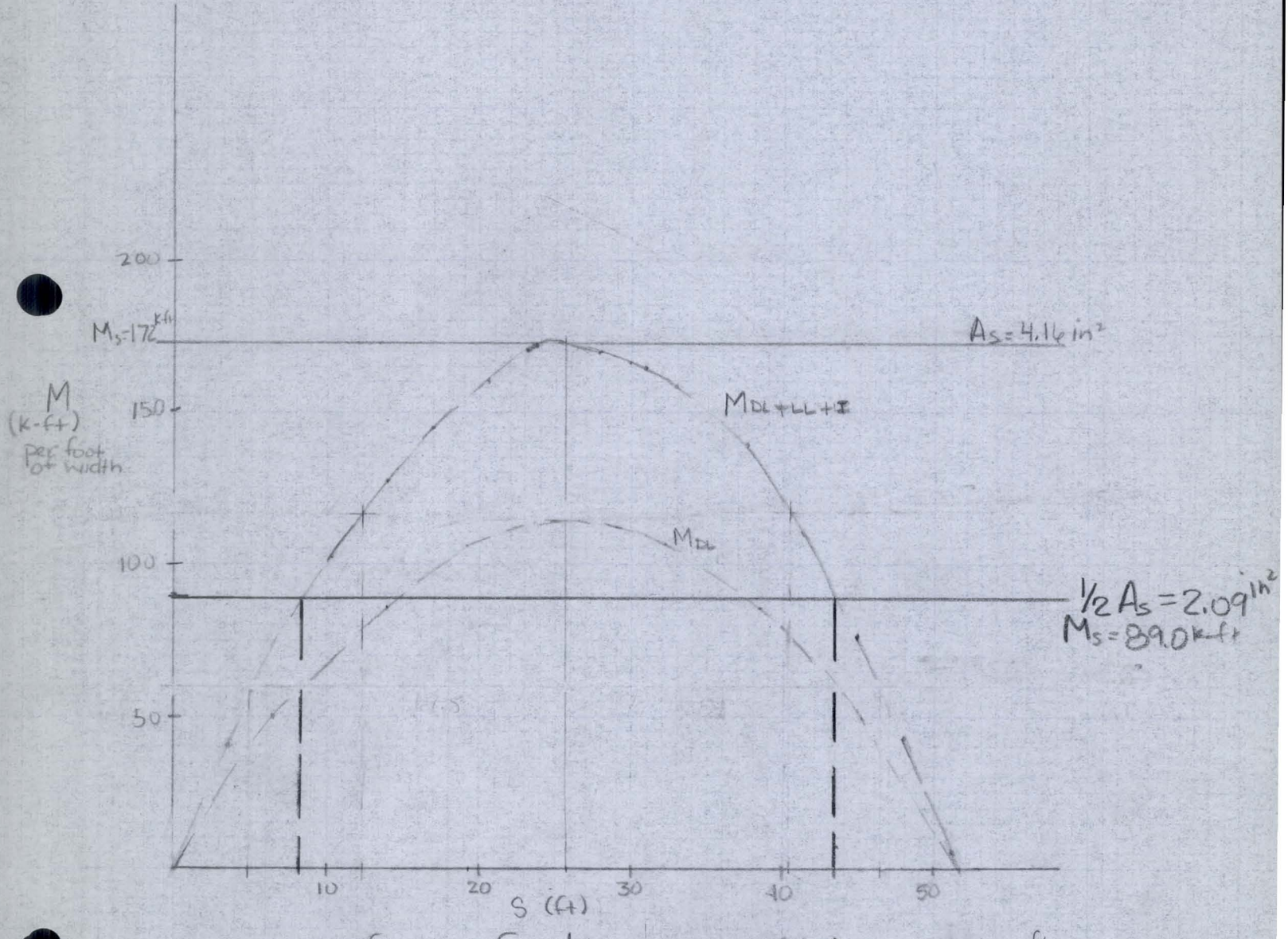
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Br. — COMPUTATION AND DATA SHEET

DETAIL Deck Slab — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 7 OF

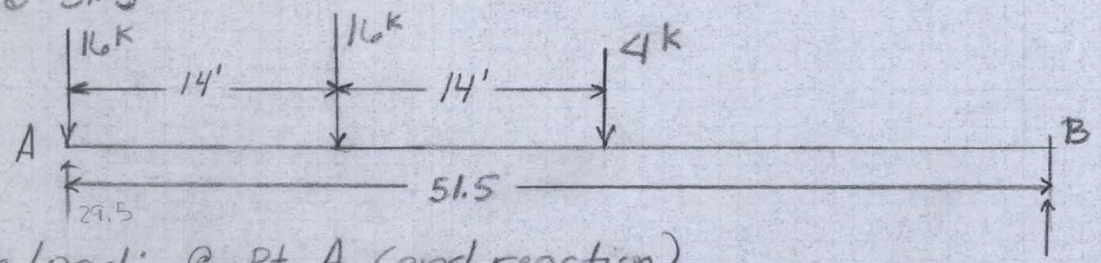




Distance from ℄ for ½ M_s = 17.5 + 2.6 = 20.1 ft ≡ 20.5 ft

Use 21'-6

S=51.5



Live Load: @ Pt A (end reaction)

V_{TABLE}: $\frac{59.1-58.5}{52-50} = \frac{59.1-V_{TABLE}}{52-51.5}$

$V_{TABLE} = 58.95$

$I = \frac{50}{L+125}$ $L=28'$ max = 0.3

$= \frac{50}{28+125} = 0.33$ ∴ use 0.3

$E = 4+0.06S$ max = 7.0'

$= 4+0.06(51.5) = 7.09$ ∴ use 7

$V_{LL+I} = \frac{V_{TABLE}}{2E} \times (1+I)$

$= \frac{58.95}{2(7)} \times (1+0.3)$

$= 5.47^{k}$ per ft of width

Dead Load @ pt A (end reaction)

d = 23.5" ⇒ thickness = 25.5"

w = (thickness x 150 #/cu ft) + 25 #/sq ft

$= \left(\frac{25.5}{12} \times 150\right) + 25$

$= 343.75$ #/sq.ft per ft of width

$= 0.344$ k/ft

$V_{DL} = \frac{0.344(51.5)}{2} = 8.86^{k}$ per ft of width

$V_{DESIGN} = V_{LL+I} + V_{DL} = 5.47 + 8.86 = 14.33^{k}$ per ft of width

DECK SLAB
CHECK SHEAR

$0.95\sqrt{f_c'} \geq V_{DES}/d$

$0.95\sqrt{5000} \geq 14.33^{x1000}/23.5(12)$

$67.2 \geq 50.8$ ok

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian - Bulldog Floodway — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE 5/28/86 CHECKED BY NPE DATE 8-86 PAGE 9 OF

Select Material

Assume 1/2 way between SW & GW

Using 0.95 Proctor = 0.54 relative density (from fig 21-5 AASHTO T99 and relative density data for sand)

$\phi = 36°$ ✓ $\gamma_o = 123$ ✓ } from fig 7

$K_o = 1 - \sin\phi$

$= 1 - \sin 36°$

$= 0.4122$ ✓

$\gamma K_o = 50.7$ ✓

Top of Deck 25.5

Bottom of Footing 9.3

16.2 Say 16.0

Ftg 2.0

stem 14.0 A ✓

$P = \gamma K_o \frac{H^2}{2} = 0.0507 \frac{H^2}{2} = 0.0254\ H^2$

$M = \frac{PH}{3} = 0.0254 H^2 \frac{H}{3} = 0.00845\ H^3$

Stem: H	H^2	H^3	P	M
2	4	8	.1016	.0676
5	25	125	.635	1.056
10	100	1000	2.54	8.45
14	196	2744	4.98	23.187

$R_{DL} = \left[\left(\frac{25.5}{12} \times 150\right) + 25\right] \frac{1}{1000} \times \frac{51.5}{2} =$ 8.85 K ✓

APPROACH SLAB $= 1.0 \times .150 \times 14/2 =$ 1.05 K ✓

$R_{LL} = 5.47/1.3 =$ 4.21 ✓

14.11 $\cos 7.40° =$ 13.99 ✓

14' Stem: $1.5 \times .15 \times 14 = 3.15$ (d=18") 3.15 ✓

17.14 ✓

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian - Bulldog Floodway — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 10 OF

$e = 0.6 + 0.03h$

$= 0.6 + 0.03(18)$

$= 1.14$ in

$= 0.095$ ft

$M = 0.095 \times 17.14$

$= 1.6$

$f'_c = 3000 \quad n = 9 \quad f_s = 20000 \quad f_c = 1200$

$M = (23.2 + 1.6)\delta$ (see next sheet)

$= 24.8 \times 1.16 = 28.8$

$1.2M_{CR} = 1410 \times \frac{1.0 \times 18^2}{6} \times 1.2 = 26.6$ K-Ft

$d^2 = \frac{M}{Kb} = \frac{28.8}{(0.186 \times 1)} = 154.8$

$d = 12.4$

2.5

14.9

3.2

18.1

Use 18" $\Rightarrow d = 15.5$

$\frac{\text{direct load}}{f_A \times b} = \frac{17.14}{.447(12)} = 3.2$

$A_s = \frac{M}{f_s jd}$

$= \frac{28.8 \times 12}{(20).883(15.5)}$

$= 1.26$

Use bars @ 6" ctr

Alt #7 & #8 $= 1.39$

$k = \frac{1}{1 + \frac{20}{9 \times 1.2}} = 0.351$

$j = 1 - \frac{.351}{3} = 0.883$

$K = \frac{1.2}{2} \times .351 \times .883$

$= .186$

$pn = \frac{1.39(9)}{12(15.5)} = 0.067$

$k = .3052$

$j = .8983$

$f_s = \frac{28.8 \times 12}{1.39(.8983)(15.5)} = 17.9$ ksi Bending $f_B = \frac{17.9}{9} \times \frac{.3052}{.6948} = .87$ ksi

direct load $f_A = \frac{17.14}{18 \times 12} = .08$ ksi $\frac{.87}{1.2} + \frac{.08}{.447} = 0.90 < 1.0$ OK

3000(.4) →

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd - Bulldog Floodway — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 11 OF

$$EI = \frac{\frac{E_c I_g}{2.5}}{1+\beta_d}$$

$$= \frac{\frac{3122(5832)}{2.5}}{1+1}$$

$$= 3641501$$

$$E_c = 57000\sqrt{f'_c}$$

$$= 57000\sqrt{3000}$$

$$= 3122019 \text{ psi}$$

$$= 3122 \text{ ksi}$$

$$I_g = \frac{12 \times 18^3}{12}$$

$$= 5832$$

4096

$$\beta_d = 1$$

$$P_c = \frac{\pi^2 EI}{(K_u \ell)^2}$$

$$= \frac{\pi^2(3641501)}{(2 \times 14 \times 12)^2} = 318.3$$

$$P_c = f_a \times F.S. \times A \Rightarrow f_a = \frac{P_c}{FS \times A} = \frac{318.3}{2.5 \times (1.32 \times 12 \times 18)} = 0.447$$

$$\frac{1+(n-1).04\,bd}{1+8(.04)\,bd}$$

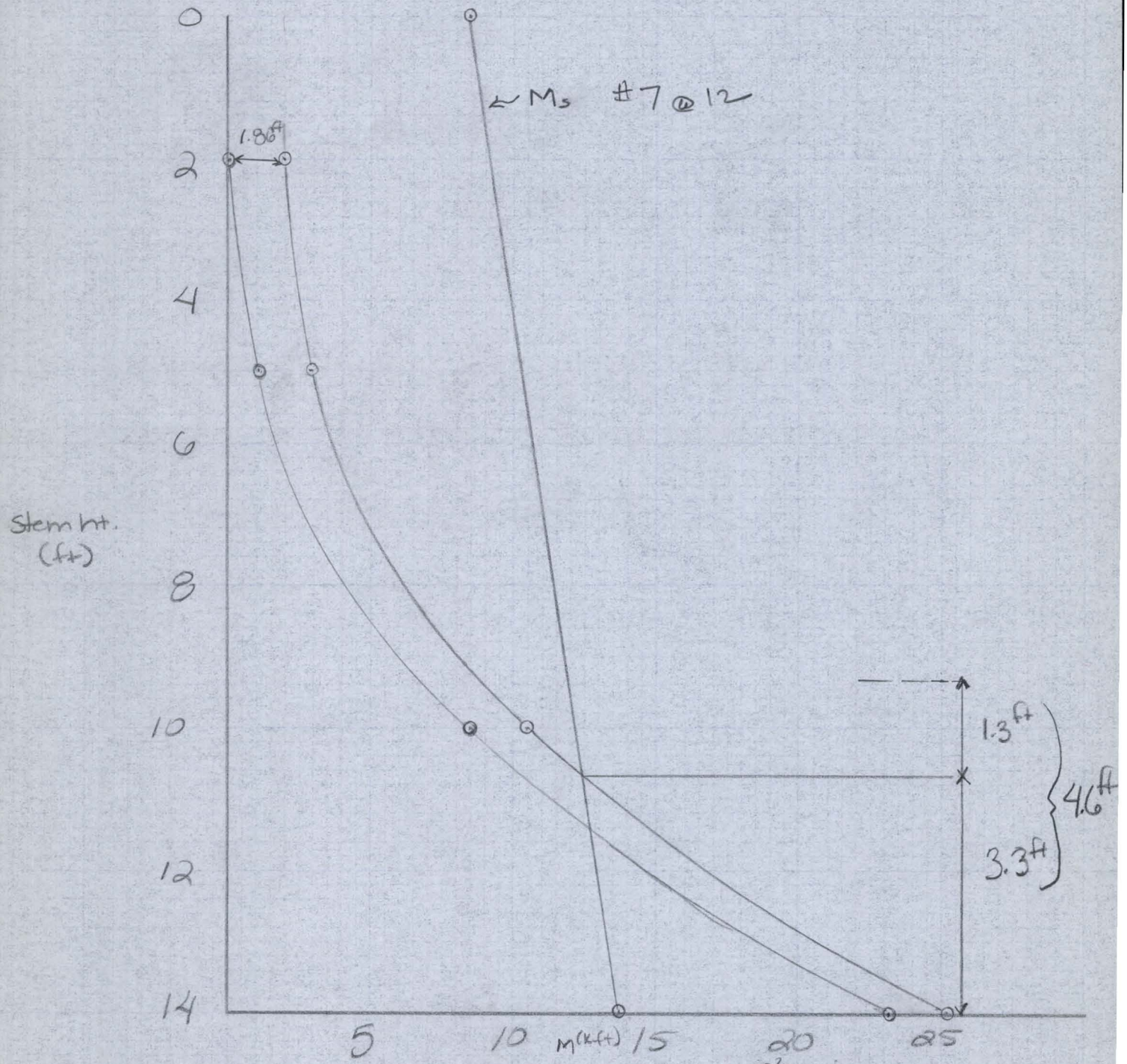
$$\delta = \frac{C_m}{1-\frac{2.5P}{\phi P_c}} = \frac{1}{1-\frac{2.5(17.14)}{(1)(318.3)}} = 1.16$$

