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COMPARISON COST ESTIMATE
CONCEPTUAL ALTERNATIVE DESIGNS
FOR THE

JOINT USE OF THE ARIZONA CANAL/ ARIZONA CANAL DIVERSION CHANNEL

PREPARED FOR
THE TASK FORCE APPOINTED BY
THE SALT RIVER PROJECT,
THE CITY OF PHOENIX, AND
THE MARICOPA COUNTY FLOOD CONTROL DISTRICT,
WITH THE ASSISTANCE OF
THE U.S. ARMY, CORPS OF ENGINEERS

OCTOBER 1987

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS
ANCHOR CENTRE TWO
2207 EAST CAMELBACK ROAD, SUITE 400
PHOENIX, ARIZONA 85016
(602) 954-7420

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CONCEPTUAL ALTERNATIVE DESIGNS
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HOWARD NEEDLES TAMMEN & BERGENDOFF

October 9, 1987

Mr. T.N. Stanton, P.E., Manager
Civil Engineering Department
Salt River Project
P.O. Box 52025
Phoenix, AZ 85072-2025

Attn: Mr. Robert E. Larchick, P.E.
Lead Engineer
Civil Engineering Department

RE: Comparison Cost Estimate of Conceptual Alternative Designs for the Joint Use of the Arizona Canal and the Arizona Canal Diversion Channel
Purchase Order No. VU-13404CSS

Dear Mr. Stanton:

Enclosed are thirty (30) copies of the estimate of reference, prepared per your request.

We have strived to produce a document that will enable SRP, as well as the Task Force consisting of SRP, the City of Phoenix and the Maricopa County Flood Control District, to arrive at a sound evaluation of the alternatives available to them at this time.

However, mention should be made of the limitations inherent in this document so that everyone understands the degree of confidence that they may place in these estimates.

Accuracy of these estimates is, at best, within a range of approximately plus or minus 25% due to the lack of engineering design plans for Alternative "B". Alternative "C", as well as the Present Design, represent closely the quantities provided in the U.S. Army Corps of Engineers in the Final Design Report of 1985. For this project, unit costs were reproduced from this report to generate the other two estimates.

Time constraints also took their toll in accuracy. Conceiving two separate projects and preparing an estimate for each in a period of three weeks is a formidable task.

Architects Engineers Planners **Anchor Centre Two - Suite 400, 2207 East Camelback Road, Phoenix, Arizona 85016, 602 954-7420**

Partners James F. Finn PE, Gerard F. Fox PE, Browning Crow PE, Charles T. Hennigan PE, Daniel J. Watkins PE, Daniel J. Spigai PE, John L. Cotton PE, Francis X. Hall PE, Robert S. Coma PE, Donald A. Dupies PE, William Love FAIA, Robert D. Miller PE, James L. Tuttle, Jr. PE, Hugh E. Schall PE, Cary C. Goodman AIA, Gordon H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goddard PE, John W. Wight, Jr. PE
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Where no figures or unit costs were avaliable in the C.O.E. Final Report, HNTB generated those costs by approximating the quantities, utilizing the ADOT Highways Division publication entitled "Construction Costs 1985", and discussing the amounts and unit costs to be used among the members of the Technical Assistance Committee.

Escalation of costs to 1987 levels was not performed upon concensus opinion of the T.A.C. Committee. Other approximations and specific conditions are listed in the body of the estimate.

We at HNTB are grateful for having been entrusted to perform the estimating services in connection with this important project and look forward to continued involvement in the project and being able to represent your interests.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Rafael Quinones D'Brassis, P.E.
Project Manager

cc: R.D. Miller
R.W. Luscombe
T.J. Klimek

RRQ/cjb
DI03.30

Description of Alternatives: Reaches 3 and 4, Arizona Canal Diversion Channel

Present Design

The Arizona Canal Diversion Channel will be a concrete rectangular section with base widths ranging from 36 to 60 feet from Cudia City Wash to 956 feet upstream from the Cave Creek confluence. The channel will have a clear-span covered section, 1297 feet long along Stanford Drive, east of 32nd Street, 4625 feet long at the Arizona Biltmore Hotel upstream from 24th Street, and a 2565 foot long double-box section between Central and Dunlap Avenues (Sunnyslope High School), with each box 29.5 feet wide and 20 to 21 feet high. From 839 feet upstream from the Cave Creek confluence at 22nd Avenue to 47th Drive, the channel will be a concrete rectangular section with a base width of 110 feet; thence the channel will transition to a concrete trapezoidal section with base widths ranging from 80 to 100 feet and side slopes of 1 vertical on 2 horizontal. As per the Task Forces instructions and for the purposes of this study, the length of Reach 4 was reduced from 21,200 feet to 11,200 feet and applies to all three alternatives.

Alternative C

Alternative C design features are identical as outlined for Present Design of the Arizona Canal Diversion Channel. However, Alternative C, as investigated in this study, incorporates an additional top slab cover for both reaches 4 and 3. For reach 4, the additional top concrete slab cover for the channel is 11,200 feet and for reach 3 is 16,235 feet. Costs for the additional top cover are summarized in the Totals Sheet for Alternative C (page 8).

Alternative B

Alternative B features modified cross sections for both reaches 4 and 3, and the relocation of the Arizona Canal in dual ten foot diameter concrete pipes. The modified cross section for reach 4 and reach 3 are illustrated in Exhibits A and B, respectively. The purposes of Alternative B, aside from providing flood control features, are to facilitate opportunities for recreational and aesthetic benefits not provided in Present Design.

RE/cjb
DI03.10

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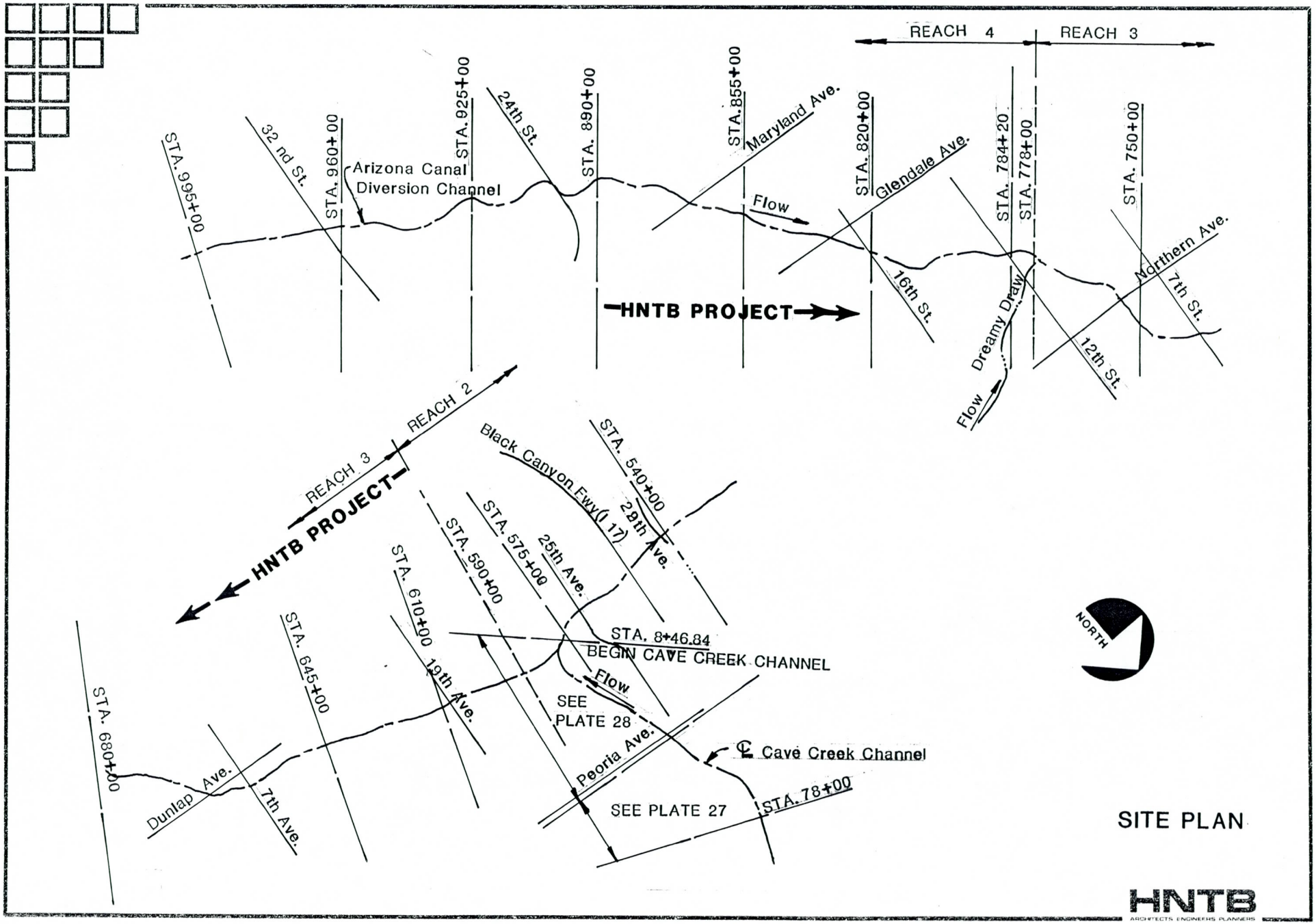
DI03.11



SITE PLAN

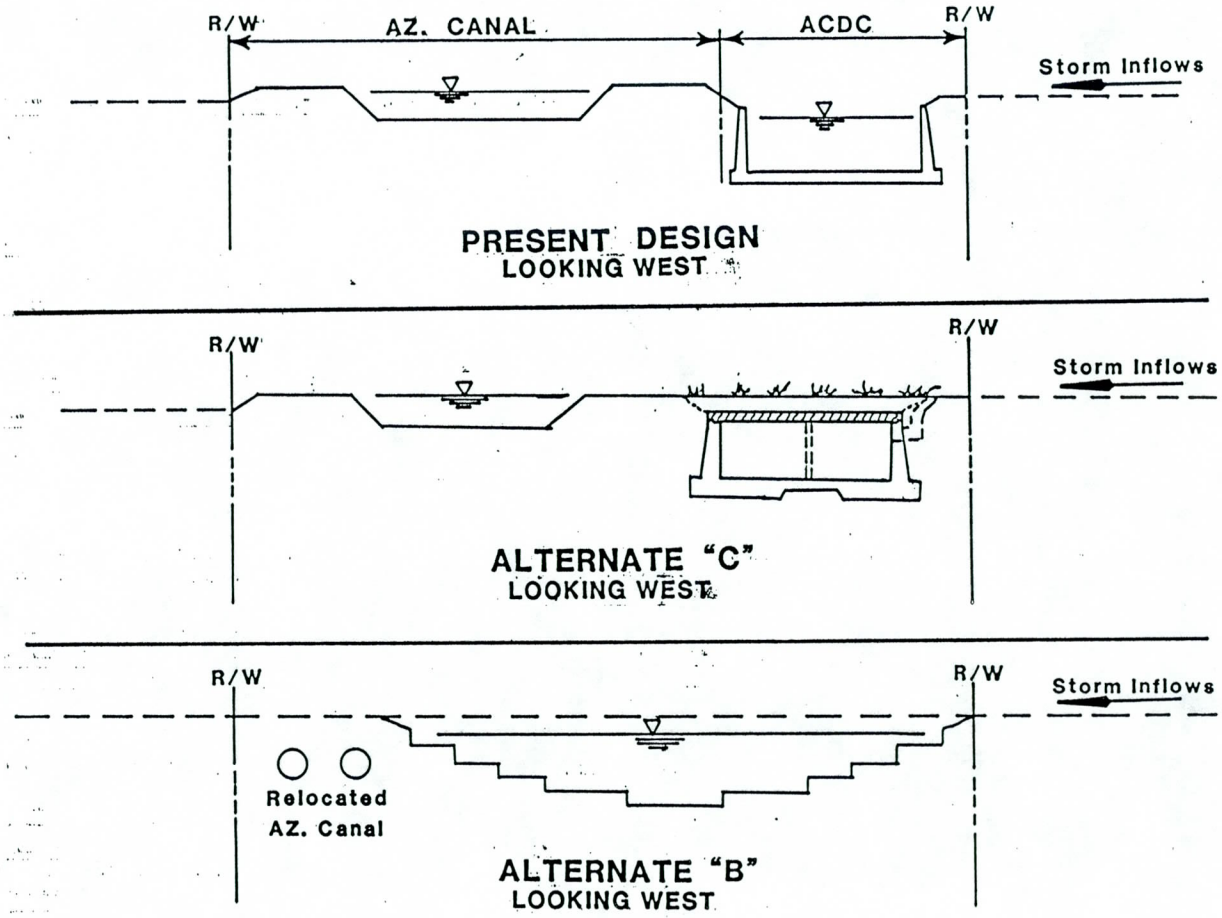
HNTB
ARCHITECTS ENGINEERS PLANNERS

ESTIMATE

ARIZONA CANAL-ACDC JOINT USE COST INVESTIGATION

SUMMARY COSTS(1)
OCTOBER 9, 1987

Description	Present Design Total Cost	Alternative C Total Cost	Alternative B Total Cost
* Total Channel Cost	49,311,755	83,058,300	65,521,569
* Lands & Damages	$27,976,588	$27,976,588	$27,976,588
* Total Relocations	$18,053,125	$18,053,125	$57,000,000
** TOTAL FLOOD CONTROL	$95,341,468	$129,088,013	$150,498,157



FOOTNOTES

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(1) Costs Based on 1985 Prices.
(2) 0.50467 * Corps Quantity Value.
(3) Same Quantity as Used by Corps.
(4) Over Excavation of 2(Two) Feet Included.
(5) Assume 8 Inch Thick Concrete Invert Floor Slabs.
(6) Use Spread Footings Per 1983 ADOT Standard Drawings:
Case II-Level Fill With 2(Two) foot Surcharge.
(7) Use Cantilever Retaining Walls Per 1983 ADOT Standard Drawings:
Case II-Level Fill With 2(Two) foot Surcharge.
(8) Assume 5.9 CWT Portland Cement Per CY Concrete.
(9) Assumed for Invert Slabs: 100 LBS Reinforcing Steel Per CY Concrete.
Steel for Walls & Footings Given in 1983 ADOT Standard Drawings:
Case II- Level Fill With 2(Two) foot Surcharge.
(10) Access Ladders and Ramps for Alternative 3 Assumed
to be Twice the Cost of Alternatives 1 & 2.
(11) SRP Arizona Channel Relocation Costs Provided With 2-10 foot
Diameter Concrete Pipes. The 1985 Construction Cost Based
on $785/LF for Installation of Both Pipes. Costs Include
Contingencies.
(12) Alternative 3/Reach 4: 4 Bridges @ ($40/sf * 220'*100')*1.42=$1,250,000/bridge
Alternative 3/Reach 3: 4 Bridges @ ($40/sf * 220'*100')*1.42=$1,250,000/bridge
(13) Top slab as stated in Corps estimate for Reach 4 not included as part
of this study. Cement and steel reinforcement quantities have been
adjusted accordingly.

TOTALS SHEET/PRESENT DESIGN OCTOBER 9, 1987

Description	Reach 4 Cudia City Wash To Dreamy Draw	Reach 3 Dreamy Draw To Cave Creek
FLOOD CONTROL		
Construction		
o Channel	$15,359,136	$25,733,993
o Engineering & Design	$1,535,914	$2,573,399
o Supervision & Administration	$1,535,914	$2,573,399
* Total Channel Cost	$18,430,964	$30,880,791
Lands & Relocations		
o Lands & Damages	$8,276,588	$19,700,000
Relocations		
o Utilities	$4,500,000	$7,000,000
o Roads & Bridges	$3,253,125	$3,300,000
* Total Relocations	$7,753,125	$10,300,000
* Total Lands/Relocations	$16,029,713	$30,000,000
** TOTAL FLOOD CONTROL	$34,460,677	$60,880,791

PRESENT DESIGN/REACH 4 - CUDIA CITY WASH TO DREAMY DRAW OCTOBER 9, 1987
STATION 890+00 TO 778+00

Description	Quantity(2)	Unit	Unit Cost	Total Cost
Task 1 - Flood Control Construction				
Channel				
o Diversion & Control of Water	1	JOB	LS	$75,700
o Clearing & Grubbing	1	JOB	LS	$21,701
o Shoring	1	JOB	LS	$138,784
o Excavation(Blasting), Channel	17,663	CY	$7.00	$123,641
o Excavation, Channel	711,585	CY	$2.95	$2,099,176
o Compacted Fill	240,223	CY	$3.20	$768,714
o Miscellaneous Fill, Compacted	21,903	CY	$0.75	$16,427
o Concrete, Invert	11,254	CY	$57.20	$643,729
o Concrete Footing	21,549	CY	$62.30	$1,342,503
o Concrete, Wall	31,088	CY	$80.00	$2,487,040
o Portland Cement	377,115	CWT	$4.20	$1,583,883
o Steel Reinforcement	7,007,343	LBS	$0.34	$2,382,497
o Invert Access Ramps	1	JOB	LS	$138,280
o Invert Access Ladders	2,720	LF	$30.00	$81,600
o Aggregate Base	2,150	CY	$15.10	$32,465
o Asphaltic Concrete Paving	2,180	TON	$36.40	$79,352
o Fencing, Channel	16,452	LF	$30.00	$493,560
o Steel Picket Gate, Single Drive	2	EA	$2,040.00	$4,080
o Steel Pipe Gate, Single Drive	7	EA	$650.00	$4,550
o Manholes	1	JOB	LS	$3,820
o Side Drain	1	JOB	LS	$42,493
o Drainage System	1	JOB	LS	$67,626
o Hydrologic Facilities	1	JOB	LS	$12,566
o Asthetic Design, Erosion Control	1	JOB	LS	$711,585
* Subtotal Channel				$13,355,771
o Contingencies				$2,003,366
* Total Channel				$15,359,136
o Engineering & Design				$1,535,914
o Supervision & Administration				$1,535,914
* Total Channel Cost				$18,430,964

PRESENT DESIGN/REACH 3 - DREAMY DRAW TO CAVE CREEK OCTOBER 9, 1987
STATION 778+00 TO 590+00

Description	Quantity(3)	Unit	Unit Cost	Total Cost
Task 1 - Flood Control Construction				
Channel				
o Diversion & Control of Water	-	-	-	-
o Clearing & Grubbing	-	-	-	-
o Shoring	1	JOB	LS	$56,700
o Excavation(Blasting), Channel	58,500	CY	$5.90	$345,150
o Excavation, Channel	1,390,000	CY	$2.50	$3,475,000
o Compacted Fill	363,000	CY	$3.20	$1,161,600
o Miscellaneous Fill, Compacted	35,900	CY	$0.75	$26,925
o Concrete, Invert	24,400	CY	$57.20	$1,395,680
o Concrete Footing	32,600	CY	$62.30	$2,030,980
o Concrete, Wall	42,100	CY	$80.00	$3,368,000
o Concrete, Top Slab	9,980	CY	$117.00	$1,167,660
o Portland Cement	634,000	CWT	$4.20	$2,662,800
o Steel Reinforcement	10,700,000	LBS	$0.34	$3,638,000
o Retaining Wall	1	JOB	LS	$70,000
o Invert Access Ramps	1	JOB	LS	$144,000
o Invert Access Ladders	380	LF	$30.00	$11,400
o Aggregate Base	4,160	CY	$15.10	$62,816
o Asphaltic Concrete Paving	4,210	TON	$36.40	$153,244
o Fencing, Channel	32,500	LF	$30.00	$975,000
o Steel Picket Gate, Single Drive	2	EA	$2,040.00	$4,080
o Steel Pipe Gate, Single Drive	12	EA	$650.00	$7,800
o Manholes	1	JOB	LS	$2,850
o Side Drain	1	JOB	LS	$65,300
o Hydrologic Facilities	1	JOB	LS	$22,400
o Asthetic Design, Erosion Control	1	JOB	LS	$1,530,000
* Subtotal Channel				$22,377,385
o Contingencies				$3,356,608
* Total Channel				$25,733,993
o Engineering & Design				$2,573,399
o Supervision & Administration				$2,573,399
* Total Channel Cost				$30,880,791

TOTALS SHEET/ALTERNATIVE C OCTOBER 9, 1987

Description	Reach 4 Cudia City Wash To Dreamy Draw	Reach 3 Dreamy Draw To Cave Creek
FLOOD CONTROL		
Construction		
o Channel	$16,010,059	$27,844,024
o Engineering & Design	$1,601,006	$2,784,402
o Supervision & Administration	$1,601,006	$2,784,402
* Subtotal Channel Cost	$19,212,071	$33,412,829
o Additional Top Slab Construction	$8,232,000	$19,151,400
o Additional Storm Inlets	$1,250,000	$1,800,000
* Total Channel Cost	$28,694,071	$54,364,229
Lands & Relocations		
o Lands & Damages	$8,276,588	$19,700,000
Relocations		
o Utilities	$4,500,000	$7,000,000
o Roads & Bridges	$3,253,125	$3,300,000
* Total Relocations	$7,753,125	$10,300,000
* Total Lands/Relocations	$16,029,713	$30,000,000
** TOTAL FLOOD CONTROL	$44,723,784	$84,364,229

ALTERNATIVE C/REACH 4 - CUDIA CITY WASH TO DREAMY DRAW OCTOBER 9, 1987
STATION 890+00 TO 778+00

Description	Quantity(2)	Unit	Unit Cost	Total Cost
Task 1 - Flood Control Construction				
Channel				
o Diversion & Control of Water	1	JOB	LS	$75,700
o Clearing & Grubbing	1	JOB	LS	$21,701
o Shoring	1	JOB	LS	$138,784
o Excavation(Blasting), Channel	17,663	CY	$7.00	$123,641
o Excavation, Channel	711,585	CY	$2.95	$2,099,176
o Compacted Fill	240,223	CY	$3.20	$768,714
o Miscellaneous Fill Compacted	21,903	CY	$0.75	$16,427
o Concrete, Invert	11,254	CY	$57.20	$643,729
o Concrete Footing	21,549	CY	$62.30	$1,342,503
o Concrete, Wall	31,088	CY	$80.00	$2,487,040
o Portland Cement	377,115	CWT	$4.20	$1,583,883
o Steel Reinforcement	7,007,343	LBS	$0.34	$2,382,497
o Invert Access Ramps	1	JOB	LS	$138,280
o Invert Access Ladders	2,720	LF	$30.00	$81,600
o Aggregate Base	2,150	CY	$15.10	$32,465
o Asphaltic Concrete Paving	2,180	TON	$36.40	$79,352
o Fencing, Channel	16,452	LF	$30.00	$493,560
o Steel Picket Gate, Single Drive	2	EA	$2,040.00	$4,080
o Steel Pipe Gate, Single Drive	7	EA	$650.00	$4,550
o Manholes	1	JOB	LS	$3,820
o Side Drain	1	JOB	LS	$42,493
o Drainage System	1	JOB	LS	$67,626
o Hydrologic Facilities	1	JOB	LS	$12,566
o Asthetic Design, Erosion Control	1	JOB	LS	$711,585
o Additional Ret. Wall Fdn. Conc.	6,500	CY	$87.08	$566,020
* Subtotal Channel				$13,921,791
o Contingencies				$2,088,269
* Total Channel				$16,010,059
o Engineering & Design				$1,601,006
o Supervision & Administration				$1,601,006
* Subtotal Channel Cost				$19,212,071
o Additional Top Slab Construction				$8,232,000
o Additional Storm Inlets				$1,250,000
* Total Channel Cost				$28,694,071

ALTERNATIVE C/REACH 3 - DREAMY DRAW TO CAVE CREEK OCTOBER 9, 1987
STATION 778+00 TO 590+00

Description	Quantity(3)	Unit	Unit Cost	Total Cost
Task 1 - Flood Control Construction				
Channel				
o Diversion & Control of Water	-	-	-	-
o Clearing & Grubbing	-	-	-	-
o Shoring	1	JOB	LS	$56,700
o Excavation(Blasting), Channel	58,500	CY	$5.90	$345,150
o Excavation, Channel	1,390,000	CY	$2.50	$3,475,000
o Compacted Fill	363,000	CY	$3.20	$1,161,600
o Miscellaneous Fill, Compacted	35,900	CY	$0.75	$26,925
o Concrete, Invert	24,400	CY	$57.20	$1,395,680
o Concrete Footing	32,600	CY	$62.30	$2,030,980
o Concrete, Wall	42,100	CY	$80.00	$3,368,000
o Portland Cement	634,000	CWT	$4.20	$2,662,800
o Steel Reinforcement	10,700,000	LBS	$0.34	$3,638,000
o Retaining Wall	1	JOB	LS	$70,000
o Invert Access Ramps	1	JOB	LS	$144,000
o Invert Access Ladders	380	LF	$30.00	$11,400
o Aggregate Base	4,160	CY	$15.10	$62,816
o Asphaltic Concrete Paving	4,210	TON	$36.40	$153,244
o Fencing, Channel	32,500	LF	$30.00	$975,000
o Steel Picket Gate, Single Drive	2	EA	$2,040.00	$4,080
o Steel Pipe Gate, Single Drive	12	EA	$650.00	$7,800
o Manholes	1	JOB	LS	$2,850
o Side Drain	1	JOB	LS	$65,300
o Hydrologic Facilities	1	JOB	LS	$22,400
o Asthetic Design, Erosion Control	1	JOB	LS	$1,530,000
o Concrete, Top Slab	9,980	CY	$117.00	$1,167,660
o Additional Ret. Wall Fdn. Con.	12,480	CY	$147.02	$1,834,810
* Subtotal Channel				$24,212,195
o Contingencies				$3,631,829
* Total Channel				$27,844,024
o Engineering & Design				$2,784,402
o Supervision & Administration				$2,784,402
* Subtotal Channel Cost				$33,412,829
* Additional Top Slab Construction				$19,151,400
o Additional Storm Inlets				$1,800,000
* Total Channel Cost				$54,364,229

