

HARZA-EBASCO

Susitna Joint Venture

Document Number

D)

UNIT PRICES - BACKUP CALCULATIONS

DEVIL CANYON

ARCH DAM CONCRETE

104

Please Return To
DOCUMENT CONTROL

Arch Dam Concrete Summary

Coarse Aggregate

Fine Aggregate

Cement

Ice Plant

Concrete Production

Refrigeration

Heating

Forming

Placing Concrete

Joint Finishes



From: Acres Consulting Services Ltd.
5259 Dorchester Road, Box 1001
Niagara Falls, Ontario
L2E 6W1

Date: April 8, 1982

Acres P5700.09
Job No.: AN-AB28

To: Acres American Incorporated
Liberty Bank Building
Main at Court
Buffalo, N.Y. 14202

Attention: Jim Plummer

Project: Susitna Hydroelectric Project

Subject: Devil Canyon
Arch Dam Concrete

Description/Title	Drawing Number	Revision	No. of Each	Code
Black Binder containing Estimate for Arch Dam Concrete - Devil Canyon. Per conversation with Jim Plummer April 6/82 photostat copy now on file in Niagara Falls office.	BOOK D		1	
Codes A - For Approval or Comment B - For Construction C - For Information D - Drawings Reviewed, No Comment E - Amend and Resubmit F - Rejected. See Comments G - Copies Sent To				

Yours very truly,

DOCUMENT TRANSMITTAL

pm for G. R. Stunden

Sign and Return Part 2

(D) Arch Dam Concrete

Arch Dam Concrete Summary



Estimate Work Sheet

ITEM REFERENCE No.

JOB No. P5700

DESCRIPTION CONCRETE FOR ARCH DAM

SHEET 1 OF 1

PROJECT SUSITNA HYDROELECTRIC

OPERATION No.

REF.

BY HEK.

CONTRACT DEVIL CANYON - ARCH DAM

DESCRIPTION

CKD DATE FEB. 23/82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION		EQUIV UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<u>CONCRETE FOR ARCH DAM</u>																
1. COARSE AGGREGATE	1,676,000	C.Y.	5 ⁴⁹	9,201,200	0 ⁶⁹	1,156,400	-	-	-	-	9 ⁷¹	16,274,000	-	-	15 ⁸⁹	26,631,600
2. FINE AGGREGATE	1,676,000	C.Y.	2 ⁵¹	4,206,800	0 ¹⁵	251,400	-	-	-	-	5 ³⁰	8,882,800	-	-	7 ⁹⁶	13,341,000
3. CEMENT 35#/# C 176 ⁶⁰ /TON	1,676,000	C.Y.	0 ⁵⁹	986,900	35 ⁵⁰	59,498,300	-	-	0 ²¹	345,600	1 ¹⁰	1,855,200	-	-	37 ⁴⁰	62,686,000
4. CRUSHED ICE PLANT	1,676,000	C.Y.	1 ⁶²	2,710,900	0 ³⁰	495,000	-	-	-	-	1 ⁹⁶	3,281,600	-	-	3 ⁸⁷	6,487,500
5. CONCRETE PRODUCTION	1,676,000	C.Y.	3 ³⁴	5,597,500	0 ³⁹	654,100	-	-	1 ¹⁵	1,920,000	1 ⁷⁰	2,855,100	-	-	6 ⁵⁸	11,026,700
6. REFRIGERATION & COOLING	1,676,000	C.Y.	5 ⁴⁰	9,038,400	2 ⁵⁰	4,179,000	-	-	-	-	1 ⁵⁸	2,651,000	-	-	9 ⁴⁸	15,868,400
7. HEATING & INSULATION	1,676,000	C.Y.	3 ²⁸	5,504,100	1 ⁸³	3,070,000	-	-	-	-	0 ⁶⁷	1,120,100	-	-	5 ⁷⁸	9,694,200
8. FORMING (INCLUDING HIGHLINE)	1,676,000	C.Y.	17 ¹¹	28,685,000	2 ⁰⁹	3,500,000	-	-	-	-	7 ¹⁶	12,500,000	-	-	26 ⁶⁶	44,685,000
9. PLACING CONCRETE	1,676,000	C.Y.	11 ⁹⁰	19,951,400	1 ⁰⁰	1,676,000	-	-	-	-	3 ⁰⁴	5,093,500	-	-	15 ⁹⁴	26,720,900
10. WATER STOPS & SEALANT	1,676,000	C.Y.	0 ⁶⁶	1,099,700	1 ⁵⁶	2,623,300	-	-	-	-	0 ¹⁶	268,700	-	-	2 ³⁸	3,991,700
TOTAL	1,676,000	C.Y.	51 ⁹⁰ 135 ¹³⁵	86,981,900	46 ⁰⁰ 35 ⁵⁰ 16.50	77,103,500	-	-	1 ³⁵	2,265,600	32 ⁶⁹ 32 ⁷⁰ 14.70	54,782,000 8 ay	-	-	131 ⁸⁹ 136 ⁻	2,21,133,000
18.00																
25 Feb 82																

(D) Arch Dam Concrete
Coarse Aggregate



Estimate Work Sheet

PROJECT SUSITNA HYDRO ELECTRIC.
CONTRACT DEVIL CANYON.

ITEM REFERENCE No. MAIN AREA DAM.
DESCRIPTION SUPPLY OF CONCRETE.
OPERATION No. REF.
DESCRIPTION COARSE AGGREGATE

JOB No. P5700.
SHEET 1 OF 1.
BY P. J. S.
CKD DATE FEB 82

DATE 10/15/82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION		Equiv UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<u>SUPPLY OF COARSE AGGERGATES.</u>																
EXCAVATION @ BORROW PITS.	1,676.000	cycl	0 ⁴⁵		0 ⁰¹		-	-	-	-	1 ¹³		-	-	1 ⁵⁹	
HAUL TO THE PLANT.	1,676.000	cycl	0 ³⁴		-	-	-	-	-	-	0 ⁹⁰		-	-	1 ²⁴	
CONSTRUCTION LOADS.	1,676.000	cycl.	0 ²⁵		-	-	-	-	-	-	0 ⁴³		-	-	0 ⁷³	
SCREENING PLANT.	1,676.000	cycl.	0 ²⁸		0 ⁰¹		-	-	-	-	0 ⁶⁵		-	-	0 ⁹⁴	
PROCESSING PLANT.	1,676.000	cycl.	3 ⁸³		0 ⁶⁷		-	-	-	-	5 ⁶⁵		-	-	10 ¹⁵	
HAUL TO STOCK pile	1,676.000	cycl.	0 ³⁴		-		-	-	-	-	0 ⁹⁰		-	-	1 ²⁴	
TOTAL.	1,676.000	cycl.	5 ⁴⁹	9,201,240	0 ⁶⁹	1,156,440	-	-	-	-	9 ⁷¹	16,273,960	-	-	15 ⁸⁹	26,631,640

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Calculations

SUBJECT

DEVIL CANYONBy HEK Date 8/2/19

Checked _____ Date _____

Project No. P5700

Calculation No. _____

Page 13 of 13COARSE AGGREGATE PROCESSING

- UNIT PRICES DEVELOPED FROM NOTES
MADE BY F. TOTH FOR WATANA
DAM EARTHWORKS.

Rev	By	Checked

SUMMARY OF UNIT PRICES

DESCRIPTION	LABOUR	MATERIAL	EQUIPMENT	TOTAL
EXCAVATION	0.451	0.007	1.131	1.589
HAUL TO PLANT	0.341	-	0.900	1.241
CONSTRUCTION RDS.	0.252	-	0.479	0.731
SCREENING	0.278	0.003	0.648	0.929
PROCESSING	3.831	0.667	5.650	10.148
HAUL TO STOCKPILE	0.341	-	0.900	1.241
TOTAL	5.494	0.677	9.708	15.879

DG



Calculations

SUBJECT

DEVIL CANYON

COARSE AGGREGATE PROCESSING

By HEK Date 82/2/19

Checked _____ Date _____

Project No. P5700

Calculation No. _____

Page 1 of 13

Rev	By	Checked

1. EXCAVATION

USE 3 - 25 CY. & 3 - 15 CY.

WALKING DRAGLINES.

THIS FLEET ENSURES A MAX. OUTPUT OF 4500 CY./HR.

AVERAGE PRODUCTION = 4000 CYD/HR.

$$\begin{aligned} \text{VOLUME TO BE EXCAVATED} &= 3,000,000 \text{ CYD.} \\ &+ \frac{300,000}{10\% \text{ LOSS OF OVERSIZE}} \\ &= 3,300,000 \text{ CYD.} \end{aligned}$$

LOOSE CY. FACTOR = 1.15

∴ VOLUME = 3.8×10^6 CYD.

$$\therefore \text{TIME FOR EXCAVATION} = \frac{3.8 \times 10^6}{4000} = 950 \text{ HRS.}$$

LABOUR: FOREMAN	=	3	x	43.03	=	129.09
MECHANIC	=	9	x	36.96	=	332.64
OILER	=	6	x	33.53	=	201.18
ELECTRICIAN	=	4	x	40.23	=	160.92
OPERATOR	=	6	x	36.96	=	221.76
TRUCK DRIVER	=	5	x	35.58	=	177.90
LABOURER	=	12	x	30.54	=	366.40
DOZER OP.	=	3	x	35.10	=	105.30
LAB. FOREMAN	=	2	x	33.23	=	66.46
CRANE OP.	=	1	x	36.96	=	36.96
LOW BOY OP.	=	1	x	35.58	=	35.58

$$1804.19 \times 950 = \$1,714,000$$

$$U/C = \$0.451/\text{CYD.}$$



Calculations

SUBJECT

By HEX Date 8/2/19 Project No. P5700

Checked _____ Date _____ Calculation No. _____

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EXCAVATION - CONT'D

MATERIAL: - STEEL PADS FOR DRAGLINES
- MOBILE ASSEMBLY SHED

$$u/c = \underline{\$0.007/cyd} \quad \text{FROM F. TOT}$$

EQUIPMENT: 680-M DRAGLINE = $3 \times 813.93 =$
 380-M DRAGLINE = $3 \times 386.34 =$
 LIGHT PLANT = $12 \times 4.50 =$
 4x4 PICKUP = $12 \times 20.00 =$
 FUEL TRUCK = $2 \times 28 =$
 SERVICE TRUCK = $3 \times 30 =$
 1 T. TRUCK = $6 \times 20 =$
 D-7 DOZER = $3 \times 85 =$
 20^T CRANE = $1 \times 65 =$
 40^T LOW BED = $1 \times 42 =$

$$4522.81 \times 950 = \$4,296,670$$

$$u/c = \underline{\$1.131/cyd.}$$

SUMMARY - EXCAVATION

LABOUR = 0.451
 MATERIAL = 0.007
 EQUIPMENT = 1.131
\$1.589/cyd.



Calculations

SUBJECT

By HEK

Date 8/2/19

Project No. P5700

Checked _____

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2. HAUL TO PLANT

DISTANCE = 2 MILES.

- USE 120 CY HAULERS
- EACH HAULER MAKES 4 TRIPS/HR.
- ASSUME 6 UNITS
- ∴ PRODUCTION = $6 \times 4 \times 120$
= 2880 cyd/HR.

TOTAL VOLUME TO BE HAULED = $1.93 \times 10^6 \times 1.30$ (30% LOSSES)
= 2.5×10^6 cyd.

∴ TIME = $\frac{2.5 \times 10^6}{2880}$ = 868 HR.

LABOUR: FOREMAN	=	2 x 38.09	=	76.18
- ATLEY OP.	=	6 x 36.84	=	221.04
✓ DOZER OP.	=	3 x 35.10	=	105.30
✓ SERV. TR. DRIVER	=	2 x 33.47	=	66.94
- PICKUP DRIVER	=	4 x 30.54	=	122.16
✓ CRANE OP.	=	1 x 35.10	=	35.10
✓ LIGHT PLANT	=	2 x 34.29	=	68.58
✓ FIELD MECH.	=	2 x 36.96	=	73.92
✓ FLAGMAN	=	4 x 30.54	=	122.16
TRAFFIC CONTR.	=	3 x 30.54	=	91.62

983.00 x 868 = \$853,244

u/c = \$0.341/cyd

ACRES**Calculations**

SUBJECT

By HEKDate 8/2/19Project No. P5700

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HAUL TO PLANT - CONT'DEQUIPMENT: PH180 ATLEY = 6 x 180 = 1080

" STANDBY = 1 x 81 = 81

DOZER D-9 = 3 x 175 = 525

LIGHT PLANT = 30 x 4.50 = 135

SERV. TRUCK = 1 x 30 = 30

FUEL TRUCK = 1 x 28 = 28

4x4 PICKUP = 4 x 20 = 80

1 TON TRUCK = 4 x 20 = 80

BULL MOOSE = 1 x 35 = 35

 $\$2074.00 \times 868 = \$1,800,232$

U/C = \$0.720/cyd.

25% STANDBY & MAINT. REPAIR = 0.180

\$0.900/cydSUMMARY - HAUL

LABOUR = 0.341

MATERIAL = -

EQUIPMENT = 0.900

\$1.241/cyd.