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd BR — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE 8/4/86 CHECKED BY NPL DATE 8-86 PAGE 12 OF



Light bar #7 @ 12" ctr ⇒ $A_s = .60$ $M_s = A_s f_s j d = \frac{0.60\ in^2}{12\ in/ft}(20\ ksi)(.883)(15.5\ in) = 13.7$

$\times (9.5\ in) = 8.4$

offset = $O_{EF} + M_{min} + M_{magnif}$

$= 0 + 1.6(1.16) = 1.86$

$\ell/20 = 14/20 = .7$ ft 15 bar diam = $15(.875\ in) = 13.1\ in = 1.1$ ft $d = 15.5\ in = 1.3$ ft

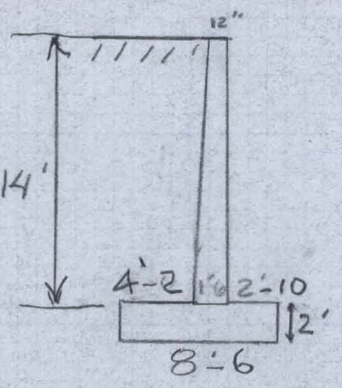
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Bridge — COMPUTATION AND DATA SHEET

DETAIL Wingwall & Abutment — FILE NO.

COMPUTED TAD DATE 8/6/86 CHECKED BY NPK DATE 8-86 PAGE 13 OF

STABILITY



		P_v		M	
Stem:	$1.0 \times 14 \times .15$	$= 2.10^k$	$\times 3.33$	$= 6.99$	K-Ft
	$.5 \times 14/2 \times .15$	$= 0.53$	$\times 4.00$	$= 2.52$	
Ftg:	$8.5 \times 2 \times .15$	$= 2.55$	$\times 4.25$	$= 10.84$	
Fill:	$4.17 \times 14 \times .12$	$= 7.00$	$\times 6.42$	$= 44.96$	
	$.5 \times 14/2 \times .12$	$= .42$	$\times 4.17$	$= 1.75$	
		12.6		67.06	

$h/3$

$P_H = \gamma K_o \frac{h^2}{2} = .0254(16)^2 = 6.50^k \times 5.33 = 34.68$

32.38

$a = \frac{32.38}{12.6} = 2.56$

Overturn FS $= \frac{67.06}{34.68} = 1.93$ OK

Sliding FS $= \frac{12.6 \times .67}{6.5} = 1.30$ < 1.50

Use key, see next sheet

Soil $p = \frac{2P}{3a} = \frac{2 \times 12.6}{3(2.56)} = 3.3$ KSF (Wingwall)

1.65

Deck DL+LL & Appro. Slab $= \frac{13.99}{8.50}\left(1 \pm \frac{6 \times .92}{8.50}\right) = 2.7$ max / 6.0 KSF

0.6 KSF min (Abutment) O.K.

$e = \frac{8.50}{2} - 2.83 - .50 = .92$ Ft

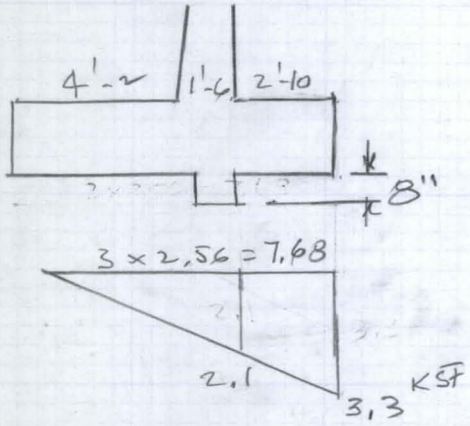
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Br — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED NPK DATE 8-83 CHECKED BY DATE PAGE 14 OF

SHEAR KEY



Wingwall Soil press

$P = 2.1$ KSF

$K_p = 3.0$

Resist Offered by Key $= P \times K_p \times h = 2.1 \times 3.0 \times 1.67 = 4.2^{K}$

Total Resist $= (12.6 \times 1.67) + 4.2 = 12.6$ (8.4)

Sliding FS $= \frac{12.6}{6.50} = 1.94 > 1.5$ for Wingwall

will be considerably higher for Abutment

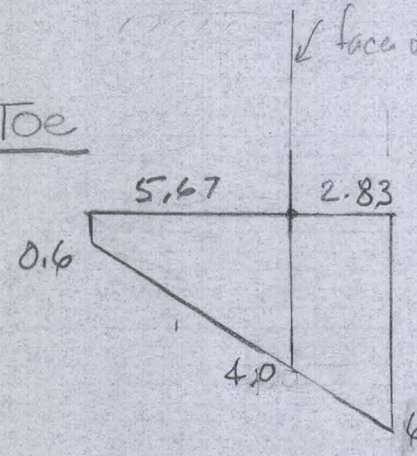
FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Br — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 15 OF

Toe



Soil p @ face of Stem = 4.0 KSF
2' Ftg 0.3
3.7

	V		M	
2.83 × 3.7 =	10.5	× 1.42 =	14.9	k-ft
$\frac{2.83}{2}$ × 2.0 =	2.8	× 1.88 =	5.3	k-ft
	13.3		20.2	k-ft

$d^2 = \frac{M}{Kb} = \frac{20.2}{.186(1)} = 108.6$ $d = 10.4$

$d = \frac{V}{\sqrt{f'_c} \times .95b} = \frac{13.3}{.055 \times .95 \times 12} = 21.2$ in > 20.5 but OK since shear was taken @ Face of Wall

Used 2'-0 Ftg $d = 20.5$

$1.2M_{dR} = \frac{.410 \times 12 \times 24^2}{6 \times 12} \times 1.2 = 47.5$ k-ft

Min $A_s = \frac{47.5 \times 12}{40 \times .9 \times 20.5} = .77$

$A_s = \frac{M}{f_s jd} = \frac{20.3 \times 12}{20(.883)(20.5)} = .67$ in²

× 1.33 = .89 in

$\Sigma_o = \frac{V}{.1 f'_c jd} = \frac{13.3}{.1(3)(.9)(20.5)} = 2.4$ in

Min $A_s = .001 \times 12 \times 16 = .19$

Used #8@12 (from Stem)	A_s	Σ_o
& #6 @ 12 Str.	.79	3.1
	.44	2.4
	1.23	5.5

FLOOD CONTROL DISTRICT of Maricopa County

PROJECT Meridian Rd Br — COMPUTATION AND DATA SHEET

DETAIL Abutment — FILE NO.

COMPUTED TAD DATE — CHECKED BY NPK DATE 8-86 — PAGE 16 OF

HEEL

1 - Top Steel

14' Fill = 14 x .12 = 1.68

Ftg $2.0 \times .15 = .3$

$1.98 \times 4.17 = \underset{K}{8.25} \times 2.08 = \underset{K\text{-}ft}{17.2}$

$d^2 = \frac{M}{KD} = \frac{17.2}{.186(1)} = 92.4 \Rightarrow d = 9.6$ in

$d = \frac{V}{\sqrt{f'_c}\, jw} = \frac{8.25}{.055(.9)(12)} = 13.9$ in

Used 2.0 Ftg $d = 20.5$ in

$1.2M_{CR} = 1.2 \times .410 \times 1.0 \times \frac{24}{\phi} = 47.5$ K-FT

Min $A_s = \frac{47.5 \times 12}{40 \times .9 \times 20.5} = .77$

$A_s = \frac{M}{f_s jd} = \frac{17.2 \times 12}{20(.883)(20.5)} = .57$ in $\times 1.33 = .76$ in²

$\ell_d = \frac{V}{.04 f'_c jd} = \frac{8.25}{.04(3).9(20.5)} = 2.5$ in

Used #8@12" @ Top of Heel

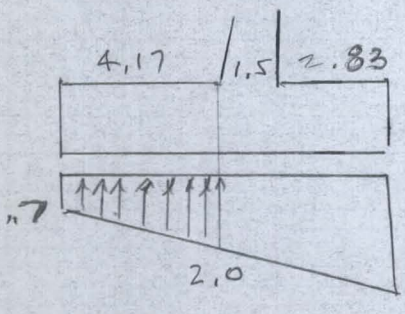
$A_s = 0.79$ in²

$\ell_d = 3.1$

2 - Bot Steel Assume No EP Thrust

Deck Lds & Stem = 17.14K

$e = \frac{8.50}{2} - 2.83 - .50 = 0.92'$



Soil $P = \frac{17.14}{8.50}\left(1 \pm \frac{6 \times .92}{8.50}\right) = 3.3$ KSF Max, 0.7 Min

V	M
$.7 \times 4.17 = 2.9 \times 2.08$	$= 6.1$ K-ft
$1.3 \times \frac{4.17}{2} = 2.7 \times \frac{4.17}{3}$	$= 3.8$
	9.9

$A_s = \frac{9.9 \times 12}{20 \times .88 \times 20.5} = .33$ in² $\times 1.33 = .44$

Used # 6 @ 12 in bot of Heel $A_s = .44$

Meridion Rd Bridge

PROJECT Meridian Rd
SHEET 17 OF 15
DESIGNED EOM
DRAWN
CHECKED NPK 8/86

Span = 51.5 FT = S
Slab thickness = 26" = t
Steel bars to use # 11 ϕ = 1.41"
Slab Clearance = 1.5"
d = Slab Effective depth
$d = 26" - 1.5 - .5(1.41) \approx 23.8$
Specification for design per AASTO 1983

1) Dead Load (per foot of Width) (AASHTO 3-3-6) D_L

due to concrete : $\left(\frac{26}{12}\right)$FT x 1 FT x 150 $\frac{Lb}{FT^3}$ = 325 $\frac{Lb}{FT}$

due to future Asphalt(2") = $\left(\frac{2}{12}\right)$FT x 1 FT x 150 $\frac{Lb}{FT^3}$ = 25 $\frac{Lb}{FT}$

D_L = total dead load = 350 $\frac{Lb}{FT}$ ✓

2) Moment due to dead load M_{DL} (per foot of Width)

$$M_{DL}/_F = \frac{D_L \times S^2}{8} = \frac{.350 \times 51.5^2}{8} = \frac{116}{107.74}\ K\text{-FT}$$

3) Live load (Per foot of Width) (AASHTO 3.24.3.2)

$E = 4 + .06S < 7$
$E = 4 + .06(51.5) = 7.09 > 7 \Rightarrow E = 7$

ONE LANE LOAD (HS 20-44) (for S = 51.5) => 654.675 K-FT/Lane
Impact = I = $50/(51.5 + 125) = .283 < .3$ I = .3

$$M_{LL+I}/_F = \frac{654.67 \times 1.283}{2E} = \frac{840.128}{14} = 60\ K\text{-FT}$$ ✓

PROJECT Meridian Rd
SHEET 18 OF ____
DESIGNED EOM
DRAWN ____
CHECKED NPK 8-86

4) Moment for design M

$$M = M_{DL} + M_{LL+I} = \cancel{107.74} + 60 = \cancel{167.7} \; 176. \; K\text{-}FT/F$$

5) Slab Design

$$f_c' = 5000 \frac{Lb}{IN^2} \; ; \; f_c = 2000 \frac{Lb}{IN^2} \; ; \; f_s = 24000 \frac{Lb}{IN^2} \; ; \; E_c = 4030509 \frac{Lb}{IN^2}$$

$n = 7$

$$k = \frac{1}{1 + \frac{f_s}{n f_c}} \Rightarrow k = \frac{1}{1 + \frac{24000}{7 \times 2000}} = .3684$$

$$J = 1 - k/3 \Rightarrow J = 1 - \frac{.3684}{3} = .8772$$

$$M_c = \frac{f_c k J b d^2}{2} \Rightarrow d_{min} = \sqrt{\frac{2M_c}{f_c k J b}} = \sqrt{\frac{2 \times \cancel{167.7}\ 176 \times 12000}{2000 \times .3684 \times .8772 \times 12}}$$