TOTALS SHEET/ALTERNATIVE B OCTOBER 9, 1987

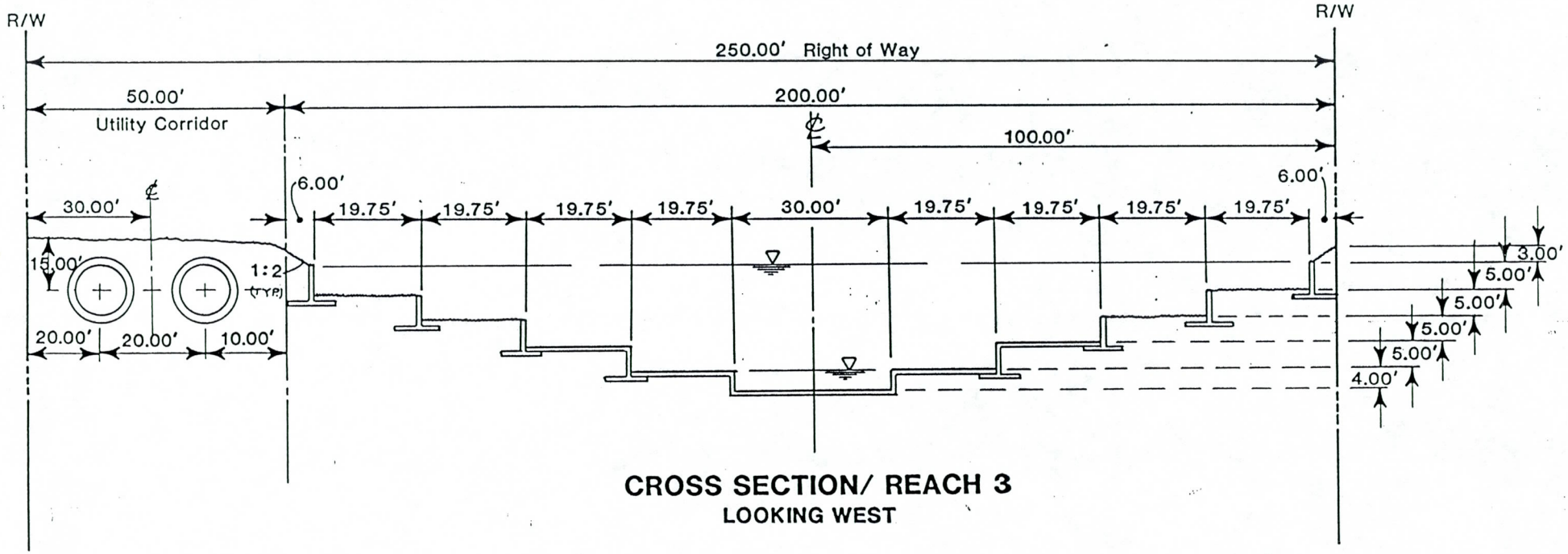
Description	Reach 4 Cudia City Wash To Dreamy Draw	Reach 3 Dreamy Draw To Cave Creek
FLOOD CONTROL		
Construction		
o Channel	$19,500,799	$35,100,509
o Engineering & Design	$1,950,080	$3,510,051
o Supervision & Administration	$1,950,080	$3,510,051
* Total Channel Cost	$23,400,958	$42,120,610
Lands & Relocations		
o Lands & Damages	$8,276,588	$19,700,000
Relocations		
o Utilities	$5,500,000	$8,000,000
o Roads & Bridges (12)	$5,000,000	$5,000,000
o SRP Arizona Canal Relocation(11)	$11,000,000	$18,500,000
o Gate Control Structures	$2,000,000	$2,000,000
* Total Relocations	$23,500,000	$33,500,000
* Total Lands/Relocations	$31,776,588	$53,200,000
** TOTAL FLOOD CONTROL	$55,177,546	$95,320,610

ALTERNATIVE B/REACH 4 - CUDIA CITY WASH TO DREAMY DRAW OCTOBER 9, 1987
STATION 890+00 TO 778+00

Description	Quantity	Unit	Unit Cost	Total Cost
Task 1 - Flood Control Construction				
Channel				
o Diversion & Control of Water(2)	1	JOB	LS	$75,700
o Clearing & Grubbing(2)	1	JOB	LS	$21,701
o Shoring(2)	1	JOB	LS	$138,784
o Excavation(Blasting), Channel(2)	17,663	CY	$7.00	$123,641
o Excavation, Channel(4)	1,321,600	CY	$2.95	$3,898,720
o Compacted Fill(2)	115,000	CY	$3.20	$368,000
o Miscellaneous Fill, Compacted(2)	10,000	CY	$0.75	$7,500
o Concrete, Invert(5)	27,664	CY	$57.20	$1,582,381
o Concrete Footing(6)	22,176	CY	$62.30	$1,381,565
o Concrete, Wall(7)	23,744	CY	$80.00	$1,899,520
o Portland Cement(8)	434,146	CWT	$4.20	$1,823,413
o Steel Reinforcement(9)	5,656,000	LBS	$0.34	$1,923,040
o Invert Access Ramps(2)(10)	1	JOB	LS	$276,560
o Invert Access Ladders(2)(10)	2,720	LF	$60.00	$163,200
o Aggregate Base(2)	2,150	CY	$15.10	$32,465
o Asphaltic Concrete Paving(2)	2,180	TON	$36.40	$79,352
o Fencing Channel(2)	16,452	LF	$30.00	$493,560
o Steel Picket Gate, Single Drive(2)	2	EA	$2,040.00	$4,080
o Steel Pipe Gate, Single Drive(2)	7	EA	$650.00	$4,550
o Manholes(2)	1	JOB	LS	$3,820
o Side Drain(2)	1	JOB	LS	$42,493
o Drainage System(2)	1	JOB	LS	$67,626
o Hydrologic Facilities(2)	1	JOB	LS	$12,566
o Asthetic Design, Erosion Control(2)	1	JOB	LS	$711,585
o Additional Earth Disposal	1,214,263	CY	$1.50	$1,821,395
* Subtotal Channel				$16,957,216
o Contingencies				$2,543,582
* Total Channel				$19,500,799
o Engineering & Administration				$1,950,080
o Supervision & Administration				$1,950,080
* Total Channel Cost				$23,400,958

ALTERNATIVE B/REACH 3 - DREAMY DRAW TO CAVE CREEK OCTOBER 9, 1987
STATION 778+00 TO 590+00

Description	Quantity	Unit	Unit Cost	Total Cost
Task 1 - Flood Control Construction				
Channel				
o Diversion & Control of Water(3)	-	-	-	-
o Clearing & Grubbing(3)	-	-	-	-
o Shoring(3)	1	JOB	LS	$56,700
o Excavation(Blasting), Channel(3)	58,500	CY	$5.90	$345,150
o Excavation, Channel(4)	2,632,000	CY	$2.50	$6,580,000
o Compacted Fill(3)	363,000	CY	$3.20	$1,161,600
o Miscellaneous Fill, Compacted(3)	35,900	CY	$0.75	$26,925
o Concrete, Invert(5)	50,760	CY	$57.20	$2,903,472
o Concrete Footing(6)	38,916	CY	$62.30	$2,424,467
o Concrete, Wall(7)	42,488	CY	$80.00	$3,399,040
o Portland Cement(8)	779,768	CWT	$4.20	$3,275,026
o Steel Reinforcement(9)	10,076,800	LBS	$0.34	$3,426,112
o Retaining Wall	1	JOB	LS	$70,000
o Invert Access Ramps(10)	1	JOB	LS	$288,000
o Invert Access Ladders(10)	380	LF	$60.00	$22,800
o Aggregate Base(3)	4,160	CY	$15.10	$62,816
o Asphaltic Concrete Paving(3)	4,210	TON	$36.40	$153,244
o Fencing, Channel(3)	32,500	LF	$30.00	$975,000
o Steel Picket Gate, Single Drive(3)	2	EA	$2,040.00	$4,080
o Steel Pipe Gate, Single Drive(3)	12	EA	$650.00	$7,800
o Manholes(3)	1	JOB	LS	$2,850
o Side Drain(3)	1	JOB	LS	$65,300
o Hydrologic Facilities(3)	1	JOB	LS	$22,400
o Asthetic Design, Erosion Control(3)	1	JOB	LS	$1,530,000
o Additional Earth Disposal	2,479,600	CY	$1.50	$3,719,400
* Subtotal Channel				$30,522,181
o Contingencies				$4,578,327
* Total Channel Construction Cost				$35,100,509
o Engineering & Design				$3,510,051
o Supervision & Administration				$3,510,051
* Total Channel Cost				$42,120,610



CROSS SECTION/ REACH 3
LOOKING WEST

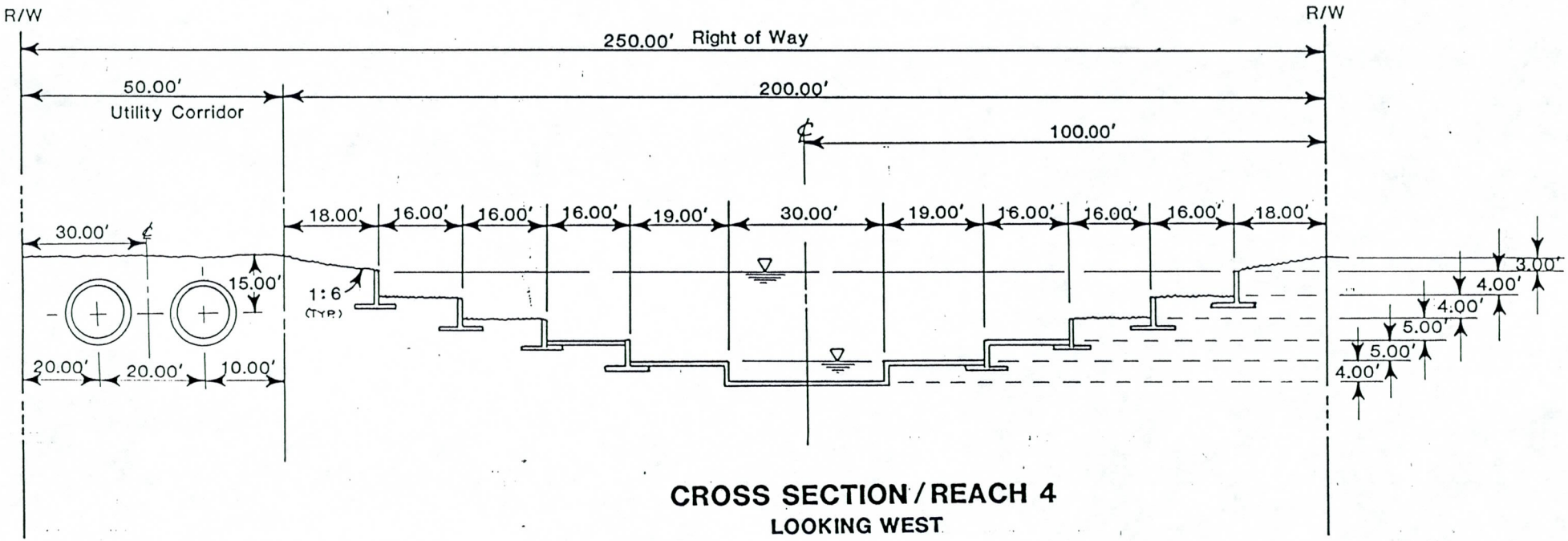
Q: 13,000 CFS
A: 2575 s.f.
P: 228 Feet
n: 0.022
V: Q÷0.9 A ≐5.61 fps
S: 0.0003 ft/ft

SCALES:
HORZ.:1": 20'
VERT.: 1" :20'

EXHIBIT "A"

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS
ANCHOR CENTRE TWO
2207 EAST CAMELBACK ROAD, SUITE 400
PHOENIX, ARIZONA 85016
(602) 954-7420

ALTERNATIVE "3" SRP/ ACDC JOINT USE CONCEPT



CROSS SECTION / REACH 4
LOOKING WEST

Q: 9000 CFS
A:2,024 sf x0.9=1,821.6 sf
P: 200 Feet
n: 0.022
V: Q÷0.9 A=5.47 fps
S: 0.0003 ft/ft

SCALES':
HORZ.:1": 20'
VERT.: 1" :20'

EXHIBIT "B"

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS
ANCHOR CENTRE TWO
2207 EAST CAMELBACK ROAD, SUITE 400
PHOENIX, ARIZONA 85016
(602) 954-7420

ALTERNATIVE "3" SRP/ ACDC JOINT USE CONCEPT

SUPPORTING DATA & COMPUTATIONS

Exhibit C
Reach 4
Corps of Engineers
Cost Estimate from
Sta. 999+93 to
Sta. 778+00

Table 12. (Continued)

(October 1985 Price Levels)

Cost Acct No.	Description	Quantity	Unit	Unit Cost	Amount Subtotal	Amount Total
	ARIZONA CANAL DIVERSION CHANNEL--CUDIA CITY WASH TO DREAMY DRAW					
	FLOOD CONTROL					
	Construction:					
09	Channel:					
	*Diversion & control of water.....	1	Job	LS	$150,000	
	*Clearing & grubbing.....	1	Job	LS	43,000	
	*Shoring.....	1	Job	LS	275,000	
	*Excavation (blasting), channel.....	35,000	CY	$7.00	245,000	
	Excavation, channel[a].....	1,410,000	CY	2.95	4,159,500	
	*Compacted fill.....	476,000	CY	3.20	1,523,200	
	*Miscellaneous fill, compacted.....	43,400	CY	0.75	32,550	
	Concrete, invert.....	22,300	CY	57.20	1,275,560	
	Concrete, footing.....	42,700	CY	62.30	2,660,210	
	Concrete, wall.....	61,600	CY	80.00	4,928,000	
	Concrete, top slab..(13)..	18,100	CY	117.00	2,117,700	
	Portland cement.....(13)..	854,000	CWT	4.20	3,586,800	
	Steel reinforcement.(13)..	16,600,000	Lbs	0.34	5,644,000	
	*Invert access ramps.....	1	Job	LS	274,000	
	*Invert access ladders.....	5,390	LF	30.00	161,700	
	*Aggregate base.....	4,260	CY	15.10	64,326	
	*Asphaltic concrete paving.....	4,320	Ton	36.40	157,248	
	*Fencing, channel.....	32,600	LF	30.00	978,000	
	*Steel picket gate, single-drive.....	3	Ea	2,040.00	6,120	
	*Steel pipe gate, single-drive.....	14	Ea	650.00	9,100	
	*Manholes.....	1	Job	LS	7,570	
	*Side drain.....	1	Job	LS	84,200	
	*Drainage system.....	1	Job	LS	134,000	
	*Hydrologic facilities.....	1	Job	LS	24,900	
	Esthetic design & erosion control.....	1	Job	LS	1,410,000	
	Subtotal, channel.....				29,951,684	

NOTE: All asterisk (*) items were multiplied by 0.50467.

Exhibit D
Reach 3
Corps of Engineers
Cost Estimate from
Sta. 778+00 to
Sta. 590+00

Table 12. (Continued)

(October 1985 Price Levels)

Cost Acct No.	Description	Quantity	Unit	Unit Cost	Amount Subtotal	Amount Total
	ARIZONA CANAL DIVERSION CHANNEL--DREAMY DRAW TO CAVE CREEK (Continued)					
	* Shoring.....	1	Job	LS	$56,700	
	* Excavation (blasting), channel.....	58,500	CY	5.90	345,150	
	Excavation (common), channel.....	1,390,000	CY	2.50	3,475,000	
	Compacted fill.....	363,000	CY	3.20	1,161,600	
	Miscellaneous fill, compacted.....	35,900	CY	0.75	26,925	
	Concrete, invert.....	24,400	CY	57.20	1,395,680	
	Concrete, footing.....	32,600	CY	62.30	2,030,980	
	Concrete, wall.....	42,100	CY	80.00	3,368,000	
	Concrete, top slab.....	9,980	CY	117.00	1,167,660	
	Portland cement.....	634,000	CWT	4.20	2,662,800	
	Steel reinforcement.....	10,700,000	Lbs	0.34	3,638,000	
	* Retaining wall.....	1	Job	LS	70,000	
	* Invert access ramps.....	1	Job	LS	144,000	
	* Invert access ladders.....	380	LF	30.00	11,400	
	* Aggregate base.....	4,160	CY	15.10	62,816	
	* Asphaltic concrete pavement.....	4,210	Ton	36.40	153,244	
	* Fencing, channel.....	32,500	LF	30.00	975,000	
	* Steel picket gate, single-drive.....	2	Ea	2,040.00	4,080	
	* Steel pipe gate, single-drive.....	12	Ea	650.00	7,800	
	* Manholes.....	1	Job	LS	2,850	
	* Side drains.....	1	Job	LS	65,300	
	* Hydrologic facilities.....	1	Job	LS	22,400	
	Esthetic design & erosion control.....	1	Job	LS	1,530,000	
	Subtotal, channel.....					22,562,385

NOTE: These cost items the same for alternatives "Present Design" and Alternate C. Asterisk (*) items the same for Alternative B except where noted.

Exhibit E
Corps of Engineers
Channel Costs

70-Sep-85

ARIZONA CANAL DIVERSION CHANNEL

Comparison of Open Rectangular Channel versus Covered Rectangular Channel

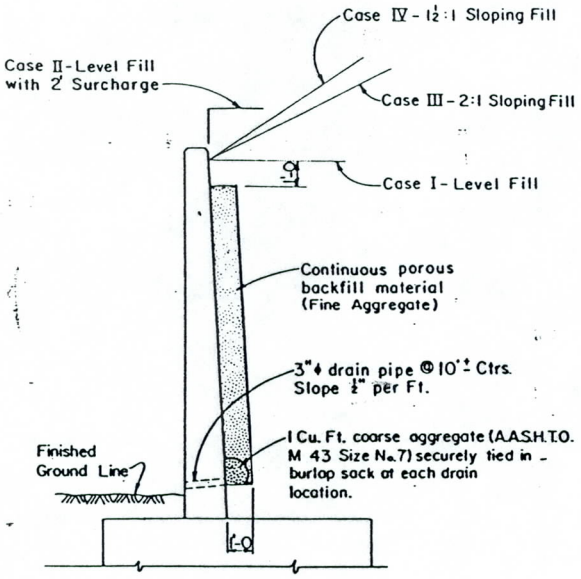
REACH		WIDTH FEET	LENGTH FEET	TOTAL CONSTRUCTION COST	COST PER FOOT	COST PER 100 FEET	
Stanford Drive just east of 32nd Street	Open Rectangular	36	1,215	$1,464,000	$1,205	$120,494	East of 24th Street Do not include
	Covered Rectangular	36	1,215	$2,274,000	$1,872	$187,160	
	Difference			$810,000	$667	$66,666	
	Percent Difference			55.3%	55.3%	55.3%	
Arizona Biltmore Hotel	Open Rectangular	36	2,910	$3,588,000	$1,233	$123,299	East of 24th Street Do not include
	Covered Rectangular	36	2,910	$5,675,000	$1,950	$195,017	
	Difference			$2,087,000	$717	$71,718	
	Percent Difference			58.2%	58.2%	58.2%	
The Pavilion	Open Rectangular	36	410	$647,000	$1,578	$157,805	East of 24th Street Do not include
	Covered Rectangular	36	410	$1,265,000	$3,085	$308,537	
	Difference			$618,000	$1,507	$150,732	
	Percent Difference			95.5%	95.5%	95.5%	
Western Savings	Open Rectangular	36	775	$1,064,000	$1,373	$137,290	East of 24th Street Do not include
	Covered Rectangular	36	775	$1,659,000	$2,141	$214,065	
	Difference			$595,000	$768	$76,775	
	Percent Difference			55.9%	55.9%	55.9%	
Herberger Park	Open Rectangular	40	448	$664,000	$1,482	$148,214	Include in Reach 4
	Covered Rectangular	40	448	$1,068,000	$2,384	$238,393	
	Difference			$404,000	$902	$90,179	
	Percent Difference			60.8%	60.8%	60.8%	
Griswold Road	Open Rectangular	50	950	$1,465,000	$1,542	$154,211	Include in Reach 3
	Covered Rectangular	2 x 25.5	950	$2,388,000	$2,514	$251,368	
	Difference			$923,000	$972	$97,157	
	Percent Difference			63.0%	63.0%	63.0%	
Hatcher Road	Open Rectangular	60	1,230	$1,847,000	$1,502	$150,163	Include in Reach 3
	Covered Rectangular	2 X 30.5	1,230	$3,611,000	$2,936	$293,577	
	Difference			$1,764,000	$1,434	$143,414	
	Percent Difference			95.5%	95.5%	95.5%	

Note: October 1984 Price Levels

FACSIMILE HEADER SHEET
(ER 105-1-5)

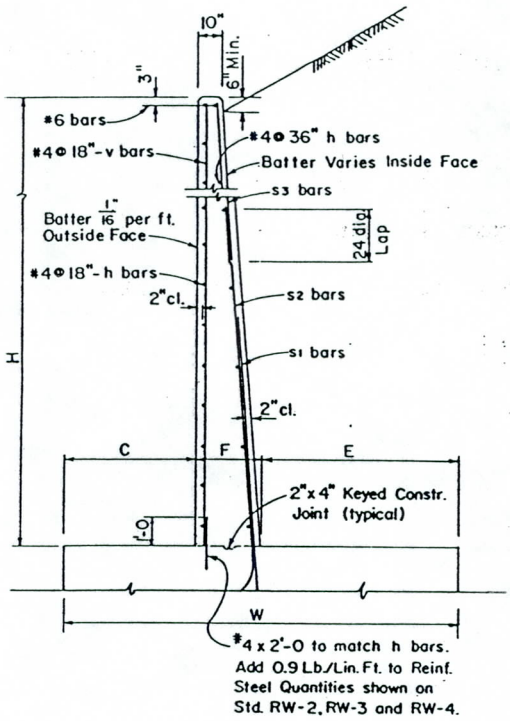
FROM (Name)	OFFICE SYMBOL	TELEPHONE NO.	RELEASER'S SIGNATURE		
Stan Lutz	SPLED-DP	FTS 798-2754	S. E. Lutz		
TO (Name)	OFFICE SYMBOL	TELEPHONE NO.	# PAGES	PRECEDENCE	DTG
Neil Erwin	MCCWRO	FTS 602-261-3071	1		
SUBJECT					

Exhibit F
ADOT Retaining Wall
Detail



TYPICAL SECTION

Showing Design Cases & Drainage



TYPICAL STEM DETAIL

CASE II - LEVEL FILL WITH 2' SURCHARGE

Dimensions						Steel List																			Quantities		
						s1			s2			s3			h	v	b			f1	t			f2			
H	W	B	C	F	E	Size	Spacing	Length	Size	Spacing	Length	Size	Spacing	Length	Number ⊕	Length	Size	Spacing	Length	Number ⊕	Size	Spacing	Length	Number ⊕	Concrete Cu. Yds. / Lin. Ft.	Steel Lbs. / Lin. Ft.	Max. Toe Press. Lbs. / Sq. Ft.
4'	3'-3	1'-3	1'-1	1'-0	1'-2	#5	12"	6'-6							3	3'-9	#5	12"	2'-6	2	#5	12"	2'-6	3	.342	22.01	1180
5'	3'-6	1'-3	1'-2	1'-0	1'-4	#5	12"	7'-6							4	4'-9	#5	12"	2'-6	2	#5	12"	2'-9	3	.387	24.43	1530
6'	4'-0	1'-3	1'-4	1'-0	1'-8	#5	12"	8'-6							5	5'-9	#5	12"	2'-9	2	#5	12"	3'-0	3	.444	27.10	1700
7'	4'-6	1'-3	1'-6	1'-0	2'-0	#5	12"	9'-6							6	6'-9	#5	12"	2'-9	3	#5	12"	3'-3	3	.502	30.19	1860
8'	5'-0	1'-3	1'-8	1'-0	2'-4	#5	9"	10'-6							7	7'-9	#5	12"	3'-0	3	#5	12"	3'-9	3	.559	36.78	2020
9'	5'-6	1'-3	1'-10	1'-0	2'-8	#5	14"	6'-0	#5	14"	11'-9				8	8'-9	#5	14"	3'-3	3	#6	14"	4'-0	4	.616	40.89	2170
10'	6'-0	1'-3	2'-0	1'-0	3'-0	#5	11"	6'-6	#5	11"	12'-9				9	9'-9	#5	11"	3'-3	3	#6	11"	4'-3	4	.673	50.60	2330
11'	6'-6	1'-3	2'-2	1'-0	3'-4	#7	12"	8'-3	#5	12"	13'-9				10	10'-9	#5	12"	3'-6	3	#6	9"	4'-9	4	.730	63.50	2480
12'	7'-0	1'-3	2'-4	1'-1	3'-7	#8	14"	8'-9	#6	14"	14'-9				11	11'-9	#6	14"	3'-9	3	#6	7"	5'-0	4	.806	76.98	2630
13'	7'-6	1'-3	2'-6	1'-2	3'-10	#8	12"	9'-0	#6	12"	15'-9				12	12'-9	#6	12"	4'-0	3	#6	6"	5'-3	4	.884	90.84	2780
14'	8'-0	1'-3	2'-8	1'-3	4'-1	#8	13"	9'-3	#7	13"	11'-0	#5	13"	7'-0	13	13'-9	#5	6½"	4'-3	3	#7	6½"	5'-9	4	.966	102.66	2940
15'	8'-6	1'-3	2'-10	1'-4	4'-4	#8	11"	9'-3	#7	11"	11'-3	#5	11"	7'-9	14	14'-9	#5	5½"	4'-6	3	#7	5½"	6'-0	4	1.051	121.44	3090
16'	9'-0	1'-5	3'-0	1'-5	4'-7	#9	11"	10'-9	#7	11"	12'-6	#5	11"	7'-9	15	15'-9	#5	5½"	4'-9	4	#7	5½"	6'-3	5	1.195	141.30	3340
17'	9'-6	1'-6	3'-2	1'-6	4'-10	#9	10"	10'-9	#7	10"	13'-0	#5	10"	8'-3	16	16'-9	#5	5"	5'-0	4	#7	5"	6'-9	5	1.318	158.86	3540
18'	10'-0	1'-7	3'-4	1'-8	5'-0	#9	12"	11'-3	#8	12"	13'-6	#6	12"	9'-3	17	17'-9	#6	6"	5'-3	4	#8	6"	7'-3	6	1.475	171.61	3750
19'	10'-6	1'-8	3'-6	1'-9	5'-3	#10	12"	12'-6	#8	12"	14'-6	#6	12"	9'-3	18	18'-9	#6	6"	5'-6	4	#8	6"	7'-6	6	1.613	193.01	3950
20'	11'-0	1'-9	3'-8	1'-10	5'-6	#10	11"	13'-0	#8	11"	15'-0	#6	11"	9'-9	19	19'-9	#6	5½"	5'-9	4	#8	5½"	7'-9	6	1.756	215.85	4150

Exhibit G
Corps of Engineers
Cost Estimate
Portion extracted from
Table 10 of estimate.

