WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

Project 3rd Lake Wash. Floating Bridge, Stage II Sheet No 127 of ..... sheets

S.R. 90 Made by YMT. Check by ..... Date 6/83 Supv. YFE/RTS

4 ~ 0.6" ϕ Strands. P.S. Tendon

Jacking $f = 195.98^{ksi}$ $F = 195.98^{ksi}(.868^{in^2}) = 170.11^K$

Seating $f = 178.16$ $F = 178.16$ " $= 154.64^K$

Final. Force $f = 145.16$ $F = 145.16$ " $= 126^K$

Anchor set $= \frac{1}{4}"$ $L = 105$ Ft.

$$\text{Elongation} = f_{Avg}\left(\frac{L}{E}\right) = \frac{\frac{1}{2}(12")}{28000}\left[\begin{array}{ll} (195.98+194.39)\,15 & = 1.2548 \\ (194.39+191.13)\,10.16 & = .8399 \\ (191.13+189.64)\,37.916 & = 3.0938 \\ (189.64+185.11)\,16.75 & = 1.3451 \\ (185.11+182)\,10.16 & = .7998 \\ (182+180.52)\,15 & = 1.1652 \end{array}\right]$$

$8.4985" = 8\frac{1}{2}$

Approx check $\Delta L = \frac{195.98+180.52}{2}(105) = \frac{1}{28000} = 8.4713"$

33003279

Rdwy. Slab

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WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

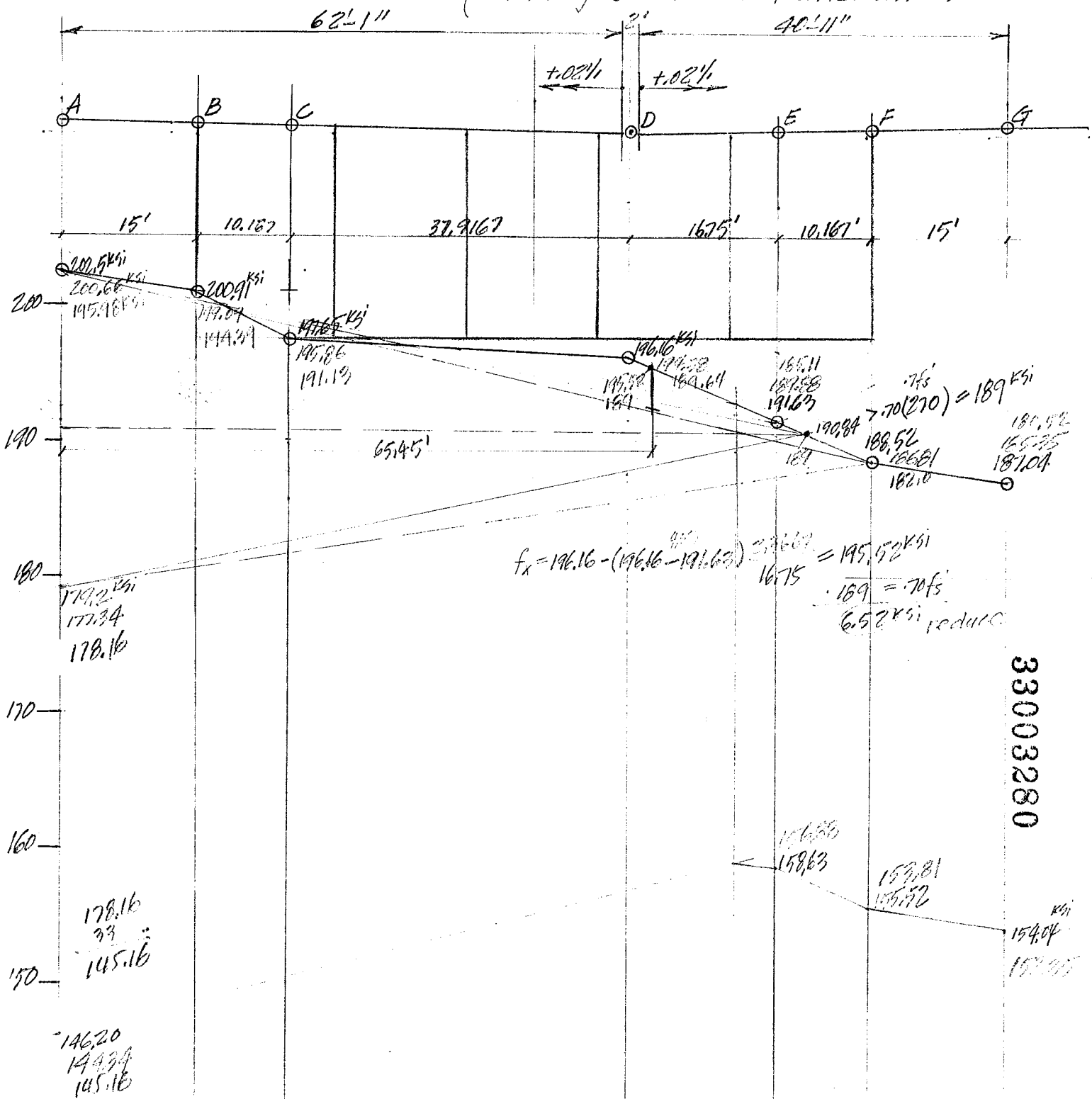
Project 3rd Lake Wash. Floating Bridge Stage II Sheet No. 124 of ..... sheets

S.R. 90 Made by Y.M. TAM Check by ..... Date 6/83 Supv. YFC/RTS.