Making $M_c = M$

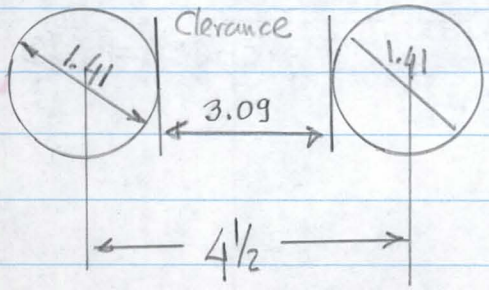
$$d_{min} = \cancel{22.78}\ 23.3 \text{ in}$$

$d = 23.8" > \cancel{22.78}$ OK//

$$M_s = A_s f_s J d \Rightarrow A_{req} = \frac{M_s}{f_s J d} \quad \text{Making } M_s = M$$

$$A_{req} = \frac{167.7 \times 12000}{24000 \times .8772 \times 23.8} = 4.016$$

Use # 11 @ 4½ => $A_s = 4.16 > 4.016$ OK//



$3.09 > 1.5 \times 1.41 = 2.11$ OK//

$3.09 > 3"$ OK//

AASHTO 8.21.1

PROJECT Meridian Rd
SHEET ___ OF ___
DESIGNED EOM
DRAWN
CHECKED NPK 8-86

distribution Reinforcement AASTO (3.24.10)

to provide for the Lateral distribution of concentrated live loads

the amount of distribution Reinforcement shall be the percentage of the main reinforcement steel Required for positive Moment

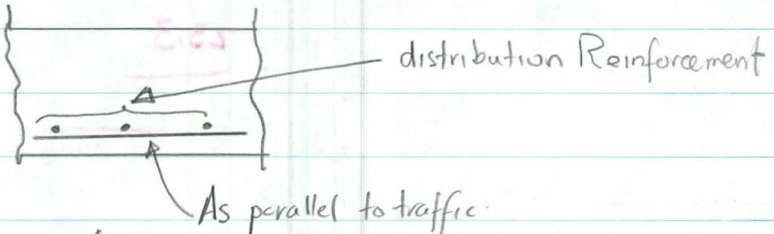
for main Reinforcement parallel to traffic

$$\% = \frac{100}{\sqrt{S}} = \frac{100}{\sqrt{51.5}} = 13.93\%$$

$$A_{sd} = \frac{13.93}{100} \times A_{req} = .1393 \times 4.016\ in^2 = .56\ in^2$$

#6 @ 9 = .59 in^2 ✓

transiene (+) moment



Shear and Bond (AASHTO 3.24.4)

Slabs designed for Bending moment in accordance with AASHTO 3.24.3 shall be considered satisfactory in bond & Shear

SHRINKAGE & TEMPERATURE REINFORCEMENT

$A_{s_{ST}} = .125\ in^2$ @ MIN (3x thickness, 18") => #4 @18 = .13 ✓

PROJECT Merritt Island
SHEET 19 OF
DESIGNED EOM
DRAWN
CHECKED NPK 8-96

distribution Reinforcement AASTO (3.24.10)

to provide for the Lateral distribution of concentrated live loads

the amount of distribution Reinforcement shall be the percentage of the main reinforcement steel Required for positive Moment

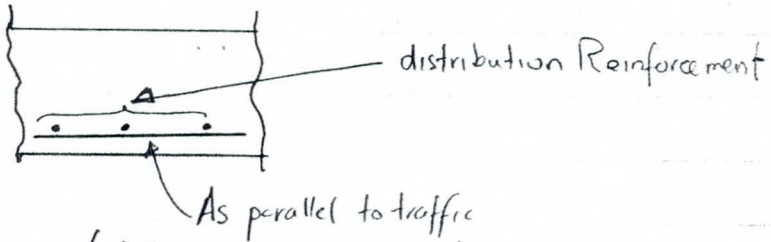
for main Reinforcement parallel to traffic

$$\% = \frac{100}{\sqrt{S}} = \frac{100}{\sqrt{51.5}} = 13.93\%$$

$$A_{sd} = \frac{13.93}{100} \times A_{req} = .1393 \times 4.016\ in^2 = .56\ in^2$$

#6 @ 9 = .59 in^2 ✓

transiene ⊕ moment



Shear and Bond (AASHTO 3.24.4)

Slabs designed for Bending moment in accordance with AASHTO 3.24.3 shall be considered satisfactory in bond & Shear

SHRINKAGE & TEMPERATURE REINFORCEMENT

$A_{s_{ST}}$ = .125 in^2 @ MIN(3xthickness, 18") => #4 @18 = .13 ✓

PROJECT Meridian Rd
SHEET 20 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-04

6) Check of Stresses on Slab Design

With $A_s = 4.16$, $n = 7$, $b = 12"$, $d = 23.8"$, $M_d = 167.7$ K-FT

$$\boxed{p = \frac{A_s}{bd}} \qquad p = \frac{4.16}{12 \times 23.8} = .01456 \qquad pn = .01456 \times 7 = .102$$

$$\boxed{k = \sqrt{2np + (np)^2} - np}$$

$$k = \sqrt{2 \times .102 + .102^2} - .102 = .3501$$

$$\boxed{J = 1 - k/3} \qquad J = .8833$$

taking $M_s = M_d$

$$\boxed{f_s = \frac{M_s}{A_s J d}} \qquad f_s = \frac{167.7 \times 12000}{4.16 \times .8833 \times 23.8} = 23011 \text{ lb/in}^2$$

$23011 < 24000 \Rightarrow$ ok //

$$\boxed{f_c = \frac{f_s\, k}{n(1-k)}} \qquad f_c = \frac{23011 \times .3501}{7(1 - .3501)} = 1770.8 \text{ lb/in}^2$$

$1770.8 < 2000 \Rightarrow$ ok

$k_{final} = .3501$

$J_{final} = .8833$

See Sheet #5 for LL+I Deflections

PROJECT Meridian Rd
SHEET 21 OF ___
DESIGNED EOH
DRAWN ___
CHECKED NPK 8-86

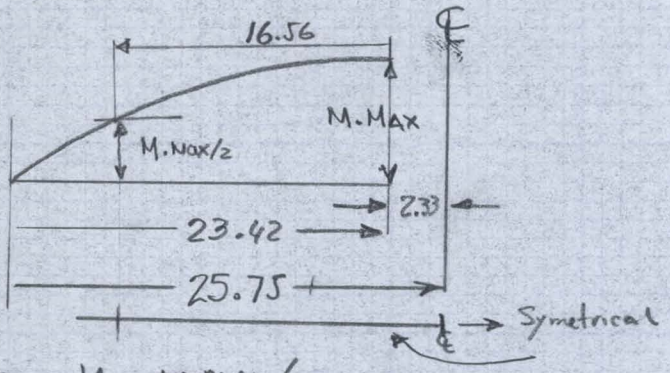
MERIDIAN RD BRIDGE

STEEL SECTIONING

a) location of Maximum moment $d_b = 1.41" = .1175$

$x = \frac{L}{2} - \frac{d}{2}$ $L = 51.5$ $d = 4.66$

$x = 51.5/2 - 4.66/2 = 23.42 FT$



x for $M = M.MAX/2$

$(23.42)^2 \longrightarrow M_{max}$

$x^2 \longleftarrow M_{max} \cdot .5$

$x^2_{M/2} = \frac{23.42^2 \times .5}{1}$

$x_{M/2} = 16.56 FT$

length of Short bars $= \left[(16.56_{FT} + 2.33_{FT}) + Max\left(\frac{L}{20}, 15 d_b\right)\right] \times 2$

$= \left[18.89 + MAX\left(2.575^{FT}, 1.76^{FT}\right)\right] \times 2$

$= \left[21.465\right] \times 2 = 42.93 FT = 42 - 11\frac{1}{4}$ ✓

$21 - 5\frac{5}{8}$ from ℄

Say $21'-6$

MERIDIAN RD BRIDGE $A_{s\,req} = 4.016$

PROJECT Meridian Rd
SHEET 22 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPL 8-8-

Development length of bars of Deck $A_b = 1.56\ in^2$

A_s = #11 @ 4½ = $A_s = 4.16\ IN^2$ $d_b = 1.41$ in

$$Ld = MAX\left(.04 A_b f_y/\sqrt{f'c}\ ,\ .0004 d_b f_y\ ,\ 12"\right)$$

AASHTO 8.25.1 8.25.1 8.25.4

$$Ld = MAX\left(\frac{.04 \times 1.56 \times 60.000}{\sqrt{5000}}\ ,\ .0004 \times 1.41 \times 60000\ ,\ 12\right)$$

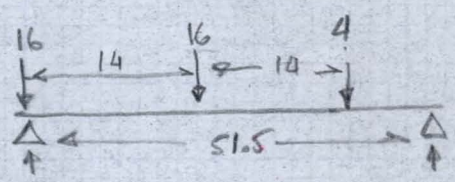
$$Ld = max\ (\ 52.9\ ,\ 33.84\ ,\ 12\ )$$

$Ld = \underline{53"}$

$$Ld \le \frac{M}{V} + La \Rightarrow La \ge Ld - \frac{M}{V}$$

$M = A_s$ (at the section) $\times f_s\, Jd$

$M = (.5 \times 4.16) \times 24000 \times .8772 \times 23.8$



$M = 86.84$ K-FT

$$V = \left[\frac{.35 \times 51.5}{2} + \frac{16K \times 1.28}{7}\left(1 + \frac{37.5}{51.5} + \frac{23.5}{4 \times 51.5}\right)\right] = 14.4$$

$$53 < \frac{86.84 \times 12}{14.4} = 72.3$$

$La = 12"$ OK//

PROJECT Meridian Rd
SHEET 23 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86

7) Computation of Deflections

with $A_s = 4.16\ in^2 = .02889\ FT^2$

$n=7,\ t=26" = 2.167\ F,\ k=.3501,\ J=.8833,\ d=23.8" = 1.983\ FT\ \ b=1\ FT$

$$I_{CR/F} = \frac{1}{3}(kd)^3 + nA_s(d-kd)^2 \qquad kd = .3501 \times 1.983 = .6942\ FT$$

$$I_{CR/F} = \frac{1}{3}(.6942)^3 + 7 \times .02889\,(1.983 - .6942)^2$$

$$I_{CR/F} = .4474\ FT^4$$

$$I_{g/F} = bt^3/12 = 1 \times (2.167)^3/12 = .848$$

$$y_T = t/2 = \frac{2.167}{2} = 1.0835$$

$$f_r = 7.5\sqrt{f'c} = 7.5\sqrt{5000} = 530\ \frac{lb}{IN^2} = 76.32\ \frac{K}{FT^2}$$

$$M_{CR/F} = \frac{f_r I_g}{y_T} = \frac{76.32 \times .848}{1.0835} = 59.73\ K\text{-}FT/F$$

Check Section 8.17.1.1. AASHTO

7-1) Immediate deflection due to dead load

$M_a = M_{DL} = 107.74\ K\text{-}FT/F$

$$\left(\frac{M_{CR}}{M_a}\right)^3 = \left(\frac{59.73}{107.64}\right)^3 = (.5543)^3 = .17039$$

$$\boxed{I_e = \left(\frac{M_{CR}}{M_A}\right)^3 I_g + \left(1 - \left(\frac{M_{CR}}{M_A}\right)^3\right) I_{CR} \leq I_g}$$

$$I_{e/F} = .17039 \times I_{g/F} + .8296\, I_{CR/F} \leq I_{g/F}$$

$$= .17039 \times .848 + .8296 \times .4474 = .5156$$

$$I_{e/F} = .5156\ FT^4$$

PROJECT Meridian Rd
SHEET 24 OF ____
DESIGNED EOM
DRAWN ____
CHECKED NPL 8-86

$$\delta_{\frac{L}{2}} = \frac{5W_e S^4}{384EI} = \frac{W_e S^2}{8} \times \frac{5S^2}{48EI} = \frac{5M_a S^2}{48EI}$$

$M_a = M_{DL}$, $E = 580393\ K/FT^2$, $I_e = .5156\ FT^4$

$$\delta_{\frac{L}{2}} \text{ Immediate} = \frac{5 \times \cancel{107.74}\ 116 \times (51.5)^2}{48 \times 580393 \times .5156} = \cancel{.0994}\ .106\ FT = \cancel{1.19}\ 1.27\ in \approx 1\ 3/16$$

7-2) Additional Long term deflection factor (ADF)

A'_s = As for temperature & SHRINKAGE = $.125\ IN^2/_F$

$$\frac{A'_s}{A_s} = \frac{.125}{4.16} = .03$$

$$ADF = \left(2 - 1.2\left(\frac{A'_s}{A_s}\right)\right) \geq .6$$

$$= (2 - 1.2 \times .03) = 1.964$$

$$\delta_{CL} \text{ Long term deflection} = 1.19'' + 1.19 \times 1.964 = 3.52'' = .2933\ FT$$

Say $3\frac{1}{2}''$

7-3) Deflected Shape:

$$\delta_{\frac{L}{2}} = \frac{5WS^4}{384EI}$$

$$W_e = \frac{\delta \times 384EI}{5 \times S^4} = \frac{.2933 \times 384 \times 580393 \times .5156}{5 \times 51.5^4}$$