Cost Acct. No.	Description	Cudia Rucy Wash to Dreamy Draw (Reach 4)	Dreamy Draw to Cave Creek (Reach 3)
	FLOOD CONTROL		
	Construction		
09.	Channel.....	$34,400,000	$25,900,000
30.	Engineering and design....	3,450,000	2,600,000
31.	Supervision and administration.....	3,450,000	2,600,000
	Total, construction.....	41,300,000	31,100,000
	Lands and relocations		
	Lands and damages.....	16,400,000 (A)	19,700,000 (B)
	Relocations		
	Utilities...(C).....	1,635,000	520,000
	Roads and bridges...(D)...	5,205,000	3,300,000
	Total relocations.....	6,840,000	3,820,000
	Total, lands and relocations.....	23,240,000	23,520,000
	Total, flood control.....	64,540,000	54,620,000

NOTES:
(A) Prorated distance percentage of 50.467% multiplied times this value for all three alternatives. Since right-of-way constant, no additional lands and damages assumed.
(B) For Reach 3, lands and damages the same for all three alternatives.
(C) Total utilities relocation for both Reaches 3 and 4 is $11,500,000. By Reach, this cost is broken out as follows: Reach 4-$4,500,000; Reach 3-$7,000,000. In alternative B, an additional $1,000,000 was added to both reaches for longitudinal relocations.
(D) For alternatives "Present Design" and "C", Reach 4, Roads & Bridges multiplied by 5/8. For Reach 3, costs of Roads & Bridges remained the same. See footnote (12) for Alternative B.

HYDRAU

TW.EL.

.....

SEQ	S	SO	S	*
1	1		0.0004479	5
2	1		0.0004479	5
3	1		0.0004479	5
4	1		0.0004479	5
5	1		0.0004479	5
6	1		0.0004479	5
7	1		0.0004479	5

*

VS 0.0005125 AVAIL.

Insert a record
for minor losses
per Paul Yarowski

PROGRAM 409

HYDRAULIC GRADIENT ELEVATIONS

CONTENTS

SECTION		PAGE
I	ABSTRACT	409-1
II	GENERAL DESCRIPTION	409-1
III	INPUT PREPARATION	409-2
IV	OUTPUT	409-4
V	ERROR LIST	409-5
VI	SAMPLE PROBLEM	409-6
	OPERATING PROCEDURES	Appendix I

Date Released Dec/1968

I ABSTRACT
PROGRAM 409
HYDRAULIC GRADIENT ELEVATIONS

The purpose of Program 409 is to determine the Hydraulic Gradient for a system of conduits of known hydraulic and geometric properties. The Program uses the Manning equation $V=\left(\frac{1.486}{n}\right) \times R^{2/3} \times S^{1/2}$ and the Continuity equation (Q=AV) to compute hydraulic slopes and depth of flow.

Program 409 can be used to check hydraulic elevations for existing and proposed drainage facilities.

II GENERAL DESCRIPTION
PROGRAM 409

Given the Trailwater Elevation for the initial conduit of a drainage system (via input), the program computes the hydraulic gradient elevation for the subsequent conduit, repeating the process until all the elevations have been computed. The program compares each elevation for maximum criteria (established via input) and indicates when said criteria has been exceeded. In addition, it outputs the formula or method used to compute each Hydraulic elevation.

The program is basically oriented toward conduits operating under full flow conditions. However, it is also designed to accept problems involving less than full flow or supercritical conditions.

Program 409 can be used to compute hydraulic gradient elevations for a system of drainage conduits as shown in fig. 1, and can accept any of the sections-shapes shown in fig. 2.

Q - A = 14.03

III INPUT PREPARATION

The input is prepared on form No 505-12-68-1500 (See sample problem in section VI.) The input variables assume the implied decimal point indicated in paragraphs III-a and III-b, however, the user may deviate from said implication by entering the desired decimal point.

Up to 99 conduits may be analysed in one computer problem. A system with more than 99 runs or a branching system may be accomodated by separating the system into two or more problems. The Trailwater Elevation for problems subsequent to the initial or previous problem must be obtained from the results of the initial or previous problem.

Each problem requires one "HEADER" card, followed by as many "DATA" cards as conduits in the problem. One or more problems may be stacked in a computer run. Any one conduit may have one or more barrels; the program treats this condition by simply dividing the input flow (Q) by the number of barrels entered.

a) HEADER CARD (Col. 1 must be blank or alpha.)

Symbol	Col's	N/A*	Scale	Description
Option	1-5	A		The following options may be used by entering 1) "DUMP", to print intermediate values. 2) "PLOT", to plot flow lines, crown lines and Max. elevation. 3) Leave Blank, to by-pass above options.
TW. EL	6-15	N	xxx.xx	Trailwater elevation for the first conduit in ft.
No. CDS	16-17	N		Number of conduits (one Card/conduit).
Job, Ref.	20-27	N		Job and Reference Numbers.
	29-80			Job Description (not required).

Not available

b) DATA CARDS (Col. 1 must be numeric.)

Symbol	Col's	N/A	Scale**	Description
CD NO	1-2	N		Card Number - Sequential number starting with 01.
Shape	4	N		One of 6 available shapes (1-6) is shown in fig. 2.
No Bar	5	N		Number of Barrels (1-9); if blank, 1 is used.
Run No.	6-10	N/A		Conduit Identification (not required).
Length	11-15	N	xxx.x	Length of conduit. (ft.)
Q	16-20	N	xxx.x	Conduit Flow (CFS).
n	21-25	N	x.xxx	Manning's coefficient of roughness.

** Unless decimal points is explicitly entered by the user, the program assumes the decimal point is located as shown in this column.

FL1	26-35	N	xxx.xx	Lower Flow line elevation (ft.)
FL2	36-45	N	xxx.xx	Upper Flow line elevation (ft.)
Max. L	46-55	N	xxx.xx	Maximum Allowable Elevation (ft.) ≠
D/H	56-60	N	xx.xx	Diameter or Height of Conduit (ft.) ≠
Width	61-65	N	xx.xx	Width of Conduit (ft.) ≠
XL	66-70	N	xx.xx	Left Slope for Shape 3 (ft.) ≠
XR	71-75	N	xx.xx	Right Slope for Shape 3 (ft.) ≠
Max. D	76-80	N	xx.xx	Maximum Depth for Shape 3 (ft.) ≠

SPECIFIC ARTIFICIALLY HIGH

* N denotes numeric, A alpha and N/A either one.

≠ Note that Columns 56-80 are used to describe the conduit shape; therefore, only the values applicable to the selected shape need to be entered.

** Unless decimal points is explicitly entered by the user, the program assumes the decimal point is located as shown in this column.

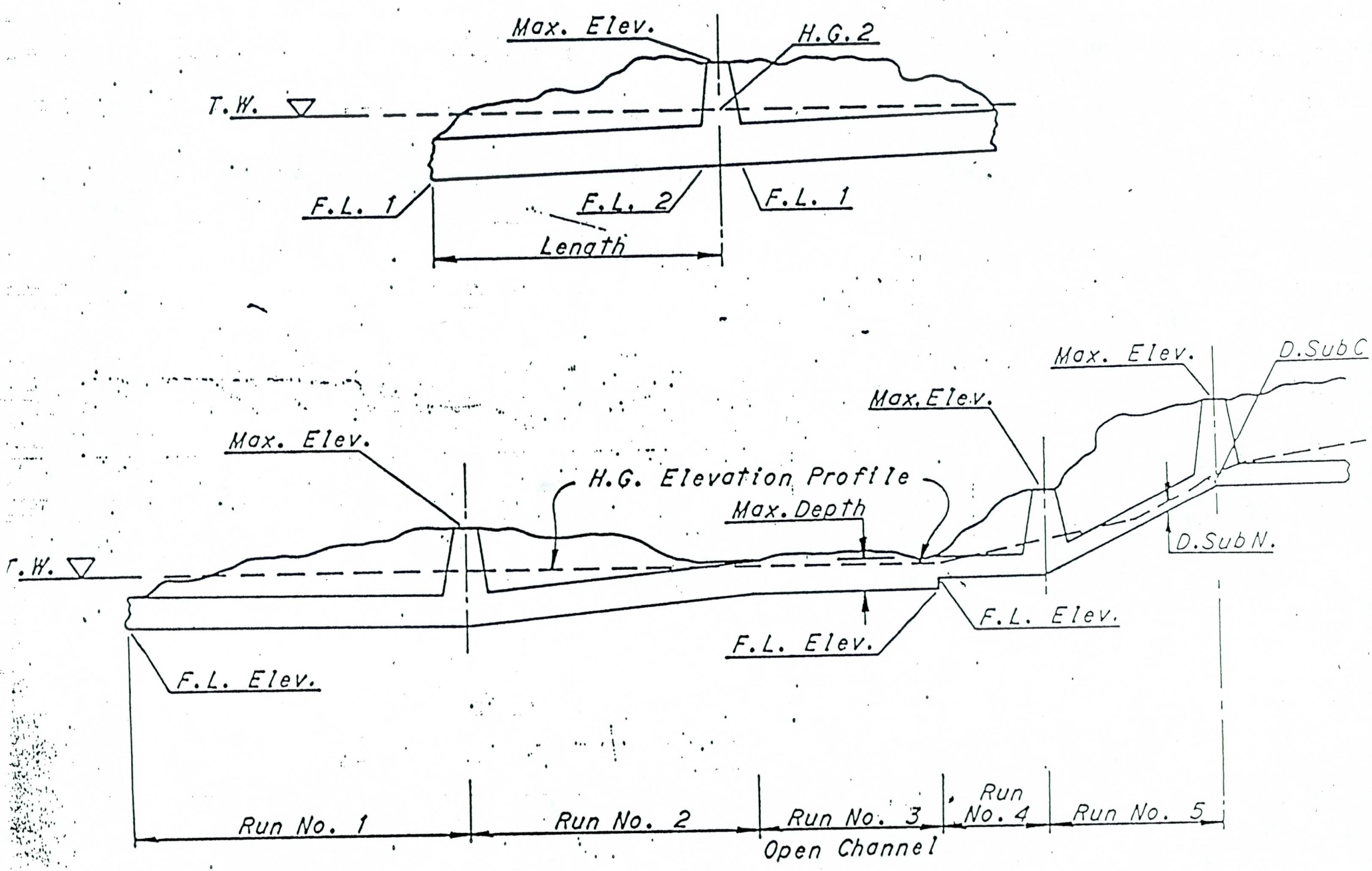

Max. Elev.
H.G.2
T.W.
F.L. 1
F.L. 2
F.L. 1
Length
Max. Elev.
D.Sub C
Max. Elev.
Max. Elev.
H.G. Elevation Profile
Max. Depth
D.Sub N.
T.W.
F.L. Elev.
F.L. Elev.
F.L. Elev.
Run No. 1
Run No. 2
Run No. 3
Run No. 4
Run No. 5
Open Channel

FIG. 1

The Maximum Elevation is a control or overflow elevation at the upper end of each run. The value must be entered for all shapes other than No. 3. If the calculated Hydraulic Gradient Elevation, exceeds the Maximum Elevation indicated the program automatically adjusts the HGE to the Maximum Elevation. The user may preclude this possibility by setting the Maximum Elevation artificially high.

For Shape No. 3, the Maximum Depth is a means of establishing a control elevation and is used in the same manner as the Maximum Elevation. Whenever Shape No. 3 is used, the Maximum Depth value must be entered.

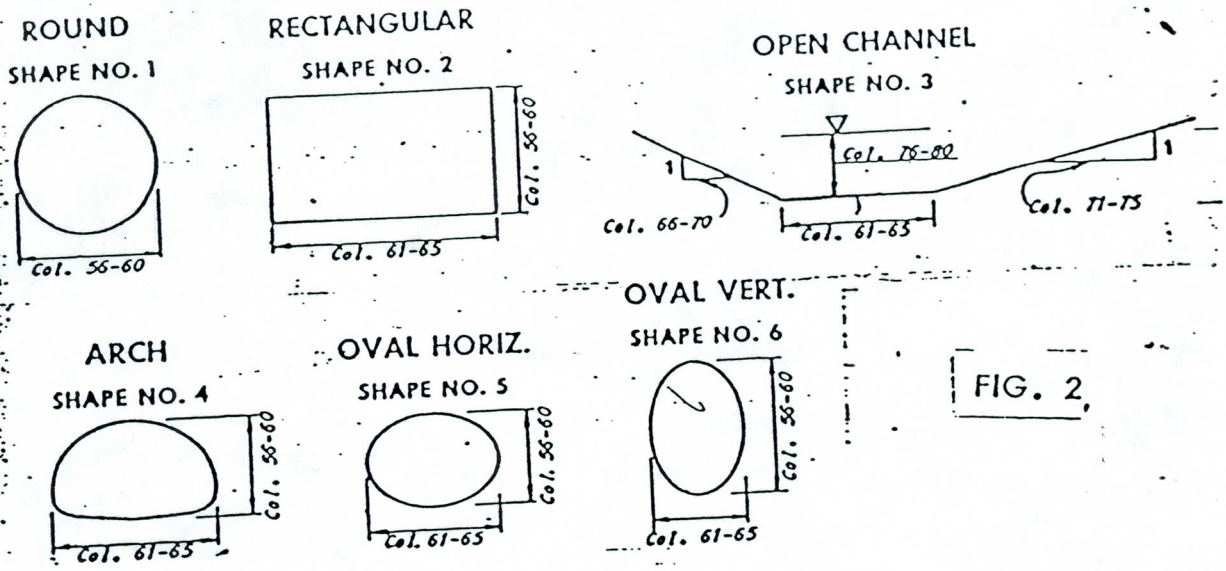


FIG. 2

*Triangular open channels may be used by setting the base width equal to zero. Vertically walled open channels may be used by setting XL, XR or both equal to zero.

IV OUTPUT

The output consists of a print back of the input values and the following calculated values.

TW. EL.	= Tailwater Elev.
DN	= Depth of Flow when calculated
DC	= Critical Depth of Flow, when calculated
SO	= Slope of conduit
S	= Hydraulic Slope
*	= Pointer from 1 to 5 indicative of formula used for determining Hydraulic elevation.

In addition by excercising the appropriate option the output may include

a) Intermediate values such as Hydraulic Radius, Area, Top Width, etc.

b) a plot of flow lines, crown lines, max. elevation and hydraulic gradients.

V ERROR LIST

All errors detected by the program are caused by input discrepancies and when they occur the problem is terminated. All errors are typed in the Typewriter and reported in the output print out.

ARIZONA C

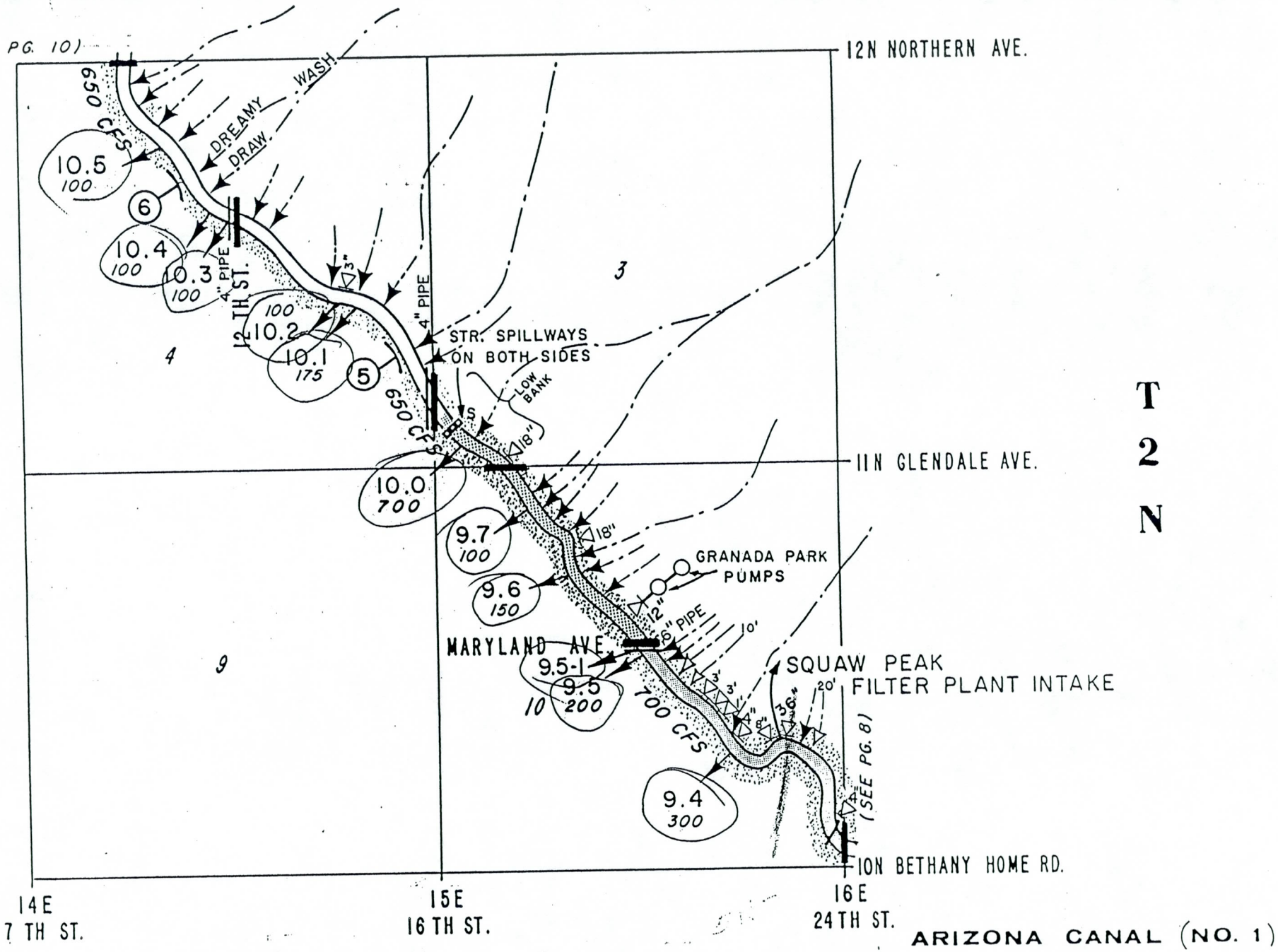
	LATERAL	GATE SEAT ELEV	NORMAL FB	HW FB	OVERFLOW	NORMAL ELEV	HW ELEV	OVERFLOW ELEV	OPERATING FLOWRATE CFS	BANK-BANK FLOWRATE CFS	HEC2 STA NO	
TAIL DRAIN			5.00	5.60	7.22	5.00	5.60	7.22	625.00		1.00	
LAT HEAD	1-20.0	1207.30	6.40	7.00	8.62	1213.70	1214.30	1215.92	625.00		1.00	
AVE	1-19.0	1210.09	5.70	6.20	7.20	1215.79	1216.29	1217.29	625.00		5534.00	
WE	1-18.0	1211.51	5.70	6.00	6.70	1217.21	1217.51	1218.21	650.00		13059.00	
51ST AVE	1-17.0	1215.12	6.40	7.20	8.90	1221.52	1222.32	1224.02	675.00		19579.00	
3RD AVE	1-16.0	1219.99	4.70	5.20	6.24	1224.69	1225.19	1226.23	700.00		27198.00	
31ST AVE	1-14.5	1223.88	6.00	6.60	7.72	1229.88	1230.48	1231.60	700.00		36194.00	
19TH AVE	1-13.0	1228.21	5.30	6.00	6.85	1233.51	1234.21	1235.06	650.00		44560.00	609+13
TH ST	1-11.0	1232.67	4.75	6.20	6.49	1237.42	1238.87	1239.16	650.00		56790.00	731+43
5TH ST	1-10.0	1237.54	4.60	5.20	5.95	1242.14	1242.74	1243.49	650.00		66051.00	824+04
SQUAW PEAK WTP									700.00		72043.00	883+96
2ND ST	1-8.0	1243.81	5.00	5.80	6.90	1248.81	1249.61	1250.71	700.00		80203.00	965+52
D X-CUT	1-6.0	1248.30	4.60	5.80	9.47	1252.90	1254.10	1257.77	1125.00		93852.00	35,643
AZFALLS	1-5.0	1269.09	5.50	6.00	7.84	1274.59	1275.09	1276.93	1600.00		100369.00	
HEAD GRAND		1271.82				1271.82	1271.82	1271.82	1600.00		105442.00	
SCOTTSDALE RD	1-3.0	1271.90	6.00	7.00	8.80	1277.90	1278.90	1280.70	1600.00		112242.00	
INDIAN SIPHON	1-1.7	1277.38	5.80	6.80	7.00	1283.18	1284.18	1284.38	1600.00		125869.00	
INDIAN WASTE						0.00	0.00	0.00	1600.00			
EVERGREEN	INDIAN LAT	1291.13	7.00	7.50	8.00	1298.13	1298.63	1299.13			159040.00	
EVERGREEN DN						0.00	0.00	0.00				
HEAD ARIZONA			6.20	6.60	7.00	6.20	6.60	7.00				
	100 200 300 400 500 600 700					283.19						
GRAND CANAL												
TAIL	2-23.0	1050.20	6.50	7.50		1056.70	1057.70	1050.20	285.00		1.00	
5 AVE	2-22.0	1062.85	5.00	5.50		1067.85	1068.35	1062.85	360.00		7611.00	
VE	2-21.0	1079.95	6.90	7.50		1086.85	1087.45	1079.95	438.00		12949.00	
TH AVE	2-20.0	1089.46	6.50	7.00		1095.96	1096.46	1089.46	550.00		20538.00	
59TH AVE	2-18.0	1094.03	5.40	6.00		1099.43	1100.03	1094.03	625.00		33377.00	
ST AVE	2-17.0	1098.10	4.80	5.50		1102.90	1103.60	1098.10	650.00		38985.00	
RD AVE	2-16.0	1102.03	5.30	6.00		1107.33	1108.03	1102.03	700.00		44297.00	
27TH AVE	2-14.0	1109.56	3.50	4.20		1113.06	1113.76	1109.56	700.00		55112.00	
INDIAN SCHOOL	2-13.3	1113.53	3.00	4.00		1116.53	1117.53	1113.53	750.00		59161.00	
H AVE	2-12.0	1118.11	3.50	4.00		1121.61	1122.11	1118.11	750.00		67478.00	
7TH ST	2-9.0	1127.15	3.50	4.00		1130.65	1131.15	1127.15	750.00		87326.00	
PUEBLO GRANDE	2-6.2	1133.49				1133.49	1133.49	1133.49	650.00		105428.00	
EBLO GRANDE DN		1135.52	5.00	5.50		1140.52	1141.02	1135.52	650.00			
INT HEAD DRAIN	2-5.8	1134.42	5.50	7.00		1139.92	1141.42	1134.42	625.00		109649.00	
TEMPE FILTER	2-4.0										122661.00	
THOMAS	2-2.0										135463.00	
RD GRAND											139200.00	