Tendon Stress Data

Roadway Slab (Typical) ~ 4 ~ .6"φ stand $P_i = .75 f_s'$

(Jacking @ one end & alternate)



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1

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Project..... Sheet No. 125 of..... sheets

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Cable path:

A. Jacking End as a base point: $4\frac{1}{2}''$ From top slab.

B. $e_{AB} = (4.5'' - 2\frac{3}{4}'')\frac{1}{12} = .1458^{ft}$ $L_{AB} = 15^{ft}$

C. $e_{BC} = (6\frac{1}{4}'' - 2\frac{3}{4}'')\frac{1}{12} = .2917^{ft}$ $L_{BC} = 10.1667^{ft}$

D. $e_{CD} = 0.$ $L_{CD} = 37.9167$

E $e_{DE} = 16.75'(.02\%)\,2 = .67'$ $L_{DE} = 16.75'$

F $e_{EF} = (6\frac{1}{4}'' - 2\frac{3}{4}'')\frac{1}{12} = .2917^{ft}$ $L_{EF} = 10.167'$

G $e_{FG} = (4.5 - 2\frac{3}{4}'')\frac{1}{12} = .1458^{ft}$ $L_{FG} = 15'$

Angle changes:

A to B $\alpha = \frac{2(4.5 - 2.75)\frac{1}{12}}{15'} = .0194$ rad.

B to C $\alpha = \frac{2(6.25'' - 2.75)\frac{1}{12}}{10.1667} = .0574$ rad.

C to D $\alpha = 0$

D to E $\alpha = \frac{2(.67')}{16.75} = .08$

E to F $\alpha = \frac{2(6\frac{1}{4} - 2\frac{3}{4})\frac{1}{12}}{10.1667} = .0574$

F to G $\alpha = \frac{2(4.5 - 2.75)\frac{1}{12}}{15} = .0194$

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Friction losses and control point jacking stress

$f_s' = 270^{ksi}$

$P_j = .75 f_s' = 202.5$

Anchor set 3/8"

$\mu = .25$

$K = .0002$

Jacking @ A

A to B

$\mu\alpha + KL = .25(.0194) + .0002(15) = .0079$

$T_B = T_0 e^{-(\mu\alpha + KL)} = 200.91^{ksi} = .9923 P_j$

A to C

$\mu\alpha + KL = .25(.0194 + .0574) + .0002(15 + 10.1667) = .0242$

$T_C = T_0 e^{-(\mu\alpha + KL)} = 197.65^{ksi} = .9761 P_j$

A to D

$\mu\alpha + KL = .25(.0194 + .0574 + 0) + .0002(15 + 10.1667 + 37.9167) = .0318$

$T_D = T_0 e^{-(\mu\alpha + KL)} = 196.16^{ksi} = .9687 P_j$

A to E

$\mu\alpha + KL = .25(.0194 + .0574 + 0 + .08) + .0002(15 + 10.1667 + 37.9167 + 16.75) = .0552$

$T_E = T_0 e^{-(\mu\alpha + KL)} = 191.63^{ksi} = .9463 P_j$

A to F

$\mu\alpha + KL = .25(.0194 + .0574 + 0 + .08 + .0574) + .0002(79.8333 + 10.1667) = .0715$

$T_F = T_0 e^{-(\mu\alpha + KL)} = 188.52^{ksi} = .9310 P_j$

A to G

$\mu\alpha + KL = .25(.0194 + .0574 + 0 + .08 + .0574 + .0194) + .0002(90 + 15) = .0794$

$T_G = T_0 e^{-(\mu\alpha + KL)} = 187.0412 = .9237 P_j$

Jacking stress @ F

$d = 202.5^{ksi} - 188.52 = 13.98^{ksi}$ $\Delta L = 3/8"$

$X = \sqrt{\frac{28000(3/8)90'}{12(13.98)}} = 75.05^{ft} < 90^{ft}$. O.K.

$\Delta f = \frac{2dX}{L} = \frac{2(13.98)75'}{90} = 23.3167^{ksi} = .1151 P_j$

Jacking stress @ E

$d = 202.5 - 191.63 = 10.87^{ksi}$

$X = \sqrt{\frac{28000(3/8)79.833}{12(10.87)}} = 80.1644^{ft} > 79.83^{ft}$

$\Delta f = \frac{2(10.87)65.45}{79.83} = 17.86$

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4 ~ .6"φ strands

Jacking Force:

stress @ the point of the length influenced by anchor set

$202.5 - (202.5 - 188.52)\frac{75.05'}{90} = 190.84$ → $202.5 - \frac{\Delta f}{2} = 202.5 - \frac{23.3167}{2} = 190.84$

$.7f_s' = .70(270) = 189$

1.84^{ksi} over the limit $.7f_s'$

Jacking Force from North end = $(.868^{in^2})(202.5^{ksi} - 1.84) = \underline{174.17^K}$/Tendon (200.66 ksi)

Seating (Stress @ Jacking End after anchor set)

$200.66 - 2(200.66 - 189) = 177.34^{ksi}$

Force = $(.868^{in^2})177.34^{ksi} = \underline{153.92^K}$

Final Force @ Jacking End:

$f = 177.34 - 33^{ksi} = 144.34^{ksi}$

$F = (.868^{in^2})144.34 = \underline{125.29^K}$

Anchor set = $\underline{3/8"}$ $L = \underline{105^{ft}}$

Elongation (inch) = $\sum_{Avg}\left(\frac{L}{E}\right) =$

$(200.66 + 199.09)\frac{1}{2}\left(\frac{12''/'}{28000}\right)15' = 1.2849"$

$(199.09 + 195.86)$ " $10.16 = .8664$

$(195.86 + 194.38)$ " $37.9167 = 3.1707"$

$(194.38 + 189.88)$ " $16.75 = 1.3792$

$(189.88 + 186.81)$ " $10.167 = .8306$

$(186.81 + 185.35)$ " $15 = 1.1962$

$8.7121" \pm \underline{8\frac{3}{4}"}$

check: $(200.66 + 185.35)\frac{1}{2}(105')12\left(\frac{1}{28000}\right) = 8.6852^{in}$ ok

Conduit size 1"x3"

Anchor size ⇒ Special.

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Friction losses and control point Jacking stress

Jacking @ G.