D10



Calculations
SUBJECT

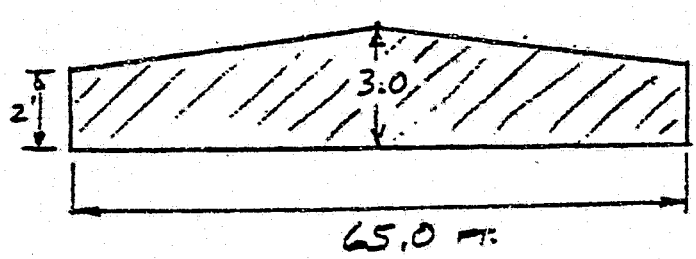
By HEK Date 8/2/19
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3. CONSTRUCTION ROADS & MAINTENANCE

ASSUMED CROSS-SECTION :



ESTIMATED LENGTH = 3 MILE
= 15,800 FT.

$$\therefore \text{VOLUME} = \left[\frac{(65.0 \times 2.5) \div 27 \right] \times 15,800$$

$$= 95,000 \text{ cyd.}$$

ASSUME SITE IS ALREADY CLEARED.
(ie. IN BORROW AREA)

a) EXCAVATION & HAUL - UNIT PRICES CALCULATED BY F. TOTH
FOR WATANA DAM.

$$\text{LABOUR} = 1.53 \times 95,000$$

$$= \$145,350$$

$$\text{MATERIAL} = 0.029 \times 95,000$$

$$= \$2,755$$

$$\text{EQUIPMENT} = 3.861 \times 95,000$$

$$= \$366,795$$

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ACRES

Calculations

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CONST. ROADS - CONT'D.b) LEVELLING

$$\begin{aligned} \text{PRODUCTION} &= 8,000 \text{ C.Y. / 10 HR. DAY.} \\ &= 800 \text{ C.Y. / HR.} \end{aligned}$$

$$\begin{aligned} \text{TIME} &= 95,000 \div 800 \\ &= 118 \text{ HRS.} \end{aligned}$$

<u>LABOUR</u> : FOREMAN	=	2 x 37.60	=	75.20
DOZER OP.	=	6 x 35.10	=	210.60
GRADER OP.	=	4 x 35.10	=	140.40
COMP. OP.	=	4 x 35.10	=	140.40
HAULER OP.	=	2 x 36.84	=	73.68
WATER TRUCK OP.	=	1 x 33.47	=	33.47
GRADEMAN	=	4 x 30.94	=	123.76
LABOUR	=	4 x 30.54	=	122.16
FLAGMAN	=	1 x 30.54	=	30.54

$$950.21 \times 118 = \$112,125$$

<u>EQUIPMENT</u> : DOZER D-8	=	4 x 162	=	648
" D-7	=	2 x 85	=	170
GRADER	=	4 x 71	=	284
COMPACTOR	=	4 x 64	=	256
HAULER	=	2 x 180	=	360
LOADER	=	1 x 185	=	185
4x4 PICKUP	=	4 x 20	=	80
WATER TRUCK	=	1 x 26	=	26

$$2009.00 \times 118 = \$237,062$$



Calculations

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CONST. ROADS - CONT'D

c) ROAD MAINTENANCE

DURATION = 4 YRS. @ 5 MONTHS/YR.
= 86 WKS. x 40 HR/WK.
= 3440 HR.

LABOUR: FOREMAN = 1 x 37.05 = 37.05
OPERATOR = 2 x 35.10 = 70.20
DRIVER = 1 x 35.58 = 35.58
LABOURER = 2 x 30.54 = 61.08

203.91 x 3440 = \$701,450

EQUIPMENT: DOZER D-7 = 1 x 85 = 85
COMPACTOR = 1 x 64 = 64
GRADER = 1 x 71 = 71
4x4 PICKUP = 1 x 20 = 20
40^T TRUCK = 1 x 113 = 113

353.⁰⁰ x 3440 = \$1,214,320

SUMMARY - CONST. ROADS

	LABOUR	MATERIAL	EQUIPMENT	TOTAL
a) ROAD BED	145,350	2,755	366,795	514,900
b) LEVELLING	112,125	-	237,062	349,187
c) MAINTENANCE	701,450	-	1,214,320	1,915,770
TOTAL	958,925	2,755	1,818,177	2,779,857
UNIT COST (VOL. = 3,800,000 cu ft)	0.252	-	0.479	0.731

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ACRES

Calculations

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Page 8 of 134. SCREENING & STOCKPILE

VOLUME = 2,500,000 cyd.

PRODUCTION = 2872 cyd/HR.

TIME = 2,500,000 ÷ 2872 = 870 HR.

LABOUR : FOREMAN = 2 × 43.03 = 86.06
 DOZER OP. = 8 × 35.10 = 280.80
 LOADER OP. = 3 × 36.96 = 110.88
 MECHANIC = 3 × 36.96 = 110.88
 ELECTRICIAN = 2 × 40.23 = 80.46
 HELPER = 3 × 30.54 = 91.62
 TRUCK DRIVER = 1 × 36.84 = 36.84

797.54 × 870 = \$693,860

U/C. = \$0.278/cyd

EQUIPMENT: DOZER D-10 = 4 × 185 = 740
 DOZER D-8 = 2 × 162 = 324
 DOZER D-6 = 2 × 60 = 120
 48" LOADER = 3 × 67.80 = 203.40
 4x4 PICKUP = 2 × 20 = 40
 SERV. TRUCK = 1 × 25 = 25
 LIGHT PLANT = 6 × 4.50 = 27
 GRIZZLY = 3 × 3 = 9

1488.40 × 870 = 1,294,900

U/C = 0.518

0.130 25% FOR STANDBY.
\$0.648/cyd.

MATERIAL:

48" BELT = \$8,000
U/C = \$0.003/cyd

SUMMARY - SCREENING

LABOUR = 0.278

MATERIAL = 0.003

EQUIPMENT = 0.648

\$0.929/cyd 17

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ACRES

Calculations

SUBJECT

By HEK Date 82/2/19Project No. P5700

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Page 9 of 135. PROCESSING AGGREGATE

PLANT CAPACITY = 440 cyd/HR.

TOTAL PROCESSED = 3,000,000 cyd.

$$\text{TIME} = \frac{3,000,000}{400} = 7500 \text{ HR.}$$

LABOUR : PLANT SUP'T.	=	1	=
FOREMAN	=	3	=
OPERATOR	=	6	=
MECHANIC	=	3	=
ELECTRICIAN	=	3	=
HELPER	=	6	=
WELDER	=	3	=
HELPER	=	3	=
LOADER OP.	=	3	=
GEN. OP.	=	1	=
HELPER	=	1	=
PIPEFITTER	=	1	=
HELPER	=	1	=

$$1305.90 \times 7500 = \$9,794,250$$

MATERIAL : CONVEYOR	=	112,000
SCREEN DECKS	=	1,650,000
WELDING MAT'L	=	125,000
BELT REPL.	=	700,000
		<u>\$2,587,000</u>

ACRES

Calculations
SUBJECT

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PROCESSING - CONT'D

EQUIPMENT: TOTAL = \$ 2260 x 7500 HR
(SEE LIST BELOW) = \$16,950,000

- 100' - 48" BELT
- 90' - 36" "
- 100' - 30" BELT
- 100' - 42" - 3" SURGE
- 100' - 36" - 3" SEC.
- 150' - 30" - 3 + 1/2 STORAGE
- 150' - 24" - 1 1/2 + 3/4 STORAGE
- 90' - 24" CRUSHER RUN
- 100' - 30" - 3/4"
- 100' - 30" - 3/4"
- 100' - 24" - 3/4" + #4
- 80' - 24" - 3/4"
- 100' - 24" - #4
- 100' - 24" SAND TO BIN
- 100' - 18" BIN TO SCREEN
- RECLAIM - 1200' - 42"

SUBTOTAL = \$489

- 1 - FEEDER HOPPER
- 1 - PRIMARY CRUSHER
- 2 - 5x14 D.D. SC.
- 2 - 48" x 60" FEEDER
- 3 - 4-14 D.D. SC.
- 1 - SEC. ROLL CRUSHER
- 1 - 42" x 60" FEEDER
- 4 - 5x14' D.D. SC.
- 2 - 32' EAGLE CLASSIFIER
- 1 - 4' - 12 S.D. SC.
- 4 - 48" x 72" FEEDER
- 1 - DOZER D-6
- 2 - LOADER
- 1 - 600 KW GEN.

SUBTOTAL = \$1771 ⇒ TOTAL = \$2260/HR.

DIG



Calculations

SUBJECT

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Date _____

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PROCESSING - CONT'D

INSTALLATION & REMOVAL = \$1,700,000

SUMMARY - PROCESSING

	LABOUR	MATERIAL	EQUIPMENT	TOTAL
PROCESS	9,794,000	2,000,000	16,950,000	28,744,000
INSTALL & REMOVE	1,700,000			1,700,000
TOTAL	11,494,000	2,000,000	16,950,000	30,444,000
UNIT COST (VOL. = 3,000,000 cyd)	3.831	0.667	5.650	10.148

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Calculations

SUBJECT

By HEK Date 8/2/19

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6. HAUL TO STOCKPILE

DISTANCE = 2 MILES

COST = SAME AS 2. HAUL TO PLANT

SUMMARY:

LABOUR = 0.341

MATERIAL = -

EQUIPMENT = 0.900

\$1.241/cyd.

Rev	By	Checked

(D) Arch Dam Concrete
Fine Aggregate



Estimate Work Sheet

PROJECT SUSITNA. HYDRO ELECTRIC.
CONTRACT DEVIL CANYON.

ITEM REFERENCE No. MAIN ARCH DAM.

DESCRIPTION SUPPLY OF CONCRETE

OPERATION No. REF.

JOB No. P5700.

SHEET 1 OF 1.

BY P. J. S.

DESCRIPTION FINE AGGERGATE PRODUCTION. CKD DATE Feb 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM. MATERIALS		SUBCONTRACTS		EQPT. OWNERSHIP		EQPT. OPERATION		Equiv UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<u>SUPPLY OF FINE AGGERGATES.</u>																
(a) EXCAVATION @ BORROW AREA.			0.45		0.07		-	-	-	-	1.13		-	-	1.52	
(b) HAUL TO PLANT			0.34		-	-	-	-	-	-	0.90		-	-	1.24	
(c) CONSTRUCTION ROADS.			0.25		-	-	-	-	-	-	0.48		-	-	0.73	
(d) SCREENING PLANT.			0.28		0.07		-	-	-	-	0.65		-	-	0.93	
(e) PROCESSING PLANT.			0.84		0.15		-	-	-	-	1.25		-	-	2.09	
(f) HAUL TO STOCKPILES.			0.34		-	-	-	-	-	-	0.90		-	-	1.24	
TOTAL.	1,676,000	cycl.	2.51	4,206,760	0.15	251,400	-	-	-	-	5.30	8,882,800	-	-	7.96	13,340,960
			2.50		0.16						5.30				7.96	

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ACRES

Calculations

SUBJECT

DEVIL CANYONBy HEK. Date 82/2/19 Project No. P5700
Checked _____ Date _____ Calculation No. _____
Page 1 of 1FINE AGGREGATE PROCESSING

- SAME PRICE AS COARSE AGGREGATE,
EXCEPT THAT ONLY 22% REQUIRES
PROCESSING COST.

∴ TAKE 22% OF PROCESSING COST. *

SUMMARY OF UNIT PRICES

DESCRIPTION	LABOUR	MATERIAL	EQUIPMENT	TOTAL
EXCAVATION	0.451	0.007	1.131	1.589
HAUL TO PLANT	0.341	-	0.900	1.241
CONST. ROADS	0.252	-	0.479	0.731
SCREENING	0.278	0.003	0.648	0.929
<u>PROCESSING*</u>	0.843	0.147	1.243	2.233
HAUL TO STOCKPILE	0.341	-	0.900	1.241
TOTAL	2.506	0.157	5.301	7.964

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Calculations

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VOL OF FINE AGGREGATE - FOR DEVIL CANYON DAM.1. SUMMARY OF CONCRETE FOR DEVIL CANYON DAM.

MAIN DAM	=	1,676,000 cycl.
SPILLWAY	=	65,900 cycl.
INTAKE	=	49,600 cycl.
DIVERSION TUNNEL	=	20,700 cycl.
POWER HOUSE	=	38,200 cycl.
TUNNELS	=	5,075 cycl.
SHAFTS	=	7,650 cycl.
BUS. TUNNEL	=	1,950 cycl.
TRANSFORMER GALL	=	2,200 cycl.
CABLE SHAFTS	=	2,800 cycl.
SURGE CHAMBER	=	1,300 cycl.
PENSTOCKS	=	21,000 cycl.
T/R	=	27,700 cycl.
CONT.		10,000 cycl.
		<u>1,930,000</u>

2. FOR MAIN DAM - FINE AGGREGATE

$$\text{VOL OF CONCRETE} = 1,676,000.$$

$$\text{LOSSES @ PLANT} = \frac{167,000}{1,843,000 \text{ cycl}} - 10\%$$

$$\text{RATIO OF FINE} = 0.52 \text{ cycl. FOR EACH 1.00 cycl. OF CONCRETE.}$$

$$\therefore \text{FINE Vol} = 0.52 \times 1,843,000 = 958,672 \text{ cycl.}$$



Calculations
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$$\begin{aligned} \text{Vol @ Stockpile} &= 958,672 \times \frac{115}{100} \\ &= 1,102,473 \text{ cycl.} \end{aligned}$$

$$\begin{aligned} \text{(e) Vol TO BE HAULED} &= 1.10 \times 1,102,473 \\ &= \underline{1,212,720 \text{ cycl.}} \end{aligned}$$

$$\begin{aligned} \text{(d) Vol TO BE PROCESSED} &= \text{loss @ Stockpile} + \text{losses @ plant} \\ &= 10\% + 10\% \\ &= \frac{120\%}{2} \times 1,212,720 \\ &= \underline{1,455,264 \text{ cycl.}} \end{aligned}$$

$$\begin{aligned} \text{(c) Vol TO BE PROCESSED @ SCREENING PLANT} \\ &= 1.10 \times 1,455,264 \text{ cycl.} \\ &= \underline{1,600,790 \text{ cycl.}} \end{aligned}$$

$$\begin{aligned} \text{(b) Vol TO BE EXCAVATED} &= 1,600,790 \times 1.10 \\ &= \underline{1,760,869} \end{aligned}$$

$$\begin{aligned} \text{(a) Haul TO PLANT} &= 1.05 \times 1,760,869 \\ &= \underline{1,848,913 \text{ cycl.}} \end{aligned}$$

D23

ACRES

Calculations

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SUMMARY SHEET - FINE

Ⓐ EXCAVATION	= 1,848,000 × 1.59	= 2,938,320
Ⓑ HAUL	= 1,760,869 × 1.24	= 2,183,478
Ⓒ SCREENING	= 1,600,000 × 0.93	= 1,488,000
Ⓓ PROCESSING	= 1,455,264 × 2.233	= 3,249,605
Ⓔ HAUL	= 1,212,720 × 1.24	= 1,503,773

$$\text{CONST. ROAD} = 1,760,869 \times 0.73 = 1,285,454$$

$$\underline{\$ 12,648,682 \div 1,676,000}$$

$$\text{AVE RATE} = \frac{\$}{7.55}$$

$$\text{cont 5\%} = 0.38$$

$$\text{AVE PRICE - FINE} = \frac{\$}{7.93}$$

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(D) Arch Dam Concrete
Cement

D25



Estimate Work Sheet

PROJECT SUSITNA. HYDRO ELECTRIC.
CONTRACT DEVIL CANYON.