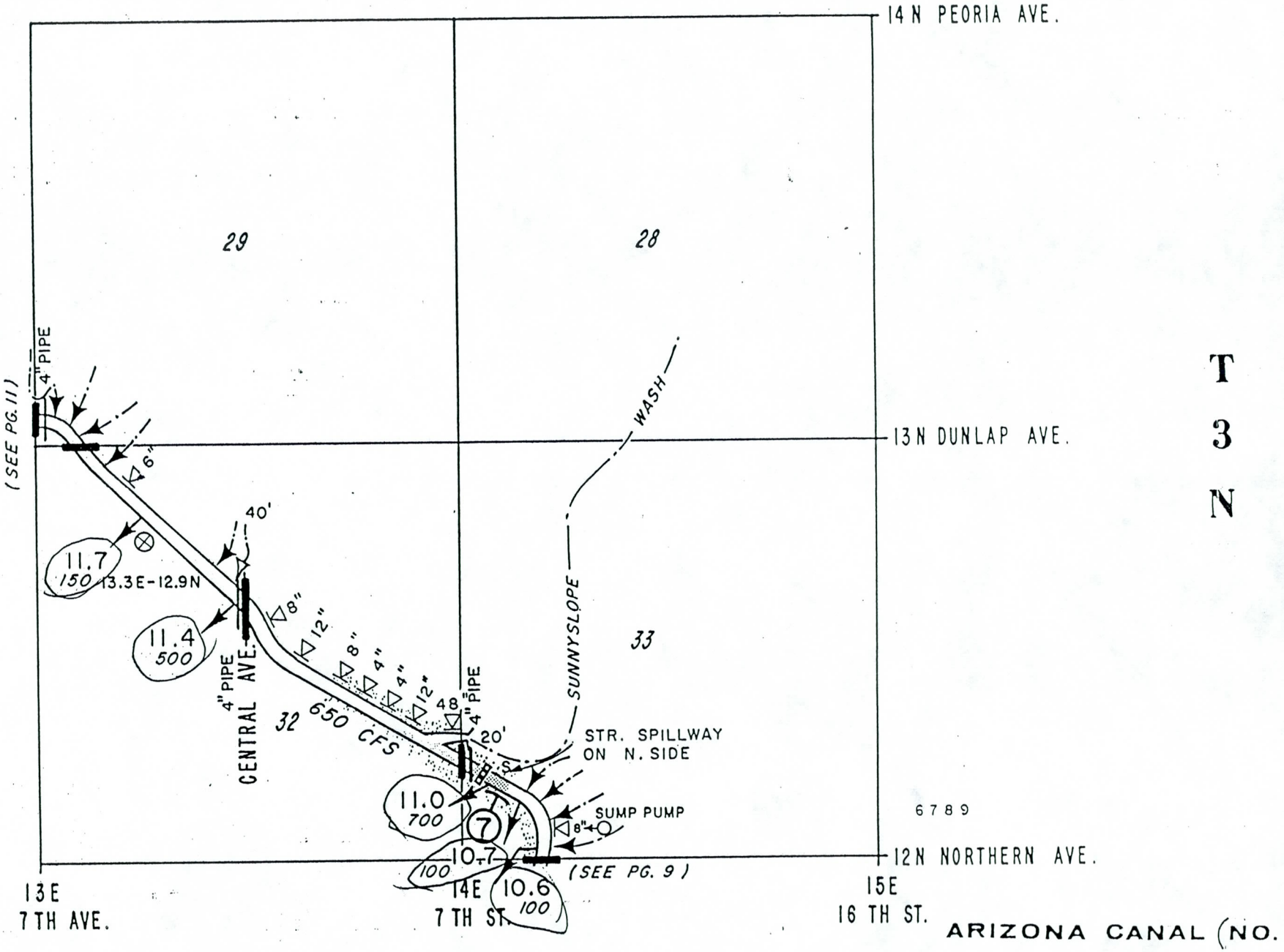
$S_f = 0.0004321$

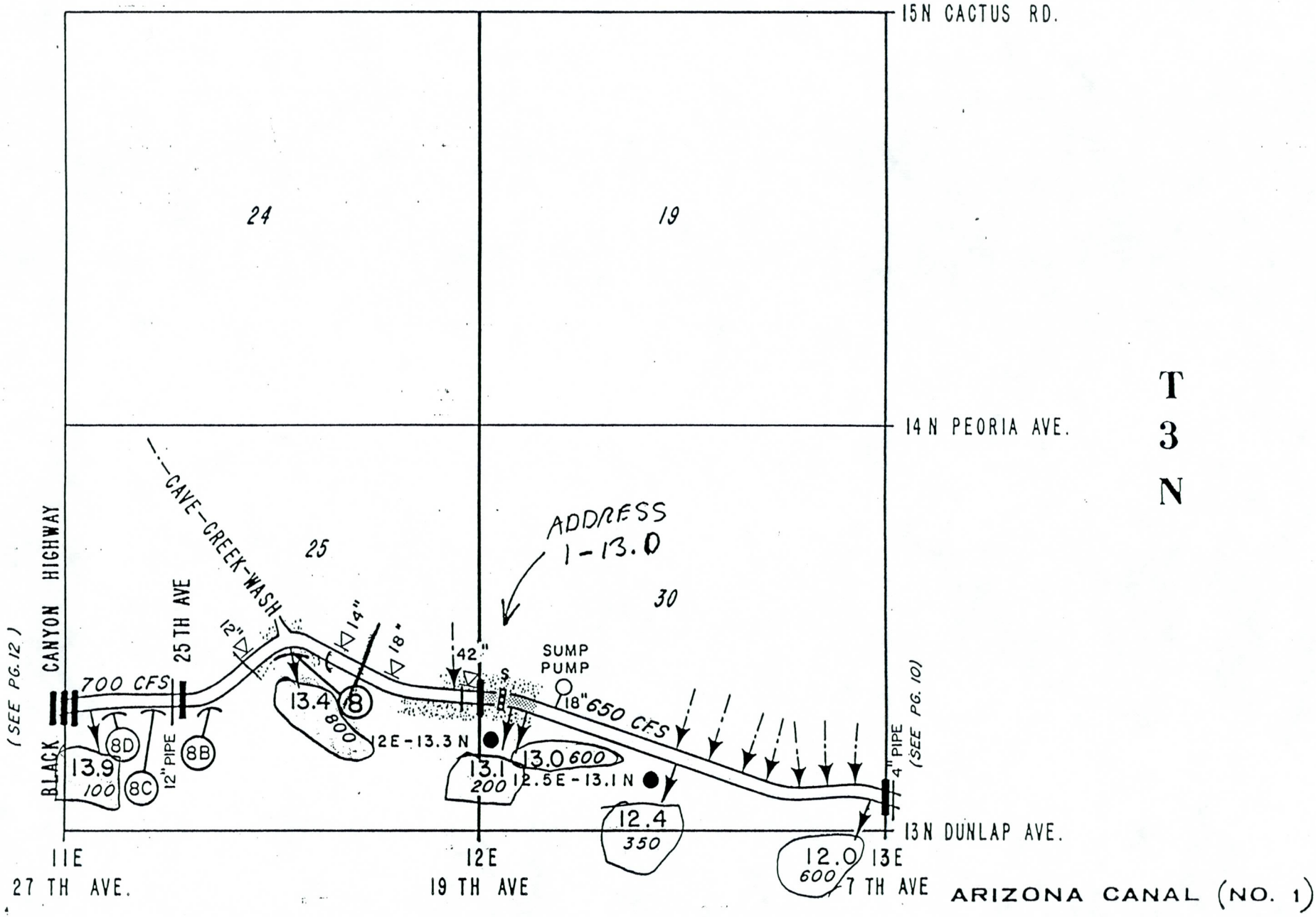
JOE- FOR YOUR INFO

Tim

RECEIVED TECH. SUPPORT 1986


(SEE PG. 10)
12N NORTHERN AVE.
650 CFS
DREAMY DRAW WASH
10.5
100
6
10.4
100
10.3
100
4" PIPE
12 TH ST.
100
10.2
10.1
175
5
4
3
4" PIPE
STR. SPILLWAYS ON BOTH SIDES
LOW BANK
650 CFS
18"
11N GLENDALE AVE.
10.0
700
9.7
100
18"
GRANADA PARK PUMPS
9.6
150
12"
6" PIPE
10'
MARYLAND AVE.
9.5-1
9.5
200
10
9
SQUAW PEAK
FILTER PLANT INTAKE
20'
3'
3'
4"
8"
36"
700 CFS
9.4
300
(SEE PG. 8)
10N BETHANY HOME RD.
14 E
7 TH ST.
15 E
16 TH ST.
16 E
24 TH ST.
ARIZONA CANAL (NO. 1)
R 3 E
T 2 N


14 N PEORIA AVE.
13 N DUNLAP AVE.
12 N NORTHERN AVE.
13 E
7 TH AVE.
14 E
7 TH ST.
15 E
16 TH ST.
29
28
33
32
WASH
SUNNYSLOPE
(SEE PG. 11)
4" PIPE
6"
40'
11.7
150
13.3E-12.9N
11.4
500
8"
12"
8"
4"
4"
12"
48"
4" PIPE
4" PIPE
CENTRAL AVE.
650 CFS
20'
STR. SPILLWAY
ON N. SIDE
11.0
700
7
SUMP PUMP
8"
10.7
100
(SEE PG. 9)
10.6
100
6 7 8 9
T
3
N
R 3 E
ARIZONA CANAL (NO.


15N CACTUS RD.
14N PEORIA AVE.
13N DUNLAP AVE.
T 3 N
24
19
25
30
CAVE-CREEK-WASH
ADDRESS
1-13.0
BLACK CANYON HIGHWAY
(SEE PG. 12)
25TH AVE
700 CFS
12"
14"
18"
42"
SUMP PUMP
18" 650 CFS
4" PIPE
(SEE PG. 10)
12" PIPE
8D
8C
8B
8
13.9
100
13.4
800
12E-13.3N
13.1
200
13.0 600
12.5E-13.1N
12.4
350
12.0
600
11E
27TH AVE.
12E
19TH AVE
13E
7TH AVE
ARIZONA CANAL (NO. 1)
R 2 E
R 3 E

CIP PROJECT SCHEDULE

PAGE 1 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 06/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/30 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 02C													
	I-17 BRIDGE (ADOT):													
	Construction	2700	XXXXXX / 000000	XXXXXX / 0000	XXXXXX	XXXXXX								
	Pay 400K to ADOT for C/M	400					X							
6C118S	ACDC R02C													
	CANAL RELOC @ 22nd AV (SRP):													
	Design to Final Plans & Specs		XXXXXX / 000000	XXX / 000										
	Const Easemnt Ident & Acquire		XXXXXX / 000000	XXX / 000										
	Construction by SRP				XX	XXXXXX								
	Payment to SRP	600					X							
6C118S	ACDC R02C													
	SEWER SIPHON @ 25th AVE:													
	Design to Final Plans & Specs	17	XXXXXX / 000000	X / 0										
	Const Easemnt Ident & Acquire		XXXXXX / 000000	X / 0										
	Bids & Contract Award			XXXX / 0000										
	Construction	420			XX	XXXXXX								

CIP PROJECT SCHEDULE

PAGE 2 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 02C													
	APS UTILITY RELOCATIONS:													
	Design to Final Plans & Specs		XXXXXX	XXXXXX										
			000000	0000										
	Construction				XXXXXX									
	Payments to Outside Agencies	93				X								
	SPOIL SITE ACQUISITION R02C:													
	Const Easemnt Ident & Acquire			XXXXXX	XXXXXX	XXX								
				0000										
	Payment of 2.3% to COE	100				X								

CIP PROJECT SCHEDULE

PAGE 3 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
			EAR	1987			1988				1989	1990	1991	
6C118S	ACDC - CAVE CREEK													
	6 PEDESTRIAN BRIDGES:													
	A/E Proposal to Contract		XXXXXX	XXX										
			000000	000										
	Design to Final Plans & Specs	53		XXX	XXXXXX	XX								
	Bids & Contract Award by COE						XXX							
	Construction by COE	600					XXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX		
	PED UNDRPSS @ PEORIA & CACTUS:													
	A/E Proposal to Contract		XXXXXX	XXXX										
			000000	0000										
	Design to Final Plans & Specs	35		XX	XXXXXX	XXXX								
	Const Easemnt Ident & Acquire				XX	XXXXXX	XXXX							
	Bids & Contract Award (After Cave Creek)											XXX		
	Construction (After Cave Creek)	500										X	XX	

CIP PROJECT SCHEDULE

PAGE 4 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC - CAVE CREEK													
	MISC UTIL RELOC-SEWER, WATER ETC													
	A/E Proposal to Contract		XXXXXX 000000	XX 00										
	Design to Final Plans & Specs	26		XXXX 00	XXXXXX									
	Const Easemnt Ident & Acquire			XXX 0	XXXXXX	XX								
	Bids & Contract Award				XX	XXXX								
	Construction	300				XXX	XXX							
	CAVE CREEK FEDERAL PROJECT:													
	R/W Acquisition	6000	XXXXXX 000000	XXXXXX 0000	XXX									
	Payment to CDE (2.3%)	600					X							
	SPOIL SITE ACQUISITION CAVE CR:													
	Const Easemnt Ident & Acquire			XXXXXX 0000	XXXXXX	XXXXX								

CIP PROJECT SCHEDULE

PAGE 5 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 03													
	SEWER SIPHON @ 19th AVE:													
	Design to Final Plans & Specs		XXXXXX	XXX										
			000000	000										
	Const Easemnt Ident & Acquire			XXXXXX	XX									
				0000										
	Bids & Contract Award			XX	X									
	Construction	250			XXXXX									
	WATERLINE (48") RELOC @ 19th AVE:													
	Design to Final Plans & Specs		XXXXXX	XXXX										
			000000	0000										
	Const Easemnt Ident & Acquire			XXXXXX	XXX									
				0000										
	Bids & Contract Award			X	XX									
	Construction	250			XXXX									
	GASLINES @ 19th AVE (SW GAS):													
	Design to Final Plans & Specs		XX	XXXXXX										
			00	0000										
	Construction				XXXXXX	XX								
	Payments to Outside Agencies	150				X								
						X								

CIP PROJECT SCHEDULE

PAGE 6 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 03													
	BRIDGE & MISC UTIL @ 19th AVE:													
	Design to Final Plans & Specs	103	XXXXX OOOOO	XXXXXX OOOO	XX									
	Const Easemnt Ident & Acquire			XXXXXX OOOO	XXX									
	Bids & Contract Award				XXX	X								
	Construction	1085				XXXXX	XXXXXX	X						
	Payments to Outsice Agencies (SWG)	150							X					
	SAN SEWER 17th TO 15th & DEMOL 17th TO 9th													
	Design to Final Plans & Specs	10	XXX OOO	XXXX OOOO										
	Bids & Contract Award					XX								
	Construction	100				XXXX	XXXX							
	SAN SIPHON @ DUNLAP and SEWER LINE & DEMOL 9th Av to DUNLAP:													
	Design to Final Plans & Specs	38	XXXX OOOO	XXXX OOOO										
	Const Easemnt Ident & Acquire			XXXXXX OOOO	X									
	Bids & Contract Award			XX	X									
	Construction	370			XXXXX									

CIP PROJECT SCHEDULE

PAGE 7 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987/1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988/1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 03													
	BRIDGE & UTIL @ 7th AVE:													
	Design to Final Plans & Specs	80	XXX OOO	XXXXXX OOOO	XX									
	Const Easemnt Ident & Acquire			XXXXXX OOOO	XXX									
	Bids & Contract Award				XXX									
	Construction	780				XXXXXX	XXXXXX	X						
	Payments to SWG & Mtn. Bell	30					X							
	SUNNYSLOPE H.S. REGRADING:													
	Design to Final Plans & Specs	20		XXX O	XXXXXX	XXX								
	Const Easemnt Ident & Acquire				XXXXX	XXXXX								
	Construction (COE)								XXXXXX	XXXXXX	XXXXXX	XXXX		
	Payments to Outside Agency (COE)	250						X						
	CENTRAL AVE UTILITIES AND SEWER LINE CENTRAL to 7th ST:													
	Design to Final Plans & Specs	62		XXX O	XXXXXX	XX								
	Const Easemnt Ident & Acquire			X	XXXXXX	XXX								
	Bids & Contract Award					XXX								
	Construction	300					XXXXXX	XX						
	Payments to Outside Agency Southwest Gas & Mntn Bell							X						

CIP PROJECT SCHEDULE

PAGE 8 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL 1987 QTR 1 JLAGSP	FISCAL YEAR 1987 /1988 QTR 2 OCNVDC	FISCAL YEAR 1987 /1988 QTR 3 JAFBMR	FISCAL YEAR 1987 /1988 QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	FISCAL YEAR 1988 /1989 QTR 2 OCNVDC	FISCAL YEAR 1988 /1989 QTR 3 JAFBMR	FISCAL YEAR 1988 /1989 QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 03													
	LIFT STATION, BRIDGE, UTILITIES & DEMOL @ 7th STREET:													
	Design to Final Plans & Specs	108	XXX 000	XXXXXX 0000										
	Const Easemnt Ident & Acquire			X 0	XXXXXX 0000	XXX								
	Bids & Contract Award					XXX								
	Construction	940					XXXXXX	XXXXXX						
	Payments to Outside Agencies SWG, Phoenix (Lift Sta C&M)	50							X					
	SAN SIPHON @ NORTHERN AVE:													
	Design to Final Plans & Specs	25	XXXX 0000	XXXX 0000										
	Const Easemnt Ident & Acquire				XXXXXX 0000	XX								
	Bids & Contract Award				X	X								
	Construction	248				XXXXX								
	SEWER & DEMO NORTHERN to 11th ST:													
	Design to Final Plans & Specs	10		X 0	XXXXXX 0000	XX								
	Const Easemnt Ident & Acquire				XXXXX 000	XXXXXX	X							
	Bids & Contract Award						XX							
	Construction	110						XX	XXXX					

CIP PROJECT SCHEDULE

PAGE 9 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 03													
	NORTHERN AVE BRIDGE & UTIL:													
	Design to Final Plans & Specs	90	XXX	XXXXXX	XXX									
			OOO	OOOO										
	Const Easemnt Ident & Acquire			XXXXX	XXXXXX	XXXXXX								
				OOO										
	Bids & Contract Award						XXXX							
	Construction	770					X	XXXXXX	XXXXXX					
	U/G ELEC RELOC 230 KV @ 10th ST:													
	Design to Final Plans & Specs		XXXXXX	XXXXXX	XXXXXX	XXXXXX								
			OOOOOO	OOOO										
	Construction								XXXXX					
	Payments to Outside Agencies	1700								X				
	DEMO West of 12th ST @ SUNDANCE:													
	Design to Final Plans & Specs	5		XX	XXXXXX	XXXXXX	XXX							
	Const Easemnt Ident & Acquire			XX	XXXXXX	XXXXXX	XX							
	Bids & Contract Award						XXX							
	Construction	80					XX	XXXXX						
	DUNLAP & CENTRAL AVE BRIDGES (Dbl Barrel Boxes by COE 0													
	Construction (By COE with Reach								X	XXXXXX	XXXXXX	XXXXXX		
	Payment to COE	1216						X						

CIP PROJECT SCHEDULE

PAGE 10 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 03													
	SPOIL SITE ACQUISITION R03:													
	Const Easemnt Ident & Acquire			XXX	XXXXXX	XXXXXX	XXXXXX	X						
				O										
	Payment of 2.3% to COE	700						X						

CIP PROJECT SCHEDULE

PAGE 11 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987/1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988/1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	SAN SIPHON @ 12TH street:													
	Select A/E & Award Contract			XXX	XXXX									
				O										
	Design to Final Plans & Specs	25			XX	XXXXXX	XXXXXX							
	Const Easemnt Ident & Acquire					XXXXX	XXXXXX	XXXXXX	X					
	Bids & Contract Award						X	XX						
	Construction	300							XXXXXX					
	BRIDGE & UTILITIES @ 12th ST:													
	Select A/E & Award Contract			XXX	XXX									
				O										
	Design to Final Plans & Specs	70			XX	XXXXXX	XXXXXX	XXXXXX						
	Const Easemnt Ident & Acquire					XXXXX	XXXXXX	XXXXXX	XXXXXX					
	Bids & Contract Award								XXXX					
	Construction	700							X	XXXXXX	XXXXXX			
	DEMOLITION 12th ST to 16th ST:													
	Select A/E & Award Contract	5		XXX	XXX									
				O										
	Design to Final Plans & Specs				XXX	XXXXXX	XX							
	Const Easemnt Ident & Acquire					XXXXXX	XXXXXX	XXXXXX	XXXXXXX					
	Bids & Contract Award									XXXX				
	Construction	30									XXXXXX	XX		

CIP PROJECT SCHEDULE

PAGE 12 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	GLENDALE AVE SIPHON:													
	Select A/E & Award Contract			XXX	XXX									
				O										
	Design to Final Plans & Specs	25				XX	XXXXXX	XXX						
	Const Easemnt Ident & Acquire						XXXXXX	XXXXXX						
	Bids & Contract Award							XX	XX					
	Construction	300								XXXXXX				
	GLENDALE AVE BRIDGE & UTILITIES:													
	Select A/E & Award Contract	70		XX	XXXX									
	Design to Final Plans & Specs					XX	XXXXXX	XXXXXX	XXXX					
	Const Easemnt Ident & Acquire						XXX	XXXXXX	XXXXXX	XX				
	Bids & Contract Award									XXXX				
	Construction	700									XXXXXX	XXXXXX		
	SAN SIPHON 16th STREET:													
	Select A/E & Award Contract	25		XX	XXXX									
	Design to Final Plans & Specs					XX	XXXXXX	XXXX						
	Const Easemnt Ident & Acquire						XXXXXX	XXXXXX	XXXX					
	Bids & Contract Award							XX						
	Construction	300								XXXXXX				

CIP PROJECT SCHEDULE

PAGE 13 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL 1987 QTR 1 JLAGSP	FISCAL YEAR 1987 /1988 QTR 2 OCNVDC	FISCAL YEAR 1987 /1988 QTR 3 JAFBMR	FISCAL YEAR 1987 /1988 QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	FISCAL YEAR 1988 /1989 QTR 2 OCNVDC	FISCAL YEAR 1988 /1989 QTR 3 JAFBMR	FISCAL YEAR 1988 /1989 QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	BRIDGE & UTILITIES @ 16th STREET (After Glendale Bridge)													
	Select A/E & Award Contract	70			XXX XXXX O									
	Design to Final Plans & Specs					XXX	XXXXXX	XXXXXX	XXXXXXX					
	Const Easemnt Ident & Acquire						X	XXXXXX	XXXXXX	XXXXXX	XXXXXX			
	Bids & Contract Award										XXX			
	Construction	700										XXXX		
	Payments to Other Agencies (APS)											X		
	SQUAW PEAK PKWY (18th Pl.):													
	Design to Final Plans & Specs (By Phoenix)		XXXXXX OOOOOO	XXXXXX OOOO	XXXXXX	XXXXXX	XX							
	Construction (by Phoenix)							XXXXXX	XXXXXX	XXXXXX	XXXXXX	X		
	Payments to Other Agencies (PHX)	1500										X		
	DEMOLITION 18th St to 20th St:													
	Select A/E & Award Contract	5			XX XXXX									
	Design to Final Plans & Specs					XX	XXXXXX	XXXXXX	XXXXXX	XXXXXX				
	Const Easemnt Ident & Acquire						XXX	XXXXXX	XXXXXX	XXXXXX	XXX			
	Bids & Contract Award								XXXXXX	XXX				
	Construction	20							XXXXXX	XXXXX	X			

CIP PROJECT SCHEDULE

PAGE 14 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987/1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988/1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	SAN SIPHON & SEWER @ MARYLAND AV:													
	Select A/E & Award Contract				X									
	Design to Final Plans & Specs	25				X	XXXXXX	XXX						
	Const Easemnt Ident & Acquire					XXXXXX	XXXXXX							
	Bids & Contract Award						XXX	XX						
	Construction	300							XXXXXX					
	BRIDGE @ MARYLAND AVE:													
	Select A/E & Award Contract				XX	XXX								
	Design to Final Plans & Specs	80			XXX	XXXXXX	XXXXXX	XXXX						
	Const Easemnt Ident & Acquire					XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX				
	Bids & Contract Award										XXX			
	Construction	800									XXX	XXX		
	AZ CANAL RELOC to 24th St:													
	Design to Final Plans & Specs				XXX	XXXXXX	XXXXXX	XXX						
	Const Easemnt Ident & Acquire					XXXXXX	XXXXXX	XXX						
	Construction								XXXXXX					
	Payments to Other Agencies (SRP)	1000								X				

CIP PROJECT SCHEDULE

PAGE 15 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	SQUAW PEAK WTP RELOCATIONS:													
	Select A/E & Award Contract			XX	XXXXXX	XXXXXX								
	Design to Final Plans & Specs						XXXXXX	XXXXXX						
	Const Easemnt Ident & Acquire						XXXXXX	XXXXXX	XXXXXX	XX				
	Bids & Contract Award									XXXX				
	Construction	400									XXXXXX	XX		
	SAN SIPHON @ 24th St & SEWER LINE 24th St to 27th St:													
	Select A/E & Award Contract			XX	XXXXXX	XXXX								
	Design to Final Plans & Specs	20					XX	XXXXXX	X					
	Const Easemnt Ident & Acquire						XXXXX	XXXXX						
	Bids & Contract Award							XXX						
	Payments to Other Agencies	200							XXXXXX					
	SEWERLINE 24th St to 25th Pl:													
	Select A/E & Award Contract			XX	XXXXXX	XXXXXX	XXX							
	Design to Final Plans & Specs	30					XXXX	XXXXXX	XXXX					
	Const Easemnt Ident & Acquire							XXXXXX	XXXXXX	XXX				
	Conctruction by COE											XXXX	XXXX	
	Payments to Other Agencies (SWG & COE)	205										X		

CIP PROJECT SCHEDULE

PAGE 16 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 06/87 QTR 4 APMYJN	FISCAL YEAR 1987/1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988/1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	SAN SIPHON @ BILTMORE:													
	Select A/E & Award Contract				XX	XXXX								
	Design to Final Plans & Specs	20				XXX	XXXXXX	XXXXX						
	Const Easemnt Ident & Acquire					XX	XXXXXX	XXXXX						
	Bids & Contract Award							X	XX					
	Construction	200								XXXXXX				
	AZ CANAL RELOC @ BILTMORE:													
	Design to Final Plans & Specs (by SRP)						XXX	XXXXXX	XXXXXX	XXXXXX	XXXXX			
	Const Easemnt Ident & Acquire						XX	XXXXXX	XXXXXX	XXXXXX	XXXX			
	Construction (by SRP)											XXXX		
	Payments to Other Agencies (SRP)	600										X		
	SAN SIPHON & WATERLINE @ 32nd St & STANFORD Dr:													
	Select A/E & Award Contract			XXX	XXXXXX	XX								
	Design to Final Plans & Specs	25				XXXX	XXXXXX	XXXXXX	XXXXXX	XXX				
	Const Easemnt Ident & Acquire						XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXX			
	Bids & Contract Award										XXX	X		
	Construction	300										XXX		

CIP PROJECT SCHEDULE

PAGE 17 DATE SEP 17, 1987

TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	BILTMORE TUNNEL STUDY:													
	Select A/E & Award Contract			XXXXX O										
	Design to Final Plans & Specs	60			XXXXXX	X								
	CUDIA CITY WASH SEDIMENT BASIN:													
	Select A/E & Award Contract			XXXXX O			XXX							
	Preliminary Design	5			XX									
	Design to Final Plans & Specs	60						XXX	X					
	Const Easemnt Ident & Acquire						XXXXXX	XXXXXX	X					
	Bids & Contract Award								XXXX					
	Construction	4000								XX	XXXXXX	XXX		

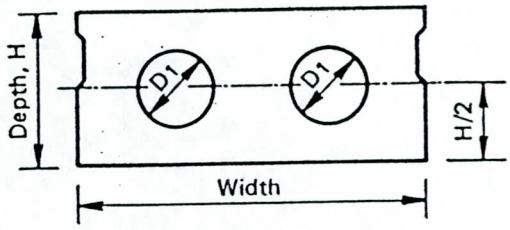
CIP PROJECT SCHEDULE

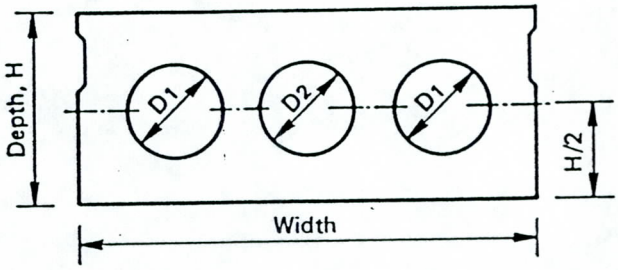
PAGE 18 DATE SEP 17, 1987

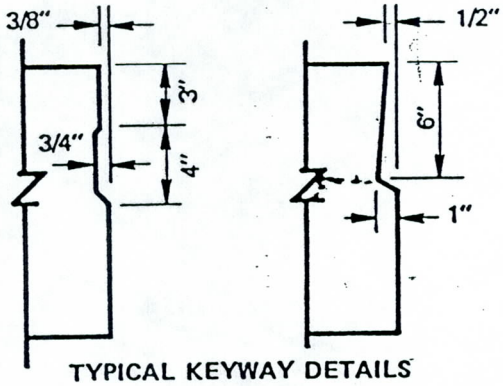
TASK NUMBER	TASK DESCRIPTION /PHASE	EST COST	FISCAL 86/87 QTR 4 APMYJN	FISCAL YEAR 1987 /1988 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FISCAL YEAR 1988 /1989 QTR 1 JLAGSP	QTR 2 OCNVDC	QTR 3 JAFBMR	QTR 4 APMYJN	FY 89/90 JULJUN	FY 90/91 JULJUN	FY 91/92 JULJUN
6C118S	ACDC REACH 04													
	BRIDGES at 24th ST & 32nd ST (Boxes by COE)													
	Construction (By COE w/ Reach 04											XX	XXXXXXX	XX
	Payment to COE	2000										X		
	SPOIL SITE ACQUISITION R04:													
	Const Easemnt Ident & Acquire					XXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX			
	Payment of 2.3% to COE	700									X			

Voided slabs

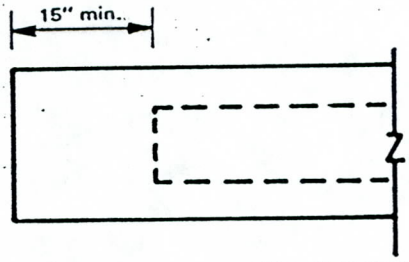
Voided slabs are similar to solid slabs except that they are cast with cylindrical voids to reduce dead load. The sections tabulated below are the former AASHO-PCI standards which can span up to 50 ft for HS20 loadings. Sections with widths and depths other than those tabulated are available from some precasting plants.