G to F

$\mu\alpha + KL = .25(.0194) + .0002(15) = .0099$

$T_F = T_0 e^{-(\mu\alpha+KL)} = 200.92^{ksi} = .9922\ P_j$

G to E

$\mu\alpha + KL = .25(.0194 + .0574) + .0002(15 + 10.167) = .0242$

$T_E = T_0 e^{-(\mu\alpha+KL)} = 197.65^{ksi} = .9761\ P_j$

G to D

$\mu\alpha + KL = \overset{.0392}{.25(.0194 + \overset{.1568}{.0574 + .08})} + \overset{.0080}{.0002(15 + \overset{41.9167}{10.167 + 16.75})} = .0476$

$T_D = T_0 e^{-(\mu\alpha+KL)} = 193.09^{ksi} = .9535\ P_j$

G to C

$\mu\alpha + KL = \overset{.0392}{.25(.0194 + .0574 + .08 + 0)} + \overset{.0160}{.0002(15 + 10.167 + 16.75 + \overset{79.8333}{97.9167})} = .0552$

$T_C = T_0 e^{-(\mu\alpha+KL)} = 191.63^{ksi} = .9463\ P_j$

G to B.

$\mu\alpha + KL = \overset{.0536}{.25(.1568 + .0574)} + \overset{.0180}{.0002(\overset{79.833}{79.833} + \overset{90}{10.1667})} = .0715$

$T_B = T_0 e^{-(\mu\alpha+KL)} = 188.92^{ksi} = .9309\ P_j$

G to A

$\mu\alpha + KL = \overset{.0584}{.25(.2142 + .0194)} + \overset{.0210}{.0002(90 + 15)} = .0794$

$T_A = T_0 e^{-(\mu\alpha+KL)} = 187.04 = .9237\ P_j$

Jacking stress @ B

$d = 202.5 - 188.92 = 13.98^{ksi}$

$x = \sqrt{\dfrac{28000(3/8)90}{12(13.98)}} = 75.05' < 90'$

$\Delta_f = \dfrac{2dx}{L} = \dfrac{2(13.98)}{90}75.05 = 23.317^{ksi}$

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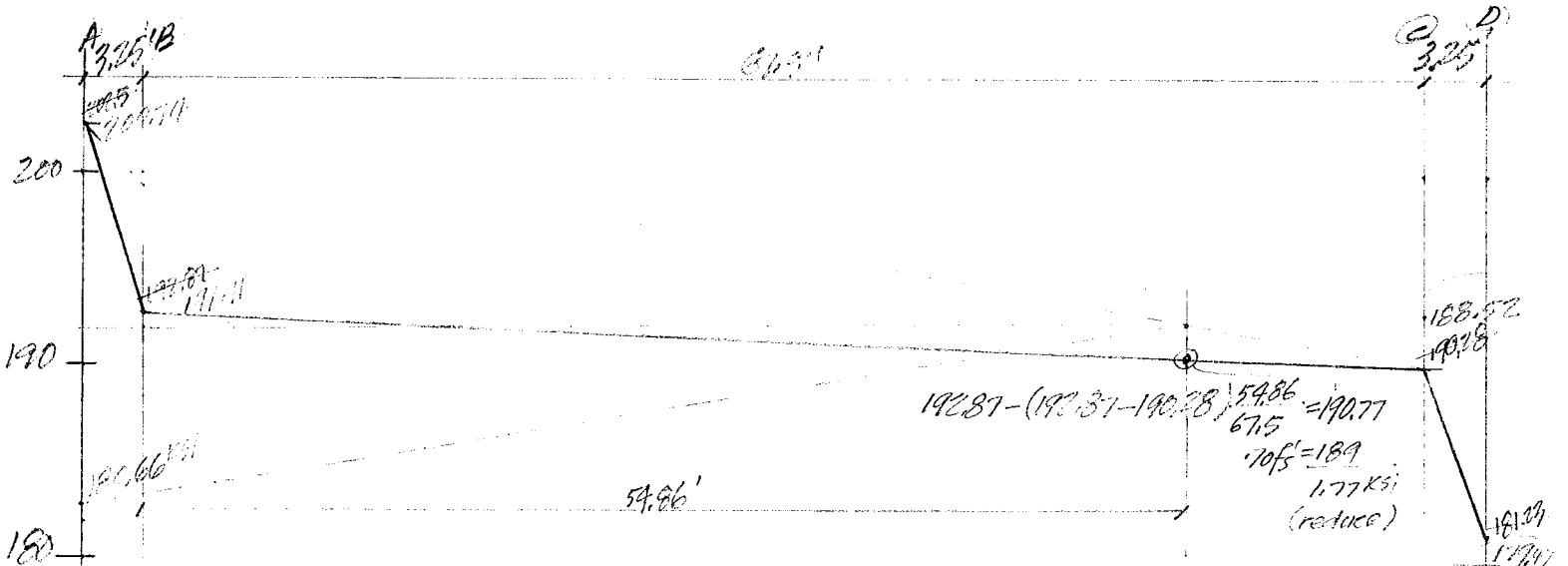
Bottom slab Tendon

B.S. Tendon

$L = 75' - (.5' + .5') = 74$ Ft.



Angle changes.

A to B $\alpha = \frac{2(3.75/12)}{3.25} = .1923$ B to C $\alpha = 0$

(C to D)

Friction losses and control point.

A to B $\mu\alpha + KL = .25(.1923) + .0002(3.25) = .0487$

$T_B = 192.87$ ksi $= .9524$ Pj

A to C $\mu\alpha + KL = .25(.1923) + .0002(74 - 3.25) = .0[illegible]$ (70.75')

$T_C = 190.28$ ksi $= .9397$ Pj

A to D $\mu\alpha + KL = .25(.1923)2 + .0002(74) = .1110$

$T_D = 181.23$ ksi $= .8950$ Pj

Jacking stress @ C $d = 202.5 - 190.28 = 12.22$ ksi

$X = \sqrt{\frac{20{,}000(\frac{1}{4})\,70.75}{12(12.22)}} = 58.11$ Ft < 70.75 Ft. o.k.

$\Delta f = \frac{2dX}{L} = \frac{2(12.22)\,58.11}{70.75} = 20.08$ ksi

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BOTTOM SLAB

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4 ~ 0.6" ϕ strands B.S Tendon B.S. Tendon

Jacking Force: $f = 200.74^{ksi}$ $F = f(.868^{in}) = \underline{174.24^{k}}$

Seating. $f = 180.66$ $F = f(\ \text{"}\ ) = \underline{156.81^{k}}$

Final. $f = 180.66 - 33 = 147.66^{ksi}$ $F = f(\text{"}) = \underline{128.17^{k}}$

Anchor set $= \underline{\frac{1}{4}"}$ Length $\underline{74^{ft}}$

Elongation $\Delta l = \frac{1}{28000}\left[\frac{200.74+191.11}{2}(3.25) + \frac{191.11+188.52}{2}(67.5) + \frac{188.52+179.47}{2}(3.25)\right]$

$= .0227' + .4576' + .0214 = .5017' = \underline{6.0203^{in}}$

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TABLE

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Pontoon D — Longest Tendon.