$W_e = .9582\ K/_F$

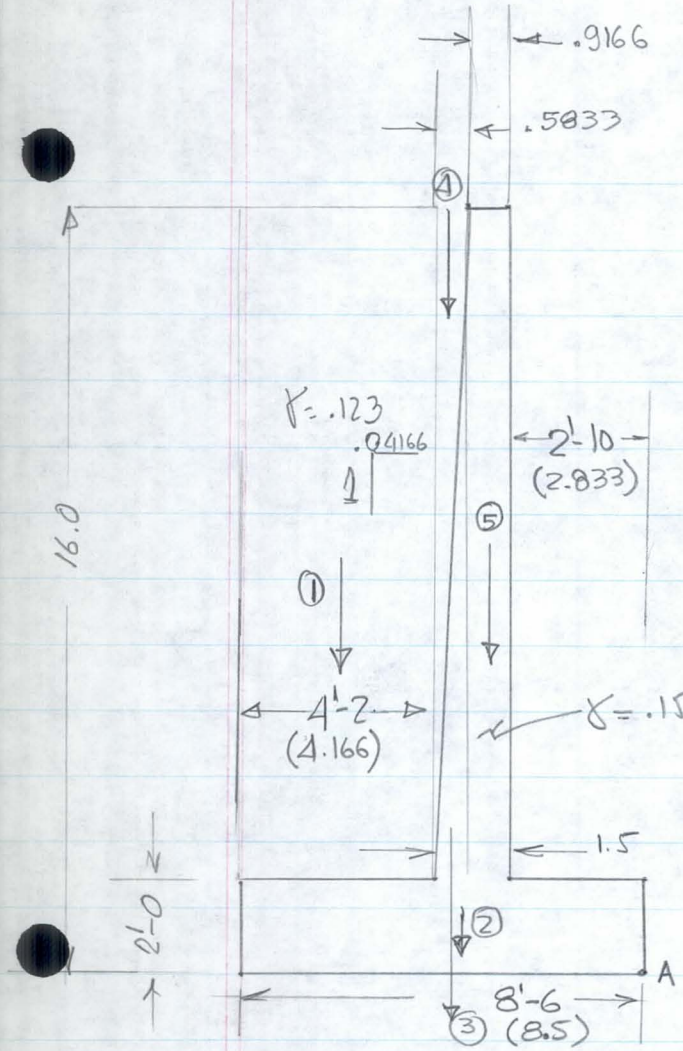
$$\delta(x) = \frac{W_e x}{24EI}\left(S^3 - 2Sx^2 + x^3\right) = \frac{.9582x\left(51.5^3 - 103x^2 + x^3\right)}{24 \times 580393 \times .5156}$$

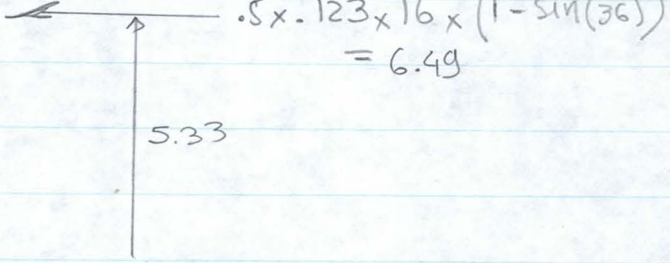
$\delta(x) = 1.334 \times 10^{-7} x\left(x^3 - 103x^2 + 136590\right)$ for Camber Calculations

See sh #5 for LL+I Deflections

WING WALL stability Analysis

PROJECT Meridien Rd
SHEET 25 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86





$M_o = 6.49 \times 5.33 = 34.6$

Stability Compatations

area	γ	Force	Arm	Moment
① 4.166 x 14 x	.123	7.17	$2.833+1.5+\frac{4.166}{2}$ = 6.416	46.00
② 8.5 x 2 x	.150	2.55	8.5÷2 = 4.25	10.84
③ (.5833 x 14÷2) x	.150	0.61	$2.833+.9166+1\times.5833/3$ = 3.95	2.41
④ (.5833 x 14÷2) x	.123	0.50	$2.833+.9166+2\times.5833/3$ = 4.138	2.07
⑤ .9166 x 14 x	.150	1.92	$2.833+.9166/2$ = 3.291	6.32

$\Sigma F_V = 12.75$ $\quad$ $\Sigma M_R = 67.64$

Overturning factor of Safety = $\frac{67.64}{34.6} = 1.955 \approx 2.0$

Safety factor against Sliding = $\frac{\Sigma F_r}{\Sigma F_H} = \frac{(\Sigma F_V)\times \tan\varphi}{\Sigma F_H} = \frac{12.75\times\tan(32)}{6.49} =$

$= 1.22 \Rightarrow$ Requires a Key

Location of the Resultant = $\frac{\Sigma M_r - \Sigma M_o}{\Sigma F_V} = \frac{67.64-34.6}{12.75} = 2.6 < \frac{8.5}{3} = 2.83$

PROJECT Meridian Rd
SHEET 26 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPL 8-83

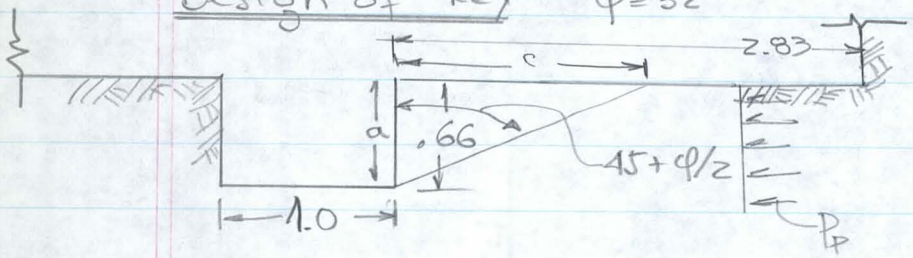
Location of Resultant (cont)

$3 \times a = 3 \times 2.6 = 7.8 < 8.5$

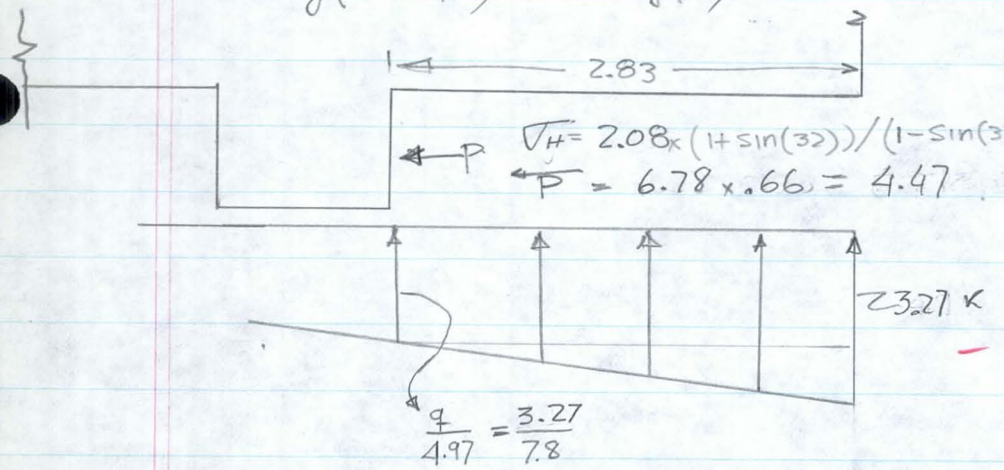
$$\frac{q_{max} \times 3a}{2} = \Sigma F_V = 12.75$$

$$q_{max} = \frac{12.75 \times 2}{7.8} = 3.26$$

Design of Key $\varphi = 32°$



$c = a \tan g(45 + 32/2) = .66 \tan g(61) = 1.19 < 2.83 \Rightarrow OK$



$\sigma_H = 2.08 \times (1 + \sin(32))/(1 - \sin(32)) = 6.78$ KSI

$P = 6.78 \times .66 = 4.47$

friction $= \Sigma F_V \times \tan g(32)$

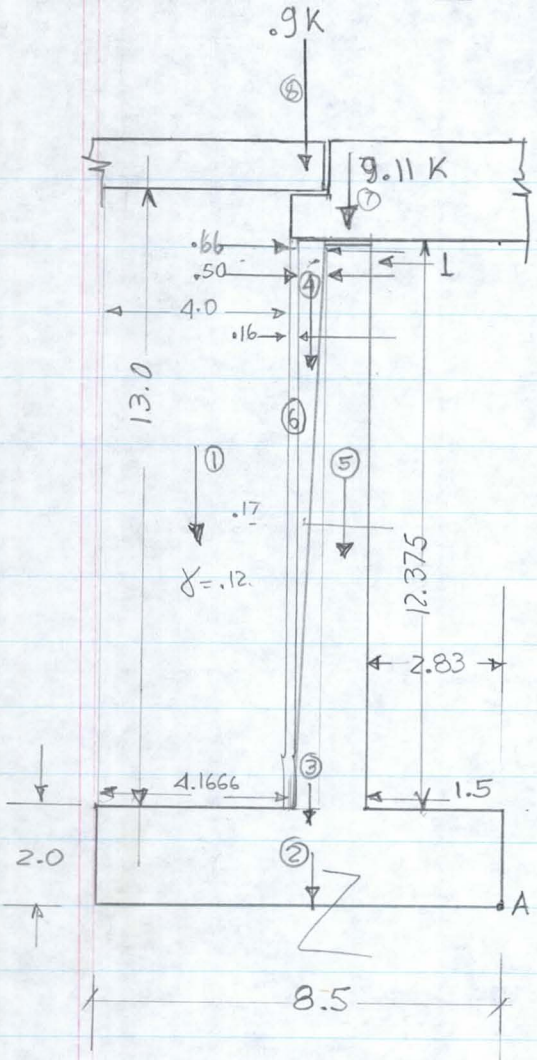
$= 12.75 \times \tan g(32) =$

$= 7.96$

Factor of Safety Against Sliding $= \frac{7.96 + 4.47}{6.49} = 1.91$

SOIL PRESSURE UNDER DEAD LOAD ONLY

PROJECT Meridian Rd
SHEET 27 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPK 8-86



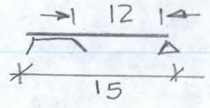
Weight of deck + asphalt:

$\left(\frac{26}{12}\right)FT \times 1\,FT \times \left(\frac{51.5+1}{2}\right) \times .15\,\frac{K}{FT^3} = 8.53$

$+ \quad \left(\frac{2}{12}\right)FT \times 1\,FT \times \left(\frac{51.5+1}{2}\right) \times .15\,\frac{K}{FT^3}$

$= 9.18$ Kips Per foot of Abut $= 9.11$ K

Weight of Appr. Slab:



$\left(\frac{12}{12}\right)FT \times 1\,FT \times \left(\frac{12}{2}\right)FT \times .15\,\frac{K}{FT^3} = .9\,K$

$P = \sum_{i=1}^{3} P_i = 9.11 + .9 = 10.01$

① $= 4.0 \times 13 \times .123 = 6.40$

② $= 8.5 \times 2.0 \times .150 = 2.55$

③ $= .5 \times 12.375 \times .5 \times .15 = .46$

④ $= .5 \times 12.375 \times .5 \times .12 = .37$

⑤ $= 1.0 \times 12.375 \times .15 = 1.86$

⑥ $= .16 \times 12.375 \times .12 = .28$

$\Sigma P = 21.93$

Stability Computations: taken moments about A

force			ARM	MOMENT
①	6.40	2.83 + 1.5 + 4/2	= 6.33	40.51
②	2.55	8.5/2	= 4.25	10.84
③	.46	2.83 + 1 + .66/3	= 4.16	1.91
④	.37	2.83 + 1 + 2×.66/3	= 4.27	1.58
⑤	1.86	2.83 + 1/2	= 3.33	6.19
⑥	.28	2.83 + 1.5 + .16/2	= 4.41	1.23
⑦	9.11	2.83 + 1/2	= 3.33	30.33
⑧	.90	2.83 + 1 + .66/2	= 4.16	3.74
	$\Sigma P = 21.93$			$\Sigma M_R = 96.33$

$M_o = 34.6$ $F_s = 2.78$

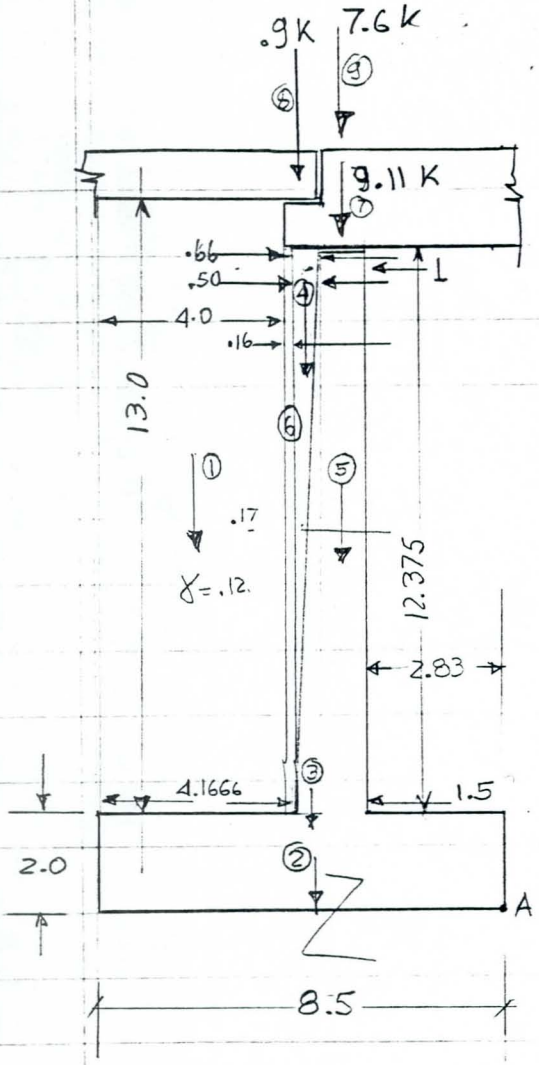
Location of the Resultant $= \frac{96.33 - 34.6}{21.93} = 2.81 = a$

$2.81 < \frac{8.5}{3} = 2.83$

Soil Pressure $= 2 \times 21.93 / (3 \times 2.81) = 5.2\ K/FT^2 < 10\ K/FT^2$ OK//

ABUTMENT UNDER DEAD LOAD & LIVE LOAD + Impact

PROJECT Meridian Rd
SHEET 28 OF ___
DESIGNED EOH
DRAWN ___
CHECKED NPK 8-83



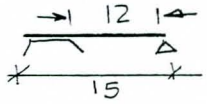
Weight of deck + asphalt

$\left(\frac{26}{12}\right)$FT x 1 FT x $\left(\frac{51.5+1}{2}\right)$ x $.15\frac{K}{FT^3}$ = 8.53

+ $\left(\frac{2}{12}\right)$FT x 1 FT x $\left(\frac{51.5+1}{2}\right)$ x $.15\frac{K}{FT^3}$

= 9.18 Kips Per foot of Abut = 9.11 K

Weight of Appr. Slab :



$\left(\frac{12}{12}\right)$FT x 1 FT x $\left(\frac{12}{2}\right)$FT x $.15\frac{K}{FT^3}$ = .9 K

$P = \sum_{i=1}^{3} P_i = 7.6 + 9.11 + .9 = 17.61$ K.