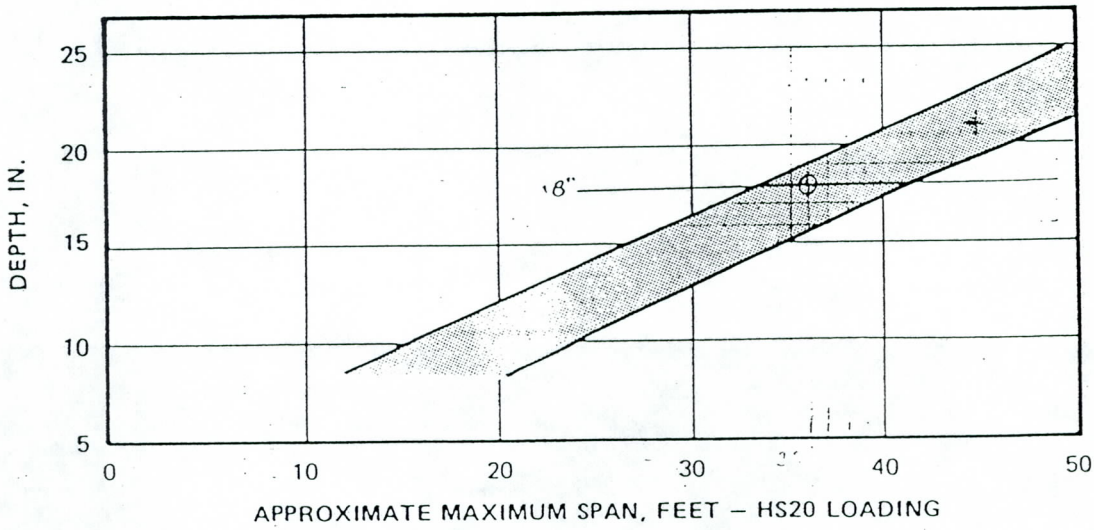
TYPICAL KEYWAY DETAILS



TYPICAL LONGITUDINAL SECTION

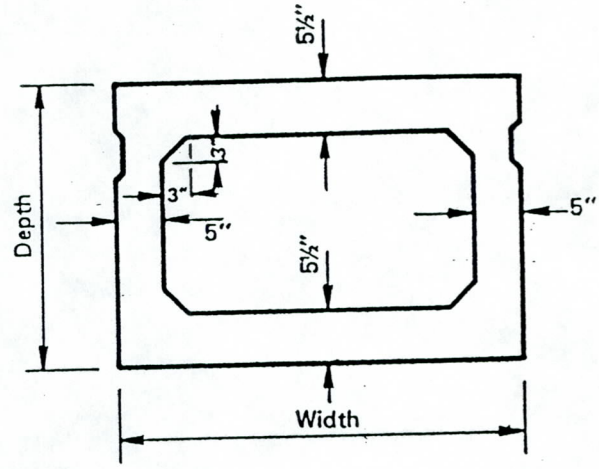
TYPICAL SECTION PROPERTIES

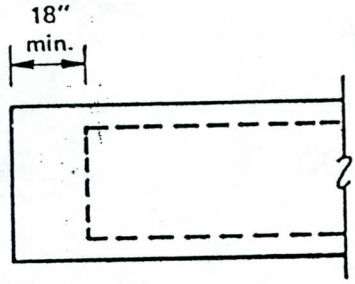
Width ft	Depth in.	No. of Voids	Void Dia. in. D1	Void Dia. in. D2	Weight lb/ft	Net Area in.^{2}	I_x in.^{4}	S in.^{3}
3	15	2	8	—	457	439	9,725	1296
3	18	2	10	—	511	491	16,514	1835
3	21	2	12	—	552	530	25,747	2452
4	15	3	8	8	593	569	12,897	1720
4	18	3	10	10	654	628	21,855	2428
4	21	3	12	10	733	703	34,517	3287



Box beams

The box beams shown are the former AASHO-PCI standard sections. They can be used either as adjacent units with or without an added wearing surface or spaced apart in which case the deck slab is cast-in-place using integral precast, prestressed deck panels. Box beams for railway loadings have been standardized by AREA.

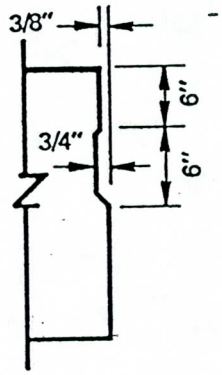




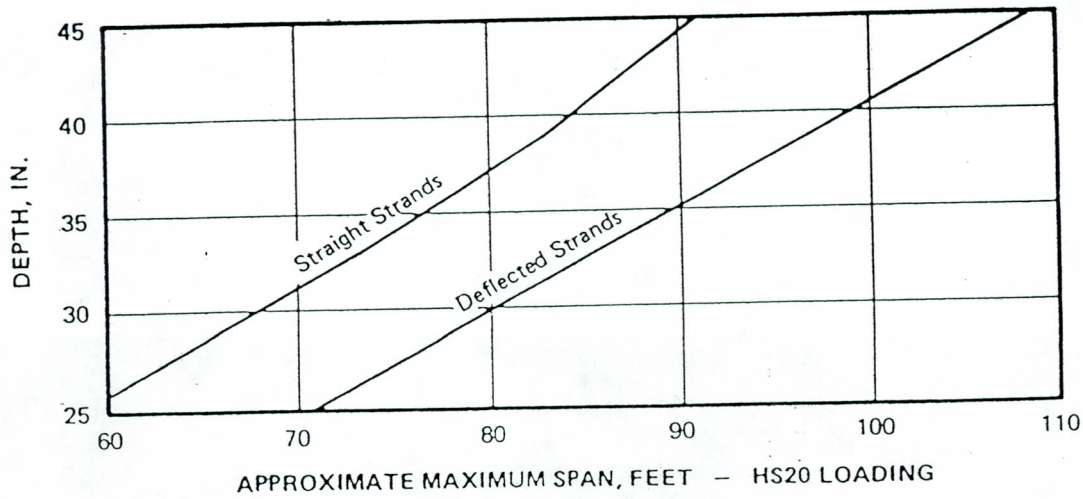
TYPICAL LONGITUDINAL SECTION

TYPICAL SECTION PROPERTIES

Type	Width ft	Depth in.	Weight lb/ft	Net Area in.^{2}	I_x in.^{4}	y_b in.	S_b in.^{3}	S_t in.^{3}
B I-36	3	27	584	561	50,334	13.35	3770	3687
B II-36	3	33	647	621	85,153	16.29	5227	5096
B III-36	3	39	709	681	131,145	19.25	6813	6640
B IV-36	3	42	740	711	158,644	20.73	7653	7459
B I-48	4	27	722	693	65,941	13.37	4932	4838
B II-48	4	33	784	753	110,499	16.33	6767	6629
B III-48	4	39	847	813	168,367	19.29	8728	8542
B IV-48	4	42	878	843	203,088	20.78	9773	9571



TYPICAL KEYWAY DETAIL



HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-5-87	Job No. 11924
	Checked by	Date	Sheet No.

For DETERMINATION OF CEMENT TO CONCRETE RATIO FOR USE IN ALTERNATIVE 3

* FROM TABLE 12 CORPS OF ENGINEERS COST ESTIMATE

REACH 4 DESCRIPTION CUDIA CITY WASH TO DREAMY DRAW

DESCRIPTION	QUANTITY	UNIT
CONCRETE, INVERT	22,300	CY
CONCRETE, FOOTING	42,700	CY
CONCRETE, WALL	61,600	CY
CONCRETE, TOP SLAB	18,100	CY

Σ = 144,700 CY CONCRETE

PORTLAND CEMENT 854,000 CWT

RATIO $\frac{\text{CEMENT}}{\text{CONCRETE}} = \frac{854{,}000 \text{ CWT}}{144{,}700 \text{ CY}} = 5.90187$ CWT CEMENT/CY CONCRETE

REACH 3 DREAMY DRAW TO CAVE CREEK

DESCRIPTION	QUANTITY	UNIT
CONCRETE, INVERT	24,400	CY
CONCRETE, FOOTING	32,600	CY
CONCRETE, WALL	42,100	CY
CONCRETE, TOP SLAB	9,980	CY
Σ	109,080	CY CONCRETE

PORTLAND CEMENT = 634,000 CWT

RATIO CEMENT/CONCRETE = $\frac{634{,}000 \text{ CWT}}{109{,}080 \text{ CY}} = 5.81225$ CWT CEMENT/CY CONCRETE

* USE 5.90 CWT CEMENT/CY CONCRETE

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-5-87	Job No. 11924
	Checked by	Date	Sheet No.
For ACDC - ARIZONA CANAL JOINT USE CONCEPT			

TOTAL QUANTITIES REACH 4 ALTERNATIVE B = ALTERNATIVE 3

EXCAVATION	118 CY/LF	× 11,200 FT	=	1,321,600 CY
CONCRETE				
INVERT	2.47 CY/LF	"	=	27,664 CY
WALLS	2.12 CY/LF	"	=	23,744 CY
FOOTINGS	1.98 CY/LF	"	=	22,176 CY
STEEL	505 LBS/LF	"	=	5,656,000 LBS
PORTLAND CEMENT	(73,584 CY)(5.9 CWT/CY)		=	434,146 CWT PORTLAND

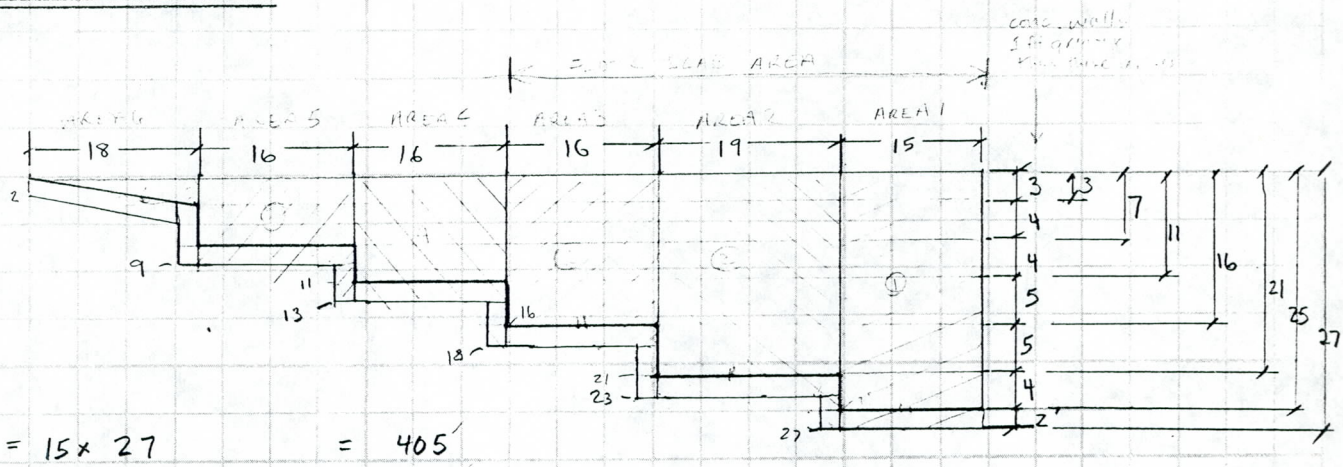
TOTAL QUANTITIES REACH 3 ALTERNATIVE B = ALTERNATIVE 3

EXCAVATION	140 CY/LF	× 18,800 FT	=	2,632,000 CY
CONCRETE				
INVERT	2.70 CY/LF	× "	=	50,760 CY
WALLS	2.26 CY/LF	× "	=	42,488 CY
FOOTINGS	2.07 CY/LF	× "	=	38,916 CY
STEEL	536 LBS STEEL/LF	"	=	10,076,800 LBS
PORTLAND CEMENT	(132,164 CY)(5.9 CWT/CY)		=	779,768 CWT PORTLAND

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 09-25-87	Job No. 11924
	Checked by CVM	Date 10-3-87	Sheet No. 1
For ACDC COST ESTIMATE REACH 4 CROSS-SECTION II			

EXCAVATION, CHANNEL ½ SECTION



AREA 1 = 15 × 27 = 405

AREA 2 = 19 × 23 + 2 × 4 = 445

AREA 3 = 16 × 18 + 2 × 5 = 298

AREA 4 = 16 × 13 + 2 × 5 = 218

" 5 = 16 × 9 + 2 × 4 = 152

" 6 = ½(18)(3) + 2(11) + 2(6) = 6171.5

1579 ft² ½ SECTION USE 1580 ft²

1589.5

* NOTE

1 FT³ = 0.03704 CY

TOTAL SECTION = 3,160 ft²

VOLUME EXCAVATED ON UNIT LENGTH BASIS = 3,160 FT³ = 117 CY

= 117 CY/L.F.

USE 118 CY/L.F.

4E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by	Date	Job No. 11924
	Checked by	Date	Sheet No.
For EXHIBIT F			

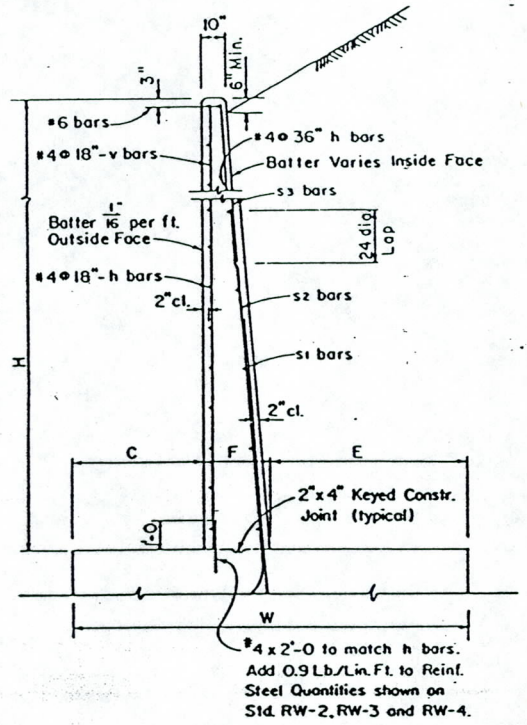
CASE II - LEVEL FILL WITH 2' SURCHARGE

Dimensions						Steel List																		Quantities		Max. Toe Press. Lbs./Sq.Ft.
						s1			s2			s3			h	v	b			f1	t			f2			
H	W	B	C	F	E	Size	Spacing	Length	Size	Spacing	Length	Size	Spacing	Length	Number	Length	Size	Spacing	Length	Number	Size	Spacing	Length	Number	Concrete Cu. Yds./Lin. Ft.	Steel Lbs./Lin. Ft.	
4'	3'-3	1'-3	1'-1	1'-0	1'-2	#5	12"	6'-6							3	3'-9	#5	12"	2'-6	2	#5	12"	2'-6	3	.342	22.01	1180
5'	3'-6	1'-3	1'-2	1'-0	1'-4	#5	12"	7'-6							4	4'-9	#5	12"	2'-6	2	#5	12"	2'-9	3	.387	24.43	1530
6'	4'-0	1'-3	1'-4	1'-0	1'-8	#5	12"	8'-6							5	5'-9	#5	12"	2'-9	2	#5	12"	3'-0	3	.444	27.10	1700
7'	4'-6	1'-3	1'-6	1'-0	2'-0	#5	12"	9'-6							6	6'-9	#5	12"	2'-9	3	#5	12"	3'-3	3	.502	30.19	1860
8'	5'-0	1'-3	1'-8	1'-0	2'-4	#5	9"	10'-6							7	7'-9	#5	12"	3'-0	3	#5	12"	3'-9	3	.559	36.78	2020
9'	5'-6	1'-3	1'-10	1'-0	2'-8	#5	14"	6'-0	#5	14"	11'-9				8	8'-9	#5	14"	3'-3	3	#6	14"	4'-0	4	.616	40.89	2170
10'	6'-0	1'-3	2'-0	1'-0	3'-0	#5	11"	6'-6	#5	11"	12'-9				9	9'-9	#5	11"	3'-3	3	#6	11"	4'-3	4	.673	50.60	2330
11'	6'-6	1'-3	2'-2	1'-0	3'-4	#7	12"	8'-3	#5	12"	13'-9				10	10'-9	#5	12"	3'-6	3	#6	9"	4'-9	4	.730	63.50	2480
12'	7'-0	1'-3	2'-4	1'-1	3'-7	#8	14"	8'-9	#6	14"	14'-9				11	11'-9	#6	14"	3'-9	3	#6	7"	5'-0	4	.806	76.98	2630
13'	7'-6	1'-3	2'-6	1'-2	3'-10	#8	12"	9'-0	#6	12"	15'-9				12	12'-9	#6	12"	4'-0	3	#6	6"	5'-3	4	.884	90.84	2780
14'	8'-0	1'-3	2'-8	1'-3	4'-1	#8	13"	9'-3	#7	13"	11'-0	#5	13"	7'-0	13	13'-9	#5	6½"	4'-3	3	#7	6½"	5'-9	4	.966	102.66	2940
15'	8'-6	1'-3	2'-10	1'-4	4'-4	#8	11"	9'-3	#7	11"	11'-3	#5	11"	7'-9	14	14'-9	#5	5½"	4'-6	3	#7	5½"	6'-0	4	1.051	121.44	3090
16'	9'-0	1'-5	3'-0	1'-5	4'-7	#9	11"	10'-9	#7	11"	12'-6	#5	11"	7'-9	15	15'-9	#5	5½"	4'-9	4	#7	5½"	6'-3	5	1.195	141.30	3340
17'	9'-6	1'-6	3'-2	1'-6	4'-10	#9	10"	10'-9	#7	10"	13'-0	#5	10"	8'-3	16	16'-9	#5	5"	5'-0	4	#7	5"	6'-9	5	1.318	158.86	3540
18'	10'-0	1'-7	3'-4	1'-8	5'-0	#9	12"	11'-3	#8	12"	13'-6	#6	12"	9'-3	17	17'-9	#6	6"	5'-3	4	#8	6"	7'-3	6	1.475	171.61	3750
19'	10'-6	1'-8	3'-6	1'-9	5'-3	#10	12"	12'-6	#8	12"	14'-6	#6	12"	9'-3	18	18'-9	#6	6"	5'-6	4	#8	6"	7'-6	6	1.613	193.01	3950
20'	11'-0	1'-9	3'-8	1'-10	5'-6	#10	11"	13'-0	#8	11"	15'-0	#6	11"	9'-9	19	19'-9	#6	5½"	5'-9	4	#8	5½"	7'-9	6	1.756	215.85	4150

ADOT Retaining Wall
Detail

WALL HEIGHT	VOLUME WALL	VOLUME FOOTING	TOTAL
5'	4.58 ft³	4.375 ft³	0.332 CY
6'	5.50 ft³	5.00 ft³	0.389 CY

% OF TOTAL	WALL	FOOTING
5'	0.511	0.489
6'	0.524	0.476



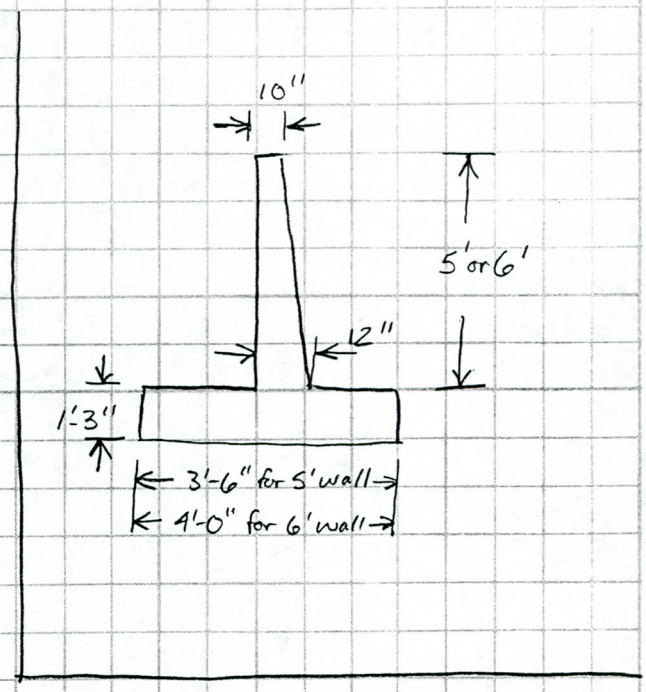
TYPICAL STEM DETAIL

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by DJM	Date 10-5-87	Job No. 11924
	Checked by	Date	Sheet No.

For ACDC ALT 3 REACH 3 COST CALCS.

RETAINING WALL VOL. CALCS
BASED UPON STANDARD ADOT RETAINING WALL DATA
(SEE EXHIBIT F)



FOR 5' HIGH WALL

WALL: $\frac{1}{2}\left(\frac{10+12}{12}\right)(5)(1) = 4.58\,ft^3$

FOOTING: $(3.5')(1.25')(1') = 4.375\,ft^3$

TOTAL $= 8.955\,ft^3$

%: WALL $= 4.58/8.955 = 0.511$
FOOTING $= 4.375/8.955 = 0.489$

USING TOTAL VOLUME GIVEN OF 0.387 cy

VOL WALL: $0.387(0.511) = 0.198$ cy

VOL FOOTING: $0.387(0.489) = 0.189$ cy

FOR 6' HIGH WALL

WALL: $\frac{1}{2}\left(\frac{10+12}{12}\right)(6)(1) = 5.50\,ft^3$, FOOTING: $(4)(1.25)(1) = 5.00\,ft^3$
TOTAL: $10.50\,ft^3$

%: WALL $= 5.50/10.50 = 0.524$, FOOTING $= 5.0/10.50 = 0.476$

USING TOTAL VOLUME GIVEN OF 0.444 cy

VOL WALL: $0.444(0.524) = 0.233$ cy

VOL FOOTING: $0.444(0.476) = 0.211$ cy

1E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-5-87	Job No. 11924
	Checked by	Date	Sheet No.

For ACDC - ARIZONA CANAL JOINT USE REACH 3 ALTERNATIVE 3

ASSUME ALL FLOOR SLAB ARE 8 INCH THICK

CONCRETE, INVERT (FLOOR SLABS)

1 SLAB @ 30' x 1 FT UNIT WIDTH x 8/12 = 20 FT³ = 0.7407 CY
4 SLAB @ 19.75' x 1 FT UNIT WIDTH x 8/12 = 52.6667 FT³ = 1.951 CY

Σ = 2.69 CY/LF

USE 2.70 CY/LF

STEEL REINFORCEMENT FOR INVERTS SLABS

ASSUME: 100 LBS STEEL / CY CONCRETE

(2.70 CY/LF)(100 LBS / CY CONCRETE) = 270 LBS STEEL / LF.

RETAINING WALL STEEL

2 WALLS @ 5' = 2 (24.43 LBS/LF) = 48.86 LB/LF
8 WALLS @ 6' = 8 (27.10 LBS/LF) = 216.80 LBS/LF

Σ 265.66 LBS/LF

USE 266.0 LBS STEEL/LF

TOTAL STEEL: (270 + 266) = 536 LBS STEEL/LF

CONCRETE, WALLS

ADOT STANDARD DETAIL

2 WALLS @ 5' 2(0.511 * .387) = 0.396 CY/LF (0.198)
8 WALL @ 6' 8(0.524 * 0.444) = 1.861 CY/LF

Σ 2.26 CY/LF

USE 2.26 CY/LF

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by PAE	Date 9-25-87	Job No. 11923
	Checked by LJM	Date 10-5-87	Sheet No. 2/4
For ACDC COST ESTIMATES ALT 3 REACH 4			

CONCRETE, INVERT (FLOOR SLABS) ASSUME 8" FLOOR SLABS

1 SLAB @ 30' × 1 FT UNIT LENGTH × 8/12 FT = 20 FT³/L.F = 0.7408 CY/L.F.
2 SLABS @ 19' × 1 FT UNIT LENGTH × 8/12 FT = 25⅓ FT³/L.F. = 0.9384 CY/L.F.
2 SLABS @ 16' × 1 FT UNIT LENGTH × 8/12 FT = 21.33 FT³/L.F. = 0.7902 CY/L.F.

Σ 2.469 CY./L.F

USE 2.47 CY/L.F.

STEEL REINFORCEMENT FOR SLABS

ASSUME 100 LBS STEEL/CY CONCRETE

(2.47 CY CONCRETE/LIN FT)(100 LBS STEEL/CY CONCRETE) = 247 LBS/LIN FT.