ITEM REFERENCE No. Supply of concrete
DESCRIPTION Cement for concrete.
OPERATION No. REF.
DESCRIPTION MAIN ARCH DAM

JOB No. P5700.
SHEET 1 OF 1
BY P.J.S.
CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM. MATERIALS		SUBCONTRACTS		EQPT. OWNERSHIP		EQPT. OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
<u>CEMENT FOR CONCRETE</u>																
(a) MOB/DEMOL/TRANSPORTATION	-	-	7 ¹	69,400		19,200	-	-		345,600		34,100	-	-		468,300
(b) SITE PREPARATION.	-	-	9	90,500		43,500	-	-	-	-		53,000	-	-		187,000
(c) ERECTION & INSTALLATION.	-	-	8	80,700		20,000	-	-	-	-		28,900	-	-		129,600
(d) TEST & COMMISSION.	-	-	5	53,600		40,000	-	-	-	-		11,200	-	-		104,800
(e) OPERATION OF PLANT.	-	-	4 ¹	407,300		32,000	-	-	-	-		83,200	-	-		522,500
(f) DISMANTLE @ SITE	-	-	8	80,700		20,000	-	-	-	-		28,900	-	-		129,600
(g) FOUNDATION & SERVICES.	-	-	9	90,500		43,500	-	-	-	-		53,000	-	-		187,000
(h) TOWER. - STAND-RY.	-	-	6	61,600		39,400	-	-	-	-		214,000	-	-		315,000
(i) GENERAL CLEAN-UP.	-	-	3	27,600		19,700	-	-	-	-		23,900	-	-		71,200
(j) MISCELLANEOUS.	-	-	3	25,000		25,000	-	-	-	-		30,000	-	-		80,000
(k) supply of Silo	-	-		-		-	-	-	-	-		1,295,000	-	-		1,295,000
(l) supply of CEMENT.	-	-		-		59,196,000	-	-	-	-		-	-	-		59,196,000
TOTAL.	1,676,000	Cycl.	0 ⁵⁹	986,900	35 ⁵⁰	59,498,300			0 ²¹	345,600	1 ¹⁰	1,855,200	-	-	37 ⁴⁰	62,686,000

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Calculations

SUBJECT

DEVIL CANYON

CEMENT FOR CONCRETE - 70 SILOS

By P. SINGH Date 82/2/2 Project No. P5700

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@ TRANSPORTATION TO SITE

NO. OF SILOS = 70

WEIGHT/SILO = 6.75 TONS.

TOTAL WEIGHT = 6.75 x 70

= 540 TONS

= 1,080,000 lbs.

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A. BY LAND IN LOWER 48

(i) LOADING @ RAIL SPUR

TIME = 64 HR.

LABOUR: FOREMAN =

= 33.23

3-IRONWORKER =

= 112.23

OPERATOR =

= 35.10

180.56 x 64 HR. = \$11,556

MATERIAL: LUMBER = 800

CHAIN = 800

MISC. = 800

\$2,400

EQUIPMENT: CRANE 50^T =

= 65

FLATBED =

= 12

TRUCK =

= 10

MISC. =

= 2

89.00 x 64 = \$5,696

(ii) TRANSPORT

RATE = \$0.03/lb

COST = 0.03 x 1,080,000 lbs.

= \$32,400



Calculations

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By P. SINGH Date 82/2/2

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TRANSPORTATION - CONT'D

A. (iii) UNLOADING & LOADING TO SHIP

SAME CREW AS A.(i) ; TIME = 32 HR.

LABOUR = 5,778

MATERIAL = 2,400

EQUIPMENT = 2,848

11,026

A. SUMMARY :

LABOUR	=	17,334	x 2 WAYS	=	34,700
MATERIAL	=	4,800		=	9,600
EQUIPMENT	=	8,544		=	17,100
SUB-CONTRACT	=	32,400		=	64,800
					<u>\$126,200</u>

B. BY SEA TO ALASKA

(i) TRANSPORT : RATE = \$0.09 / lb

COST = 0.09 x 1,080,000
= \$ 97,200

(ii) UNLOADING @ ANCHORAGE :

SAME AS A.(iii)

LABOUR = 5,800

MATERIAL = 2,400

EQUIPMENT = 2,800

\$11,000

B. SUMMARY :

LABOUR	=	5,800	x 2	=	11,600
MATERIAL	=	2,400		=	4,800
EQUIPMENT	=	2,800		=	5,600
SUB-CONTRACT	=	97,200		=	194,400
					<u>108,200 x 2 WAYS = \$216,400</u>



Calculations

SUBJECT

By P. SINGH Date 82/2/2

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TRANSPORTATION - CONT'D

C. BY LAND TO SITE (IN ALASKA)

(i) LOADING:

SAME AS A(i)

LABOUR = 11,556

MATERIAL = 2,400

EQUIPMENT = 5,696

19,652

(ii) TRANSPORT:

RATE = \$0.04 / lb

COST = $0.04 \times 1,080,000$
= \$43,200

C. SUMMARY:

LABOUR = 11,556 x 2 = 23,100

MATERIAL = 2,400 = 4,800

EQUIPMENT = 5,696 = 11,400

SUB-CONTRACT = 43,200 = 86,400

62,852 x 2 = \$125,700

ACRES**Calculations**

SUBJECT

D29
By P. SINGH Date 82/2/2 Project No. P5700
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⑥ SITE PREPARATION

- CLEARING, FOUNDATIONS, ETC.

TIME = 240 HR.

LABOUR : FOREMAN = 40.35
LABOURER = 122.16
IRONWORKER = 74.82
CARPENTER = 69.02
OPERATOR = 35.10
DRIVER = 35.58
377.03 x 240 HR = \$90,487

MATERIAL : TIMBER (FORMS) = 8,000
REBARS = 16,000
A-BOLTS = 3,500
CONCRETE = 16,000
\$43,500

EQUIPMENT : BACKHOE = 53
F.E.L. = 30
DOZER = 85
READY MIX TRUCK = 25
SMALL TOOLS = 12
PICKUP = 16
221.00 x 240 = \$53,040

SUMMARY :

LABOUR = 90,500
MATERIAL = 43,500
EQUIPMENT = 53,000
\$187,000



Calculations

SUBJECT

By P. SINGH Date 82/2/2
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© ERECTION & INSTALLATION OF SILOS

$$\text{TIME} = 4 \text{ HR/SILO} \times 70 = 280 \text{ HR.}$$

LABOUR : FOREMAN = 40.35
 IRONWORKER = 149.64
 OPERATOR = 36.96
 LABOURER = 61.14

$$288.09 \times 280 \text{ HR} = \$80,665$$

MATERIAL : TEMP. BRACING = 16,000
 WIRE ROPE = 2,000
 GROUTING = 1,000
 MISC. = 1,000
 20,000

EQUIPMENT : CRANE 50^T = 70
 COMPRESSOR (350) = 18
 AIR TOOLS/HOSE = 5
 MISC. = 10

$$103.00 \times 280 = \$28,840$$

SUMMARY :

LABOUR = 80,700
MATERIAL = 20,000
EQUIPMENT = 28,900
 \$129,600



Calculations

SUBJECT

DBI
By P. SINGH Date 82/2/2 Project No. P5700
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① TEST & COMMISSION SILOS

TIME = 160 HRS.

LABOUR: FOREMAN = 43.03
2 PIPEFITTER = 74.48
1 ELECTRICIAN = 80.46
MECHANIC = 39.17
OPERATOR = 36.93
1 LABOURER = 61.08

$$335.15 \times 160 = \$53,624$$

MATERIAL: CONSUMMABLE = 8,000
BLOCK, ETC. = 16,000
MISC. = 16,000
\$40,000

EQUIPMENT: WORKING PLATFORM = 8
PICKUP = 32
WELDER = 6.65
GAS CUTTING TORCHES = 10
SMALL TOOLS = 8
MISC. = 5

$$69.65 \times 160 = \$11,144$$

SUMMARY:

LABOUR = 53,600
MATERIAL = 40,000
EQUIPMENT = 11,200
\$104,800



Calculations

SUBJECT

By P. SINGH Date 82/2/2

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② OPERATION OF SILOS

TIME = LOADING & SERVICE CALLS
= 50 HR./WK X 208 WK.
= 10,400 HRS.

LABOUR: MECHANIC = 1 No. X 39.17 X 10,400 HR. = \$407,368

MATERIAL: PAINT = 8000
GREASE/OIL/LUBE = 8000
CONSUMMABLE = 8000
MISC. = 8000
32,000

EQUIPMENT: SMALL TOOLS = 4.00
MISC. = 4.00
8.00 X 10,400 = \$83,200

SUMMARY:

LABOUR = 407,300
MATERIAL = 32,000
EQUIPMENT = 83,200
\$522,500

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Calculations

SUBJECT

D33

By P. SINGH Date 82/2/2

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④ DISMANTLE @ SITE

SAME AS ③ ERECTION & INSTALLATION

LABOUR = 80,700
MATERIAL = 20,000
EQUIPMENT = 28,900
\$ 129,600

⑨ SITE CLEARING & LEVELLING

SAME AS ⑥ SITE PREPARATION

LABOUR = 90,500
MATERIAL = 43,500
EQUIPMENT = 53,000
\$ 187,000



Calculations

SUBJECT

By P. SINGH Date 82/2/2

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(h) POWER

(i) TRANSMISSION LINE (DISTANCE = 2000 FT)

TIME = 100 HR.

LABOUR: FOREMAN = 43.03

OPERATOR = 140.40

MECHANIC = 70.20

LABOURER = 61.08

ELECTRICIAN = 201.15

$515.86 \times 100 \text{ HR.} = \$51,586$

MATERIAL: POLES, CROSS BARS, ETC. = 6,000

WIRE ROPE & STAY = 6,000

CONDUCTOR = 6,000

BREAKER & SWITCHES = 5,400

MISC. = 6,000

\$29,400

EQUIPMENT: CABLE REEL TRUCK = 30

POWER WINCHES = 60

DOZER = 81

PICKUP 4x4 = 50

TRUCK AUGER = 65

MOBILE HOIST = 40

CRANE 20T = 60

COMPRESSOR (350) = 30

DRILL & HOSES = 20

MISC. = 2

SMALL TOOLS = 2

$440.00 \times 100 = \$44,000$

SUMMARY: LABOUR = 51,600 41%

MATERIAL = 29,400 24%

EQUIPMENT = 44,000 35%

\$125,000

40

AGRES

Calculations

SUBJECT

By P. SINGH Date 82/2/2

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POWER - CONT'D

(ii) STAND-BY GENERATOR (100 KW DIESEL)

IDLING TIME = 3 HR/WK.

TIME TO SUPPLY POWER = 6 HR/WK.

OPERATING TIME = 9 HR./WK. X 208 WK.
= 1875 HR.

SUMMARY:

LABOUR = 40

EQUIPMENT = 20

MATERIAL = 10

SUB-CONTRACT = 10

80.00 x 1875 HRS. = \$150,000

(iii) MISCELLANEOUS

- REPAIR/SERVICE BY MANUFACTURER

SUB-CONTRACT = \$40,000

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Calculations

SUBJECT

D36

By P. SINGH Date 82/2/2

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i) GENERAL CLEAN-UP

TIME = 80 HR.

LABOUR : FOREMAN = 38.06
 OPERATOR = 184.80
 LABOURER = 122.16
 345.02 x 80 HR. = \$27,600

MATERIAL : CONSUMMABLE = 10,000
 OTHER = 9,700
 \$19,700

EQUIPMENT : DOZER = 155
 F.E.L. = 30
 BACKHOE = 53
 PICKUP = 16
 GRADER = 45
 299.00 x 80 = \$23,920

SUMMARY :

LABOUR = 27,600
MATERIAL = 19,700
EQUIPMENT = 23,900
 \$71,200

i) MISCELLANEOUS

PROVISIONAL SUM = \$80,000



Calculations

SUBJECT

By P. SINGH Date 82/2/2 Project No. P 5700
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(K) PURCHASE OF SILOS.

CAPACITY OF SILO = 75 TON

PRICE = \$21,880 CANADIAN - INCLUDING ALL ACCESSORIES
AND FILLING EQUIPMENT
= \$18,233 U.S. (\$1 U.S. = \$1.20 CAN.)