① = 4.0 x 13 x .123 = 6.40

② = 8.5 x 2.0 x .150 = 2.55

③ = .5 x 12.375 x .5 x .15 = .46

④ = .5 x 12.375 x .5 x .12 = .37

⑤ = 1.0 x 12.375 x .15 = 1.86

⑥ = .16 x 12.375 x .12 = .28

ΣP = 29.53

Stability Computations : taken moments about A

			ARM	MOMENT
force ①	6.40	2.83 + 1.5 + 4/2	= 6.33	40.51
②	2.55	8.5/2	= 4.25	10.84
③	.46	2.83 + 1 + .66/3	= 4.16	1.91
④	.37	2.83 + 1 + 2x.66/3	= 4.27	1.58
⑤	1.86	2.83 + 1/2	= 3.33	6.19
⑥	.28	2.83 + 1.5 + .16/2	= 4.41	1.23
⑦	9.11	2.83 + 1/2	= 3.33	30.33
⑧	.90	2.83 + 1 + .66/2	= 4.16	3.74
⑨	7.60	2.83 + 1/2	= 3.33	25.31
ΣP = 29.53				ΣM_R 121.64

$M_o = 34.6$, $FS_o = 3.5$

Location of the Resultant = $\frac{121.64 - 34.6}{29.53} = 2.94 = a$

$2.94 > \frac{8.5}{3} = 2.83$

=> Resultant is within the midle thirth.

Soil Pressure : $3xa = 3 \times 2.94 = 8.82 > 8.5$ then:

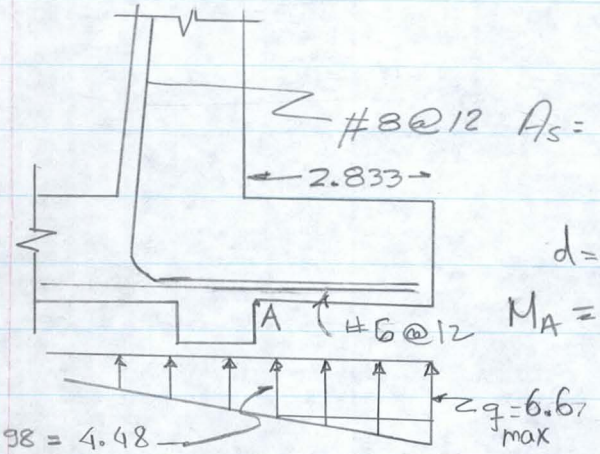
$q = \frac{\Sigma P}{b}\left(1 + \frac{6e}{b}\right)$, $e = |a - b/2| = |2.94 - \frac{8.5}{2}| = 1.31$

$q = (29.53/8.5)(1 + 6 \times 1.31/8.5) = 6.6 \frac{K}{FT^2}$ $q_{FT^2} = .26\ K/FT^2$

$q_{max} = 6.6 < 10$ OK!!

PROJECT Meridian Rd
SHEET 29 OF ___
DESIGNED EOM
DRAWN ___
CHECKED NPL 8-86

Toe Design



$1.2M_{CR} = 1.2 \times .410 \times 1.0 \times \frac{24}{6} = 47.5$ K-Ft

$d = 24 - 3 - \frac{1}{2} = 20.5$

$M_A = \frac{4.48(2.833)^2}{2} + \frac{2}{3} \times \frac{2.833^2 \times 2.12}{2} \times = 23.65$

2' Ftg $.3 \times \frac{2.83^2}{2} = -1.12$

22.4

$d = 20.5 \quad p = .79/(12 \times 20.5) = .0032 \quad np = 9 \times .0032 = .029 \quad k = .213 \quad J = .929$

$f_s = \frac{M_s}{A_s J d} = \frac{23.65 \times 12000}{.79 \times .929 \times 20.5} = 18864 < 20000$ OK// ✓

22.4 → 15245

1.23/1.33

$f_c = \frac{f_s K}{n(1-K)} = \frac{18864 \times .213}{9(1-.213)} = 567 < 1200$ OK// ✓

Shear At section A

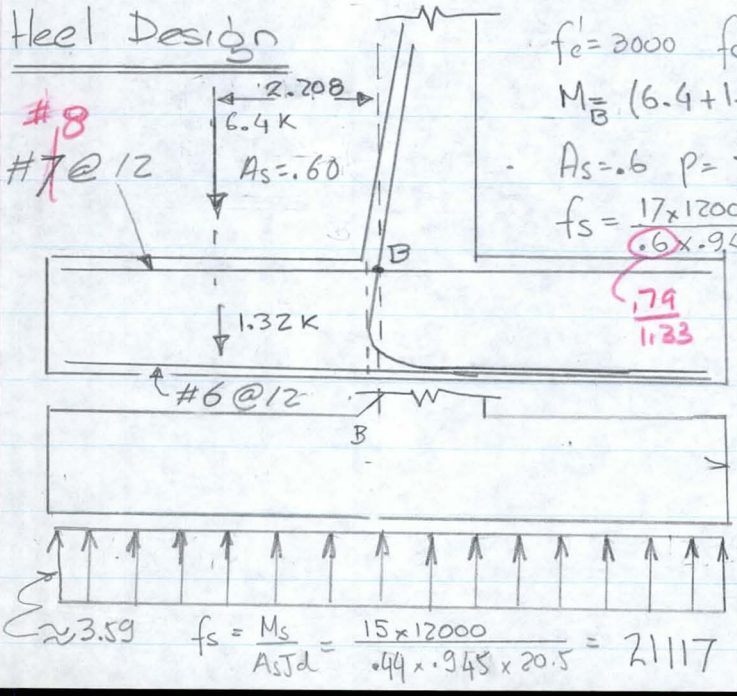
$V = 4.48 \times 2.833 + 2.12 \times 2.833 \times .5 - 2.833 \times 2 \times .15 = 14.84$ kips

$v_a = .95\sqrt{f'c} = .95\sqrt{3000} = 52$ lb/in²

$v = 14.84/(12 \times 20.5) = 60$ lb/in²

? O.K. since shear was taken @ Face of wall

Heel Design



$f'c = 3000 \quad f_c = 1200 \quad n = 9 \quad f_s = 20000$

$M_B = (6.4 + 1.32) \times 2.208 = 17$ K-FT ✓

$A_s = .6 \quad p = \frac{.6}{12 \times 20.5} \quad np = .022 \quad k = .18 \quad J = .94$

$f_s = \frac{17 \times 12000}{.6 \times .94 \times 20.5} = 17644 < 20000 \Rightarrow$ OK//

17822

.6 → .79 / 1.23

$f_c = \frac{f_s k}{n(1-k)} = \frac{17644 \times .18}{9(1-.18)} = 430 < 1200$ OK//

If Earth pressure does not develop fully then:

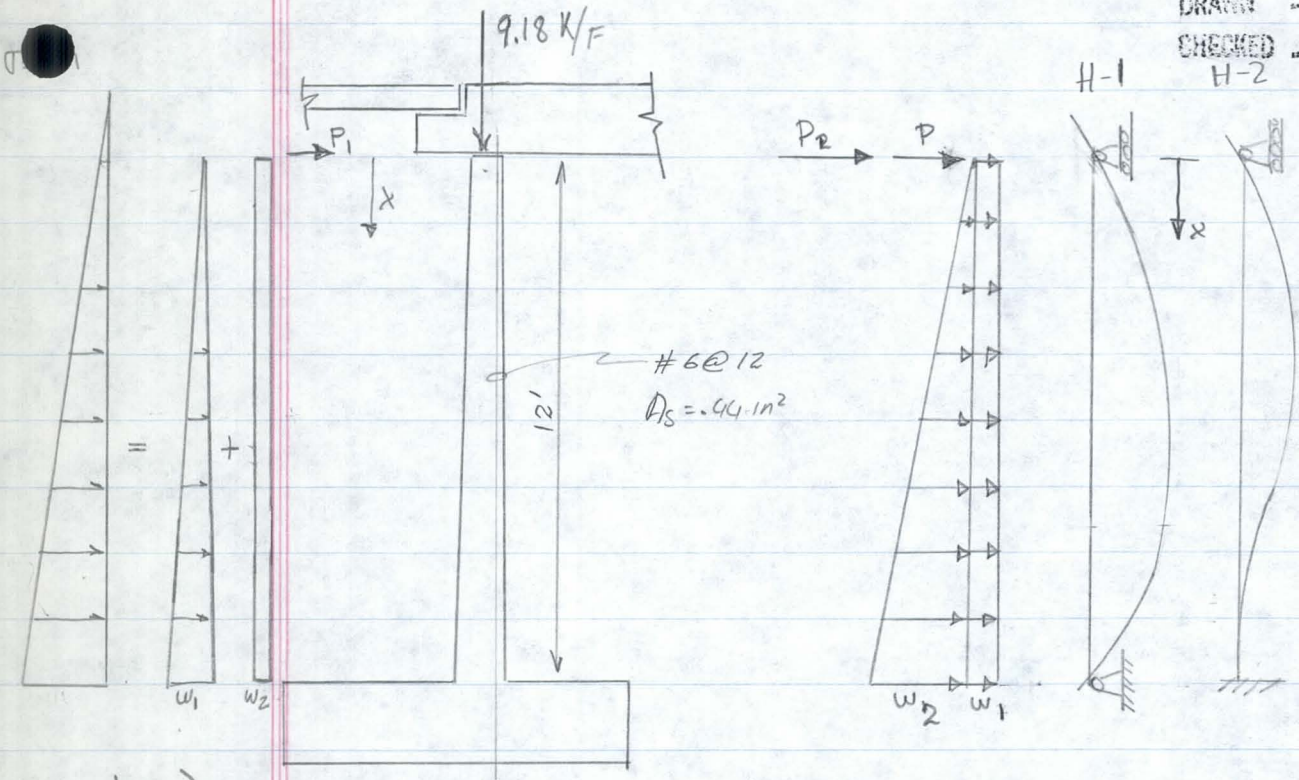
$M_B = \frac{3.59 \times 4.16^2}{2} - \frac{6.4 \times (4.16)}{2} - \frac{1.32 \times (4.16)}{2} =$

$M_B = 15$ K-F, $A_s = .44$ $p = .00178$ $n = 9$

$k = .165$ $J = .945$ ✓

$f_s = \frac{M_s}{A_s J d} = \frac{15 \times 12000}{.44 \times .945 \times 20.5} = 21117$

PROJECT Meridian Rd
SHEET 30 OF
DESIGNED EOM
DRAWN
CHECKED NPK 11-86



H-1)

$W_2 = 708$ lb/FT $W_1 = 102 \frac{lb}{FT}$ $L = 12$ FT

H-1) $M(x) = \frac{w_1 x^2}{2} + \frac{w_2 x^3}{6L} - Rb\,x$

for simple supported $Rb = \frac{w_1 L}{2} + \frac{w_2 L}{6} = \frac{102 \times 12}{2} + \frac{708 \times 12}{6}$

$Rb = 2028$ lb

$\frac{dM(x)}{dx} = w_1 x + \frac{w_2 x^2}{2L} - Rb = 0$

$a = w_2/24 = 29.5$ $b = w_1 = 102$ $C = -Rb = -2028$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-102 \pm \sqrt{102^2 + 4 \times 29.5 \times 2028}}{2 \times 29.5}$

$x = 6.74$ $M(6.74) = \frac{102 \times 6.74^2}{2} + \frac{708 \times 6.74^3}{72} - 2028 \times 6.74 = -8341$

$M_{max} = 8.3$ K-FT $d = 12 + .5 \times 6.74 - 1.5 - .5(.5) \approx 13.6$

$f_c' = 3000$ psi ; $f_c = 1200$; $f_s = 20000$; $n = 9$

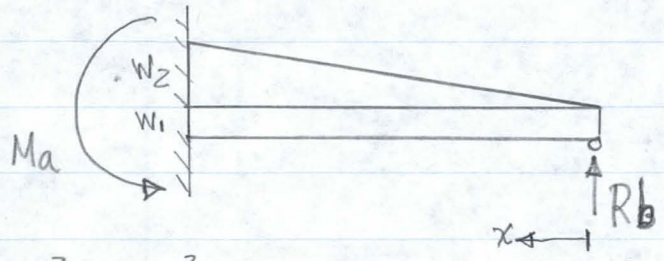
$p = .44/(12 \times 13.6) = .0027$ $np = .0243$ $k = \sqrt{2np + np^2} - np = .1974$ $J = .934$