USE 250 LBS STEEL/LIN. FT

CONCRETE, WALLS

(5' WALL + FOOTING ⇒ 0.387 CY CONCRETE/LF)
(6' WALL + FOOTING ⇒ 0.444 CY CONCRETE/LF)

6 WALLS @ 5' ⇒ 6 (0.1852 CY/L.F.) = 1.11 CY/L.F
4 WALL @ 6' ⇒ 4 (0.222 CY/L.F.) = 0.89 CY/L.F.

Σ 2.00 CY/L.F.

USE 2.00 CY/L.F.

CONCRETE, FOOTINGS

(0.489 × 0.387)

6 FOOTINGS (FOR 5' WALLS) 6(0.2018 CY CONCRETE/LF) = 1.21 CY/L.F.
4 FOOTINGS (FOR 6' WALLS) 4(0.222 CY CONCRETE/LF) = 0.01 CY/L.F

(0.476 × 0.444)

Σ 2.10 CY/L.F.

USE 2.10 CY/L.F.

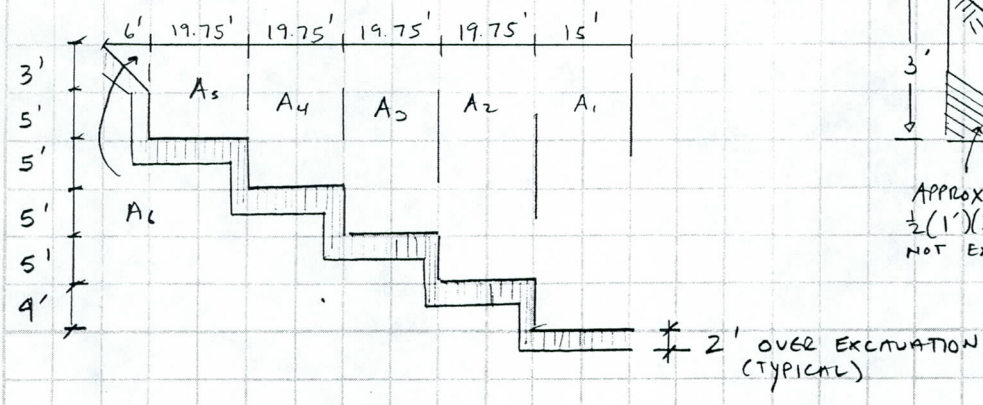
CONCRETE FOR FOOTINGS

1E101-0374-20M

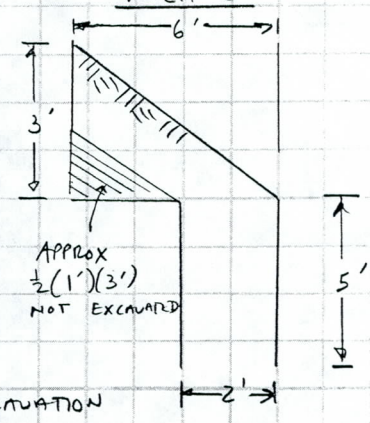
HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-5-87	Job No. 11924
	Checked by	Date	Sheet No.

For ACDC - ARIZ CANAL JOINT USE ALTERNATIVE 3 - REACH 3

EXCAVATION, CHANNEL



AREA 6



$A_1 = 15(29) = 435.00$ ✓

$A_2 = 19.75(25) + 4(2) = 501.75$ ✓

$A_3 = 19.75(20) + 5(2) = 405.00$ ✓

$A_4 = 19.75(15) + 5(2) = 306.25$ ✓

$A_5 = 19.75(10) + 5(2) = 207.50$ ✓

$A_6 = 3(6) - \frac{1}{2}(1)(3) + (5)(2) = 26.50$

$1,882.00\ FT^2 \rightarrow$ USE $1,885\ FT^2$

VOLUME EXCAVATED PER UNIT LENGTH OF 1 FT.

$1885\ FT^2\ (1\ FT) = 1885\ FT^3 = 69.82\ CY / \frac{1}{2}$ CHANNEL SECTION

$= 139.64\ CY$ FULL CHANNEL SECTION

USE 140 CY/LF ALTERNATIVE 3 REACH 3

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-5-87	Job No. 11324
	Checked by	Date	Sheet No.
For AC DC - ARIZ CANAL	REACH 3 ALTERNATIVE 3		

CONCRETE, FOOTINGS

2 @ 5' 2(0.489 * 0.387) = 0.378
8 @ 6' 8(0.476 * 0.444) = 1.691
Σ 2.069 CY/LF

USE 2.07 CY/LF

PORTLAND CEMENT

CONCRETE

INVERT	2.70
WALLS	2.26
FOOTING	2.07

Σ 7.03 CY/LF x 18,800' = 132,164 CY CONCRETE

(132,164 CY CONCRETE)(5.90 CWT PORTLAND / CY CONCRETE) = 779,768 CWT

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RLFZ	Date 9-27-87	Job No. 11924
	Checked by RG	Date 10-7-87	Sheet No.
For SRP CHANNEL RELOCATION COST ESTIMATE			

REACH 4

(STA 890+00 TO STA. 778+00 = 11,200 LF)

SRP CHANNEL TO BE RELOCATED WITH 2 - 10'ϕ PIPES. COST ESTIMATE DEVELOPED FROM 1985 PRICE FOR 8'ϕ STORM SEWER.

12TH STREET OVER I-10 8'ϕ CLASS 3

3 BIDS @ $240, $250, & $360/LF : AVG = $283/LF

FOR 10'ϕ ASSUME ADDITIONAL 25% CONSTRUCTION COST

- 8'ϕ @ $260/LF
- ADD'T CONST. COST @ 25% 10'ϕ $66/LF

10'ϕ CONSTRUCTION COST $326/LF
DOUBLE BOXES (X2) ~ $652

ENGINEERING + DESIGN (10%) $66

SUPERVISION + ADMINISTRATION (10%) $66

TOTAL DBL 10'ϕ PIPES ~ $785/LF

REACH 4: CONSTRUCTION COST = 11,200 LF × $785/LF = $8,792,000
REACH 3: " " = 18,800 LF × $785/LF = $14,758,000

BOXES: 4 EACH (2 PER REACH) @ $1 MILLION EACH (INCLUDING GATED CONTROL STRUCTURES) = $2M/EACH

GATED CONTROL STRUCTURES FOR REACH 3 AND REACH 4

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-5-87	Job No. 11924
	Checked by RE - RQ	Date 10-6-87	Sheet No. 1/2

For ARIZONA CANAL / ACDC JOINT USE

ALTERNATIVE 1 = PRESENT DESIGN REACH 4

DELETION OF TOP SLAB FROM CORPS ESTIMATE
CUDIA CITY WASH TO DREAMY DRAW - * TABLE 12

A) CONCRETE, TOP SLAB = 18,100 CY
CONCRETE, TOTAL (REACH 4) = 144,700 CY ← SUMMATION OF CONCRETE FOR INVERT, WALLS, FOOTINGS AND TOP SLAB

PERCENTAGE CONCRETE, TOP SLAB = $\frac{18,100}{144,700} \times 100 = 12.5\%$

B) REDUCTION IN CEMENT DUE TO DELETION OF CONCRETE, TOP SLAB

OF PORTLAND = 854,000 CWT ← CORPS' VALUE

REDUCTION = (0.125)(854,000 CWT) = 106,750 CWT
REVISED CEMENT = (854,000 - 106,750) = 747,250 CWT

LENGTH OF REACH 4 = STA. 999+93 - STA. 778+00 = 22,193 LF
LENGTH OF REACH 4 UNDER STUDY = 11,200 L.F.

RATIO = $\frac{11200}{22193} = 0.50467$

AMOUNT OF CEMENT FOR REACH 4 UNDER THIS STUDY

= (747,250)(0.50467) = 377,115 CWT PORTLAND CEMENT

---

* REDUCTION IN STEEL REINFORCEMENT DUE TO DELETION OF TOP SLAB
= (16,600,000 LBS STEEL) - (18,100 CY)(~~100~~ 150 LBS STEEL/CY CONCRETE)
= ~~14,790,000~~ 13,885,000 LBS STEEL *SEE PAGE 2

QUANTITY OF STEEL IN ALT 1 / REACH 4 REVISED
= (~~14,790,000~~ 13,885,000)(0.50467) = ~~7,464,069~~ 7,007,343 LBS STEEL

* ASSUME 100 LBS STEEL / CY CONCRETE

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RQB	Date 10-6-87	Job No. 11924
	Checked by	Date	Sheet No. 2/2
For			

STEEL QUANTITY FOR TOP SLAB REACH 4

$^{*}\ w = 0.6\ K/LF = 600\#/F$
$= 50\#/in$

$L = 40.5' = 486\ IN$

$$\text{MOMENT} = \frac{w}{8}L^2 = \frac{50\#/in}{8}(486)^2$$

$$M = 1{,}476{,}225\ \#\text{-in}$$

$$M = Rbd^2 = (271)(12)d^2 = 1{,}476{,}225\ \#\cdot in$$

$R_{s,c} = 271$
$(f_s = 24,\ K,\ f_c' = 3750\ psi.)$

$$d = 21.3''$$
$$+ 1\tfrac{1}{2} \approx 24''$$

$$A_s f_s j d = 1{,}476{,}225$$

$$A_s = \frac{1{,}476{,}225}{(24\times10^3)(7/8)(21.3)} = 3.3\ in^2/FT$$

$$A_s = 3.3\ in^2/FT$$

use 2 #9 and 1 #10 bars
3.4# 4.303#

$$2(3.4) + 4.303 = 11.1\ LB$$

$$11.1\ LBS \times 41 = 455.1\ \#$$

$$\frac{455\ \#}{\dfrac{2' \times 41' \times 1'}{27\ \frac{FT^3}{CY}}} = 149.85\ \#/CY$$

use 150 #/CY

150 LBS STEEL / CY CONCRETE
FOR TOP SLAB

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-7-87	Job No. 11924
	Checked by	Date	Sheet No.
For			

REACH 3 ADDITIONAL RETAINING WALL CONCRETE + STEEL

(per ASW calculations 10-2-87 sheet 15)

Concrete: 50' + 60' wide segment 10,400 + 2080 = 12,480 CY

STEEL: 50' + 60' wide segment 2200 K = 2,200,000 LBS

CEMENT: $(12{,}480)(5.9 \frac{CWT}{CY}) = 73{,}632$ CWT

12,480	× $62.30 =	777,504
2,200,000	× $ 0.34 =	748,000
73,632	× $ 4.20 =	309,254
		$1,834,758

$\frac{\$1{,}834{,}758}{12{,}480} = \$147.016$ → use $147.02/CY

REACH 4 ADDITIONAL RETAINING WALL CONCRETE + STEEL

(per ASW calculations 10-2-87 sheet 15)

Concrete: 40' wide segment 6500 CY

STEEL: NO ADDITIONAL STEEL REQUIRED ON REACH 4 FOR RETAINING WALL

CEMENT: $(6500)(5.9 \frac{CWT}{CY}) = 38{,}350$ CWT PORTLAND

6500 × 62.30	= $404,950 ✓	concrete
	= $0	steel
38,350 × 4.20	= $161,070	cement
	$566,020	
	÷ 6500 =	$87.08/CY

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-3-87	Job No. 11924
	Checked by	Date	Sheet No.

For JOINT ARIZONA CANAL/ACDC COST INVESTIGATION FOOTNOTES

ALTERNATIVE 1 REACH 4 (PRESENT DESIGN)

ROADS & BRIDGES (SEE EXHIBIT G)

REACH 4 ROADS + BRIDGES = (5/8) CORP OF ENGINEERS VALUE

= (5/8)(5,205,000) = $ 3,253,125

REACH 4 OF CORP STUDY CONTAINS 8 BRIDGES. TWO BRIDGES (32ND ST) NOT INCLUDED IN THIS STUDY BUT ARE CONTAINED IN CORP STUDY. ARIZONA BILTMORE'S NORTHBOUND AND SOUTHBOUND BRIDGES ARE COUNTED AS 1 BRIDGE (TOTAL: 5 BRIDGES)

ALT 1 REACH 3: ROADS & BRIDGES SAME AS CORP VALUE (SEE EXHIBIT G).

UTILITIES RELOCATION

TOTAL UTILITIES RELOCATION FOR BOTH REACH 3 AND REACH 4

= $ 11,500,000 *

* MARICOPA COUNTY FLOOD CONTROL DISTRICT

PER REACH: REACH 4 = $ 4,500,000

REACH 3 = $ 7,000,000

$ 11,500,000

FOR ALTERNATIVE B: ADD AN ADDITIONAL $1,000,000 TO EACH REACH TO ACCOUNT TO LONGITUDINAL RELOCATIONS

ALTERNATIVE C REACH 4

* ADDITIONAL RETAINING WALL FOUNDATION CONCRETE COST = $ 87.08/CY (INCLUDES CEMENT & CONCRETE) NO STEEL

* ADDITIONAL TOP SLAB COST INCLUDES OVERALL CONTINGENCIES, PROFIT, DESIGN, ETC.

= (42 × 11,200) = 470,400 SF @ $17.50/SF = $ 8,232,000

* STORM INLETS = COST INCLUDES CONTINGENCIES, ETC. (TANNER Co. BID PRICE)

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-3-87	Job No. 11924
	Checked by	Date	Sheet No.

For JOINT ARIZONA CANAL/ ACDC COST INVESTIGATION FOOTNOTES

ALTERNATIVE C REACH 3

ADDITIONAL TOP SLAB CONSTRUCTION

LENGTH OF EXISTING TOP SLAB = 2,565 LF

LENGTH OF 62' WIDE CHANNEL = (13900 - 2565) = 11,335 LF

LENGTH OF 52' WIDE CHANNEL = 4900 LF

62' = 60' + 1+1

52' = 50' + 1+1

2' OF BEARING (1 FOOT ON EACH SIDE)

AREA OF TOP SLAB:

(11,335 × 62) + (4900 × 52) = 957,570 SF

TANNER Co. BID PRICE = $20/SF

∴ 957,570 SF * $20/SF = $19,151,400

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RAE	Date 10-8-87	Job No. 11924
	Checked by	Date	Sheet No.

For JOINT USE ARIZONA CANAL/ACDC COST INVESTIGATION

CALCULATION OF ADDITIONAL EARTH DISPOSAL FOR ALTERNATIVE B

DESCRIPTION	REACH 4 QUANTITY CY	REACH 3 QUANTITY CY
1) EXCAVATION, (BLASTING) CHANNEL	17,663	58,500
2) EXCAVATION, CHANNEL	1,321,600	2,632,000
3) COMACTED FILL	115,000	363,000
4) MISCELLANEOUS FILL, COMPACTED	10,000	35,900
ADD'L EARTH DISPOSAL = 1+2-(3+4)	1,219,263	2,479,600
HAULING COST @ $1.50/CY	$1,821,395	$3,719,400

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	MISCELLANEOUS QUANTITY CALCULATIONS	MADE BY [illegible] DATE 9/28/87 CHECKED BY RAE DATE 9/28/87 ITEM NO. PAGE NO.

JOB NO. 11924-11-04 JOB NAME SRP/ACDC JOINT-USE CONCEPT

CONTRACT OR STRUCTURE ARIZONA CANAL ITEM NAME RELOCATION:

MEMBER _____ LOCATION OF MEMBER _____

DISTRIBUTION SYSTEM:

	LAT.	"Q" CFS	"D" IN.	L FT.	UNIT PRICE $/LF	AMOUNT PIPE $	UNIT PRICE $/STR.	AMOUNT T.O. STR. $
	9.4	7.5	21	200	45.-	9,000.-	4000	4,000.-
	.5	5.0	18	"	40.-	8,000.-	3,500	3,500.-
REACH 4	.6	3.8	15	"	35.-	7,000.-	3,000	3,000.-
	.7	2.5	12	"	30.-	6,000.-	2,500.-	2,500.-
	10.0	17.5	33	"	80.-	16,000.-	10,000	10,000.-
	.1	4.4	18	"	40.-	8,000.-	3,500.-	3,500.-
	.2	2.5	12	"	30.-	6,000.-	2,500	2,500.-
	.3	2.5	12	"	"	6,000.-	"	2,500.-
	.4	2.5	12	"	"	6,000.-	"	2,500.-
	.5	2.5	12	"	"	6,000.-	"	2,500.-
REACH 3	.6	2.5	12	"	"	6,000.-	"	2,500.-
	.7	2.5	12	"	"	6,000.-	"	2,500.-
	11.0	17.5	33	"	80.-	16,000.-	10,000	10,000.-
	.4	12.5	27	"	60.-	12,000.-	8,000	8,000.-
	.7	3.8	15	"	35.-	7,000.-	3,000.-	3,000.-
	12.0	15.0	30	"	75.-	15,000.-	10,000	10,000.-
	.4	8.8	24	"	50.-	10,000.-	5,000.-	5,000.-
	13.0	15.0	30	"	75.-	15,000.-	10,000.-	10,000.-
	.1	5.0	18	"	40.-	8,000.-	3,500	3,500.-
						$173,000.-		91,000.00

DIST. SYSTEM GRAND TOTAL = $264,000.-

USE: $300,000.-

DISTRIBUTE: $\left(\frac{89}{264}\right)(300,000) = \$101,136.-$ REACH 4 2 OK.

198,864.- " 3 LEAVE @ $10.-/LF

300,000.-

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	MISCELLANEOUS QUANTITY CALCULATIONS	MADE BY [illegible] DATE 9/28/87 CHECKED BY RAE DATE 9/28/87 ITEM NO. PAGE NO.

JOB NO. 11924-11-04 JOB NAME SRP/ACDC JOINT USE CONCEPT.

CONTRACT OR STRUCTURE ARIZONA CANAL ITEM NAME RELOCATION

MEMBER 2-10'-0"ϕ RGRCP LOCATION OF MEMBER S/AZ. CANAL (EXIST.)

LATERAL #	Q (M.I)	Q-CFS	ΣQ	Q-AZ	ΔQ	ΔQ	ΔQ/QAZ	Dϕ	
9.4	300	7.5	7.5	700	692.5	692.5	98.93%	1.78'	21
.5	200	5.0	12.5	"	680.0	687.5	98.21"	1.46'	18
.6	150	3.8	16.3	"	663.7	683.7	97.67"	1.27'	15
.7	100	2.5	18.8	"	644.0	681.2	97.31"	1.03'	12
10.0	700	17.5	36.3	"	608.6	663.7	94.81"	2.73'	33
.1	175	4.4	40.7	650	567.9	659.3	101.43"	1.37'	18
.2	100	2.5	43.2	"	524.7	656.8	101.05"	1.03'	12
.3	100	2.5	45.7	"	479.0	654.3	100.66"	1.03'	"
.4	100	2.5	48.2	"	430.8	651.8	100.28"	1.03'	"
.5	100	2.5	50.7	"	386.1	649.3	99.89"	1.03'	"
.6	100	2.5	53.2	"	326.9	646.8	99.51"	1.03'	"
.7	100	2.5	55.7	"	271.2	644.3	99.12"	1.03'	"
11.0	700	17.5	73.2	"	198.0	626.8	96.43"	2.73'	33
.4	500	12.5	85.7	"	113.1	614.3	94.51"	2.30'	27
.7	150	3.8	89.5	"	23.6	610.5	93.92"	1.27'	15
12.0	600	15.0	104.5	"	(80.0)	595.5	91.61"	2.52'	30
.4	350	8.8	113.3	"	(194.2)	586.7	90.26"	1.93'	24
13.0	600	15.0	128.3	"	(142.5)	571.7	87.95"	2.52'	30
.1	200	5.0	133.3	"	(275.8)	566.7	87.18"	1.46'	18
	5,325	133.3	ΣQ						

$$* \; D\phi = \sqrt{\frac{4Q}{\pi V}} = \sqrt{\frac{4Q}{3\pi}} = (0.65147)\sqrt{Q}$$

V = 3 FPS

7 x 200' = 1,400 LF - 12" RCP
2 x 200' = 400 LF - 15" "
3 x 200' = 600 LF - 18" "
1 x 200' = 200 LF - 21" "
1 x 200' = 200 " - 24" "
1 x 200' = 200 " - 27" "
2 x 200' = 400 " - 30" "
2 x 200' = 400 " - 33" "
19 3,800 LF - 24"ϕ

USE: 4,000 LF - 24"ϕ RGRCP @ $75/LF = $300,000.

S102-974-3M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	MISCELLANEOUS QUANTITY CALCULATIONS	MADE BY [illegible] DATE 9/29/87 CHECKED BY DATE ITEM NO. PAGE NO. 1

JOB NO. 11924-11-04 JOB NAME SRP-ACDC - REACH 4:

CONTRACT OR STRUCTURE _____ ITEM NAME _____

MEMBER _____ LOCATION OF MEMBER _____

		ADJ. LETA.	AMOUNT.
PER C.O.E.: (p 14)			
* LENGTHS ADJUSTED PER LATEST C.O.E. PLANS.			
	DIFF.		
STANFORD DR.	$ 667.-	1,297.-	$ 865,099.-
AZ. BILTMORE	$ 717.-	3,287.-	$2,356,779.-
THE PAVILLION	$1,507.-	463.-	$ 697,741.-
WESTERN SAVINGS:	$ 768.-	875.-	$ 672,000.-
TOTALS:	$ 775.-	5,922.-	$4,591,619.-
REACH 4 LENGTH:			
FROM STATION	999+93		
TO "	778+00		
	221+93	= 22,193 LF	
NEW LENGTH:			
FROM STATION	890+00		
TO "	778+00		
	112+00	= 11,200 LF	
$\left[\frac{11,200}{22,193}\right] = 0.50467$			
COSTS:			
ORIG C.O.E. COST:			$ 29,951,684.-
LESS: DIFFERENTIAL COST - TOP SLAB			$ 4,591,619.-
NET CHANNEL COST - UNCOVERED =			$25,360,065.-
* 0.50467 =			$12,798,303.-
PLUS: 11,200 LF TOP SLAB @ $775/LF =			$8683,913.-

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	MISCELLANEOUS QUANTITY CALCULATIONS	MADE BY [illegible] DATE 9/29/88 CHECKED BY DATE ITEM NO. PAGE NO. 2

JOB NO. 11924-11-04 JOB NAME SRP-ACDC-RCH4.

CONTRACT OR STRUCTURE _____ ITEM NAME _____

MEMBER _____ LOCATION OF MEMBER _____

FROM DESIGN REPORT:

ADD:

ADDITIONAL STORM INLET FACILITIES:

STATION	LOCATION	"Q"	V	A	$\sqrt{A}$	L	H
835+00	OCOTILLO	1,900	5 FPS	380 SF	19.5	200	1.9
802+00	MYRTLE	2,300	"	460 "	21.5	230	2.0

PROVIDE 2' HIGH OPENING IN NORTHEAST WALL TO AFFORD ENTRY TO FLOWS (MUCH LIKE AT PRESENT).

GRADE 100 FT X 210 FT X 2 = 42,000 SF ASPHALT PAV'T. & PAVE

1,335 TONS @ $36.40/TON = $48,594.00

≈ $50,000.00

@ $25,000./INLET:

$\frac{\$25,000.}{2,300.\text{ CFS}}$ = $11.00/CFS. ≈ $15.00/CFS

22	ADD:	300 CFS	x	15.00	=	4500.
23	"	120 "	x	"	=	1,800.
25	"	120 "	x	"	=	1,800.
28	"	40 "	x	"	=	600.
29	"	150 "	x	"	=	2,250.
30	"	150 "	x	"	=	2,250.
31	"	150 "	x	"	=	2,250.

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	MISCELLANEOUS QUANTITY CALCULATIONS	MADE BY [illegible] DATE 9/29/87 CHECKED BY DATE ITEM NO. PAGE NO. 3

JOB NO. 11924-11-04 JOB NAME SRP/ACDC

CONTRACT OR STRUCTURE _____ ITEM NAME _____

MEMBER _____ LOCATION OF MEMBER _____

32 ADD 80 CFS @ $15.00 =		1,200.-
35 " 50 " " " =		750.-
37 " 50 " " " =		750.-
SIDE FLOWS: TOTAL REACH 4:		$68,150.-
MULTIPLY BY 3.7 & USE		$ 250,000.-
REACH 3:		
38: ADD 40 x $15.-		$ 600.-
39 50		
40 800		
41 100		
41 1,360		
42 25		
43 250		
44 25		
45 25		
46 25		
47 2950		
48 1,900		
49 150		
50 150		
51 150		
52 3,670		
53,54 73		
55 150		
56,57 556		
58→63 1,000		

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	MISCELLANEOUS QUANTITY CALCULATIONS	MADE BY / DATE CHECKED BY / DATE ITEM NO. / PAGE NO. 4

JOB NO. 11924-11-04 JOB NAME

CONTRACT OR STRUCTURE ITEM NAME

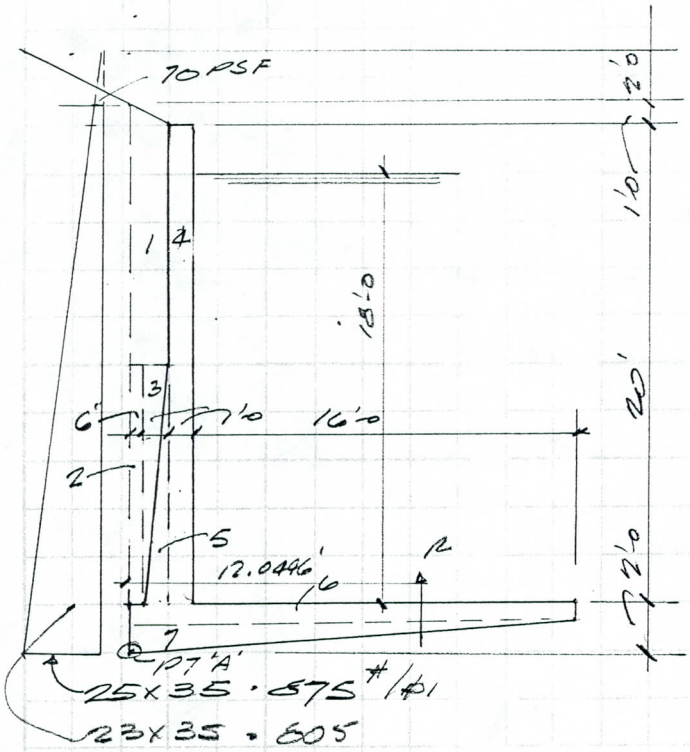
MEMBER LOCATION OF MEMBER

64 → 71 : ADD 420 CFS @ $15.-		
72 → 75 " 300 " " "		
14,109 CFS		$ 211,635.-
× 3.7 = ADD – RCH 3		$ 800,000.-

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 9-30-87	Job No. 11929-11-04
	Checked by	Date	Sheet No. 1

For ABOC DECK STUDY

20'-0 HIGH R/T. WALL



W/O WATER

Mo =	H	& Mo		Mo
1/2 x 23x70 =	805	x	2/3x23 =	12,343 k'
1/2 x 23x875 =	10062.5	x	1/3x23 =	77.146 k'
	10867.5			89.49 k'

VERTICAL LOADS

		V		M
1	10.5x1.5x120 =	1890	x .75	1417.5
2	.5x10x120 =	600	x .25	150.0
3	1/2x1x10x120 =	600	x .8333 =	500.0
4	20 x 150 =	3000	x 2	6000.0
5	1/2x1x10x150 =	750	x 1.1667 =	875.0
6	18.5 x 100 =	1850	x 9.25 =	17112.5
7	1/2x18.5x1.33x150 =	1850	x 6.1667 =	11406.0
		10540		37463.0

$\bar{X}$ = 37463 / 10540 = 3.5544

FIND BEARING PRESSURE:

Mo + M = 89.49 + 37.46 = 126.95

X = 126.95 / 10.54 = 12.0446'

e = 18.5/2 - 12.0446 = -2.7946'

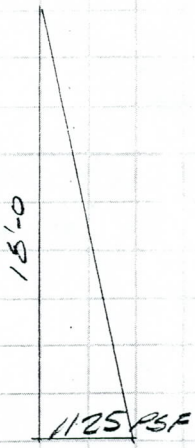
q TOE =

$$\frac{10540}{18.5}\left(1 + \frac{6 \times 2.7946}{18.5}\right) = 1086.1 \text{ PSF}$$

q HEEL

$$\frac{10540}{18.5}\left(1 - \frac{6 \times 2.7946}{18.5}\right) = 53.4 \text{ PSF}$$

W/ WATER



MR = ABOUT PT A

	H.		MR
1/2x18x1125 =	10125	x (6+2) =	81000

VERT.