Wall 1 S.W. Tendon $1\frac{3}{8}$"ϕ Bar $A = 1.58^{in^2}$ $f_s = 150^{ksi}$

The longest S.W. Tendon 3'-$4\frac{1}{2}$" ahead of ℄ Wall 10

$$L = \left[32.26 - (32.26 - 31.03)\frac{3'\text{-}4\frac{1}{2}''}{29.5}\right] - \frac{1\frac{1}{2}''}{12} + .573 - (.5 + .5) = 31.5673^{Ft}$$

Longest

Angle changes: A to B $\alpha \doteq \dfrac{2(10 - 6.75)/12}{3.25'} = .1667$ rad.

B to C $\alpha = 0$

C to D $\alpha = .1667$

Friction losses and control point (Jack at A)

A to B $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$

$T_B = 109.65^{ksi} = .9747\ P_j$

A to C $\mu\alpha + KL = .15(.1667) + .0002(\overset{28.317'}{31.567 - 3.25}) = .0307$

$T_C = 109.10^{ksi} = .9698\ P_j$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(31.567) = .0563$

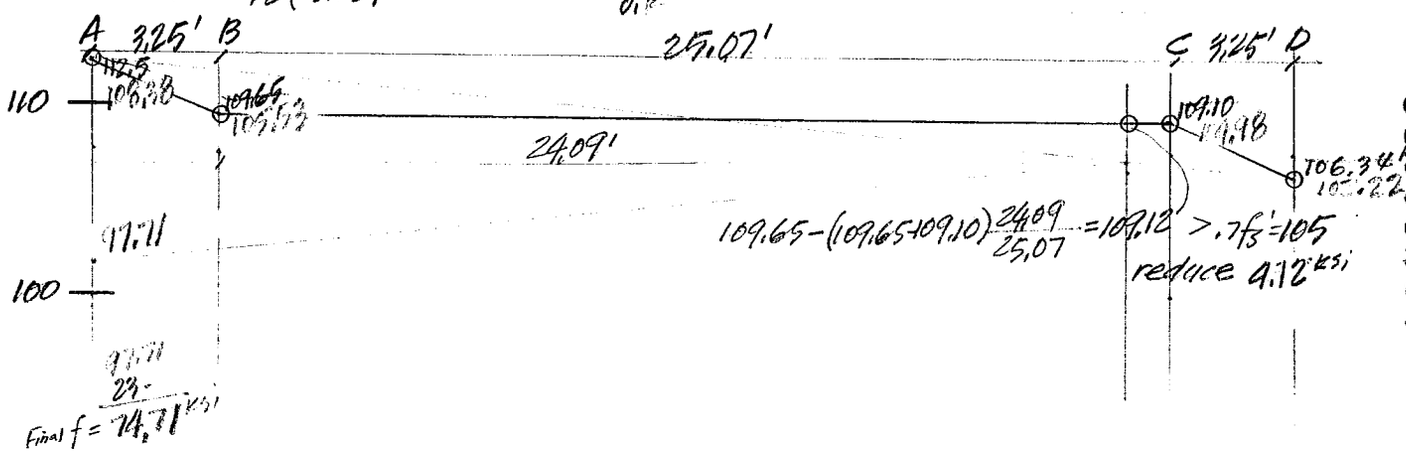
$T_D = 106.34^{ksi} = .9452\ P_j$

Jacking stress @ D

$d = 112.5 - 106.34 = 6.16^{ksi}$

$X = \sqrt{\dfrac{28{,}000(\frac{1}{16})31.57}{12(6.16)}} = 27.34^{Ft} < 31.57^{Ft}$ O.K.

$\Delta f = \dfrac{2(6.16)27.34}{31.567} = 10.67^{ksi}$



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pontoon D

1

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

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pontoon D. Longest tendon

Jacking : $f = 108.38^{ksi}$ $F = f(1.58^{in^2}) = \underline{171.24^k}$

Seating $f = 97.71^{ksi}$ $F = f(\ \ ) = \underline{154.38^k}$

Final $f = 74.71^{ksi}$ $F = f\ \ \ \ = \underline{118.04^k}$

Anchor set : $\underline{\frac{1}{16}''}$

Size $\underline{1\frac{3}{8}''\phi}$ Bar

length $\underline{31.6\ Ft.}$

Elongation $\Delta L = \frac{1}{28000}\left[\frac{108.38+105.53}{2}(3.25) + \frac{105.53+104.98}{2}(25.07) + \frac{104.98+102.22}{2}(3.25)\right]$

$= .0124' + .0942 + .0120 = .1187^{Ft} = 1.4242^{in} = \underline{1\frac{3}{8}''}$

Approx. $\Delta L = (108.38 + 102.22)\frac{31.57}{2} \cdot \frac{12}{28000} = 1.4247$ check.

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pontoon D shortest Tendon

Wall 6, S.W. Tendon 3'-0" back @ E Joint btwn. D & E

$$L = \left[22.44 + (23.39 - 22.44)\frac{3}{29.4167}\right] - \frac{1\frac{1}{2}}{12} + .15 - (.5 + .5) = 21.56^{ft}$$

Angle changes: A to B (C to D) $\alpha = \frac{2(3.25''/12)}{3.25} = .1667^{rad.}$ B to C $\alpha = 0$

Friction losses and control point

A to B. $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$

$T_B = 109.65^{ksi} = .9747\ P_j$

A to C $\mu\alpha + KL = .15(.1667) + .0002(\overset{18.31}{21.56} - 3.25) = .0287$

$T_C = 109.32 = .9717\ P_j$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(21.56) = .0543$

$T_D = 106.55 = .9471\ P_j$

Jacking stress @ D:

$d = 112.5 - 106.55 = 5.9471$

$$X = \sqrt{\frac{28000\left(\frac{1}{6}\right)21.56}{12(5.947)}} = 22.99^{ft} > 21.56^{ft}$$ NG

$\Delta L_m = \frac{112.5 + 106.55}{2} \cdot \frac{21.56(12)}{28000} = 1.0120^{in}$

$\Delta = \frac{1}{16}''$ anchor set $\quad .0625 =$

$.9495''$

mean stress $f_m = 28000 \cdot \frac{.9495}{21.56(12)} = 102.76^{ksi}$

After anchor set:

$f_A = 102.76 - (\overset{2.935}{109.49 - 106.55}) = \overset{99.13}{99.83^{ksi}}$

$f_B = 102.76 + \quad '' \quad = 105.70 < .70 f_s' = 105$ reduce $.7^{ksi}$

Jacking $f_A = 112.5 - .7 = 111.8^{ksi}$

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pontoon D

Shortest Tendon

Jacking: $f = 111.80^{ksi}$ $F = f(1.58) = 176.64^{k}$

Seating: $f = 99.13^{ksi}$ $F = f(1.58) = 156.62^{k}$

Final: $f = 99.13 - 23 = 76.13$ $F = f(1.58) = 120.29^{k}$

anchor set: $\frac{1}{16}''$

Tendon size: $1\frac{3}{8}''\phi$ Bar

Length 21.6 Ft.

Elongation $\Delta L = \frac{1}{28000}\left[\frac{111.80 + 105}{2}(21.56)12\right] = 1.0016^{in} = 1''$

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Pontoon E — Longest Tendon Longest Tendon

Wall 1, S.W. Tendon @ 3'-0" ahead of ℄ Joint E & D

$L = [22.44 - (22.44 - 22.04)\frac{3}{29.4167}] - \frac{1\frac{1}{2}}{12} + .573 - (.5 + .5) = 21.8472^{Ft}$

Angle change : A to B (C to D) $\alpha = \frac{2(10-6.75)/12}{3.25} = .1667^{rad.}$ B to C $\alpha = 0.$

Friction losses and control point

A to B $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$

$T_B = 109.65 = .9747\ P_j$

A to C $\mu\alpha + KL = .15(.1667) + .0002(\overset{18.60}{21.85 - 3.25}) = .0287$

$T_C = 109.32 = .9717\ P_j$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(21.85) = .0544$

$T_D = 106.55 = .9471\ P_j$

Jacking stress @ D

$d = 112.5 - 106.55 = 5.95$

$X = \sqrt{\frac{28000(\frac{1}{16})21.85}{12(5.95)}} = 23.14^{Ft} > 21.85$ N.G. $111.71^{ksi}(1.58^{A_s}) = 176.50$

$\Delta L_m = \frac{112.5 + 106.55}{2} \cdot \frac{21.85(12)}{28000} = 1.0256''$

$\Delta = \frac{1}{16}''$ $.0625 =$

$.9631''$

$f_m = 28000 \cdot \frac{.9631}{21.85(12)} = 102.85^{ksi}$

After anchor set :

$f_A = 102.85 - (\overset{29.4}{109.49 - 106.55}) = \overset{99.12}{99.92^{ksi}}$

$f_D = \quad '' \quad + \quad '' \quad = \overset{105}{105.79^{ksi}} > .70 f_s'$ reduce .79 ksi

Jacking $f_A = 112.5 - .79 = 111.71^{ksi}$

note : Tendon Data see pontoon D shortest Tendon except. $L = 21.85^{Ft}$, $\Delta L = \frac{1}{28000}[\frac{111.71 + 105}{2}(21.85)12] = 1.0147'' \doteq 1''$

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E 1

pontoon E — Shortest Tendon

Wall 6, 12.21 Ft back ℄ Joint btwn E & F

$L = \left[16.20 + (18.09 - 16.20)\frac{12.21}{29.167}\right] - \frac{1\frac{1}{2}}{12} + .150 - (.5 + .5) = 16.01$ Ft

Friction losses and control point.

A to B $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$ rad.

$T_B = 109.65^{ksi} = .9747\ P_j$

A to C $\mu\alpha + KL = .15(.1667) + .0002(\overset{12.76'}{16.01 - 3.25}) = .0276$

$T_C = 109.44 = .9728\ P_j$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(16.01) = .0532$

$T_D = 106.67 = .9482\ P_j$

Jacking stress @ D

$d = 112.5 - 106.67 = 5.83$

$X = \sqrt{\frac{28000(\frac{1}{16})16}{12(5.83)}} = 20.01 > 16$ Ft. N.G.

$\Delta L_m = (112.5 + 106.67)\frac{1}{2}\left(\frac{16 \times 12}{28000}\right) = .7514''$

$\Delta = \frac{1}{16}'' = .0625$

$.6889''$

$f_m = 28000\left(\frac{.6889}{16.01 \times 12}\right) = 100.40^{ksi}$

After anchor set:

$f_A = 100.40 - (\overset{2.88}{109.54 - 106.67}) = 97.52^{ksi}$

$f_D = 100.40 + \quad '' \quad = 103.28^{ksi} < .70 f_s'$ O.K.

Jacking $f_A = 112.5^{ksi}$ ✓

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pontoon E

Jacking $f = 112.5$ $F = f(1.58) = 177.75^K$

Seating $f = 97.53$ $F = f$ " $= 154.10^K$

Final $f = 97.53 - 23 = 74.53$ $F = f(\text{"}) = 117.76^K$

Anchor set $\frac{1}{16}''$

Tendon size $1\frac{3}{8}''\phi$

Length 16 Ft

Elongation $= \frac{1}{28000}\left[\frac{112.5 + 103.28}{2}(16)12\right] = .7398^{in} = \frac{3}{4}''$

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TABLE 3

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pontoon P

Wall 1 S.W. Tendon @ 3'-0" back of ℄ Joint E & D

$L = \left[20.92 - (20.92 - 20.58)\frac{3}{29.4167}\right] - \frac{1\frac{1}{2}}{12} + .573 - (.5 + .5) = 20.33^{ft}$

Friction losses and control point

A to B $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$

$T_B = 109.65 = .9747\ P_i$

A to C $\mu\alpha + KL = .15(.1667) + .0002(20.33 - 3.25) = .0289$

$T_C = 109.35 = .9720\ P_i$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(20.33) = .0541$

$T_D = 106.58 = .9474\ P_i$

Jacking stress @ D $L = 20.33'$

$d = 112.5 - 106.58 = 5.92^{ksi}$

$X = \sqrt{\frac{28000(T_6)20.33}{12(5.92)}} = 22.38^{ft} > 20.33^{ft}$ N.G.