SAY \$18,500/SILO

No. OF SILOS = 70

COST = 18,500 × 70

= \$1,295,000

AGRES

Calculations

SUBJECT

By P. SINGH Date 82/2/2

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① SUPPLY OF CEMENT

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SUPPLY PRICE RECEIVED BY D.H. MACDONALD
ON FEB. 2 / 82 :

F.A.S. ANCHORAGE	=	130.00
ANCHORAGE TO GOLD CREEK	=	20.60
GOLD CREEK TO SITE	=	16.00
LOADING TRUCK	=	10.00
		<u>\$176.60 / TON</u>

TOTAL CEMENT REQ'D = 335,200 TONS. (@ 400 lbs/cyd)

SUPPLY COST = \$176.60 x 335,200

= \$59,196,000



Calculations

SUBJECT

DEVIL CANYON

CEMENT FOR CONCRETE - SUMMARY

By P. SINGH

Date 82/2/2

Project No. P5700

Checked _____

Date _____

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PLANT = 70 SILOS
STORAGE CAPACITY = 5250 TONS.

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COST SUMMARY

ITEM	COST	ITEM	COST
a) TRANSPORTATION (2-WAY)		SUBTOTAL (B/F)	2,195,000
A. BY LAND (LOWER 48)	126,200	k) PURCHASE OF SILOS	1,295,000
B. BY SEA TO ALASKA	216,400		
C. BY LAND TO SITE	125,700	COST OF PLANT	3,490,000
b) SITE PREPARATION	187,000	l) SUPPLY OF CEMENT	59,196,000
c) ERECTION & INSTALLATION	129,600		
d) TEST & COMMISSION	104,800	TOTAL COST	62,686,000
e) OPERATION OF SILOS	522,500		
f) DISMANTLE @ SITE	129,600		
g) SITE CLEARING & LEVELLING	187,000		
h) POWER			
(i) TRANSMISSION LINE	125,000		
(ii) STAND-BY GENERATOR	150,000		
(iii) MISC.	40,000		
i) GENERAL CLEAN-UP	71,200		
j) MISCELLANEOUS	80,000		
SUBTOTAL	2,195,000		

TOTAL CONCRETE = 1,676,000 cyd.

UNIT COST = \$37.40/cyd

45

(D) Arch Dam Concrete
Ice Plant



Estimate Work Sheet

ITEM REFERENCE No. SUPPLY CONCRETE.JOB No. P5700DESCRIPTION CRUSHED ICE PLANT.SHEET 4 OF 8.PROJECT SUSITNA. HYDRO ELECTIC.

OPERATION No. REF.

BY P.J.S.CONTRACT DEVIL CANYON.DESCRIPTION MAIN AREA. DAM.

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM. MATERIALS		SUBCONTRACTS		EQPT. OWNERSHIP		EQPT. OPERATION		EQUIV UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<u>CRUSHED ICE PLANT.</u>																
<u>A. SUPPORT SERVICES.</u>	400,000	TON.		346,476		80,000		-		-		278,400		-		704,876
- MOBILIZATION.																
- LOADING & HANDLING																
- UNLOADING & HANDLING																
- ASSEMBLE & ERECT.																
- TEST & COMMISSIONING.																
- WINTER SHUT DOWN.																
- DISMANTLE & REMOVE.																
- WISE.																
<u>B. OPERATION OF ICE PLANT.</u>	400,000	TON		1,204,774		350,000		-		-		1,935,000		-		3,489,774
<u>C. GENERAL SERVICES.</u>																
- HANDLING.	400,000	TON		307,000		25,000		-		-		305,300		-		727,300
- CRUSHING.	400,000	TON		365,000		20,000		-		-		365,200		-		750,200
- STORAGE.	400,000	TON.		397,664		20,000		-		-		397,664		-		815,325
<u>TOTAL - ICE</u>	400,000	TON.	⁷⁸ 6	2,770,914	²⁹ 1	495,000		-		-	²⁰ 8	3,281,564		-		6,487,478
	1,676,000	cycl.	⁶² 1	-	³⁰ 0	-		-		-	⁹⁶ 1	-		-	⁸⁷ 3	

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Calculations

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By _____ Date _____ Project No. _____
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© HANDLING, CRUSHING & STORAGE

(iii) LABOUR - STORAGE

FORMAN. = $\frac{1}{3}$ NO. = 14.35
 LABOUR = 2 NO = 61.08
 OPERATOR = $\frac{1}{2}$ NO. = 17.05

 92.48 x 4300 = \$ 397,664

EQUIPMENT - STORAGE

TRUCK = 20.00
 FORK LIFT = 20.00
 MISC. TOOLS = 1.00
 MISC. = 1.00

 42.00 x 4300 Hrs = \$ 180,600

MATERIALS - STORAGE

- Blkg. = 5,000.
 - CONSUMABLE = 5,000.
 - WARE & MISC. = 5,000.
 - OTHER = 5,000.

 \$ 20,000.

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ACRES

Calculations

SUBJECT

CRUSHED ICE PLANT FOR CONCRETE PRODUCTION

By P. J. S. Date _____

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ASSUMPTIONS.

FOR MAIN THE ICE PLANT

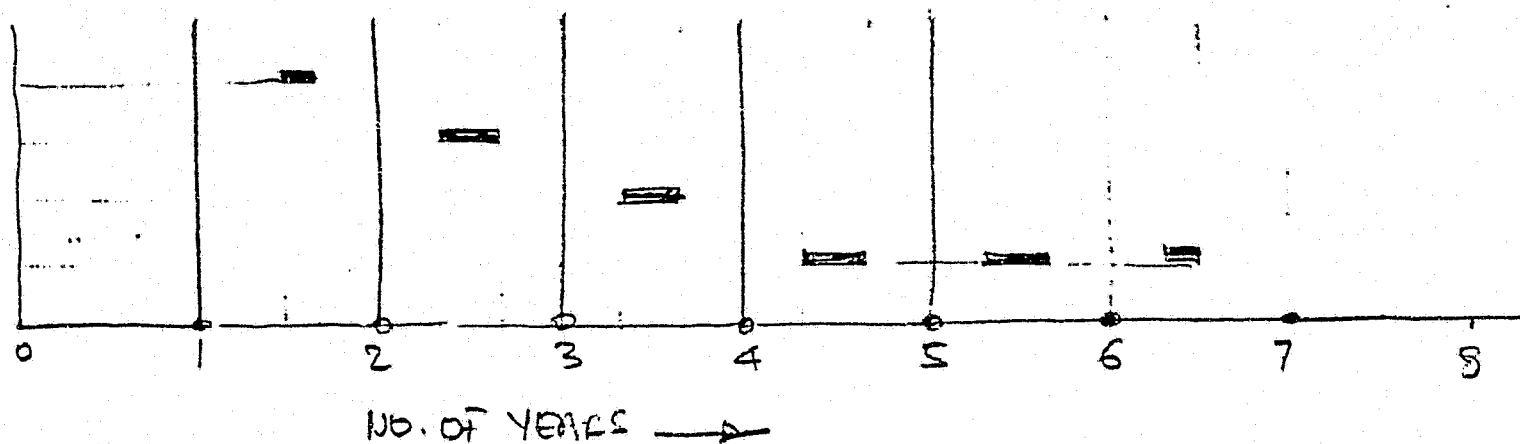
WORKING TIME = 9 HR/DAY.

NO. OF DAY PER WK = 6.

NO. OF MONTH PER YR = 4.

NO. OF YEAR = 4.

$$\text{OPERATING TIME} = 9 \times 6 \times 4 \times 4 = 432 \text{ HRS.}$$



WATER REQUIRED PER CYCL = 30 gallons.

RATE CAPACITY OF CONC. PLANT = 250 CYCL/HR.

OPERATING TIME = 9 HR/DAY.

$$\begin{aligned} \text{DAILY WATER REQUIREMENT} &= 30 \times 9 \times 250 \\ &= 67,500 \text{ gal.} \end{aligned}$$

ASSUME THE WATER REPLACED BY ICE.

ICE REQUIREMENT = 68,000 gallon of WATER.

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ACRES

Calculations

SUBJECT

CRUSHED ICE PLANT

By _____ Date _____ Project No _____

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WT. OF WATER = 65 lb/cu ft.
USE 10 lb/GALON.

$$\text{TOTAL WT. OF ICE} = \frac{68.000}{2.000} \times 10 = \frac{680 \text{ TONS.}}{\text{OF ICE}}$$

$$\text{PLANT CAPACITY} = \frac{680}{9} = 76 \text{ TONS/HR.}$$

$$\text{RATE CAPACITY} = 100 \text{ Ton/HR.}$$

A. BREAKDOWN OF TIME FOR SUPPORT CREW.

- MOBILIZATION	=	54
- LOADING & HANDLING	=	30
- UNLOADING & HANDLING	=	24
- ASSEMBLE & ERECTION	=	54
- TESTING & COMMISSIONING	=	54 x 4 x 2 = 432
- WINTER SHUT DOWN	=	= 432
- REMOVAL	=	54
- WISE	=	54
		<u>1180 ~ 1200 Hrs</u>

SUPPORT CREW.

FORMAN	=	43.02
OPERATOR - CRANE	=	35.10
OPERATOR - PLANT	=	35.10
MECHANIC	=	70.20
ELECT.	=	40.23
CARPENTER	=	34.51
LABOUR	=	30.54
		<u>\$ 288.89 x 1200</u>
		<u>\$ 346,476</u>

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ACRES

Calculations

SUBJECT

By _____ Date _____

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Support Equipment

CRANE.	=	65 ⁰⁰
Pickup	=	20 ⁰⁰
Air comp.	=	27 ⁰⁰
AIR TOOLS.	=	10 ⁰⁰
BOOM TRUCK	=	30 ⁰⁰
WELDER.	=	20 ⁰⁰
Cutting Equip	=	15 ⁰⁰
PIPE BENCH.	=	20 ⁰⁰
MILLING TOOLS.	=	20 ⁰⁰
Misc	=	5 ⁰⁰
=		232 ⁰⁰ X 1200 Hr = \$278,400

MATERIALS.

PIPES & FITTING.	=	20,000.
PLUMBING CONSUMABLE	=	10,000
LUMBER & Poly Film	=	10,000.
CONSUMABLE FOR PLANT.	=	30,000
Misc	=	10,000
=		\$80,000.

(A) Support crew.

LABOUR	=	346,476
Equip	=	278,400.
MATERIAL	=	80,000.
		<u>\$704,876.</u>

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Calculations

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② OPERATION OF ICE PLANT.

TOTAL WORKING HOURS = 4300.

LABOUR.

FORMAN.	=	43.03
MECHANIC.	=	35.10
ELECT.	=	40.23
OPERATOR	=	35.10
OWNER.	=	35.10
LABOUR	=	91.62
		\$ 280.18 x 4300 = \$ 1,204,774

EQUIPMENT.

Pickup	=	16 ⁰⁰
ICE PLANT	=	130 ⁰⁰
FORK LIFT.	=	30 ⁰⁰
PUMPS.	=	124 ⁰⁰
COMPRESSOR	=	140 ⁰⁰
SMALL TOOLS	=	10 ⁰⁰
		450 ⁰⁰ x 4300 = \$ 1,935,000.

MATERIALS

CONSUMABLE	=	100,000
GASES.	=	200,000
MISC	=	50,000
		\$ 350,000.

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Calculations

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C) HANDLING, CRUSHING & STORAGEi) LABOUR - HANDLING.

$$\text{FORMAN} = \frac{1}{3} = 14.35$$

$$\text{LABOUR} = 2 \text{ NO.} = 61.08$$

$$\text{DEWIER} = \frac{1}{2} \text{ NO} = 17.00$$

$$\text{OPERATOR} = 1 \text{ NO} = -$$

$$= 92.43 \times 4300 = \$ 397,449$$

EQUIPMENT - HANDLING

$$\text{Pickup} = 16.00$$

$$\text{FORK LIFT.} = 20.00$$

$$\text{Hopper - \& BELT.} = 5.00$$

$$\text{WT. Equip} = 5.00$$

$$\text{TRUCK} = 20.00$$

$$\text{Misc} = 5.00$$

$$71.00 \times 4300 \text{ HZ} = \$ 305,300$$

MATERIAL - HANDLING

$$\text{CONSUMABLE} = 10,000$$

$$\text{LUMBER.} = 5,000$$

$$\text{FELT \& BURLAP.} = 5,000$$

$$\text{Misc} = 5,000$$

$$\$ 25,000.00$$

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Calculations

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(c) HANDLING, CRUSHING & STORAGE

(i) LABOUR - CRUSHING.

FORMAN.	= $\frac{1}{2}$ NO.	= 14.35
LABOUR	= 1 NO.	= 30.54
DRIVER	= -	= -
OPERATOR	= 1 NO	= 35.10
		<u>\$</u>
		= 79.99 x 4300 = 343,957

EQUIPMENT - CRUSHING.

CRUSHING PLANT	=	35 ⁰⁰
SCREENING PLANT.	=	25 ⁰⁰
CONVEYOR BELT.	=	15 ⁰⁰
WT. SCALE	=	5 ⁰⁰
MISC	=	5 ⁰⁰
		<u>85 x 4300 Hrs = \$ 365,500.</u>

MATERIAL - CRUSHING.

CONSUMABLE	=	5 000
WIMBER.	=	5 000
FELT & REWRAP.	=	5 000
MISC	=	5 000
		<u>\$ 20,000</u>

(D) Arch Dam Concrete
Concrete Production



Estimate Work Sheet

ITEM REFERENCE No.

JOB No. P 5700

DESCRIPTION CONCRETE PRODUCTION

SHEET 1 OF 1

PROJECT SUSITNA HYDROELECTRIC

OPERATION No.

REF.

BY HEK.

CONTRACT DEVIL CANYON

DESCRIPTION MAIN ARCH DAM

CKD

DATE FEB. 22/82.