18x62.5 = 1125 PSF

	10540		37460
16x1125 =	18000	x 10.5	189000
	28540		226460

$\bar{X}$ = 7.9348'

1E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 9-30-87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 12

For ACDC - COVER STUDY

20'-0 HIGH R/T. WALL

W/ WATER

$\Sigma M = 126.95 + 189.0 - 81.00$
$= 234.95$

$\bar{X} = 234.95 / 28.54 = 8.2323$

$e = 9.25 - 8.2323 = 1.0177$

$q_{TOE} =$

$$\frac{28540}{18.5}\left(1 - \frac{6e}{18.5}\right) = 1033.5 \text{ PSF}$$

q_{HEEL}

$$\frac{28540}{18.5}\left(1 + \frac{6e}{18.5}\right) = 2051.9 \text{ PSF}$$

MOMENT IN WALL

W/O WATER

$\frac{1}{2} \times 21 \times 505 = 8452.5 \times 7 = 59170$
$\frac{1}{2} \times 21 \times 70 = 375.0 \times 14 = 10290$
$69,460^{\#'}$

④ $3,000 \times .5$ -1.5
⑤ $.75 \times 1.33$ -1.0
$66.96^{K'}$

CHECK STEM

EXIST. REIN'G.

#6 @ 6 + #7 @ 12 + 8 @ 12
.88 + .60 + .79 = 2.27

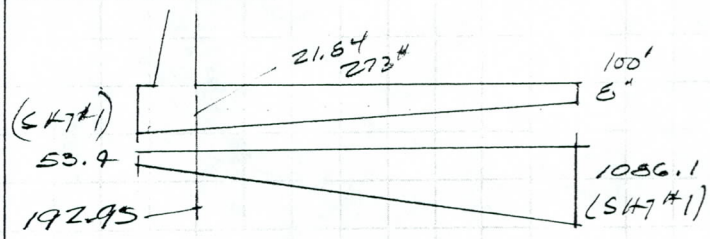
$\rho = 9.29 \times 2.27 / 12 \times 21.5 = .0817$

$k = .3306$, $J = .8897$ $2/kJ = 6.7959$

$$f_c = \frac{66.96 \times 12^{K}(2/kJ)}{12 \times 21.5^2} = 984.4 \text{ PSI}$$

$$f_s = \frac{66,960 \times 12^{K}}{2.27 \times J \times 21.5} = 18504.0 \text{ PSI}$$

CHECK BASE



M =

$\frac{1}{2} \times 16 \times 1086.1 = 8688.8 \times 2/3 \cdot 16 = 92650$
$\frac{1}{2} \times 16 \times 192.95 = 1543.6 \times 16/3 = 8230$
100910
$- \frac{1}{2} \times 273 \times 16 \times 1/3 \times 16 = -11650$
$- \frac{1}{2} \times 100 \times 16 \times 2/3 \times 16 = -8530$
80730

$d = 21.54 - 3.5 = 18.34''$

$\rho = 9.29 \times 2.27 / 12 \times 18.34 = .0958$

$k = .3523$, $J = .8826$, $2/kJ = 6.4322$

$$f_c = \frac{80.73 \times 12(2/kJ)}{12 \times 18.34^2} = 1.544 \text{ KSI}$$

NG

$$f_s = \frac{80.73 \times 12}{2.27 \times J \times 18.34} = 26.37 \text{ KSI}$$

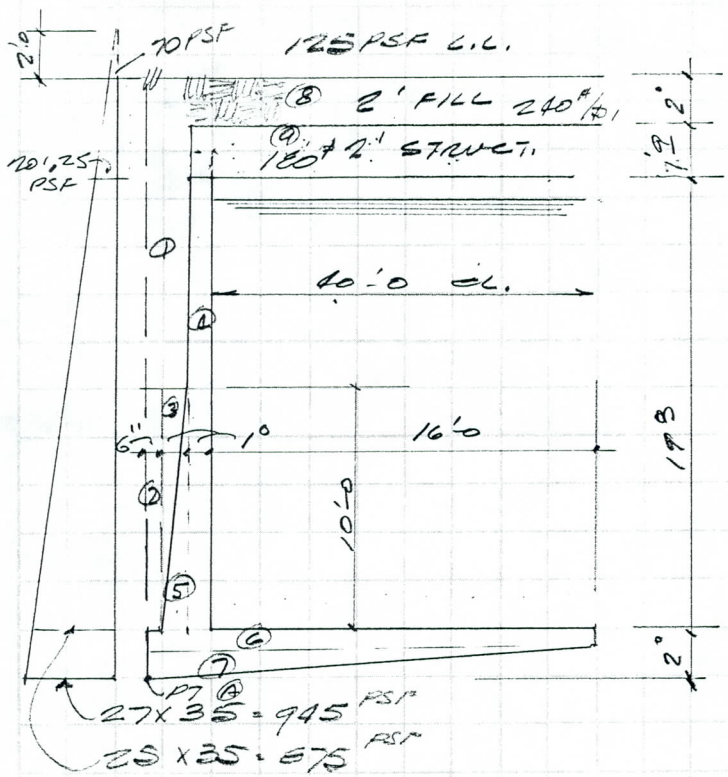
NG!

1E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 9-30-87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 3

For ACDC COVER STUDY

20'-0" HIGH WALL W/ COVER



H & Mo

$\frac{1}{2} \times 21.25 \times 201.25 = 2138.3 \times \frac{21.25}{3} = 30292.3$

$\frac{1}{2} \times 21.25 \times 945 = 100406 \times \frac{21.25}{3} = 71121.1$

101413.4

VERT. LOAD W/O LL ABOUT PT (A)

1	13 X 1.5 X 120 =	2340 X .75 =	1755
2	.5 X 10 X 120 =	600 X .25 =	150
3	½ X 1 X 10 X 120 =	600 X .8333 =	500
4	19.25 ± 150 =	2888 X 2 =	5775
5	½ X 1 X 10 X 150 =	750 X 1.167 =	875
6	18.5 X 100 =	1850 X 9.25 =	17112.5
7	½ X 18.5 X 200 =	1850 X 6.167 =	11408.0
8	21 X 245 =	5145 X 2	10290.0
9	21 X 180 =	3780 X 2	7560
		19803	55425
LL	21 X 125 =	2625 X 2	5250
		22430	60675

DETERMINE BEAR'G PRESS.

W/O LL

$\Sigma M = 101415 + 55425$

156840

$X = 156840 / 19805 = 7.92'$

$e = 9.25 - 7.92 = 1.33$

q_{TOE}

$\frac{19805}{18.5}\left(1 - \frac{6e}{18.5}\right) = 608.8$ PSF

q_{HEEL}

$\frac{19805}{18.5}\left(1 + \frac{6e}{18.5}\right) = 1532.3$ PSF

W/LL

$\Sigma M = 101415 + 60675$

$= 162090$

$X = 162090 / 22430 = 7.23'$

$e = 7.23 - 9.25 = -2.02$

$q_{TOE} = \frac{22430}{18.5}\left(1 - \frac{6e}{18.5}\right) = 416.7$ PSF

$q_{HEEL} = \frac{22430}{18.5}\left(1 + \frac{6e}{18.5}\right) = 2008.1$ PSF

1E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 9-20-87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 4

For ACRC DECK STUDY

CHECK STEM FOR ADDED LOAD

M @ BASE · STEM

$\frac{1}{2} \times 19 \times 210 = 1995 \times \frac{2}{3} \times 19 = 25270$

$\frac{1}{2} \times 19 \times 875 = 8312.5 \times \frac{1}{3} \times 19 = 52650$

77.92 k'

$- 2850 \times .5 \quad -1.43$

$750 \times 1.33 \quad -1.00$

$5145 \times .5 \quad -2.57$

$5040 \times .5 \quad -2.52$

13785 $\quad$ 70.40 k'

As = 2.27 #'

np = .0517

k = .3308, J = .8897, 2/kJ = 6.7959

$f_c = \frac{70.40 \times 12 \, (2/kJ)}{12 \times 21.5^2} = 1.035$ ksi

$f_w = 13{,}785 / 24 \times 12 = .048$

1.083 ksi

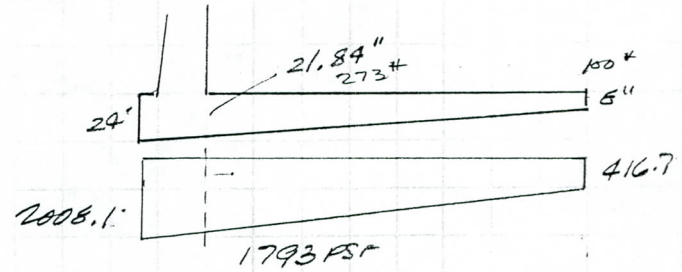
OK

$f_s = \frac{70.4 \times 12}{2.27 \times .8897 \times 21.5} = 19.46$ ksi

< 20 ksi

OK

BASE



M =

$\frac{1}{2} \times 416.7 \times 16 = 3333.6 \times \frac{2}{3} \times 16 = 35558.4$

$\frac{1}{2} \times 2008.1 \times 16 = 16064.8 \times \frac{1}{3} \times 16 = 85678.9$

121237.3

$- \frac{1}{2} \times 273 \times 16 = 2184 \times \frac{1}{3} \times 16 = -11648.0$

$- \frac{1}{2} \times 100 \times 16 = 800 \times \frac{2}{3} \times 16 = -8533.3$

101056.0

As = 101.06 / 1.44 × 18.3 = 3.84 #'

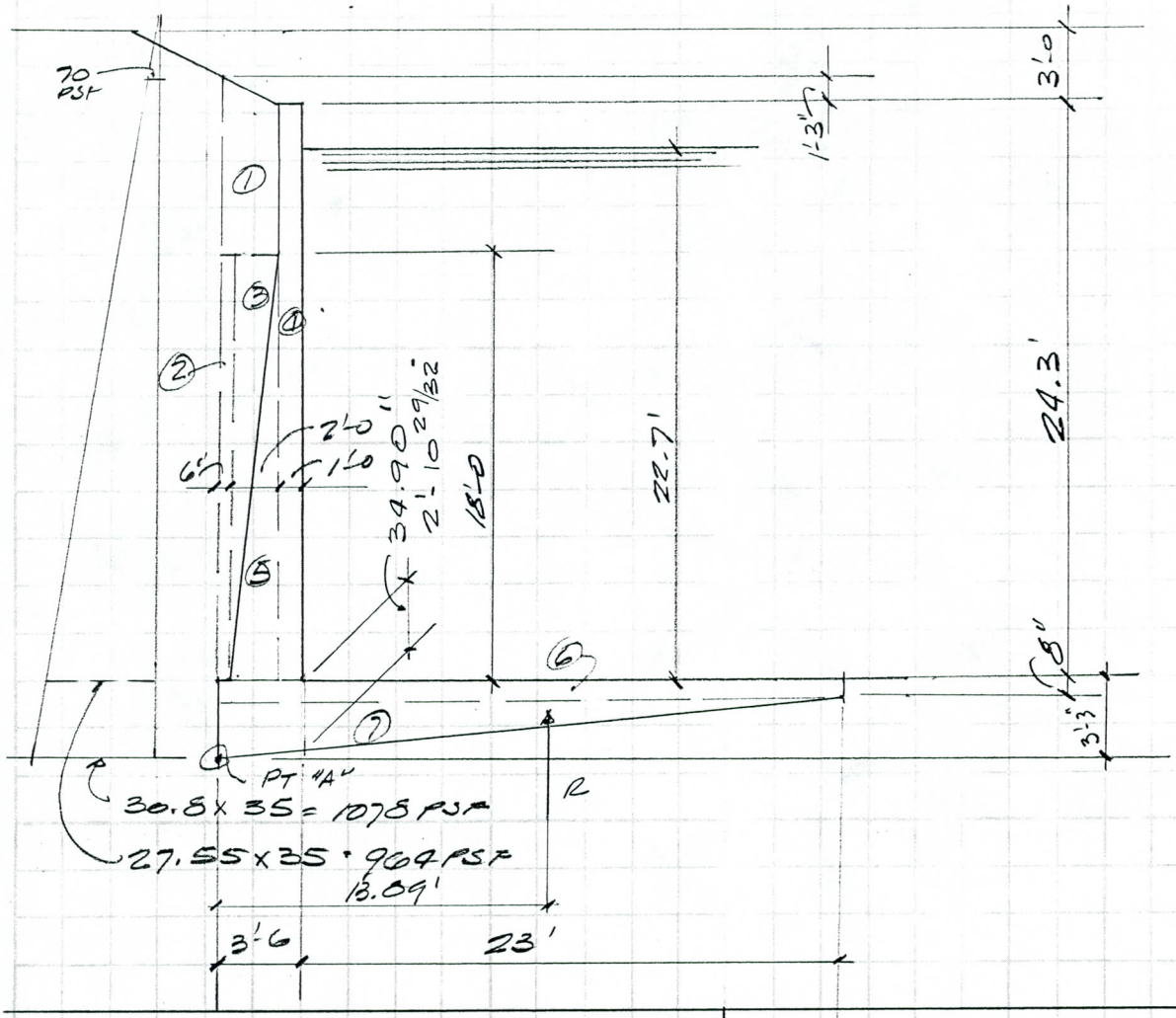
TRY #10 @ 4, #9 @ 3

1E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by daa	Date 9-30-87	Job No. 11929.11-04
	Checked by	Date	Sheet No. 5

For ACDC COVER STUDY

FOR WALL #7 - 24.3'



W/O WATER

	H		M0
$\frac{1}{2}\cdot 28.8 \times 70 =$	1008	$\times \frac{2}{3} \times 28.8 =$	19354
$\frac{1}{2}\cdot 28.8 \times 1078 =$	15523	$\times \frac{1}{3} \times 28.8 =$	149023
			168377

VERT (MOM ABOUT PT "A")

			M
1	6.93 x 2.5 x 120 =	2078 x 1.25	2598
2	.5 x 18 x 120 =	1080 x .25 =	270
3	$\frac{1}{2}$ x 2 x 18 x 120 =	2160 x 1.167 =	2520
4	24.3 x 150 =	3645 x 3 =	10935
5	$\frac{1}{2}$ x 2 x 18 x 150 =	2700 x 1.833 =	4950
6	26.5 x 100 =	2650 x 13.25 =	35112.
7	$\frac{1}{2}$ x 26.5 x $\frac{3'}{12}$ x 150 =	5134 x $\frac{26.5}{3}$ =	45354
		19447	101739

FIND BEARING PRESSURE

$\Sigma M = 168377 + 101739 = 270116$ #'

$X = 270116 / 19447 = 13.89'$

$e = 13.89 - 26.5/2 = 0.64'$

$q_{TOE} = \frac{19447}{26.5}\left(1 + \frac{6e}{26.5}\right)$ 840.2 PSF

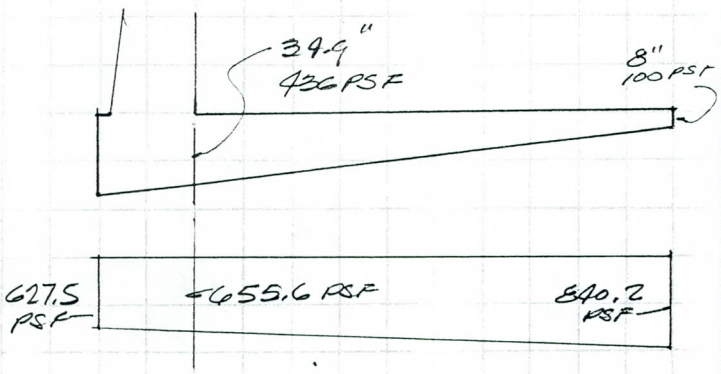
$q_{HEEL} = \frac{19447}{26.5}\left(1 - \frac{6e}{26.5}\right) = 627.5$ PSF

IE101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 9-30-87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 6

For ACDC COVER STUDY

CHECK BASE



SHEAR & MOMENT

$\frac{1}{2} \times 23 \times 840.2 = 9662.3 \times \frac{2}{3} \cdot 23 = 146156$

$\frac{1}{2} \times 23 \times 655.6 = 7539.4 \times \frac{1}{3} \cdot 23 = 57,802$

205958

$-\frac{1}{2} \times 23 \times 100 = -1150 \times \frac{2}{3} \cdot 23 = -17633$

$-\frac{1}{2} \times 23 \times 436 = -5014 \times \frac{1}{3} \cdot 23 = -38441$

149884 #'

AREA OF STEEL

#8 @ 6 + #9 @ 6

1.58 + 2.0 = 3.58

$d = 34.9 - 3.5 = 31.4''$

$np = 9.29 \times 3.58 / 12 \times 31.4 = .0863$

$K = .3411$, $J = .8863$, $2/KJ = 6.6162$

$f_c = \frac{149,884 \times 12 (2/KJ)}{12 \times 31.4^2} = 1006$ PSI

OK

$f_s = \frac{149,884 \times 12}{3.58 \times .8863 \times 31.4} = 18053$ PSI

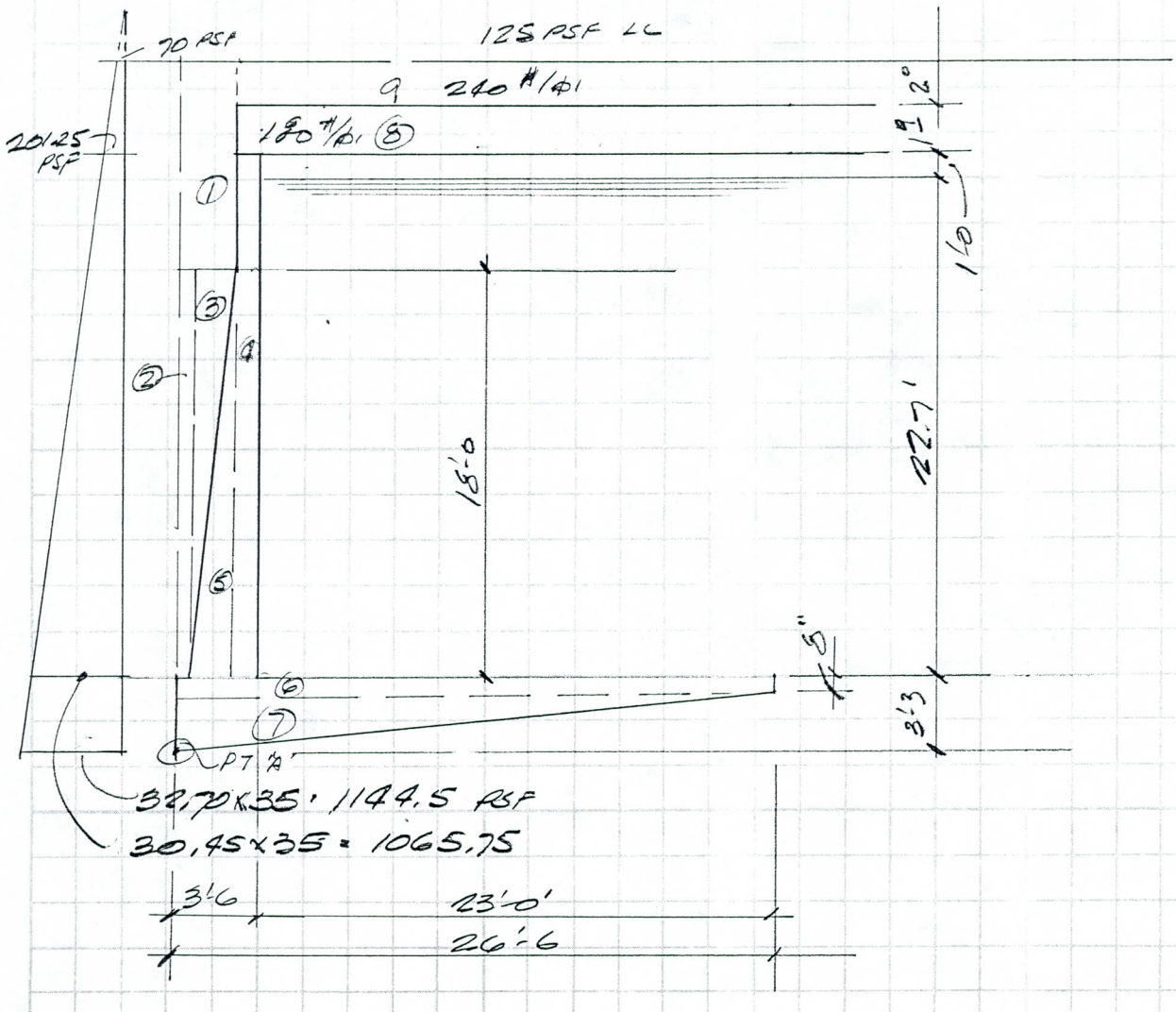
OK

ME101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 9-30-87	Job No. 11189-11-04
	Checked by	Date	Sheet No. 7

For ACDC COVER STUDY

FOR 24.3' w/ COVER



w/o WATER

	H	Mo
1/2 x 26.95 x 201.25 =	2711.8 x 2/3 x 26.95 =	48723
1/2 x 26.95 x 1144.5 =	15422.1 x 1/3 x 26.95 =	138542.0
		187265

VERT. LOADS & MOMENTS ABOUT PT "A"

		Y		M.
1	9.7 x 2.5 x 120 =	2910	x 1.25	3637.5
2	.5 x 18 x 120 =	1080	x .25	270.0
3	.5 x 2 x 18 x 120 =	2160	x 1.1667 =	2520.0
4	23.7 x 150 =	3555	x 3 =	10665.0
5	.5 x 18 x 2 x 150 =	2700	x 1.83 =	4950.0
6	26.5 x 100	2650	x 13.25 =	35112.0
7	1/2 x 26.5 x 31/12 x 150 =	5134	x 26.5/3 =	45354
		20189		102508.5

S.T.		20189		102508.5
E	21 x 245 =	5145	x 3	15435.0
9	21 x 180 =	3780	x 3	11340.0
		29114		129285
L.L	21 x 125 =	2625	x 3	7875.0
LL	2.5 x 125	313	x 1.25	390.5
		32052		137550
				187265
BEARING PRESS.				324815

X = 324815 / 32052 = 10.134

e = 10.134 - 13.25 = -3.116 < B/6

1E101-0374-20M

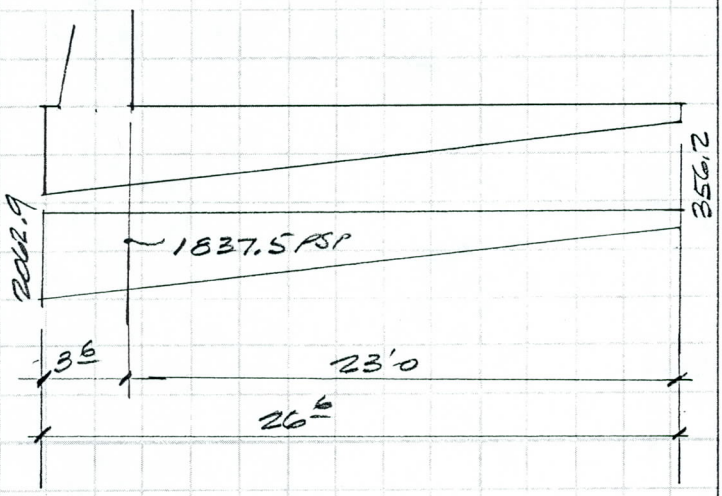
HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by dgg	Date 10-1-87	Job No. 11184-11-04
	Checked by	Date	Sheet No. 8

For ACRC COVER STUDY

FOR 24.3' WALL
w/ COVER

$q_{TOE} = \frac{32052}{26.5}\left(1 - \frac{6e}{26.5}\right) = 356.2 \text{ PSF}$

$q_{HEEL} = \frac{32053}{26.5}\left(1 + \frac{6e}{26.5}\right) = 2062.9 \text{ PSF}$



SHEAR & MOMENT

$\frac{1}{2} \times 23 \times 1837.5 = 21131.25 \times \frac{1}{3} \times 23 = 162006$

$\frac{1}{2} \times 23 \times 356.2 = 4096.3 \times \frac{2}{3} \times 23 = 62810$