$\Delta L_m = \left(\frac{112.5 + 106.58}{2}\right) \cdot \frac{20.33(12)}{28000} = .9544^{in}$

$\Delta_2 = T_6 =$ $\frac{.0625}{.8919^{in}}$

$f_m = 28000 \cdot \frac{.8919}{20.33(12)} = 102.37^{ksi}$

After anchor set

$f_A = 102.37 - (109.50 - 106.58) = 99.45^{ksi}$ (2.92)

$f_D = 102.37 + \quad " \quad = 105.29^{ksi} > .70 f_s' = 105^{ksi}$

reduce $.29^{ksi}$

At Jacking $f_A = 112.5 - .29 = 112.21^{ksi}$

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pontoon P — Longest Tendon

Jacking $f = 112.21^{ksi}$ $F = f(1.58) = 177.29^{k}$

Seating $f = 99.16$ $F = f(1.58) = 156.67^{k}$

Final $f = 99.16 - 23 = 76.16^{ksi}$ $F = f(\cdot) = 120.33^{k}$

Anchor set $\frac{1}{16}''$

Tendon size $1\frac{3}{8}''\phi$ Bar.

Length 20.33 Ft.

Elongation $\Delta L = \frac{1}{28000}\left[\frac{112.21 + 105}{2}(20.33)12\right] = .9963^{in}$

The shortest Tendon stress Data same as pontoon E — Shortest Tendon

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pontoon Q. Longest Tendon

Wall 1, S.W. Tendon 3'-4½" back of ℄ wall 16.

$$L = \left[31.86-(31.86-30.36)\frac{3'-4\frac{1}{2}''}{29.5}\right] - \frac{1\frac{1}{2}}{12} + .573 - (.5+.5) = 31.1364^{Ft}$$
(31.14')

Friction losses and control point.

A to B $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$

$T_B = 109.65^{ksi} = .9747\ P_j$

A to C $\mu\alpha + KL = .15(.1667) + .0002(31.14 - 3.25) = .0306$

$T_C = 109.11^{ksi} = .9699\ P_j$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(31.14) = .0562$

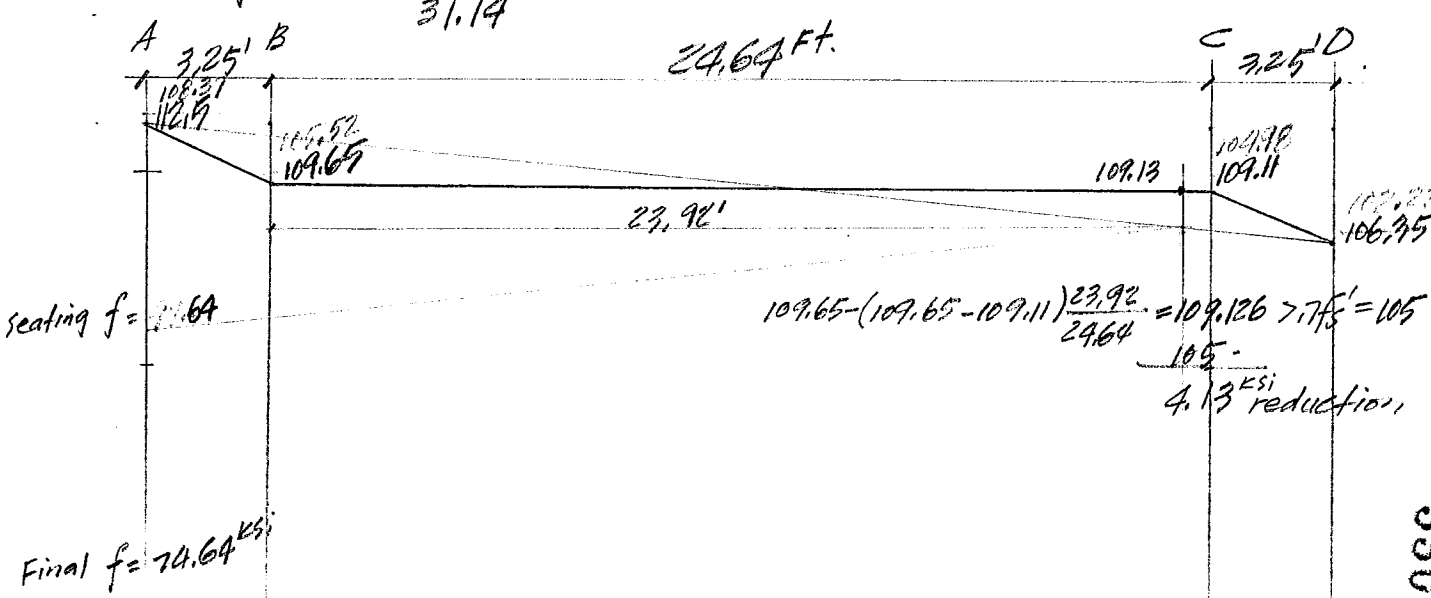
$T_D = 106.35 = .9453\ P_j$

Jacking stress @ D

$d = 112.5 - 106.35 = 6.15^{ksi}$

$$X = \sqrt{\frac{28000\left(\frac{1}{16}\right)31.14}{12(6.15)}} = 27.17^{Ft} < 31.14^{Ft}\ \text{o.k.}$$

$$\Delta f = \frac{2(6.15)\,27.17}{31.14} = 10.73^{ksi}$$



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pontoon Q.