$f_s = M/(A_s J d) = \frac{8.3 \times 12000}{.44 \times .934 \times 13.6} = 17820 < 20000$ OK //

$f_c = f_s k / n(1-k) = \frac{17820 \times .1974}{9(1-.1974)} = 487 < 1200$ OK //

PROJECT Meridian Rd
SHEET 31 OF ____
DESIGNED EOM
DRAWN ____
CHECKED NPK 11-86

H-2)



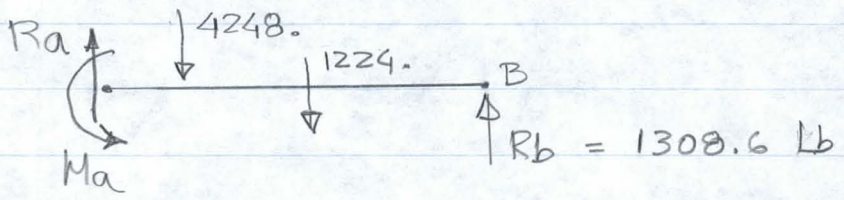
$W_2 = 708$

$W_1 = 102$

$L = 12$

$$M_a = \frac{W_1 L^2}{8} + \frac{W_2 L^2}{15}$$

$$M_a = \frac{102 \times 144}{8} + \frac{708 \times 144}{15} = 8633 \text{ lb-FT}$$



$$4248 \times 4 + 1224 \times 6 - 8633 - Rb \times 12 = 0$$

$$15703 = Rb \times 12$$

$$Rb = 1308.6$$

$$\Rightarrow Ra =$$

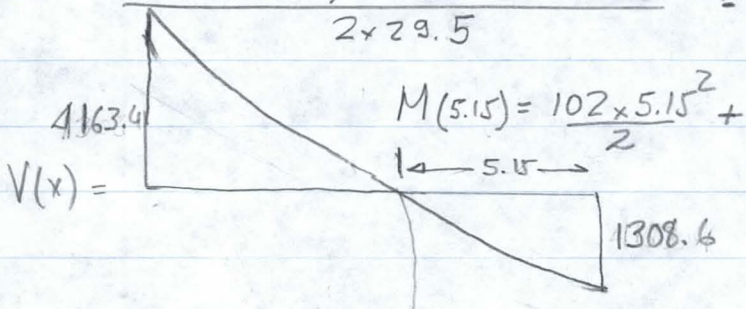
(+) $$M(x) = \frac{W_1 x^2}{2} + \frac{W_2 x^3}{6L} - Rb\,x$$

$$\frac{dM(x)}{dx} = W_1 x + \frac{W_2 x^2}{2L} - Rb = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$a = W_2/2L = 708/24 = 29.5 \qquad b = W_1 = 102 \qquad c = -Rb = -1308.6$

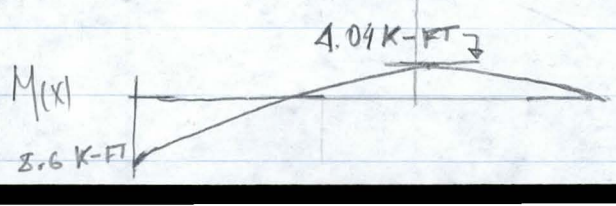
$$x = \frac{-102 + \sqrt{(102)^2 + 4 \times 29.5 \times 1308.6}}{2 \times 29.5} = 5.15$$



$$M(5.15) = \frac{102 \times 5.15^2}{2} + \frac{708 \times 5.15^3}{72} - 1308 \times 5.15$$

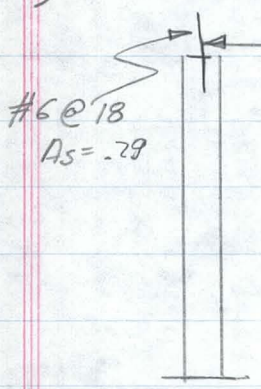
$$= -4040.4 \text{ lb-FT}$$

$$\approx 4.04 \text{ K-FT}$$



$4.04 < 8.3$ from H-1

H-3)



EP

EQ = .05 × 9.18 K/FT × 2 = 918 Lb/FT

1308 Lb/FT + 918 = 2226 = V = 2.22 K/FT

f_v

.29 × 13.5 = 3.91 K/FT > 2.22 OK//

PROJECT Meridian Rd
SHEET 32 OF ____
DESIGNED EOM
DRAWN ____
CHECKED NPK 11-86

BID SCHEDULE

MERIDIAN ROAD AND IRONWOOD DRIVE BRIDGES

ITEM NO.	WORK OR MATERIAL	MAG SECTION OR SCS SPEC. NO.	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobililzation	SCS 8	1	Lump Sum	XXX	
2	Structure Excavation	MAG 206		C.Y.		
3	Fill Construction	MAG 211	3280	C.Y.		
4	Structure Backfill	MAG 206		C.Y.		
5	Untreated Base	MAG 310	920	Tons		
6	Asphalt Concrete	MAG 321	370	Tons		
7	Bituminous Prime Coat	MAG 315	7	Tons		
8	Concrete Class "AA"	MAG 505	438	C.Y.		
9	Concrete Class "A"	MAG 505	521	C.Y.		
10	Steel Reinforcement	MAG 727	152,730	lbs.		
11	Pedestrian Handrail	MAG 520	158	L.F.		
12	Survey	SCS 210	1	Lump Sum	XXX	

6. ITEMS OF WORK AND CONSTRUTION DETAILS - Meridan Road and Ironwood Drive Bridges

Sections 1 through 5 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications and construction details contained herein:

a. Supsidiary Item, Clearing and Grubbing, MAG Section 201

1. This item shall consist of clearing and grubbing of all areas within the limits of the roadways and Bulldog Floodway as necessary for the construction of the bridges and approach roadways.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges

Section 1 through 6 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications and construction details contained herein:

a. Subsidiary Item, Removal of Existing Improvements, MAG Section 350

1. This work shall consist of removal and disposal of all existing improvements necessary for the construction of the bridges and approach roadways.

2. Arrangements for disposal of all removed materials shall be the responsibility of the Contractor.

3. Section 350.4, Payment - No separate payment will be made for Removal of Existing Improvements. Compensation for this item shall be included in the contract bid price for the construction or installation of the bid items to which Removal of Existing Improvements are incidental or appurtenant.

b. Subsidiary Item, Cooperation with Utilities, MAG Section 105.6

1. An attempt has been made to determine the location of all underground utilities and drainage pipes, culverts and structures; however, it shall be the Contractor's responsibility to cooperate with the pertinent utility companies so that any obstructing utility installation may be adjusted. Should the Contractor's operations result in damage to any utility the location of which has been brought to his attention, he shall assume full responsibility for such damage.

2. The following phone numbers should put the Contractor in contact with the proper personnel:

Flood Control District	262-1501
Mountain Bell Telephone Company	163-3219
Salt River Project	273-2202
Arizona Public Service	271-7014
Location Staking (A.P.S., Mtn. Bell, S.R.P.)	263-1000
Maricopa County Highway Department	262-3631
Pinal County Highway Department	1-868-5801

3. No separate payment will be made for cooperation with utilities. Compensation for this item shall be included in the contract bid price for the construction or installation of the bid items to which cooperation with utilities are incidental or appurtenant.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Pollution Control

1. This item shall consisit of all measures required to control dust, erosion, sedimentation, or any other form of pollution resulting from the Contractor's activities in construction of the bridges and the approach roadways.

2. Permits for earth moving may be obtained from the Bureau of Air Pollution Control, Maricopa County Department of Health Service, 1845 East Roosevelt, telephone 258-6381.

3. No separate payment will be made for pollution control. Compensation for this item shall be included in the contract bid price for the construction or installation of the bid items to which pollution control are incidental or appurtenant.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Items of work to be performed in conformance with this specification and construction details are:

a. Bid Item 1, Mobilization

1. This item shall consist of the mobilization of the Contractor's equipment and forces for the construction of all work required under this project.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges

Sections 1 through 6 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications construction details contained herein:

a. Susidiary Item, Water, MAG Section 225

1. This item shall consist of furnishing and applyling all water required for performanace of the work described for the construction of the bridges and approach roadways.

~~Method of Payment~~ ? in MAG

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Removal of Water

1. This item shall consist of the Contractors responsibility to protect the structure and construction site from excessive or detrimental flooding within the right-of-way which may occur during the construction period and until final acceptance of the completed project.

2. The Contractor's plans for control of surface water and any dewatering necessitated by rainfall or runoff into construction area shall be furnished to the Contracting Officer prior to perfrormance of any excavation or earthfill work.

3. No separate payment will be made for Removal of Water. Compensation for this item shall be included in the contract bid price for the construction of installation of the bid items to which removal of water are incidental or appurtenant.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges

Sections 1 through 11 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Unified Standard Specifications and construction details contained herein:

a. Bid Item 2, Structure Excavation, MAG Section 206

1. This item shall consist of all excavation required for the construction of the bridge abutments as shown on the drawings.

2. All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown for spoil on the bulldog Floodway drawings.

3. Measurement and payment shall be defined as follows:

a. The upper limit shall be the original ground surface as it exists prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

The volume will be measured and computed to the nearest cubic yard by the method of average cross sectional end areas. Payment will include compensation for all subsidiary work incidental and appurtenant.

b. Subidiary Item, Roadway Excavation, MAG Section 205

1. Roadway excavation shall consist of excavation involved in the grading and construction of roadways as shown on the drawings.

2. Section 205.2, unsuitable material and Section 205.6, surplus material -- will be designated as waste and shall be disposed of at the locations shown for spoil on the Bulldog Floodway drawings.

3. No spearate payment will be made for Roadway Excavation. Compensation for this item will be included in Bid Item 3, Fill Construction.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Sections 1 through 9 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Unified Standard Specifications and construction details contained herein:

a. Bid Item 3, Fill Construction, MAG Section 211

1. This item shall consist of constructing the embankment for the approach roadways as shown on the drawings.

2. Fill material shall be suitable material free of all debris and vegetation obtained from required excavation from the Bulldog Floodway.

3. Depressions and ditches shall be cleaned of all loose or wet soils and widened to accommodate compaction equipment. Sloping surfaces shall be benched to provdide a level surface for fill placement.

4. Compaction shall be to a minimum of 95% of the maximum density as determioned in accordance with AASHTO T-99, Method D and T-191 or ASTM D-2922 and D-3017 within a moisture content range of plus or minus 2% of optimum.

5. The volume of Fill Construction within the specified zone boundaries and paylimits will be measured and completed to the nearest cubic yard by the method of average cross sectional and areas.

   The pay limits shall be those of the completed bid item, in place, measured from the original ground surface within the limits of the dimensions shown on the plans and will include compensation for all subsidiary incidental and appurtenant work and subsidiary items Roadway Excavation and Subgrade Preparation.

b. Bid Item 4, Structure Backfill, MAG Section 206

1. This item shall consist of furnishing, placing and compacting special backfill material around the bridge abutments as shown on the drawings.

2. Special Backfill shall be Type "A" Select Material in accordance with Table 702 of the Uniform Standard Specifications, compacted to a minimum of 95% of the maximum density as determined by AASHTO T-99, Method A, and T-191 or ASTM D-2922 and D-3017. Compaction equipment should be maintained at least two (2) feet from the structue.

4. The volume of Structure Backfill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas.

   The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface and will include compensation for all subsidiary incidental and appurtenant work and subsidiary items Drainfill Fine Aggregate and Drainfill Coarse Aggregate.

c. Subsidiary Item, Subgrade Preparation, MAG Section 301

1. This item shall consist of preparation of subgrades to the required lines and grades for the bridge approach roadways.

2. No separate payment will be made for Subgrade Preparation. Compensation for this item will be included in Bid Item 3, Fill Construction.

d. Bid Item 5, Untreated Base, MAG Section 310

1. This item shall consist of the aggregate base for the approach roadways as shown on the drawings.

2. Select material and aggreagate base shall be crushed and conform to the requirements of MAG Section 702. Select material shall be Type A.

3. The quantity of Untreated base within the specified limits will be measured to the nearest ton by actual weight. For each load of Untreated Base placed as specified, the Contractor shall furnish to the Engineer a statement of delivery ticket showing the weight to the nearest 0.1 ton, of Untreated Base delivered.

   Payment for Untreated Base will be made at the contract unit price and will include compensation for all subsidiary work incidental and appurtenant.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Drainfill Fine Aggregate

1. This item shall consist of furnishing and installing drainfill fine Aggregate along the abutment walls as shown on the drawings.

2. The material shall be well graded within the following limits of gradation:

Sieve Size	Percent Passing
2"	100
3/4	90-100
#4	60-100
#10	40-100
#20	20-75
#40	0-55
#60	0-40
#100	0-25
#200	0-5

3. The material shall contain sufficient moisture to permit placing with minimum segregation.

4. Compaction shall be Class III, same as for Special Backfill

5. No separate payment will be made for Drainfill Fine Aggregate. Compensation for this item will be included in Bid Item 4, Structure backfill.

b. Subsidiary Item, Drainfill Coarse Aggregate

1. This item shall consist of furnishing and installing Drainfill Coarse Aggregate along the abutment walls as shown on the drawings.

2. The Drainfill material shall be well graded within the following limits of gradation:

Sive Size	Percent Passing
2"	100
3/4"	90-100
1/2"	60-100
3/8"	40-80
#4	5-25
#10	0-8
#20	0-5

ASTM 448, gravel size #78 meets this requirement.