224816

$-\frac{1}{2} \times 23 \times 436 = 5014 \times 23/3 = -38441$

$-\frac{1}{2} \times 23 \times 100 = 1150 \times \frac{2}{3} \cdot 23 = -17633$

$168742^{\#'}$

$f'_c = \frac{168742 \times 12 (2/K)}{12 \times 31.4^2} = 1132.3 \text{ PSI}$

$f_s = \frac{168742 \times 12}{3.58 \times .8863 \times 31.4} = 20324 \text{ PSI}$

1.6 % OVER

HE101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASW	Date 10/1/87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 9
For			

For 50' wide canal (with deck) no water

Assume 20' high wall

$M_o = 89.49$ '-k

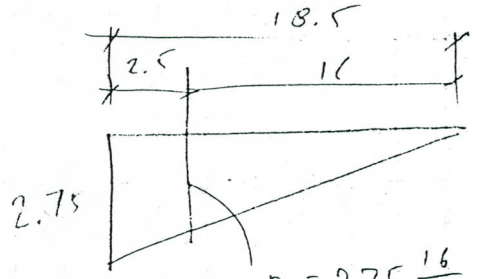
		P	r	M
(8)	26' × .245 =	6.370	2'	12.74
(9)	26' × 0.20 =	5.200	2'	10.40
LL	26' × 0.125 =	3.250	2'	6.50
		14.820		29.64
w/o Deck		10.54		37.46
Total		25.36		67.10
			M_o =	89.49
				156.59

$$x = \frac{156.59}{25.36} = 6.17$$

$$e = \frac{18.5}{2} - 6.17 = 3.07 \approx \frac{b}{6} \text{ OK}$$

$$p_{TOE} = \pm 0$$

$$p_{HEEL} = 25.36 \frac{2}{18.5} = 2.750 \text{ KSF}$$



$$p_1 = 2.75 \frac{16}{18.5} = 2.38$$

$$M = \frac{1}{6} 2.38 \times 16^2 = 101.4 \text{ '-k}$$

$$f_c = \frac{2M}{kjbd^2} \Rightarrow d = \sqrt{\frac{2M}{kjb f_c}}$$

$$d_{req'd} = \sqrt{\frac{2 \times 101.4 \times 12000}{(.33)(.89)(12)(1200)}} = 24''$$

$$A_s req'd = \frac{M}{(.89)(24) f_s} = 2.84 \text{ in}^2$$

Apply same moment to the wall

$$f_c \text{ available} = 1200 - \frac{P = 25360}{12 \times 24} = 1112 \text{ psi}$$

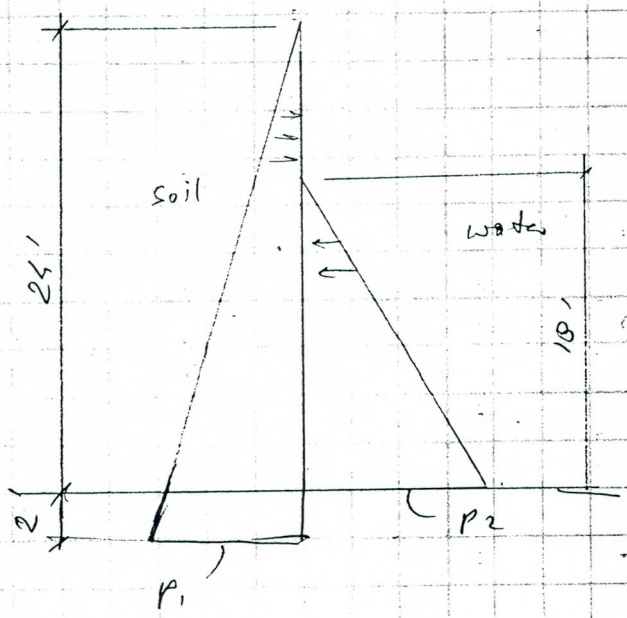
$$d_{req'd} = 24 \sqrt{\frac{1200}{1112}} = 25''$$

$$A_s req'd = 2.84 \frac{24}{25} = 2.73 \text{ in}^2$$

101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASW	Date 10/2/87	Job No. 11924-11-05
	Checked by	Date	Sheet No. 10
For			

50' wide canal with deck & walls



assume: water pressure causes increase of soil pressure from 35 to 40 of e.f.p.

$p_1 = 26 \times 0.04 = 1.04$

$p_2 = 18 \times 0.0624 = 1.123$

$H_s = \frac{1}{2} p_1 26 = 13.52$

$H_w = \frac{1}{2} p_2 18 = 10.11$ k

$M_s = 13.52 \frac{1}{3} 26 = 117.2$

$M_w = 10.11 (\frac{1}{3} 18 + 2) = 80.9$

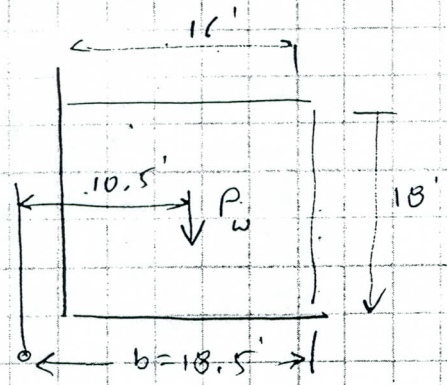
$M_o = 36.3$

101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASW	Date 10/2/87	Job No. 11 924-11-04
	Checked by	Date	Sheet No. 11
For			

50' wide canal with water

~~horizontal pressure of water balances soil pressure; therefore, $M_o = 0$~~ $M_o = 36.3$



$P_w = 16' \times 18' \times 0.0624 = 17.97\ k$

$M_w = 17.97 \times 10.5 = 188.7\ '\text{-}k$

67.1

$M_T = 255.8\ '\text{-}k$

$M_o = 36.3$

292.1

$P_T = 17.97 + 25.36 = 43.33$

$x = \frac{M_T}{P_T} = 6.74$

$e = \frac{18.5}{2} - 6.74 = 2.5' < \frac{b}{6}$

$P_{s\ \text{heel}}^{\text{toe}} = \frac{43.33}{18.50}\left(1 \pm \frac{6 \times 2.5}{18.5}\right) =$

$= 2.34 \pm 0.81$

$P_{toe} = 1.53\ KSF$

$P_{heel} = 3.15\ KSF$

too large

add 9" to heel

$\Delta M = 43.33 \times 0.75 = 32.5\ '\text{-}k$

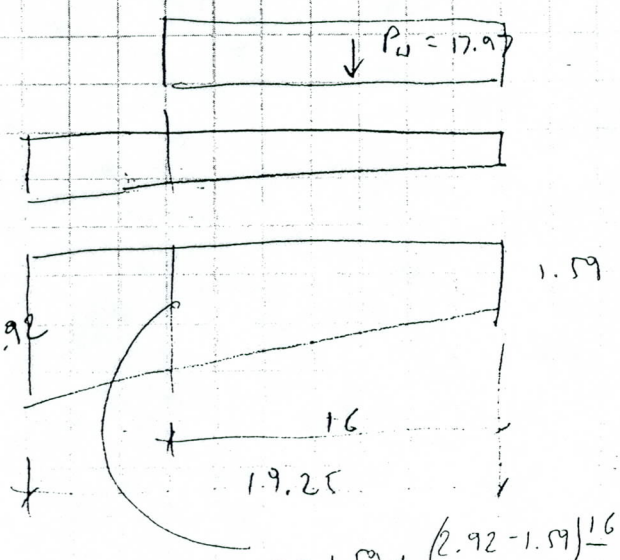
$x = \frac{292.1 + 32.5}{43.33} = 7.49$

$e = \frac{19.25}{2} - x = 2.13$

$P_{s\ \text{heel}}^{\text{toe}} = \frac{43.33}{19.25}\left(1 \pm \frac{6 \times 2.13}{19.25}\right) =$

$= 2.25 \pm 0.66 = \begin{cases} 2.915 \\ 1.59 \end{cases}$

very ok.



$p = 1.59 + (2.92 - 1.59)\frac{16}{19.25} =$

$= 2.70$

$M = 1.59\frac{16^2}{2} + (2.70 - 1.59)\frac{16^2}{6} - 17.97 \times 8 =$

$= 107.12\ '\text{-}k$

101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASW	Date 10/2/87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 12
For			

50' with water & deck

$$d_{req'd} = 24\left(\frac{107.12}{101.4}\right)^{\frac{1}{2}} = 24.66$$

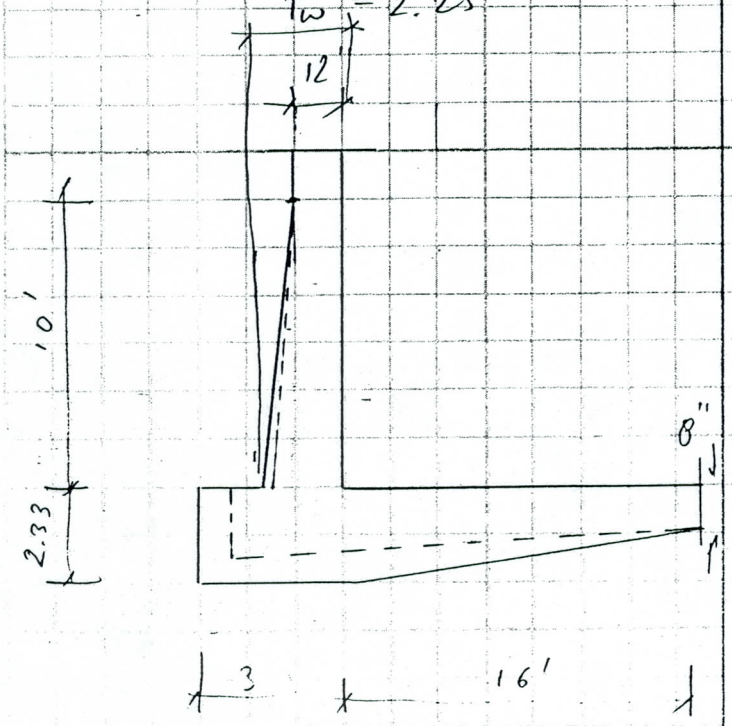
say OK

2.7% overstress in concrete

$$A_{s\ req'd} = 2.84\ \frac{107.12}{101.4} = 3.0\ in^2$$

Summary per 1 wall

50' wide canal with deck needs



Concrete area as was

Stem (10') $\frac{1+2}{2}10' = 15\ ft^2$

Slab (16') $\frac{0.67+2}{2}16' = 21.4\ ft^2$

heel $2.5' \times 2'(\pm) = 5$

$41.5\ ft^2$

as needed

Stem $\frac{1+2.25}{2}10 = 16.25$

Slab $\frac{0.67+2.33}{2}16 = 24.00$

Heel $2.33 \times 3 = 6.99$

47.24

− 41.5

$\Delta A = 5.74\ ft$

Steel

was 2.27

needed 3.0

$\Delta A_s = 0.73\ in^2$

length needed $= 16' \cdot \frac{2}{3} \times 2 = 21.3\ ft.$ (wall & slab)

weight $= \frac{0.73}{0.79} \times 2.67 \times 21.3 = \underline{53\ lb}$

area of #8 — weight of #8

101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASW	Date 10/1/87	Job No. 11924-11-04
	Checked by	Date	Sheet No. 13
For			

For 60' wide canal with deck / no water

Assume 20' high walls

$M_o = 89.49'\text{-}k$

		P	r	M
(8)	31' × .245 =	7.6	2	15.19
(9)	31 × .200 =	6.2	2	12.4
LL	31' × .125 =	3.9	2	7.75
		17.70		35.34
w/o Deck		10.54		37.46
		28.24		72.80
			M_o =	89.49
				162.30

$x = \frac{162.30}{28.24} = 5.75$

$e = \frac{18.5}{2} - x = 3.50 > \frac{18.5}{6}$

Needs widen bottom slab 9"

$\Delta M = 28.24 \times 0.75 = 21.18$

162.30

183.48

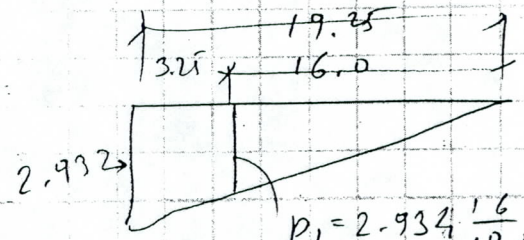
$x = \frac{183.48}{28.24} = 6.50$

$e = \frac{19.25}{2} - 6.50 = 3.125' < \frac{19.25}{6}$

Assume p_s

$p_{TOE} = 0$

$p_{HEEL} = 28.24 \frac{2}{19.25} = 2.934$



$p_1 = 2.934 \frac{16}{19.25} = 2.44$

$M = \frac{1}{6} 2.44 \times 16^2 = 104.05$

$d_{req'd} = 24 \sqrt{\frac{104.05}{101.4}} = 24.3$

say 24"

A_s req'd $= \frac{104.05 \times 12}{(.89)(24)(20)} = 2.92 \text{ in}^2$

Apply some moment to the wall

f_c available $= 1200 - \frac{P = 28240}{12 \times 24} = 1102$ psi

$d_{req'd} = 24.3 \sqrt{\frac{1200}{1102}} = 25.4$ in

say 25 in

A_s req'd $= 2.92 \frac{24}{25} = 2.80 \text{ in}^2$

E101-0374-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASD	Date 10/2/87	Job No. 11923-11-04
	Checked by	Date	Sheet No. 14
For			

60' wide canal with deck & water

$M_o = 36.3$ '-k

$P_w = 17.97$ k

$M_w = 188.7$ '-k

$M_T = 72.8 + 36.3 + 188.7 = 297.8$

$P_T = 28.24 + 17.97 = 46.21$

widen slab by 9"

$\Delta M = 46.21 \times 0.75 = 34.66$ '-k

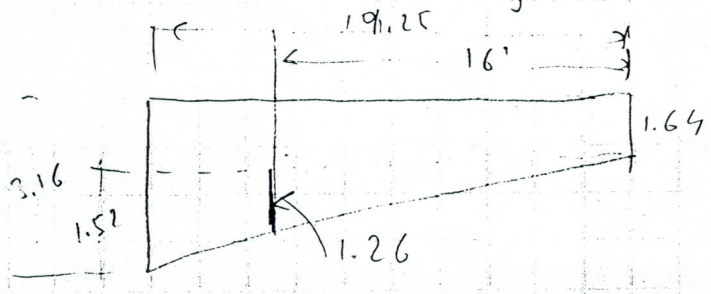
$$x = \frac{297.8 + 34.66}{46.21} = 7.19'$$

$$e = \frac{19.25}{2} - 7.19 = 2.43$$

$$P_{T,4} = \frac{46.21}{19.25}\left(1 + \frac{6 \times 2.43}{19.25}\right) =$$

$$= 2.4 \pm 0.76 = \begin{matrix} 3.16 \\ 1.64 \end{matrix}$$

say OK



$$M = 1.64\frac{16^2}{2} + 1.26\frac{16^2}{6} - 17.97 \times 8 =$$

$= 119.92$ '-k

$$d_{req'd} = 24\left(\frac{119.92}{101.4}\right)^{\frac{1}{2}} = 26''$$

$$A_{s\,req'd} = \frac{119.92 \times 12}{(.89)(26)(20)} = 3.11 \text{ in}^2$$

Area of concrete req'd

stem (10') $\frac{1 + \left(\frac{26+3}{12}\right)}{2} 10 = 17.08$

slab (16') $\frac{0.67 + \frac{26+4}{12}}{2} 16 = 25.36$

heel $\left(\frac{26+4}{12}\right) \times \left[\frac{9}{12} + \frac{6}{12} + \frac{26+3}{12}\right] = 9.17$

51.61

was 41.50

10.11 cy

Steel

was 2.27
need 3.11 } $\Delta A = 0.84$ in^2

length needed = 21.3 ± ft.

$$\text{weight} = \frac{0.84}{0.79} 2.67 \times 21.3 = 60.5 \text{ lb}$$

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HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by ASW	Date 10/2/87	Job No. 11924-11-04
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For			

60' segment

Concrete

$13,900 \text{ Ft} \times 2 \text{ walls} \times \frac{10.11}{27} =$

10,400 CY

Steel

$13,900 \times 2 \times \frac{60.5}{1000} = 1,682$ kips

50' segment

Concrete

$4900 \times 2 \times 5.74 \frac{1}{27} = 2,083$ CY

Steel

$4900 \times 2 \times 53 \frac{1}{1000} = 519$ kips

40' segment

$11200' \times 2 \times \frac{7.84}{27} = 6,504$ CY

TOTAL

Concrete:

60' wide segment	10,400 CY
50' wide "	2,080
40' " "	6,500
	18,980 CY

SAY 19,000 CY

Steel:

60' wide	1,682 k
50' wide	519 k
40' wide	—
	2,201 k

SAY 2,200 k

Assume concrete 80 \$/CY
steel 40 \$/lb

19 000 × 80	=	1,520,000
2200 × 400	=	880,000
		2,400,000

E101-0374-20M

Top of wall accomodation for deck bearing

a) Seismic requirements of support width

$H = 8 + 0.02L = 8 + 0.02 \times 60 =$

$= 9.2'' < 12''$ exist.

OK.

No top of wall widening req'd except if approach slab would be needed (not on a full length)

b) Check bearing pressure for 60' span

soil	7.6 k
structure	6.2 k
DL	= 13.8 k

LL 16k 16k 4k

15' 15' 35'

A B 62'

$R_A = 16 + 16\frac{48}{62} + 4\frac{34}{62} = 30.58$ k

distribution area say 4'

$LL = \frac{30.58}{4} = 7.6$ k

no Impact factor

Reaction $= 13.8 + 7.6 = 21.4$ k

$P_{allowable}^{concrete} = 0.3 f_c' \times 2 = 1800$

$P_{allowable}$ ponds $= 800 \leftarrow$ governs

Area needed $\frac{21400}{800} = 26.8$ in^2

use neoprene strip 4" wide

$A = 4 \times 12 = 48$ in$^2 > 26.8$

OK.

Conclusion

no top of wall widening needed.

Deck structure

40' span

24" precast prestressed voided slab (4' wide slabs)

50' span

27" precast prestressed box beam (4' wide)

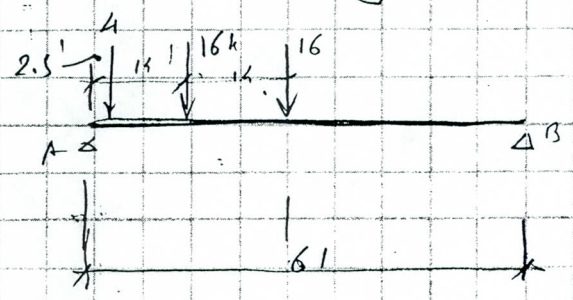
60' span

33" precast prestressed box beam (4' wide)

E101-0374-20M

Check assumption for 60' span

Find equivalent span of bridge with no soil (equivalent i.e. with the same bending moment)

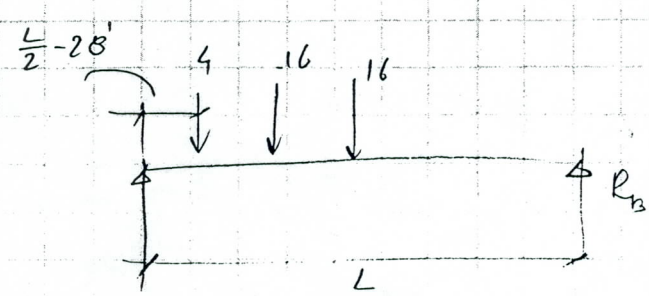


$$R_B = 16\,\frac{30.5+16.5}{61} + 4\,\frac{2.5}{61} = 12.5\text{ k}$$

$$M_{max} = 12.5\times 30.5 +$$

$$+\ 4\text{ ft wide slab}\times(0.2+0.245)\frac{61^2}{8} =$$

$$= 381.25 + 828 = 1209.5\text{ ft-k}$$



$$R_B = \frac{16}{2} + 16\,\frac{\left[\frac{L}{2}-14\right]}{L} + 4\,\frac{\left[\frac{L}{2}-28\right]}{L}$$

$$M_{max} = R_B\,\frac{L}{2} + 4\times 0.2\,\frac{L^2}{8} =$$

$$= 8\cdot\frac{L}{2} + 8\frac{L}{2} - 112 + 2\frac{L}{2} - 56 +$$

$$+\ 0.1L^2 = 0.1L^2 + 9L - 168$$

$$0.1L^2 + 9L - 168 = 1210$$

$$0.1L^2 + 9L - 1378 = 0 \rightarrow L = 80.7$$

Per PCI "short span bridges" use

33" deep precast prestressed box beams

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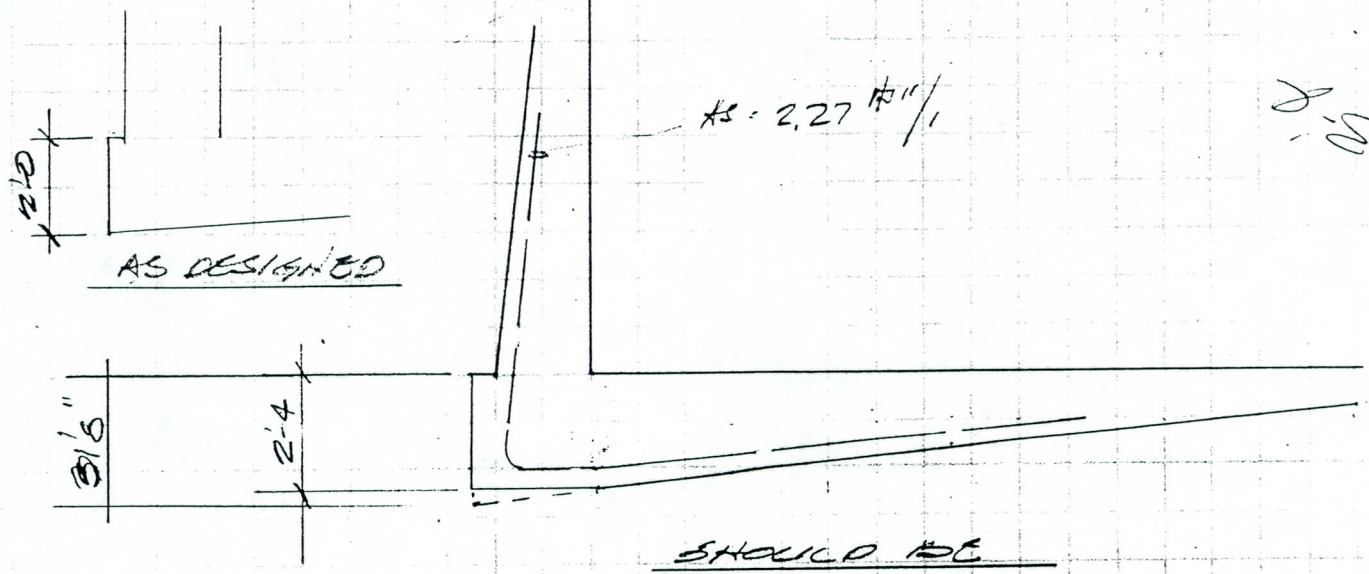
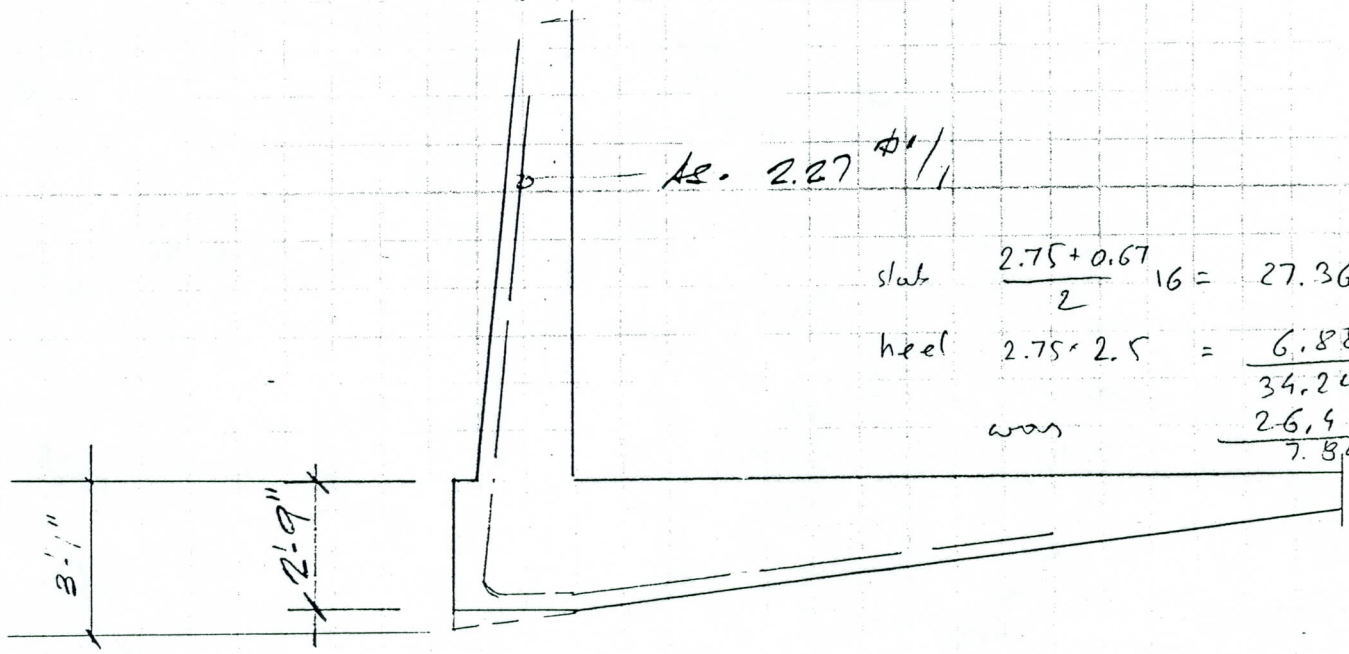
For			

TO 20'-0 –





slab $\frac{2.75+0.67}{2}$ 16 = 27.36 ft²

heel 2.75 × 2.5 = 6.88

34.24

was 26.4

7.84 ft²

WILL BE REQ'D W/ COVER

ABOVE 20'-0

ADD 1" TO FTG

E101-0374-20M