Jacking $f = 108.37^{ksi}$ $F = f(1.58) = \underline{171.22^{K}}$

Seating $f = 97.64$ $F = f(1.58) = \underline{154.27^{K}}$

Final $f = 97.64 - 23 = 74.64$ $F = f(1.58) = \underline{117.93^{K}}$

Anchor set $\underline{\frac{1}{16}''}$

Tendon length $\underline{31.14\ Ft}$

elongation,

$$\Delta L = \frac{1}{28000}\left[\frac{108.37+105.52+104.98+102.22}{4}(3.25)2 + \frac{105.52+104.98}{2}(24.64)\right]$$

$$= .0244' + .0926' = .1171\ Ft = 1.4047'' = \underline{1\tfrac{3}{8}''}$$

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Pontoon Q

Wall 6 S.W. Tendon 3'-0" Back @ ℄ Joint btwn P & Q

$L = \left[20.92 + (21.85 - 20.92)\frac{3}{29.467}\right] - \frac{1\frac{1}{2}}{12} + .15 - (5 + .5) = 20.0158^{ft}$ (20.02')

Friction losses and control point.

A to B $\mu\alpha + KL = .15(.1667) + .0002(3.25) = .0256$

$T_B = 109.65^{ksi} = .9747\ P_j$

A to C $\mu\alpha + KL = .15(.1667) + .0002(20.02 - 3.25) = .0284$ (16.77)

$T_C = 109.36 = .9720\ P_j$

A to D $\mu\alpha + KL = .15(.1667)2 + .0002(20.02) = .0540$

$T_D = 106.59 = .9474\ P_j$

Jacking stress @ D

$d = 112.5 - 106.59 = 5.9143$

$X = \sqrt{\frac{28000(T_6)\,20.02}{12(5.91)}} = 22.22^{ft} > 20.02'$ N.G.

$\Delta L_m = (112.5 + 106.59)\frac{1}{2} \cdot \frac{20.02'(12)}{28,000} = .9399''$

$\Delta_2 = \frac{1}{16}''$ $= .0625$

$.8774''$

The mean stress, $f_m = 28000\left(\frac{.8774}{20.02 \times 12}\right) = 102.26^{ksi}$

After anchor set

$f_A = 102.26 - (109.51 - 106.59)\frac{1}{2} = 99.35^{ksi}$ (2.915) (99.18)

$f_D = 102.26 + (\quad " \quad)\frac{1}{2} = 105.175^{ksi} > .7f_s' = 105$ (105)

reduce, $.175^{ksi}$

At Jacking $f_A = 112.5 - .175 = 112.325^{ksi}$

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pontoon Q Shortest Tendon

Jacking $f = 112.33^{ksi}$ $F = f(1.58) = 177.47^{k}$

Seating $f = 99.18^{ksi}$ $F = f$ " $= 156.7^{k}$

Final $f = 99.18 - 23 = 76.18$ $F = f(1.58) = 120.36^{k}$

anchor set: $\frac{1}{16}''$

Tendon size $1\frac{3}{8}''\phi$ Bar

Length 20.02 Ft.

Elongation $\Delta L = \frac{1}{28{,}000}\left(\frac{112.33 + 105}{2}\right) 20.02(12) = .9323'' = 1''$

.675

.05"

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I.W. Tendon - Pontoon D Longest Tendon [illegible]

Wall 2. $L = 31.5673 - (\underset{\text{Wall 1}}{.573} - \underset{\text{Wall 2}}{.277}) = 31.2713^{Ft}$

.296

Angle changes $\alpha = 0$

Friction losses and control point

End (A) to End (B). $\mu\alpha + KL = 0 + .0002(31.27') = .0063$

$T_B = 111.80^{ksi} = .9938\ P_j$

Jacking stress @ B

$d = 112.5 - 111.80 = .7014^{ksi}$

$X = \sqrt{\dfrac{28000(\frac{1}{16})31.27}{12(.7014)}} = 80.63^{Ft} \gg 31.27^{Ft}$

$.70 f_s' = .70(150) = 105^{ksi}$ max @ End (B) after anchor set

Jacking stress $105 + .70 = 105.70^{ksi}$

$\Delta L_m = \dfrac{112.5 + \overset{112.15'}{112.5 - .70}}{2} \cdot \dfrac{31.27'(12)}{28000} = 1.5030''$

Anchor set. $\Delta L = \frac{1}{16}''$ $= .0625 -$

$1.4405''$

$f_m = 28000 \cdot \dfrac{1.4405/12}{31.27} = 107.4863^{ksi}$

After Anchor set

$f_A = 107.4863 - \dfrac{.70}{2} = \overset{104.30^{ksi}}{107.1363^{ksi}}$

$f_B = 100.6863 + \dfrac{.70}{2} = \overset{105^{ksi}}{107.8363} > .70 f_s' = 105^{ksi}$ reduce 2.8363

Jacking $f_A = 112.5 - 2.8363 = 109.66^{ksi}$

Final stress $f_A = 104.3 - 23 = 81.3^{ksi}$

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I.W. Tendon

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I. W. Tendon – pontoon D Length of I W Tendon

Jacking: $f = 109.66^{ksi}$ $F = f(1.58) = 173.27^{ksi}$

Seating $f = 104.3$ $F = f(1.58) = 164.79^{ksi}$

Final $f = 81.3$ $F = f(1.58) = 128.45^{ksi}$

Anchor set $\frac{1}{16}''$

Tendon size $1\frac{3}{8}''\phi$ Bar

Length 31.27^{ft}

Elongation $\Delta L = \frac{1}{28000}\left[\frac{(109.66)2 - .70}{2}(31.27)12\right] = 1.4649'' = 1\frac{1}{2}''$

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I W Tendon – Pontoon E Shortest Tendon

Wall 5 $L = 16.01' - (.15 + .147) = 15.71^{ft}$ (.297)

Angle changes $\alpha = 0$

Friction losses and control point.