3. The drainfill material shall contain sufficient moisture to permit placing with minimum segregation.

4. Compaction shall be Class III. same as for Structural Backfill

5. No separate pay will be made for Drainfill Coarse Aggregate. Compensation for this item will be included in Bid Item 4, Structure Backfill.

26. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Sections 1 through 25 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Unified Standard Specifications and construction details contained herein:

a. Bid Item 6, Asphast Concrete, MAG Section 321

1. The bituminous material to be used shall be either AC-20 or AC-40 complying with Tabel 711-1A of MAG specifications as revised in 1983.

2. The mineral aggregate shall meet the grading requirements for Mix Designation C-3/4 in accordance with Section 710 of the Uniform Standard Specifications.

3. In addition to pugmill type mixing plants, Drum Dryer Mixers will be allowed in accordance with Standard Specificaiton 710.9. The moisture content of the bituminous mixture immediately behind the paver shall not exceed three percent.

4. The proper proportioning of the material at the cold feed shall be determinid by the Contractor and approved by the Engineer prior to the production of asphalt concrete. Production shall not commence until calibration tests indicate that an acceptable product can be obtained.

5. The correct proportions of each aggregate size introduced into the mixer shall be drawn from the storage bins by an approved type of continuous feeder which shall supply the correct amount of aggregate in proportion to the bituminous material and shall be so arranged that the proportion of each aggregate size can be separately adjusted. The continuous feeder for the aggregate may be mechanically or electrically activated.

6. The plant shall be equipped with a sampling device to take representative composite samples of the cold feed. If tests indicate non-compliance with specifications, operations shall cease until proper corrections have been made.

7. The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials. Mixing shall continue until the uniformity of coating, when tested in accordance with requirement of AASHTO T 195, is a least 95 percent.

8. Measurement and Payment shall be in accordance with Sections 321.8 and 321.9 and will include compensation for subsidiary Item, Pavement Matching and Surface Replacement.

b. Bid Item 7, Bituminous Prime Coat, MAG Section 315

1. The bituminous material shall be Grade MC-70 or MC-250 Liquid Asphalt as determined by the Engineer. Prime coat shall be applied to the total width of the Aggregate Base Material at the rate of 0.40 gallons per square yard.

c. Subsidiary Item, Pavement Matching and Surface Replacement, MAG Section 336

1. Existing pavements which are to be matched by the new roadway pavement shall be trimmed to a neat, straight and vertical edge. The trimmed edges shall be painted with a light coat of emulsified asphalt immediately prior to constructing the new abutting pavement.

2. No separate payment will be made for Pavement Matching and Surface Replacement. Compensation for this item will be included in Bid Item 6, Asphalt Concrete.

d. Bid Item 8, Concrete Class "AA", MAG Section 505

1. This item shall consist of furnishing, forming, and placing all Concrete Class "AA" required to construct the bridges as shown on the drawings. This item shall also include furnishing and installing the Elastomeric Bearing Pads, galvanized sheet metal strips, premolded joint filler and steel roadway angle or pipe hanger assemblies as shown on the drawings.

2. Concrete shall conform to Section 725 except that Class"AA" Concrete shall have a strength of 5000 psi at 28 days.

3. The use of fly ash will be permitted.

4. The top surface of the bridge deck shall be cured by the liquid-membrane curing compound method and by the water curing method. The curing compound shall be applied progressively immediately following the surface finishing operation. Liquid-membrane curing compound shall be applied at a rate of one gallon per 100 square feet. The curing compound shall form a continuous unbroken surface. Water curing shall be applied not later than four after the completion of the deck finishing operations and shall be applied for a period of a least 7 days after placing.

5. See MAG Section 505.8 and 726 for additional requirements.

6. Cast-in-place dimensional tolerances shall be in accordance with Section 601.4.02(A) of the Arizona Department of Transporation Highways Division Standard Specifications for Road and Bridge Construction, edition of 1982.

7. Elastomeric Bearing Pads (Neoprene) shall be in accordance with ADOT requirements and shall be made of durometer 60 neoprene.

Pads shall conform to the dimensions and thickness shown on the drawings.

8. Premolded Joint Filler (Premold Joint) shall conform to MAG Section 729.1 of the Uniform Standard Sepcifications.

9. No vehicular loads will be permitted on the bridges before the lapse of twenty-one (21) days from the date of the last pour of concrete for the deck, unless approval is obtained in writing from the Engineer.

10. The Contractor shall take special precautions to keep the area around the bridges properly barricaded and marked with flares to prevent automotive traffic from running into the floodway or crossing the new bridges prior to the acceptance of the completed project by the Engineer.

11. Measurement and payment shall be in accordance with Section 505.10 and will include compensation for subsidiary item, Traffic Control.

e. Bid Item 9, Concrete Class "A", MAG Section 505

1. This item shall consist of furnishing, forming, and placing all Concrete Class "A" required to construct the bridge abutments as shown on the drawings. This item shall also include furnishing and installing premolded joint filler and weep hole drains as shown on the drawings.

2. Concrete shall conform to Section 725 except that Class "A" Concrete shall have a strength of 4000 psi at 28 days.

3. The use of fly ash will be permitted.

4. See MAG Sections 505.8 and 726 for additional requirements.

5. Cast-in-place dimensional tolerances shall be in accordance with Section 601.4.02 (A) of the Arizona Department of Transportation Highways Division Strandard Specifications for Road and Bridge Construction, Edition of 1982.

6. Premolded Joint Filler (Premold Joint) shall conform to MAG Sections 729.1 of the Uniform Standard Specifications.

7. The Contracotr shall take special precautions to keep the area around the bridge abutments properly barricaded and marked with flares to prevent automotive traffic from running into the floodway.

8. Measurement and payment shall be in accordance with Section 505.10 and will include compensation for subsidiary item, Traffic Control.

f. Subsidiary Item, Traffic Control, MAG Section 401

1. The Contractor will be authorized to close only one (1) mile road at a given time during the duration of the project.

2. The number and kind of barricades, signs, delineators, barriers and all other traffic control devices and the approval of the contractors method of application of all traffic control measures, shall not relieve the contractor of the responsibility of protecting the work, the workmen and the traveling public.

3. The Contractor shall install and maintain decelerations and Sand berms (approximately five feet high) in the path of through traffic prior to bridge construction or excavation. Sand berms shall remain until the bridge is open to the traffic.

4. The contractor shall provide a detailed traffic control plan for approval at the pre-job conference. The plan shall show all types of signs, sand berms and their placement.

5. All necessary signs, barricades and centerline vertical panels shall remain three working days beyond acceptance of the project by the County.

6. No separate payment will be made for Traffic Control. Compensation for this item will be included in Bid Item 8, Concrete Class "AA" and Bid Item 9, Concrete Class "A".

10. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Sections 1 through 9 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Unified Standard Specifications and construction details contained herein:

a. Bid Item 10, Steel Reinforcement, MAG Section 727

1. This item consists of furnishing and installing all steel reinforcement required for the construction of the bridge structures.

2. All steel shall be Grade 60.

3. Measurement and payment for items of work for which specific unit prices are established in the contract, the weight of reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of reinforcement will be based on the unit weights established in Tables 34-1 and 34-2. Computation of weights for welded wire fabric not shown in Table 34-2 shall be based on ACI Standard 315. The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps. The weight of supports and ties will not be included in the measurement for payment.

Payment for furnishing and placing reinforcing steel will be made at the contract unit price. Such payment will constitute full compenstation for all labor, materials, equipment and all other items necessarsy and incidental to the completion of the work including preparing and furnishing bar schedules, lists or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, storing,, cutting, bending, cleaning and securing all reinforcement.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Sections 1 through 6 of this specification do not apply. Items of work to be performed shall be in conformance with the Maricopa Association of Governments (MAG) Uniform Standard Specifications for Public Works Construction dated 1979 and current revisions thereto, together with the Maricopa County Highway Department Supplement to the Unified Standard Specifications and construction details contained herein:

a. Bid Item 11, Pedestrian Handrail, MAG Section 520

This item shall consist of furnishing all materials and constructing the pedestrian handrail as shown on the drawings.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Meridian Road and Ironwood Drive Bridges.

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 12, Survey

1. This item shall consist of furnishing personnel, equipment, materials and performing surveys required for Bridge:

   a. Construction Layout
   b. Computation of Quantities
   c. "As-Built" Construction Drawings

2. The Contractor shall provide the Government Representative a statement of qualifications, including specific experience of each of the survey personnel assigned to the job.

3. The Contractor shall provide the Government Representative a schedule of surveys to be performed.

CONSTRUCTION SPECIAL PROVISIONS
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FOR
MERIDIAN ROAD BRIDGE, AND
IRONWOOD DRIVE BRIDGE

PROPOSED WORK: The work includes the construction of two reinforced concrete bridges, approach roadways and other miscellaneous items of work required for the completion of the project.

LOCATION OF WORK: The work is located at two different locations near Apache Junction, Arizona.

1. Meridian Road approximately 3000 feet north of Lost Dutchman Blvd.
2. Ironwood Road approximately 1450 feet north of Lost Dutchman Blvd.

SPECIFICATIONS: The work embraced herein and as shown on the plans for the construction of this project shall be done in accordance with the Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction dated 1979 and the current revisions thereto, together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications and the Construction Special Provisions contained herein.

PRECEDENCE OF CONTRACT DOCUMENTS: In case of a discrepancy or conflict the Project Plans will govern over both the MAG Uniform Standard Specifications and the MCHD Supplement. These Construction Special Provisions will govern over the MAG Uniform Standard Specifications, the MCHD Supplement and the Project Plans.

WORK STANDARDS: The Contractor shall comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330) as supplemented by Department of Labor Regulations (29 CFR Part 5)

CONTRACT TIME: The Contractor shall start work within seven (7) calendar days and complete all work on the project within [ ] days after the date of Notice to Proceed.

WATER, LIGHT, POWER, HEAT, TELEPHONE: All water for construction purposes, drinking water, lighting, temporary electric power, heat and telephone service shall be arranged for and provided for the requirements of the work by the Contractor at his expense.

PROGRESS SCHEDULE: The Contractor shall submit his proposed work progress schedule to the Chief Engineer and General Manager for approval before starting the work.

ITEM COMMENTS: The herein contained Construction Special Provisions supplement the Uniform Standard Specifications; however, in case of conflict, these Special Provisions supersede the Uniform Standard Specifications.

GENERAL COMMENT: The cost of all work required under this contract as shown on the plans for which there are no specific items shown on the Bidding Schedule, shall be included in the prices bid for related items.

SUBSECTION 101.2 - DEFINITIONS AND TERMS: Change the definition of Budget Project to read as follows: A project financed by funds set aside in the annual budget or otherwise approved by the Board of Directors of the Flood Control District of Maricopa County.

Change the definition of Engineer to read as follows: The Chief Engineer and General Manager of the Flood Control District of Maricopa County acting directly or through his duly authorized representative.

Change the definition of Owner to read as follows: The Flood Control District of Maricopa County, acting through its legally constituted officials, officers or employees.

SECTION 102 - ADDENDA & SUBMISSION OF BIDDING SCHEDULE: It shall be the responsibility of prospective bidders to determine, prior to submission of a bid, if any addenda have been issued. This may be accomplished by calling 602-262-1501. Any addendum issued, if not already bound into the Special Provisions, must be included as a part of the Special Provisions, and any quantities on the Bidding Schedule requiring change shall be adjusted by pen and ink to the new figure.

Bids that do not include appropriate addenda and show appropriate changes to the Bidding Schedule shall be invalid.

SECTION 102.5 - PREPARATION OF PROPOSAL: The bidders Arizona State Contractor's License number and classifications need not be shown on the proposal. The possession of such a license is no longer a bidding requirement; however, the Contractor may be required to provide certification of prior satisfactory completion for similar construction.

SECTION 103.6 - CONTRACTORS'S INSURANCE: Concurrently with the execution of the contract, the Contractor shall furnish a Certificate of Insurance. The types of insurance and the limits of liability shall be as indicated thereon, i.e.

$1,000,000	bodily injury per person
$5,000,000	bodily injury each occurrence
$1,000,000	property damage

SECTION 105.2 - PLANS AND SHOP DRAWINGS: The number of copies of plans/shop drawings required for review and/or approval shall be as follows:

Initial submittal: Three (3) copies. One (1) copy will be returned to the Contractor.

Final Submittal: Five (5) copies. Two (2) copies will be returned to the Contractor.

SUBSECTION 105.6 - COOPERATION WITH UTILITIES: An attempt has been made to determine the location of all underground utilities and drainage pipes, culverts and structures; however, it shall be the Contractor's responsibility to cooperate with the pertinent utility companies so that any obstructing utility installation may be adjusted. Should the Contractor's operations result in damage to any utility the location of which has been brought to his attention, he shall assume full responsibility for such damage.

The following phone numbers should put the Contractor in contact with the proper personnel:

Flood Control District	262-1501
Mountain Bell Telephone Company	163-3219
Salt River Project	273-2202
Arizona Public Service	271-7014
Location Staking(A.P.S.,Mtn.Bell, S.R.P.)	263-1000
Maricopa County Highway Department	262-3631
Pinal County Highway Department	1-868-5801

SECTION 105.8 CONSTRUCTION STAKES, LINES AND GRADES: The project control line and bench mark elevation are shown on the drawings and will be established by the Engineer. The Contractor shall establish offset stakes and temporary bench marks for referencing the designated construction lines and grades. The Contractor shall provide all rough grade, fine grade, and structural reference lines and shall be responsible for their conformance with the plans and specifications.

Survey work shall be performed by a qualified and experienced surveyor under the supervision of a licenses surveyor.

No separate payment will be made for construction surveying and the cost thereof shall be included in the price bid for related items of work.