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM. MATERIALS		SUBCONTRACTS		EQPT. OWNERSHIP		EQPT. OPERATION		EQUIV UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
CONCRETE PRODUCTION																
(a) MOBILIZATION @ YARD				5,900		2,500		-		-		1,700		-		10,100
(b) HANDLING @ YARD				12,200		3,500		-		-		12,700		-		28,400
(c) TRANSPORTATION (2-WAY TRIP)				-		-		-		-		-		-		-
(i) BY LAND IN LOWER 48				4,200		4,000		-		18,000		4,800		-		31,000
(ii) BY SEA TO ALASKA				-		-		-		60,000		-		-		60,000
(iii) BY LAND TO SITE				8,400		1,000		-		18,000		7,000		-		34,400
(d) SITE PREPARATION				6,000		1,000		-		-		4,500		-		11,500
(e) FOUNDATION & SERVICES				68,100		11,300		-		-		50,600		-		130,000
(f) ASSEMBLE & DISASSEMBLE PLANT				71,400		14,000		-		-		29,600		-		115,000
(g) ERECTION & REMOVAL OF PLANT				57,000		6,000		-		-		35,200		-		98,200
(h) TEST & COMMISSION PLANT				55,300		7,600		-		-		34,400		-		97,300
(i) WINTERIZATION OF PLANT				60,200		200,000		-		-		23,800		-		284,000
(j) OPERATION OF PLANT				3,230,700		247,700		-		-		316,000		-		3,794,400
(k) HEATING WATER & AGGREGATE				-		-		-		1,804,000		-		-		1,804,000
(l) SERVICE & MAINTENANCE				136,900		42,000		-		-		48,800		-		227,700
(m) READY MIX TRUCKS				1,685,700		-		-		-		1,060,700		-		2,746,400
(n) POWER				-		-		-		-		-		-		-
(i) TRANSMISSION LINE				16,000		10,000		-		-		14,000		-		40,000
(ii) STAND-BY GENERATOR				3,500		6,000		-		-		53,800		-		63,300
(iii) MISC.				-		-		-		20,000		-		-		20,000
(o) DEMOBILIZATION				9,000		4,000		-		-		5,000		-		18,000
(p) CONCRETE LAB				40,000		60,000		-		-		100,000		-		200,000
(q) GENERAL CLEAN-UP				40,000		10,000		-		-		50,000		-		100,000
(r) MISC.				80,000		20,000		-		-		100,000		-		200,000
(s) DEMOBILIZATION @ YARD				7,000		3,500		-		-		2,500		-		13,000
(t) AGG. HANDLING EQUIPMENT				-		-		-		-		350,000		-		350,000
(u) SUPPLY OF PLANT				-		-		-		-		550,000		-		550,000
TOTAL	1,676,000	C.Y.	3 ³⁴	5,597,500	3 ²⁹	654,100	-	-	1 ¹⁵	1,920,000	1 ⁷⁰	2,855,100	-	-	6 ⁵⁸	11,026,700

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Calculations

SUBJECT
DEVIL CANYON
CONCRETE PRODUCTION

By HEK Date 82/2/22
Checked _____ Date _____

Project No. P5700.09
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CAPACITY = 250 cyd/HR.

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COST SUMMARY

ITEM	COST	ITEM	COST
a) MOBILIZATION @ YARD	10,100	m) READY MIX TRUCKS	2,746,400
b) HANDLING @ YARD	28,400	n) POWER	
c) TRANSPORTATION (2-WAY)		- TRANSMISSION LINE	40,000
- BY LAND (LOWER 48)	31,000	- STAND-BY GENERATOR	63,300
- BY SEA	60,000	- MISC.	20,000
- BY LAND (ALASKA)	39,400	o) DEMOBILIZATION	18,000
d) SITE PREPARATION	11,500	p) CONCRETE LAB	200,000
e) FOUNDATION & SERVICES	130,000	q) GENERAL CLEAN-UP	100,000
f) ASSEMBLE & DISASSEMBLE PLANT @ SITE	115,000	r) MISC.	200,000
g) ERECTION & REMOVAL OF PLANT.	98,200	s) DEMOBILIZATION @ YARD	13,000
h) TESTING & COMMISSIONING	97,300	t) AGG. HANDLING EQUIP.	350,000
i) WINTERIZATION OF PLANT	284,000	u) SUPPLY OF PLANT	550,000
j) OPERATION OF PLANT	3,799,400	PLANT TOTAL \$11,026,700	
k) HEATING AGGREGATE & WATER	1,804,000	TOTAL CONCRETE = 1,676,000 cyd.	
l) SERVICE & MAINTENANCE	227,700	UNIT COST = \$6. ⁵⁸ /cyd	
C.F.	6,726,000		

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ACRES

Calculations

SUBJECT
DEVIL CANYON
CONCRETE PRODUCTION

By P. SINGH Date 82/2/15 Project No. P5700

Checked _____ Date _____ Calculation No. _____

Page 1 of 18② MOBILIZATION @ CONTRACTOR'S YARD

TIME = 20 HR.

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LABOUR:

1	FOREMAN	=	36.21
2	OPERATOR	=	70.20
4	LABOURER	=	122.16
1	MECHANIC	=	35.10
1	OTHER	=	30.00
293.67 x 20HR = \$5873			

MATERIAL:

TIMBER	=	500
PACKING MAT'L	=	1000
ROPE & CHAIN	=	200
MISC.	=	800
\$2,500		

EQUIPMENT:

1	PICKUP	=	16
1	CRANE 15 ^T	=	35
1	BOOM TRUCK	=	20
	SMALL TOOLS	=	10
	MISC.	=	5
86. x 20 HR. = \$1720			

SUMMARY

LABOUR	=	5900
MATERIAL	=	2500
EQUIPMENT	=	1700
\$10,100		



Calculations

SUBJECT
DEVIL CANYON

By P. SINGH Date 82/2/15
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⑥ HANDLING @ CONTRACTOR'S YARD - LOADING TRUCKS

TIME = 40 HRS.

LABOUR: 1 FOREMAN = 38.06
2 OPERATOR = 73.92
1 MECHANIC = 35.10
4 LABOURER = 122.16
1 DRIVER = 35.58
304.82 x 40 HR. = \$12,193

MATERIAL: CHAIN/SLING = 500
ROPE/BLOCKS = 1500
MISC. = 1500
\$3500

EQUIPMENT: PICKUP = 16
CRANE 15^T. = 35
CRANE 50^T = 175
TRACTOR-TRAILER = 81
SMALL TOOLS = 5
MISC. = 5
317.00 x 40 HR. = \$12,680

SUMMARY

1 LABOUR = 12,200
MATERIAL = 3,500
EQUIPMENT = 12,700
\$28,400

ACRES

Calculations

SUBJECT

By P. SINGH Date 82/2/15

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© TRANSPORTATION TO SITE & BACK

(i) BY LAND IN LOWER 48

LOADING TIME = 8 HR.

LABOUR :	1	FOREMAN	=	38.06
	4	LABOURER	=	122.16
	1	OPERATOR	=	36.96
	1	DRIVER	=	35.58
	1	MECHANIC	=	35.10
				<u>267.86</u>
				$\times 8 \text{ HR.} = \$2143$

MATERIAL: L.S. = \$2000

<u>EQUIPMENT:</u>	CRANE 50 ^T	=	175
	TRACTOR-TRAILER	=	81
	PICKUP	=	16
	FLAT BED	=	20
	SMALL DOLS	=	5
	MISC.	=	5
<u>302.00</u>			
$\times 8 \text{ HR.} = \$2416$			

SUB-CONTRACT : - TRANSPORT

RATE = \$0.03/1b

WEIGHT = 300,000 lbs. (ASSUMED)

COST = $0.03 \times 300,000$
= \$9,000

SUMMARY :

LABOUR	=	2100	$\times 2$	=	4,200
MATERIAL	=	2000		=	4,000
EQUIPMENT	=	2400		=	4,800
SUB-CONTRACT	=	9000		=	18,000
					<u>15,500</u>
					$\times 2 = \$31,000$

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ACRES**Calculations**

SUBJECT

DSS

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TRANSPORTATION - CONT'D(ii) BY SEA TO ALASKA

- INCLUDES LOADING & UNLOADING.

SUB-CONTRACT :

RATE = \$ 0.10 / lb.

WEIGHT = 300,000 lbs.

COST = 0.1 x 300,000

= \$ 30,000

= \$ 60,000

1 - WAY

2 - WAY.

(iii) BY LAND TO SITE

LOADING & UNLOADING TIME = 16 HR.

LABOUR : 1 FOREMAN = 38.06
1 MECHANIC = 35.10
1 OPERATOR = 36.96
5 LABOURER = 152.70

262.82 x 16HR. = \$ 4205MATERIAL : L.S. = \$ 500

EQUIPMENT : CRANE SD^T = 175
PICKUP = 16
FLAT BED = 20
MISC. = 5

216.00 x 16 HR. = \$ 3456SUB-CONTRACT

- HAULAGE

RATE = \$ 0.03 / lb

COST = 0.03 x 300,000
= \$ 9,000

SUMMARY (FOR 2-WAY TRIP):

LABOUR = 8,400
MATERIAL = 1,000
EQUIPMENT = 7,000
SUB-CONTRACT = 18,000

\$ 34,400 63

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Calculations

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By P. SINGH Date 82/2/15 Project No. P5700
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① SITE PREPARATION

TIME = 20 HR.

LABOUR: 1 FOREMAN = 36.21
1 MECHANIC = 35.10
3 OPERATOR = 105.30
4 LABOURER = 122.16
298.77 x 20 HR. = \$5975

MATERIAL:
TIMBER = 200
PIPE (C.S.P.) = 200
DRILL STEEL = 200
HOSE / NOZZLE = 200
MISC. = 200
\$1000

EQUIPMENT:
DOZER D-7 = 85
F.E.L. 3 C.Y. = 30
PICKUP = 16
AIR TRACK = 22.50
COMPRESSOR (350) = 18
DUMP TRUCK = 40
SMALL TOOLS = 5
222.50 x 20 HR. = \$4450

SUMMARY:
LABOUR = 6,000
MATERIAL = 1,000
EQUIPMENT = 4,500
\$11,500

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Calculations

SUBJECT

By P. SINGH Date 82/2/15Project No. P5700

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Page 6 of 18② FOUNDATION & SERVICES

- EXCAVATION, CONCRETE, SERVICES, ETC.

TIME = 216 HR.

<u>LABOUR</u> :	1	FOREMAN	=	= 40.35
	2	CARPENTER	=	= 69.02
	2	IRONWORKER	=	= 74.82
	2	LABOURER	=	= 61.08
	2	OPERATOR	=	= 70.20

315.47 x 216 HR. = \$68,142

<u>MATERIAL</u> :	A-BOLTS	=	1000
	CONCRETE	=	4000
	REBAR	=	2,000
	FORMS	=	3,000
	BRACING	=	1,000
	MISC.	=	300
			<u>\$11,300</u>

<u>EQUIPMENT</u> :	DOZER D-7	=	85
	BACKHOE 1½ CY.	=	53
	F.E.L. 3 CY.	=	30
	PICKUP	=	16
	BOOM TRUCK	=	20
	COMPRESSOR (365)	=	18
	WATER PUMP	=	5.15
	HOSE & NOZZLES	=	2
	SMALL TOOLS	=	5

234.15 x 216 HR. = \$50,576

<u>SUMMARY</u> :	LABOUR	=	68,100
	MATERIAL	=	11,300
	EQUIPMENT	=	50,600
			<u>\$130,000</u>

65

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Calculations

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② ASSEMBLE THE PLANT

TIME = 54 HR.

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LABOUR:

1	FOREMAN	=	38.06
2	MECHANIC	=	70.20
3	OPERATOR	=	110.88
10	LABOURER	=	305.40
2	DRIVER	=	71.16
2	CEMENT FIN.	=	65.10

$660.72 \times 54 \text{ HR.} = \$35,679$

MATERIAL:

ROPE / SLING	=	2000
MISC. STEEL	=	2000
BOLTS / WASHER, ETC.	=	2000
MISC.	=	1000
		<u>\$7,000</u>

EQUIPMENT:

WELDING EQ.	=	6.65
CRANE 20 ^T .	=	60
BOOM TRUCK	=	20
FLATBED	=	20
COMPRESSOR = 2 x 18.00	=	36
CRANE 50 ^T . = 1/2 x 175.00	=	87.50
F.E.L. 4 C.Y. = 1/4 x 30.00	=	7.50
PICKUP	=	16
SMALL TOOLS	=	5
MISC.	=	5
CUTTING & BURNING	=	10

$273.65 \times 54 \text{ HR.} = \$14,777$

SUMMARY:

LABOUR	=	35,700	x 2	=	71,400
MATERIAL	=	7,000		=	14,000
EQUIPMENT	=	14,800		=	29,600
		<u>\$57,500</u>	x 2	=	<u>\$115,000</u>

TO INCLUDE DISASSEMBLING.

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Calculations

SUBJECT

By P. SINGH

Date 82/2/15

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⑨ ERECTION OF PLANT

TIME = 54 HR.