End to End. $\mu\alpha + KL = 0 + .0002(15.71') = .0031$

Ⓐ Ⓑ $T_B = 112.147^{ksi} = .9969\ P_i$

$d = 112.5 - T_B = .3529^{ksi}$

$.70f_s' = .70(150) = 105^{ksi}$ max. @ End after anchor set

Jacking stress $= 105 + .35 = 105.35^{ksi}$ max.

$$\Delta L_m = \frac{112.5 + 112.5 - .35}{2} \cdot \frac{15.71'(12)}{28000} = .7563''$$ (112.325)

Anchor set $\Delta L = \frac{1}{16}''$ $= .0625 - .6938''$

$$f_m = 28000 \cdot \frac{.6938/12}{15.71} = 103.0422^{ksi} < .70f_s'$$

After Anchor set

$$f_A = 103.04 - \frac{.35}{2} = 102.87^{ksi}$$

$$f_B = 103.04 + \frac{.35}{2} = 103.22^{ksi} < .70f_s' = 105^{ksi}$$ OK

Jacking stress $f_A = 112.5^{ksi}$

Final stress: $f_A = 102.87 - 23 = 79.87^{ksi}$

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I. W. Tendon – Pontoon E Shortest Tendon

Jacking $f = 112.50^{ksi}$ $F = f(1.58^{in^2}) = \underline{177.75^{K}}$

Seating $f = 102.04$ $F = f(1.58) = \underline{161.22^{K}}$

Final $f = 79.87^{ksi}$ $F = f(1.58) = \underline{126.19^{K}}$

Anchor set $\underline{\frac{1}{16}''}$

Tendon size $\underline{1\frac{3}{8}''\phi}$

Length $\underline{15.71}$ Ft

Elongation $\Delta L = \frac{1}{28000}\left[\frac{(112.5)2 - .35}{2} \cdot \underline{15.71(12)}\right] = .7563'' = \underline{\frac{3}{4}''}$

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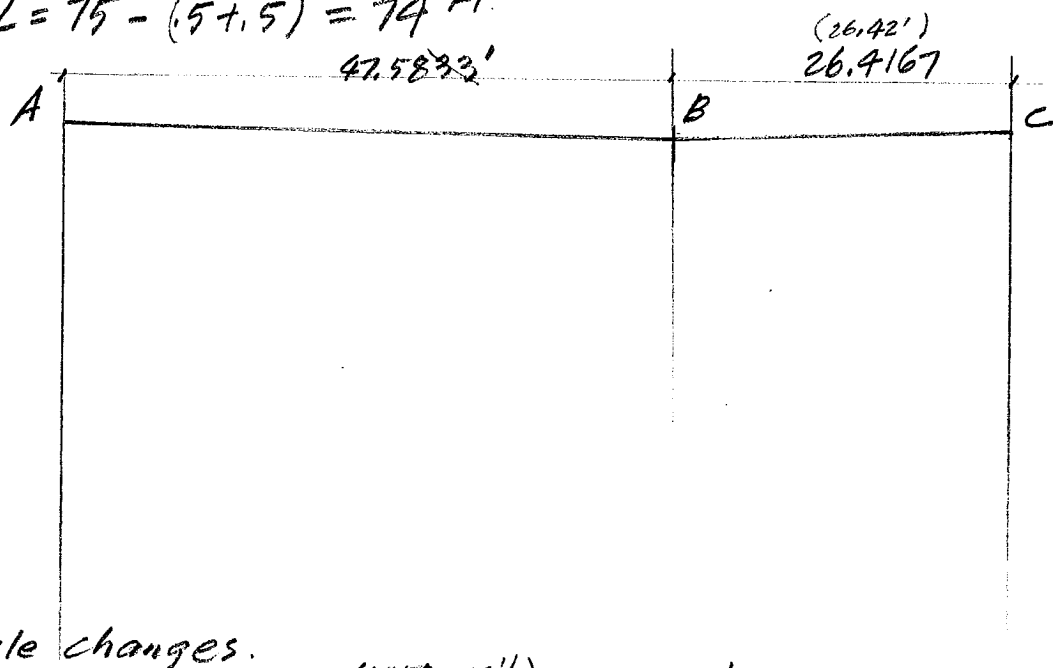
$\boxed{T.W}$ & $\boxed{Tr.S}$ Tendons. 4~.6"φ. Strands.

$L = 75 - (.5 + .5) = 74^{Ft}$



Angle changes.

A to B $\alpha = \frac{2(47.58 \times .02'/_1)}{47.58} = .04$ rad.

B to C $\alpha = \frac{2(26.42 \times .02'/_1)}{26.42} = .04$ rad.

Friction losses and control point Jacking stress

A to B $\mu\alpha + KL = .25(.04) + .0002(47.58) = .0195$

$T_B = 198.59^{ksi} = .9807\ P_j$ $\quad .75 f_s' = 202.5^{ksi}$

A to C $\mu\alpha + KL = .25(.04 + .04) + .0002(74) = .0348$

$T_C = 195.574^{ksi} = .9658\ P_j$

Jacking @ C. $d = 202.5 - 195.57 = 6.93^{ksi}$

$X = \sqrt{\frac{28000(\frac{1}{4})74}{12(6.93)}} = 78.94' > 74^{Ft}$

$\Delta f_m = \frac{202.5 + 195.57}{2} \cdot \frac{74'(12)}{28000} = 6.3123''$

$\Delta = \frac{1}{4}''$ anchor set. $= .25$

$6.0623''$

$f_m = 28{,}000 \cdot \frac{6.0623''/12}{74} = 191.15^{ksi}$

33003304

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T.W, Tr.S [illegible]

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After anchor set

$f_A = 191.15 - \frac{6.93}{2} = \cancel{187.69}\ 182.07\ ksi$

$f_c = 191.15 + \text{"} = \cancel{194.62}\ 189\ ksi\ ksi > .70 f_s' = 189\ ksi$

reduce $5.62\ ksi$

Jacking stress $f_A = 202.5 - 5.62 = 196.88\ ksi$

Final: $f = 182.07 - 33 = 149.07\ ksi$

DATA

Jacking $f = 196.88\ ksi$ $F = f(.868\ in^2) = \underline{170.89\ k}$

Seating: $f = 182.07$ $F = f(\text{"}) = \underline{158.04\ k}$

Final $f = 149.07$ $F = f(\text{"}) = \underline{129.39\ k}$

Anchor set $\underline{\frac{1}{4}"}$

Tendon size $4 \sim \underline{0.6"\phi}$

Length: $\underline{74\ ft.}$

Elongation $\Delta l = \frac{1}{28000}\left[\frac{196.88 + 189}{2}(74)12\right] = 6.119\ in = 6\frac{1}{8}"$

33003305