SECTION 107.2 - PERMITS: The Contractor shall be responsible for obtaining all permits and licenses, pay all charges, fees, taxes and give all notices necessary and incidental to the due and lawfull prosecution of the work. Permits for earth moving may be obtained from the Bureau of Air Pollution Control, Maricopa County Department of Health Services, 1845 East Roosevelt telephone number 258-6381.

SECTION 108.5 - LIMITATIONS OF OPERATIONS: Should the Contractor elect to perform any work after regular working hours, on weekends, or legal holidays, any charges incurred by the District for inspection of the work, surveys, or tests of materials will be deducted from monies due or to become due to the Contractor.

SECTION 108.9 - FAILURE TO COMPLETE ON TIME: The actual cost per calendar day incurred by the District for Consultant Administrative and Inspection Services on this project will be added to the daily charges as indicated by TABLE 108, LIQUIDATED DAMAGES, and will be deducted from monies due or to become due to the Contractor for each and every calendar day that work shall remain uncompleted after the time specified for the completion of the work in the proposal, or as adjusted by the Engineer. Nothing contained in this provision shall prohibit the District from deducting from monies due or to become due to the Contractor any other costs incurred by the District directly attributable to the delay in completing this contract.

SECTION 201 - CLEARING AND GRUBBING: The work under this item consists of removal and disposal of all trees, stumps, ~~asphaltic pavement and structures~~ within the limits of the roadways and floodway as necessary for the construction of this project.

No separate payment will be made for Clearing and Grubbing and the costs thereof shall be included in the price bid for related items of work.

SECTION 205 ROADWAY EXCAVATION: Roadway excavation shall conform to Section 205 of the uniform Standard Specifications.

No separate payment will be made for this item. Payment for all work under this section, including watering and compacting, shall be included in ITEM 211 - FILL CONSTRUCTION

SECTION 206 - STRUCTURE EXCAVATION AND BACKFILL; Structure Excavation consists of the removal of material for the construction of the bridge abutments as indicated on the plans and shall be in accordance with Section 206 of the Uniform Standard Specifications.

Structure Backfill consists of the furnishing, placing and compacting special backfill material around the bridge abutments as indicated on the plans and shall be in accordance with Section 206 of the Uniform Standard Specifications.

Special Backfill shall be Type "A" Select Material in accordance with Table 702 of the Uniform Standard Specifications, compacted to a minimum of 95% of the maximum density as determined by AASHTO T-99, Method A, and T-191 or ASTM D-2922 and D-3017. Compaction equipment should be maintained at least two (2) feet from the structure.

No separate payment will be made for Structure Excavation and Backfill or for Special Backfill and the cost of these items shall be included in the contract price bid for the items to which they are appurtenant.

SECTION 210 - BORROW EXCAVATION: Borrow excavation shall consist of the furnishing and placing of borrow material in the roadway embankments in accordance with Section 210 of the Uniform Standard Specifications and as shown on the plans.

No separate payment will be made for this item. Payment for all work under this section, including watering and compacting, shall be included in ITEM - 211 - FILL CONSTRUCTION.

SECTION 211 - FILL CONSTRUCTION: The work under this section consists of constructing the embankment for the approach roadways in accordance with SECTION 211 of the Uniform Standard Specifications. The material required for the construction of the fill shall be suitable material free of all debris and vegetation, obtained from the Bulldog Floodway.

Prior to the placement of fill material all loose soil, vegetation, any roadside debris existing pavement, and existing structures within the proposed fill areas shall be completely removed. Depressions and ditches shall be cleaned of all loose or wet soils and widened to accommodate compaction equipment. Sloping surfaces shall be benched to provide a level surface for fill placement.

All exposed subgrade surfaces shall be scarified, brought to the proper moisture content and compacted for a minimum depth of eight (8) inches.

The fill shall be compacted in horizontal lifts to subbase level. The depth of the uncompacted lifts shall not exceed eight (8) inches.

Compaction shall be to a minimum of 95% of the maximum density as determined in accordance with AASHTO T-99, Method A, and T-191 or ASTM D-2922 and D-3017 within a moisture content range of plus or minus 3% of optimum.

The quantities of fill required to construct embankments for approach roadways will be those of the completed bid item, in place, measured from the original ground surface, within the limits of the dimensions shown on the plans. Volume will be computed by the average end area method.

The cost of all related work, such as, clearing and grubbing excavation, borrow excavation, hauling and disposal of debris and unsuitable materials, watering, and subgrade preparation, shall be incidental to and included in the price bid for Fill Construction in addition to the work specified in Section 211 of the Uniform Standard Specifications.

Payment for all work under this section will be made at the unit price bid per cubic yard for ITEM 211 - FILL CONSTRUCTION.

SECTION 225 - WATERING: The work under this item shall be in accordance with Section 225 of Uniform Standard Specifications and Maricopa County Highway Department Supplement.

The cost of watering will be included in the price bid for the construction operation to which such watering in incidental or appurtenant.

SECTION 301 - SUBGRADE PREPARATION: Subgrade preparation shall also include the preparation of subgrades to the required lines and grades for the bridge approach slabs, in addition to the work specified in Section 301 of the Uniform Standard Specifications.

No separate payment will be made for subgrade preparation and the cost thereof shall be included in the price bid for related items of work.

SECTION 310 - UNTREATED BASE: Select Material and Aggregate Base shall conform to the requirements of Section 702 of the Uniform Standard Specifications. Select Material and Aggregate Base shall be crushed in accordance with Section 702.2 Select Material shall be Type "A".

The Contractor will be required to furnish the Engineer certified weight tickets covering all of the Select Material and Aggregate Base placed on the project. Final pay quantities will be based upon the scale tickets accepted by the Engineer.

SECTION 315 - BITUMINOUS PRIME COAT: The bituminous material shall be Grade MC-70 or MC-250 liquid asphalt as determined by the Engineer. Prime coat shall be applied to the total width of the Aggregate Base Material at the rate of 0.40 gallon per square yard unless otherwise specified by the Engineer.

SECTION 321 - ASPHALT CONCRETE: The bituminous material to be used shall be either AC-20 or AC-40 complying with Table 711-1A of the Uniform Standard Specifications as revised in 1983.

The mineral aggregate shall meet the grading requirements for Mix Designation C-3/4 in accordance with Section 710 of the Uniform Standard Specifications.

In addition to pugmill type mixing plants, Drum Dryer Mixers will be allowed in accordance with Standard Specification 710.9. The moisture content of the bituminous mixture immediately behind the paver shall not exceed three percent.

The proper proportioning of the material at the cold feed shall be determined by the Contractor and approved by the Engineer prior to the production of asphalt concrete. Production shall not commence until calibration tests indicate that an acceptable product can be obtained.

The correct proportions of each aggregate size introduced into the mixer shall be drawn from the storage bins by an approved type of continuous feeder which shall supply the correct amount of aggregate in proportion to the bituminous material and shall be so arranged that the proportion of each aggregate size can be separately adjusted. The continuous feeder for the aggregate may be mechanically or electrically activated.

The plant shall be equipped with a sampling device to take representative composite samples of the cold feed. If tests indicate non-compliance with specifications, operations shall cease until proper corrections have been made.

The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials. Mixing shall continue until the uniformity of coating, when tested in accordance with the requirement of AASHTO T 195, is at least 95 percent.

SECTION 336 - PAVEMENT MATCHING AND SURFACE REPLACEMENT: Existing pavements which are to be matched by the new roadway pavement shall be trimmed to a neat, straight and vertical edge. The trimmed edges shall be painted with a light coat of emulsified asphalt immediately prior to constructing the new abutting pavement. Costs for this work shall be incidental to the pavement construction.

SECTION 350 - REMOVAL OF EXISTING IMPROVEMENTS: The work under this item shall consist of the removal and disposal of existing pavement, and any other obstacle to construction, whether shown on the plans or not, unless specifically called out on the plans to be removed or relocated by other agencies.

Arrangements for disposal of all waste material shall be the responsibility of the Contractor.

No separate payment will be made for Removal of Existing Improvements and the cost of this item shall be included in contract price bid of related items.

SECTION 401 - TRAFFIC CONTROL: Traffic control shall conform to the applicable paragraphs of Section 401 of the MAG Uniform Standard Specifications with revision, the Maricopa County Supplement thereto and these Special Provisions.

The Contractor will be authorized to close only one (1) mile road at a given time during the duration of the project.

The number and kind of barricades, signs, delineators, barriers and all other traffic control devices and the approval of the contractors method of application of all traffic control measures, shall not relieve the contractor of the responsibility of protecting the work, the workmen and the traveling public.

The Contractor shall install and maintain deceleration sand berms (approximately five feet high) in the path of through traffic prior to bridge construction or excavation. Sand berms shall remain until the bridge is open to the traffic.

The contractor shall provide a detailed traffic control plan for approval at the pre-job conference. The plan shall show all types of signs, sand berms and their placement.

All necessary signs, barricades and center line vertical panels shall remain three working days beyond acceptance of the project by the County.

SECTION 505 - CONCRETE STRUCTURES: The work under this section consists of constructing in place the concrete bridges in accordance with the plans and Section 505 of the Uniform Standard Specifications.

The concrete shall conform to Section 725, except that Class "AA" Concrete shall have a minimum strength of 5,000 psi at 28 days. The reinforcing steel shall be Grade 60 and shall conform to Section 727 of the Uniform Standard Specification

The use of fly ash will be permitted in all concrete mixes.

The top surface of the bridge deck shall be cured by the liquid-membrane curing compound method and by the water curing method. The curing compound shall be applied progressively immediately following the surface finishing operation. Liquid-membrane curing compound shall be applied at a rate of one gallon per 100 square feet. The curing compound shall form a continuous unbroken surface. Water curing shall be applied not later than four hours after the completion of the deck finishing operations and shall be applied for a period of at least 7 days after placing. See Sections 505.8 and 726 of the Uniform Standard Specifications for additional information and materials to be used.

Cast-in-place dimensional tolerances shall be in accordance with Section 601.4.02(A) of the Arizona Department of Transportation Highways Division Standard Specifications for Road and Bridge Construction, Edition of 1982.

Elastomeric Bearing Pads (Neoprene) shall be in accordance with ADOT requirements and shall be made of durometer 60 neoprene. Pads shall conform to the dimensions and thicknesses shown on the drawings. No separate payment will be made for bearing pads, and the costs thereof shall be included in the price bid for items to which they are appurtenant.

Premolded Joint Filler (Premold Joint) shall conform to Section 729.1 of the Uniform Standard Specifications.

No separate payment will be made for furnishing and placing Elastomeric Bearing pads, galvanized sheet metal strips, premolded joint filler, weep hole drain assemblies and their appurtenant fine and coarse aggregates, steel roadway angle or pipe hanger assemblies and the costs thereof shall be included in the price bid for concrete.

Payment for all work under this section will be made at the unit bid price per cubic yard for ITEM 505-1 CLASS "AA" CONCRETE for Deck Slab and ITEM 505-2 CLASS "A" CONCRETE for all other parts of the structure and at the unit price bid per pound for ITEM 505-3 REINFORCING STEEL.

GENERAL COMMENT: The cost of all work required under this contract as shown on the plans for which there are no specific items shown on the Bidding Schedule, shall be included in the prices bid for related items.

An attempt has been made to determine the location of all underground utilities and to design the location and elevation of all irrigation and drainage pipes, culverts and structures so as not to interfere with the existing utilities, however, it shall be the Contractor's responsibility to cooperate with the pertinent utility companies so that any obstructing utility installation may be adjusted.

Any facility or work which may be performed for the accommodation of any utility shall be paid for by the utility owner. The Contractor shall make all arrangements that may be necessary for the construction and any financial agreement shall be solely between the Contractor and the utility owner.

The Flood Control District reserves the right to adjust design grades or the location of drainage structures prior to construction, if it should become necessary in the opinion of the Engineer, without additional cost to the District.

It shall be the Contractor's responsibility to protect the structure and construction site form any excessive or detrimental flooding, within the stream right-of-way which may occur during the construction period and until final acceptance of the completed bridge by the Engineer.
Upon completion of the construction, the Contractor shall clear the stream bed and work area of all debris to the satisfaction of the Engineer.

No vehicular loads will be permitted on the bridges before the lapse of twenty-one (21) days from the date of the last pour of concrete for the deck, unless approval is obtained in writing from the Engineer.

The Contractor shall take special precautions to keep the area around the structures properly barricaded and marked with flares to prevent automotive traffic from running into the floodway or crossing the new structures prior to the acceptance of the completed project by the Engineer.

GUARANTEE: The Contractor shall guarantee the structures for one year against faulty materials, faulty workmanship and failure to meet the specifications' requirements. Said guarantee by the Contractor shall not apply to damage caused by earthquakes or other acts of God, land subsidence or faulty operations or any abuse of the structures by others.

ENGINEER'S ESTIMATE

Project:

Contract: FCD

Item No.	Approximate Quantity	Unit	Description	Unit Cost	Extended Amount
211	3280	CY	FILL	1.50	4920.
310	920	TN	Agg Base	8.00	7360.
315	9	TN	Bituminous Prime Coat	300.00	2700.
321	370	TN	ASPHALT CONC. PAV.	30.00	11100.
505.1	438	CY	Class AA Concrete (5000 PSI)	200.00	87600.
505.2	521	CY	Class A Concrete	170.00	88570.
505.3	152730	Lbs	Reinforcing Steel	0.35	53455.
520.1	158	L/Ft	HANDRAIL	60.00	9480.

The Bidder hereby acknowledges receipt of and agrees
this proposal is based on the following Addenda

Total 265.185.00

+ 25%

331481.00