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LABOUR: 1 FOREMAN = 40.35
2 MECHANIC = 70.20
2 OPERATOR = 73.92
4 LABOURER = 122.16
4 IRONWORKER = 149.64
2 CARPENTER = 71.02

527.29 x 54 HR. = \$28,474

MATERIAL: CONSUMMABLES = 1000
ROPE, SLING, ETC. = 500
TEMP. BRACING = 500
OTHER = 1000
\$3000

EQUIPMENT: CRANE 50^T = 175
CRANE 20^T = 60
CHERRY PICKER = 20
2 - WORKING PLATFORM = 8
2 - COMPRESSOR = 36
PICKUP = 16
SMALL TOOLS/HOSE = 5
MISC. = 5

325.00 x 54 HR. = \$17,550

SUMMARY:

LABOUR = 28,500 x 2 = 57,000
MATERIAL = 3,000 = 6,000
EQUIPMENT = 17,600 = 35,200
49,100 x 2 = \$98,200

TO INCLUDE REMOVAL

D60

ACRES

Calculations

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Page 9 of 18① TEST & COMMISSION PLANT

$$\text{TIME} = 40 \text{ HR/YR} \times 4 \text{ YR.} = 160 \text{ HR.}$$

Rev	By	Checked

LABOUR: 1 FOREMAN = 43.03
 2 MECHANIC = 70.20
 1 ELECTRICIAN = 40.23
 2 OPERATOR = 70.20
 4 LABOURER = 122.16

$$345.82 \times 160 \text{ HR.} = \$55,331$$

MATERIAL: TOOLS = 200
 CONSUMMABLES = 200
 MISC. = 200
 CEMENT = 3000
 AGGREGATE = 4000
 \$7,600

EQUIPMENT: CRANE 15^T = 40
 BOOM TRUCK = 20
 2 - PICKUP = 32
 2 - COMPRESSOR (600) = 54
 2 - WELDER = 14.30
 2 - READY MIX TRUCK = 50.
 MISC. = 5

$$215.30 \times 160 \text{ HR.} = \$34,448$$

SUMMARY:

LABOUR = 55,300
 MATERIAL = 7,600
 EQUIPMENT = 34,400
\$97,300

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ACRES

Calculations

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By P. SINGH Date 82/2/15Project No. P5700

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Page 10 of 18① WINTERIZATION OF PLANT & STOCKPILES

$$\text{TIME} = 40 \text{ HR/YR.} \times 4 \text{ YR.} = 160 \text{ HR.}$$

Rev	By	Checked

LABOUR: 1 FOREMAN = 40.35
 4 LABOURER = 122.16
 2 CARPENTER = 69.02
 2 OPERATOR = 70.20
 2 IRONWORKER = 74.82

$$376.55 \times 160 \text{ HR.} = \$60,248$$

MATERIAL: POLY FILM = 20,000
 TIMBER & NAILS = 10,000
 STEEL = 10,000
 WIRE ROPE = 10,000
 TARPS = 30,000
 MISC. = 20,000

$$100,000 \times 4 \text{ YR.} \div 2 \text{ USES} = \$200,000$$

EQUIPMENT: CRANE 15 T. = 35
 BOOM TRUCK = 20
 FLAT BED = 20
 PICKUP = 16
 SAWS = 20
 COMPRESSOR (350) = 18
 TOOLS = 10
 MISC. = 10

$$149.00 \times 160 \text{ HR.} = \$23,840$$

SUMMARY:

LABOUR = 60,200
 MATERIAL = 200,000
 EQUIPMENT = 23,800
\$284,000

D62



Calculations

SUBJECT

By P. SINGH Date 82/2/15 Project No. P-700
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① OPERATION OF PLANT

OPERATING TIME = 9,752 HRS.

LABOUR: 3 OPERATOR = 105.30
 3 MECHANIC = 105.30
 3 ELECTRICIAN = 120.69
331.29 x 9752 HR.
= \$3,230,740

MATERIAL: PARTS = 1.00
 CONSUMMABLE = 5.50
 REPAIRS = 3.50
 SERVICES = 4.20
 MAJOR REPAIRS = 2.00
 LUB / OIL = 8.20
 MISC. = 1.00
25.40 x 9,752 HR. = 247,700

EQUIPMENT: PICKUP = 16
 CRANE 15^T = $\frac{1}{4} \times 35$ = 8.75
 WELDING EQ. = 6.65
 MISC. = 1.00
32.40 x 9752 HR. = \$315,965

SUMMARY:
 LABOUR = 3,230,700
 MATERIAL = 247,700
 EQUIPMENT = 316,000
\$3,794,400

ACRES

Calculations

SUBJECT

By P. SINGH

Date 82/2/15

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① HEATING WATER & AGGREGATE

TOTAL CONCRETE = 1,676,000 cyd.

TOTAL FINE AGG. = 868,000

TOTAL COARSE AGG. = 1,102,000 cyd.

ASSUMPTIONS:

- ① HEATING IS FROM 20° F. TO 55° F.
- ② NO MOISTURE TO BE REMOVED FROM FINE AGGREGATE
- ③ NATURAL GAS IS USED FOR HEATING
@ RATE OF 20¢/LITRE.
- ④ 50 % OF AGGREGATE REQUIRES HEATING.

A. WATER - EQUIPMENT

OWNERSHIP: BOILER = 200,000
PIPE & FITTINGS = 20,000
ENCLOSURE = 10,000
MISC. = 20,000
\$250,000

OPERATION: FUEL = \$80,000

B. COARSE AGGREGATE

ENCLOSURE = 0.10
EQUIP. - RENTAL = 10.40
- OPERATION (2.0 l/cyd) = 0.40
LABOUR = 0.40
MATERIAL = 0.10

\$1.40/cyd × 560,000 cyd.

= \$784,000

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Calculations

SUBJECT

By P. SINGH Date 82/2/15

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HEATING - CONT'D

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C. FINE AGGREGATE

ENCLOSURE = 0.10

EQUIP. - RENTAL = 0.40

- OPERATION (2.5 l/cyd) = 0.50

LABOUR = 0.40

MATERIAL = 0.10

$\$1.50/\text{cyd} \times 460,000 \text{ cyd.}$

$= \$690,000$

SUMMARY :

A. WATER = 330,000

B. COARSE AGG. = 784,000

C. FINE AGG. = 690,000

\$1,804,000

DGE



Calculations

SUBJECT

By P. SINGH Date 82/2/15 Project No. P5700
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① SERVICE & MAINTENANCE

$$\begin{aligned} \text{WORKING TIME} &= 3 \text{ HR/DAY} \times 1300 \text{ DAYS} \\ &= 3,900 \text{ HR.} \end{aligned}$$

Rev	By	Checked

$$\text{LABOUR: 1 MECHANIC} = 35.10 \times 3900 \text{ HR.} = \$136,890$$

$$\begin{aligned} \text{MATERIAL: FUEL} &= 10,000 \text{ gal.} \times 1.00/\text{gal.} = 10,000 \\ \text{LUBE/OIL} &= 5000 \text{ gal.} \times 4.80 = 24,000 \\ \text{CONSUMMABLE} &= 2,000 \text{ gal.} \times 2.00 = 4,000 \\ \text{MISC.} &= \text{L.S.} = 4,000 \\ &= \underline{\$42,000} \end{aligned}$$

$$\begin{aligned} \text{EQUIPMENT: PICKUP} &= \frac{1}{4} \times 16 = 4.00 \\ \text{SERVICE TRUCK} &= \frac{1}{4} \times 30 = 7.50 \\ \text{SMALL TOOLS} &= 0.50 \\ \text{MISC.} &= 0.50 \\ &= \underline{12.50} \times 3900 \text{ HR.} \\ &= \underline{\$48,750} \end{aligned}$$

SUMMARY:

$$\begin{aligned} \text{LABOUR} &= 136,900 \\ \text{MATERIAL} &= 42,000 \\ \text{EQUIPMENT} &= 48,800 \\ &= \underline{\underline{\$227,700}} \end{aligned}$$



Calculations

SUBJECT

By P. SINGH Date 82/2/15

Project No. P5700

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(M) READY MIX TRUCKS

- PROVIDE 4 - 10 CY. TRUCKS.
- WORKING TIME = 9,752 HR.

Rev	By	Checked

LABOUR: 4 DRIVER = 142.32
1 LABOURER = 30.54
172.86 x 9752 HR.
= \$1,685,730

EQUIPMENT: 4 READY MIX TRUCKS (OPER.) = 60
1 PICKUP = 16
SMALL TOOLS = 2
78.00 x 9752 HR.
= \$760,656
PURCHASE TRUCKS = 300,000
\$1,060,656

SUMMARY:

LABOUR = 1,685,700
MATERIAL - -
EQUIPMENT = 1,060,700
\$2,746,400

D67

ACRES

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⑦ POWER(i) TRANSMISSION LINE

LUMP SUM PRICE = \$40,000

LABOUR = 40 %
 MATERIAL = 25 %
 EQUIPMENT = 35 %

SUMMARY:

LABOUR	=	16,000
MATERIAL	=	10,000
EQUIPMENT	=	14,000
		<u>\$40,000</u>

(ii) STAND-BY GENERATOR - DIESEL OPERATED
1000 KW.

LABOUR	=	$35.41 \times 9752 \times \frac{1}{100}$	=	3,450
MATERIAL	=		=	6,000
EQUIP. - RENTAL	=	5.00×9752	=	48,760
- OPERATION	=		=	5,000
				<u>\$63,210</u>

(iii) MISCELLANEOUS

PROVISIONAL SUM = \$20,000

DLS

ACRES

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ITEMS 0 THRU 5 - LUMP SUM ITEMS

FOR AMOUNTS SEE SUMMARY SHEET.

ITEMS INCLUDE: DEMOBILIZATION
 CONCRETE LAB
 GENERAL CLEAN-UP
 MISCELLANEOUS
 DEMOBILIZATION @ YARD.

(4) AGGREGATE HANDLING EQUIPMENT

SUPPLY PRICE = \$440,000
 SALVAGE (20%) = 90,000
\$350,000

(5) SUPPLY OF PLANT

SUPPLY PRICE = \$680,000
 SALVAGE (20%) = 130,000
\$550,000

(D) Arch Dam Concrete
refrigeration



Estimate Work Sheet

PROJECT SUSITNA. HYDROELECTRIC.
CONTRACT DEVIL CANYON.

ITEM REFERENCE No.

MAIN ARCH. DAM.

DESCRIPTION

PLACING CONCRETE

OPERATION No.

REF.

DESCRIPTION

REFRIGERATION & COOLING.

JOB No.

P5700.

SHEET

1 OF 1

BY P. J. S.

CKD

DATE FEB/82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION		Equiv UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<u>REFRIGERATION & COOLING CONCRETE</u>																
(a). MOBILIZATION & DEMOBILIZATION.		170		84,892		50,000		-		-		69,552		-		
(b) Supply & INSTALL. COOLING. pipe			21 1/10	1,855,296		3,500,000		-		-		1,224,400		-		
(c) Supply & INSTALL. REFRIGERATION PLANT				32,175		490,000		-		-		855,000		-		
(d) OPERATION OF REFRIGERATION PLANT.			1 1/10	6,694,054		84,000		-		-		406,080		-		
(e) GROUTING THE PIPES				371,532		55,000		-		-		96,000		-		
TOTAL	1,676,000	cycl.	40 5	9,038,349	50 2	4,179,000		-		-	58 1	2,651,032		-	48 9	15,868,381

D71

ACRES

Calculations

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A. MOBILIZATION & DEMOBILIZATION.

$$\text{WORKING TIME} = 2\text{WK} + 2\text{WK} = 216 \text{ Hr}$$

$\uparrow$ MOB $\uparrow$ DEMOB

LABOUR.

FORMAN.	= 1NO	x 44.75	
MECH.	= 2NO	x 35.10	= 70.20
ELECT.	= 1NO.	x 40.23	
OPERATEE	= 2NO	x 35.10	= 70.20
PIPE FITTER	= 2NO.	x 37.24	= 74.48
DRIVER.	= 1NO	x 32.08	
LABOUR	= 2NO.	x 30.54	= 61.08

$$393.02 \times 216$$

+

$$= 84,802$$

Equipment

CRANE	= 1NO	x 150 ⁰⁰
truck	= 2NO	x 100
Pick up	= 2NO	x 32
MISC.	= 1.2	x 40

$$322 \times 216 = \$ 69,552$$

MATERIAL

CONSUMABLE	= 20,000
MATERIAL	= 20,000
OTHER	= 10,000
	<u>50,000.</u>

D72

ACRES

Calculations

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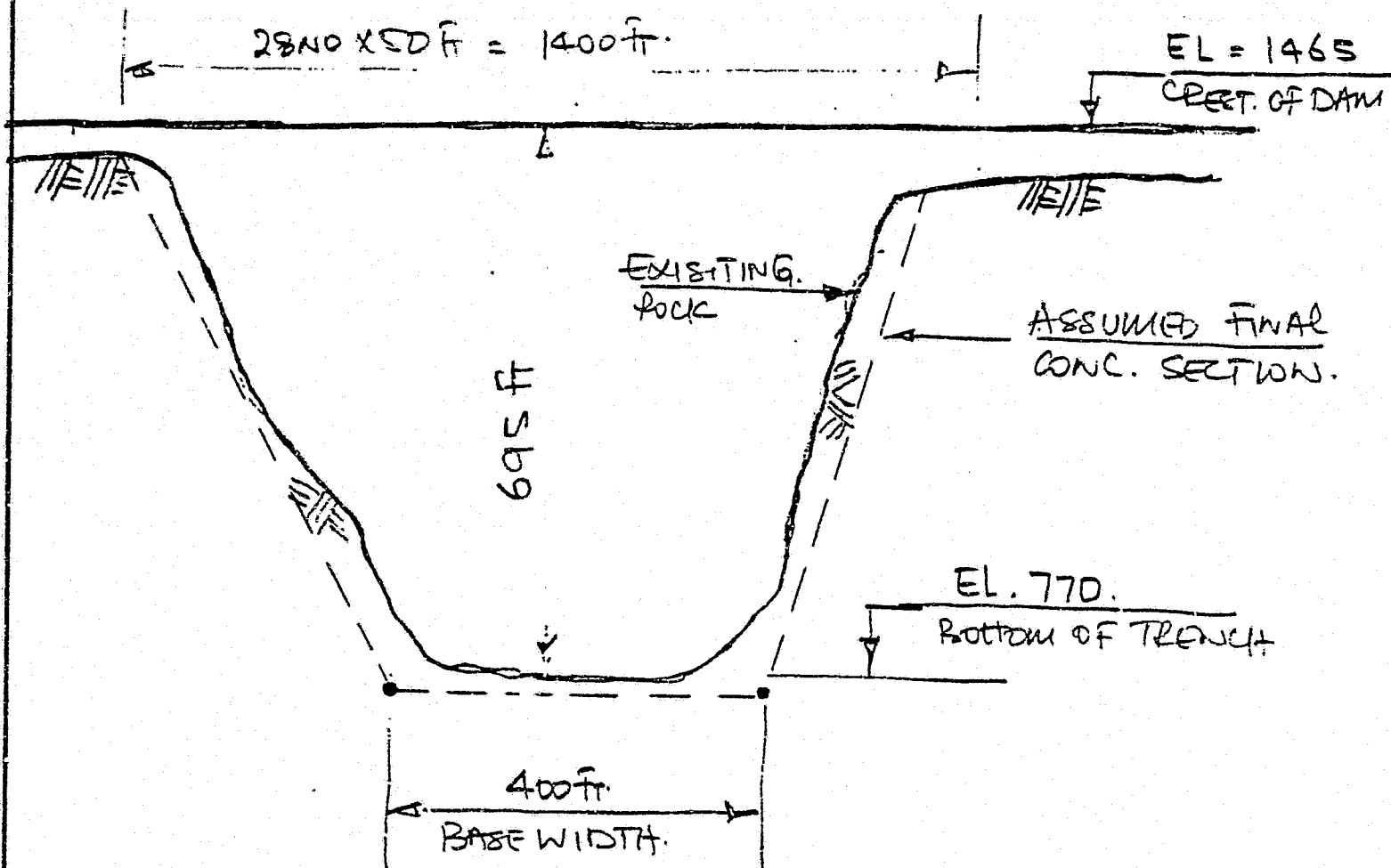
Project No. _____

Calculation No. _____

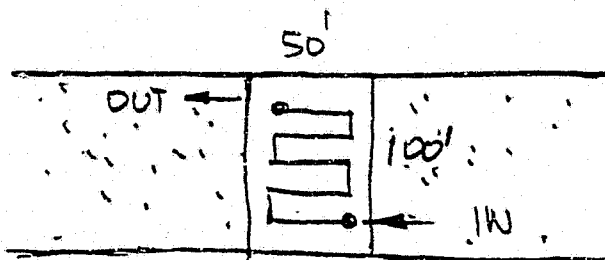
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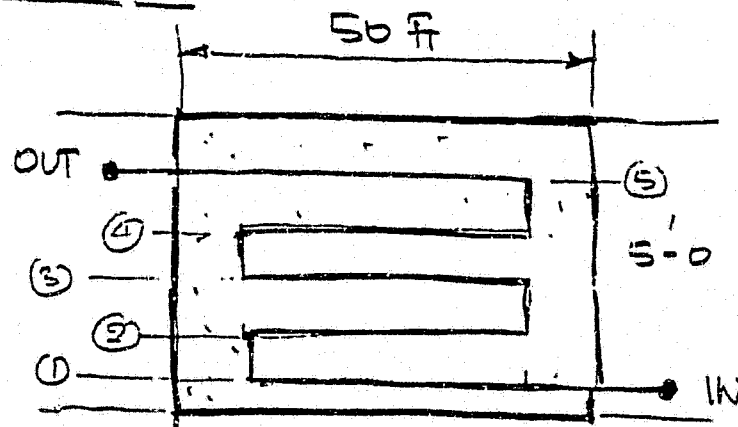
B. REFRIGERATION PLANT - PIPES Supply & INSTALLATION.



ASSUME SECTION OF DEVIL CANYON SITE



PLAN



SECTION

81

AGRES

Calculations

SUBJECT

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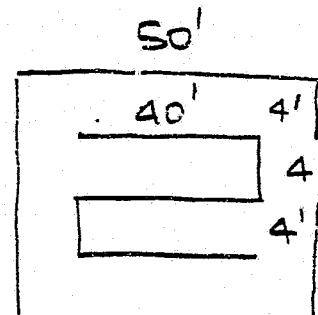
Page ____ of ____

B. - REFRIGERATION PLANT. PIPE

COOLING PIPE NETWORK.

AREA COVERED = 160 S.F.

TOTAL AREA = 50 x 80
= 4000 SF.



NO OF PIPE LINE = $\frac{4000}{200} = 20 \text{ NO.}$

LENGTH OF PIPE = $20 \times 40 + 70 \text{ ft} = 870 \text{ ft @ EACH LEVEL.}$

TOTAL PER FOUR = $870 \times 2 + 100 = 1840 \text{ ft / Block}$

NO. OF BLOCKS = 1200

TOTAL = $1840 \times 1200 = \underline{2,208,000 \text{ ft.}}$

- DISTRIBUTION PIPES = $\frac{1400}{50} = 28 \times \frac{700}{2} \times 2 = 19,600 \text{ ft}$

- TO PLANT = $1400 \times \frac{28}{4} = 9,800 \text{ ft.}$

TOTAL = $19,600 + 9,800 + 2,208,000 = 2,237,400 \text{ ft}$

= 2,300,000 ft

ASSUMMED SIZE = $1\frac{1}{2}$ " P.V.C. pipe (AVE)

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Calculations SUBJECT

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TOTAL = 800 Block @ 8 Hr.

TOTAL TIME = 6,400 Hr

LABOUR

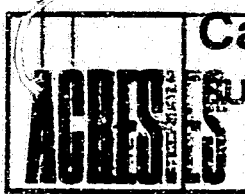
FORMAN. = 1NO x 44.75 = 44.75
 PIPE FITTERS. = 4NO. x 37.24 = 148.96
 LABOUR = 2NO x 30.54 = 61.08
 OPERATOR = 1NO x 35.10 = 35.10
 = 289.84 x 6400
 = \$ 1,855,296

EQUIPMENT

- Pickup = 2NO. x 16⁰⁰ = 32
 - AIR COMPRESSOR = 2NO. x 35⁰⁰ = 70
 - PIPE CUTTER. = 3NO x 5⁰⁰ = 15
 - PIPE THREAD = 3NO x 5⁰⁰ = 15
 - PIPE FUSION. = 3NO x 15⁰⁰ = 45
 - PIPE REPAIR = 2NO. x 10⁰⁰ = 10
 - SMALL TOOLS = L.S. x 2⁰⁰
 - MIS = L.S. x 2⁰⁰
 \$ 191⁰⁰ x 6400 Hr
 = 1,224,400

MATERIAL

6" - φ = 100,000 x 5⁰⁰ = 500,000
 4" - φ = 100,000 x 5⁰⁰ = 500,000
 2" - φ = 100,000 x 4⁰⁰ = 400,000
 1 1/2" - φ = 2,000,000 x 1⁰⁰ = 2,000,000
 ELBOW = L.S. x = 80,000
 MATERIAL CONSUMABLE = L.S. x = 20,000
 \$ 3,500,000



Calculations

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C. REFRIGERATION PLANT

TIME FOR LABOUR = 150 Hr
 FOR PLANT = 22,560 Hr.

POWER = FREE OF COST

EQUIPMENT

STATIONARY COMPRESSOR	=	5	x	25,000	=	125,000
75 H.P. MOTORS.	=	5	x	6,000	=	30,000
LOW STAGE COMPRESSOR	=	5	x	25,000	=	125,000
30 TON/DAY REF. UNIT.	=	10	x	20,000	=	200,000
HEAT EXCHANGERS	=	10	x	20,000	=	200,000
PUMPS	=	10	x	10,000	=	100,000
TANKS	=	10	x	5,000	=	50,000
CONTROLS	=	L.S.	x	20,000	=	20,000
SMALL TOOLS	=	L.S.	x	5,000	=	5,000

855,000.

MATERIAL

INSULATION	=	200,000.
Bldg	=	20,000
PIPING.	=	100,000
CONSUMABLE	=	80,000
SPARE PARTS.	=	80,000
OTHER.	=	10,000

490,000.

LABOUR

FORMAN.	=	1 No	43.03	
MECH.	=	2 No	35.10	= 70.20
ELEC.	=	1 No	40.23	
OPERATOR.	=	1 No	35.10	
LABOUR	=	2 No.	30.54	= 61.08

214.54 X 150 = 32,175

84

D 76

	Calculations		By <u> </u> Date <u> </u>	Project No. <u> </u>
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D. REFRIGERATION PLANT - OPERATION.

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TOTAL WORKING TIME = 940 DAYS = 22560 Hrs.

LABOUR

FORMAN =	= 43.03
X OPERATORS =	= 147.84
MECHANIC =	= 35.10
ELECTRICIAN =	= 40.23
LABOUR =	= 30.54
	= \$ 296.70 x 22,560 Hrs
	<u>= \$ 6,694,454</u>

EQUIPMENT

- Pickup	= 16 ⁰⁰
- SMALL TOOLS	= 1 ⁰⁰
- MISC.	= 1 ⁰⁰
	<u>\$ 18⁰⁰ x 22,560 = \$ 406,080</u>

MATERIAL

- CONSUMABLE	= 80,000
- MISC	= 1000
- OTHER FOR SAFETY	= 3000
	<u>\$ 84,000</u>

85

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ACRES

Calculations

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E. - GROUTING THE COOLING PIPES

NO. OF BLOCK = 1200

TOTAL LENGTH OF PIPES = 2000.000 Ft.

TIME = 1200 Hr ..

LABOUR.

FOREMAN = 1 NO x 43.03
 MECH. = 1 NO x 35.10
 PUMP OPERATOR = 1 NO x 35.10
 LABOURS = 4 NO x 30.54 = 122.16
 ELECT. = $\frac{1}{2}$ NO x 40.23 = 10.06
 DRIVER = $\frac{1}{2}$ NO x 32.94 = 16.48
 CEMENT FINISHER = 2 NO x 32.08 = 64.16

= 309.61 x 1200 = 371 532

EQUIPMENT.

Pumps = 10⁰⁰
 Pickup = 16⁰⁰
 GROUT PUMP = 20⁰⁰
 AIR COMPRESSOR = 35⁰⁰
 MIX. TANKS = 3⁰⁰
 MIS. Equip = 3⁰⁰
 SMALL TOOLS = 3⁰⁰
 = \$ 80⁰⁰ x 1200 Hr = 96,000

MATERIAL

Bldg = 5,000.
 CEMENT = 25,000
 SAND = 15,000
 ADMIX = 5,000
 CONSUMABLE = 5,000
 \$ 55,000

(D) Arch. Dam Concrete
Heating



Estimate Work Sheet

ITEM REFERENCE No.

JOB No. P5700

DESCRIPTION HEATING FOR CONCRETE

SHEET 1 OF 1

PROJECT SUSITNA HYDROELECTRIC

OPERATION No.

REF.

BY HEK.

CONTRACT DEVIL CANYON

DESCRIPTION

CKD DATE FEB. 23/82.

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
<u>HEATING FOR CONCRETE</u>																
A. HEATING POURED AREA			12 ²²	1,266,900		500,000		-		-		220,800		-		1,987,700
B. REMOVING ICE & SNOW			26 ²⁶	1,435,500		260,000		-		-		316,800		-		2,012,300
C. HEATING ENCLOSURE ,FOR POURING			31 ³¹	2,059,800		400,000		-		-		240,000		-		2,699,800
D. FORM INSULATION			1A ^{1A}	741,900		1,910,000		-		-		342,500		-		2,994,400
TOTAL	1,676,000	C.Y.	3 ²⁸	5,504,100	1 ⁸³	3,070,000	-	-	-	-	0 ⁶⁷	1,120,100	-	-	5 ⁷⁸	9,694,200

ACRES

Calculations

SUBJECT

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A. HEATING POURED AREA.

VOLUME OF CONCRETE = 850.000 cu ft.

TIME = 4.800 HRS.

LABOR

FORMAN.	=	1 NO	×	43.03	=	43.03
LABOUR.	=	6 NO	×	30.54	=	183.24
MECH.	=	$\frac{1}{2}$ NO	×	35.10	=	17.55
ELECT.	=	$\frac{1}{2}$ NO	×	40.23	=	20.12

263.94 × 4800

\$ 1,266,912

Equip

HEATER	=	10 NO.	=	30 ⁰⁰
TORCHES.	=	12 NO.	=	12 ⁰⁰
TOOLS.	=	L.S.	=	2 ⁰⁰
MISC.	=	L.S.	=	2 ⁰⁰

46 × 4800 = 220,800⁰⁰MATERIAL.

- CONSUMABLE	=	400,000
- MISC.	=	50,000
- OTHER	=	50,000
	\$	500,000 ⁰⁰



Calculations

SUBJECT

By _____ Date _____

Checked _____ Date _____

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B. REMOVING ICE & SNOW.

$$\text{TIME} = 4 \text{ HR} \times 1200 = 4800 \text{ HRS.}$$

LABOUR.

FORMAN. = 1 NO x 40.50
 LABOUR = 6 NO x 183.24
 MECH = 1 NO x 35.10
 DRIVER = 1 NO x 40.23

$$\$ 299.07 \times 4800 \text{ HR} = \$ 1,435,536$$

Equip

Pickup = 1 NO x 16
 TORCHES. = 10 NO. x 30
 TANKS. = 1 S. x 10
 HOSES. = 1 S. x 5
 MISC = 1 S. x 5

$$66 \times 4800 = \$ 316,800$$

MATERIAL

CONSUMABLE = 130,000
 MISC. = 120,000
 OTHER = 10,000
 \$ 260,000

ACRES

Calculations

SUBJECT

By _____ Date _____ Project No. _____

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C. HEATING ENCLOSURE, FOR POURING.

TIME = 4,800 Hrs. (INSULATION & REMOVAL)

LABOUR

FORMAN	=	1 NO	x	43.50	=	43.50
LABOUR	=	4 NO	x	30.54	=	122.16
MECH	=	1 NO	x	35.10	=	35.10
ELECT.	=	$\frac{1}{2}$ NO	x	40.23	=	20.12
CARPENTER	=	4 NO	x	34.51	=	138.04
OPERATOR	=	2 NO	x	35.10	=	70.20

n.s

$$\begin{aligned} & \$ 429.12 \times 4800 \text{ Hrs} \\ & = \$ 2,059,776. \end{aligned}$$
Equip

HEATER	=	L.S.	10 ^{0%}
lights	=	L.S.	10 ^{0%}
TOOLS	=	L.S.	10 ^{0%}
TANKS	=	L.S.	10 ^{0%}
MISC	=	L.S.	10 ^{0%}

$$\frac{\$ 240.000}{\text{Hr}} \times 4800 = \$ 240.000$$
MATERIALS

Phy Flm.	=	20,000.
Blanket.	=	100,000
TIMBER	=	150,000
HARDWARE	=	100,000.
CONSUMABLE	=	20,000.
MISC	=	10,000

$$\underline{\$ 400,000}$$



Calculations

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By _____ Date _____

Checked _____ Date _____

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D. FORM INSULATION (STEEL).

TIME = 2500 Hr

LABOUR.

FORMAN.	=	1 NO	40.35	=	40.35
CARPENTER	=	2 NO	34.51	=	69.02
IRONWORK.	=	2 NO	37.41	=	74.82
LABOUR.	=	2 NO	30.54	=	61.08
MELT	=	$\frac{1}{2}$ NO	35.10	=	17.55
OPERATOR	=	$\frac{1}{2}$ NO	35.10	=	17.55
DRIVER	=	$\frac{1}{2}$ NO	32.80	=	16.40

3.5

\$ 296.77 / Hr x 2500 Hr

= \$ 741,925

EQUIPMENT

TRUCK	=	$\frac{1}{2}$ NO	x	20 th
AIR Comp	=	2 NO	x	70 th
AIR TOOLS	=	L.S.	x	5 th
SMALL TOOLS	=	L.S.	x	5 th
Pickups	=	2 NO	x	32 th
MISC	=	L.S.	x	5 th

\$ 137 x 2500 = \$ 342,500

MATERIAL

INSULATION (40,000 S.F x 4)	=	1,600,000.
HARDWARE	=	200,000
CONSUMABLE	=	100,000
MISC	=	10,000
		<u>\$ 1,910,000</u>

(D) Arch Dam Concrete
Forming



Estimate Work Sheet

ITEM REFERENCE No.

JOB No. *P5700*DESCRIPTION *FORMING FOR ARCH DAM*SHEET *1* OF *1*PROJECT *SUSITNA HYDROELECTRIC*

OPERATION No.

REF.

BY *H.E.K.*CONTRACT *DEVIL CANYON*

DESCRIPTION

CKD DATE *FEB. 23/82.*

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM. MATERIALS		SUBCONTRACTS		EQPT. OWNERSHIP		EQPT. OPERATION		Equiv UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<i>FORMING FOR ARCH DAM</i>	<i>1,676,000</i>	<i>C.Y.</i>	<i>17¹¹</i>	<i>28,685,000</i>	<i>2⁰⁹</i>	<i>3,500,000</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>7⁹⁶</i>	<i>12,500,000</i>	<i>-</i>	<i>-</i>	<i>26⁶⁶</i>	<i>44,685,000</i>



Calculations

SUBJECT

By HEK

Date 8/2/23

Project No. P5700

Checked _____

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FORMING FOR ARCH DAM

TOTAL CONCRETE = 1,676,000 cyd.
FORM RATIO = 1 sft./cyd. (SEE NEXT SHT.)

TOTAL FORM AREA = 1,676,000 cyd.

FORMING PRODUCTION = 2.0 FT²/M.H. (FROM L. COUSINEAU)
ON FEB 15/82.

WORKING TIME = $\frac{1,676,000}{2}$
= 838,000 M.H.

1. LABOUR:

1	FOREMAN	=	1 × 43.03	=	43.03
10	CARPENTER	=	10 × 34.51	=	345.10
5	LABOURER	=	5 × 30.54	=	152.70
1/2	MECHANIC	=	1/2 × 39.17	=	19.59
1/2	ELECTRICIAN	=	1/2 × 40.23	=	20.12
1/2	OPERATOR	=	1/2 × 36.96	=	18.48

17.5 NO.

\$599.02/HR.

COST/M.H. = $\frac{599.02}{17.5}$ = \$34.23/M.H.

COST = 34.23 × 838,000
= \$28,685,000

ACRES

Calculations

By D.H. MacDonald

Date JAN 16 1982

Project No. P5700.09

SUBJECT DEVIL CANYON

Checked _____

Date _____

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ARCH DAM

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FORMWORK QUANT

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AREA FORMWORK S.F.				
U/S FACE	D/S FACE	TOTAL FACES	JOINTS	TOTAL
14,800	11,200	26,000	28,100	54,100
39,600	29,000	68,600	71,100	139,700
61,800	46,200	108,000	115,800	223,800
87,200	68,600	155,800	163,600	319,400
109,500	94,400	203,900	168,300	372,200
201,500	187,700	389,200	176,000	565,200
514,400	437,100	951,500	722,900	1674,400

TOTAL CONC = 1,676,000 cy.

FORM RATIO = 0.999 sf/cy $\approx$ 1 sf/cy

CURVED
FORM

FLAT
FORM

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Calculations

SUBJECT

By HEK

Date 8/2/23

Project No. P5700

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FORMING - CONT'D

2. MATERIAL:

a) STEEL FORM

FORMS - BUY 10 SETS @ 4,000 FT² = 40,000 FT².

ASSUME UNIT WEIGHT = 34 lbs/FT²

TOTAL WEIGHT = 40,000 x 34
= 1,360,000 lbs.

No. OF USES = $\frac{1,676,000}{40,000}$ = 42 USES.

(i) PURCHASE PRICE = \$35/FT² x 40,000
= \$1,400,000

(ii) TRANSPORTATION: TORONTO - VANCOUVER = \$0.20/lb
VANCOUVER - ANCHORAGE = 0.09/lb
ANCHORAGE - DEVIL CANYON = 0.03/lb
\$0.32/lb

COST = 0.32 x 1,360,000
= \$435,000

(iii) TAXES: FEDERAL = 0.05 x 1,400,000
= \$70,000

TOTAL STEEL FORM PRICE = 1,400,000 + 435,000 + 70,000
= \$1,905,000

b) TIMBER FORM: AREA REQ'D = 100,000 FT².
PRICE = \$5⁰⁰/FT².

∴ COST = \$500,000

ACRES

Calculations

SUBJECT

By HEK

Date 82/2/23

Project No. P5700

Checked _____

Date _____

Calculation No. _____

Page 4 of 5

FORMING - CONT'D

TOTAL MATERIAL:

STEEL FORM = 1,900,000
TIMBER FORM = 500,000
HARDWARE = 600,000
BRACING & STRUTTING = 500,000
\$3,500,000

3. EQUIPMENT:

2 - HIGHLINES = 6,500,000
SHOP = 2,000,000
TRANSPORTATION = 2,000,000
MISC. = 2,000,000
\$12,500,000

← PROVIDED BY
G. STUNDEN
DATED 21 Jan 82
ATTACHED MEMO.

4. SUMMARY:

LABOUR = 28,685,000
MATERIAL = 3,500,000
EQUIPMENT = 12,500,000

\$44,685,000

UNIT COST = $\frac{44,685,000}{1,676,000}$

= \$26.66/cyd.

D9.0

cc PJ Singh
JR Plummer
He .

#5 of 5

OFFICE MEMORANDUM

TO: Dave MacDonald ✓

Date: January 21, 1982

FROM: George Stunden

File: P5700

SUBJECT: SUSITNA EQUIPMENT

cc: AN-AN 16.

Further to your request for information on the cost of "HIGH LINES" for the Devil Canyon project, I spoke with Alec Drummond and later Jim Minson of Pitts Engineering Construction Limited, sponsoring contractor on the Revelstoke Dam in British Columbia.

Pitts has installed and is using a twin 25-ton bucket capacity highline which they purchased used from Perini. It was 12 years old and had been used on one project in California. It consists of a single fixed head tower and two radial track-mounted tail towers and spans 2,900 ft. To suit the Revelstoke topography, the head tower had to be increased in height by 100 ft, and a major excavation was required to install the track for the tail towers.

The installed cost at Revelstock is \$6 million (1980), being \$2-1/2 million purchase and modifications, and \$3-1/2 million installation. (The tail tower bench alone cost \$1 million.) Current new purchase for a similar machine is estimated at \$3 million.

Pitts used a highly regarded consultant in connection with the installation--Chuck Faris, tel 206-455-3490. If we wanted to contact him, we should refer to our discussion with Pitts.

Productions to date are as follows. (They are working three 8-h shifts, 26 days per month and 8-1/2 months per year.)

- | | |
|---------------------------|------------------------|
| - Best 8-h shift | 2,760 m ³ |
| - Best 24-h day | 6,832 m ³ |
| - Best 26-day month | 116,553 m ³ |
| - 1981 8-1/2 month season | 802,787 m ³ |

USE \$6,500,000.
FOR DEVIL CANYON

GRS:pn

[Signature]

(D) Arch Dam Concrete
Placing Concrete



Estimate Work Sheet

PROJECT *SUSITNA HYDROELECTRIC*
CONTRACT *DEVIL CANYON*

ITEM REFERENCE No.

DESCRIPTION *PLACING CONCRETE IN DAM*

OPERATION No.

REF.

JOB No. *P5700*

SHEET *1* OF *1*

BY *HEK.*

DESCRIPTION

CKD

DATE *FEB 22/82*

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION		Equiv UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<i>PLACING CONCRETE IN ARCH DAM</i>	<i>1,676,000</i>	<i>C.Y.</i>	<i>11⁹⁰</i>	<i>19,951,400</i>	<i>1⁰⁰</i>	<i>1,676,000</i>	-	-	-	-	<i>3⁰⁴</i>	<i>5,093,500</i>	-	-	<i>15⁹⁴</i>	<i>26,720,900</i>



Calculations

SUBJECT

DEVIL CANYON
MAIN ARCH DAMBy P.SINGH Date 82/2/22 Project No. P5700

Checked _____ Date _____ Calculation No. _____

Page 1 of 2PLACING CONCRETE

TOTAL CONCRETE = 1,676,000 cyd.

$$\begin{aligned} \text{PRODUCTION} &= 150 \text{ cyd/HR} + \text{LOSSES} \\ &= 100 \text{ cyd/HR (AVERAGE)} \end{aligned}$$

$$\begin{aligned} \therefore \text{WORKING TIME} &= \frac{1,676,000}{100} \\ &= 16,760 \text{ HR.} \end{aligned}$$

<u>LABOUR:</u>	2	FOREMAN	=	2 × 43.03	=	86.06
	2	HIGHLINE OPER.	=	2 × 36.96	=	73.92
	2	OILER	=	2 × 33.53	=	67.06
	3	MECHANIC	=	3 × 39.17	=	117.51
	2	ELECTRICIAN	=	2 × 40.23	=	80.46
	1	TRUCK DRIVER	=	1 × 35.58	=	35.58
	2	FLAGMAN	=	2 × 30.54	=	61.08
	10	LABOURER	=	10 × 30.54	=	305.40
	4	CEMENT FIN.	=	4 × 32.55	=	130.20
	2	CARPENTER	=	2 × 34.51	=	69.02
	2	HELPER	=	2 × 30.54	=	61.08
	1	RODMAN	=	1 × 37.41	=	37.41
	1	HELPER	=	1 × 30.54	=	30.54
	1	DOZER OPER.	=	1 × 35.10	=	35.10

35 No.

1190.42 × 16,760 HR.

= \$19,951,439

u/c = \$11.90/cyd.

MATERIAL:

PROVISIONAL SUM @ \$1.00/cyd.

= \$1,676,000

D94



Calculations

SUBJECT

By P. SINGH Date 82/2/22 Project No. P5700

Checked _____ Date _____ Calculation No. _____

Page 2 of 2PLACING CONCRETE - CONT'D

Rev	By	Checked

EQUIPMENT:

HIGHLINE - CHARGED TO FORMING

1	TRACTOR	=		=	37.00
4	TRAILER (40T)	=	4 x 12	=	48.00
6	BUCKET (12 C.Y.)	=	6 x 4	=	24.00
12	3" VIBRATOR	=	12 x 2.50	=	30.00
1	DOZER D-4	=		=	45.00
1	COMPRESSOR (600 CFM)	=		=	27.00
2	PICKUP	=	2 x 16	=	32.00
1	PANEL TRUCK	=		=	20.00
	WATER PUMP	=	L.S.	=	10.91
	MISC. SMALL TOOLS	=	L.S.	=	30.00

303.91 x 16,760 HR

= \$5,093,532

U/C = \$3.04/cyd.

SUMMARY:

LABOUR	=	19,951,000	=	11.90 /cyd.
MATERIAL	=	1,676,000	=	1.00 /cyd.
EQUIPMENT	=	5,094,000	=	3.04 /cyd.
		<u>\$26,721,000</u>		<u>= \$15.94 /cyd.</u>

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(D) Arch Dam Concrete
Joint Finishes



Estimate Work Sheet

ITEM REFERENCE No.

JOB No. P5700

DESCRIPTION CONCRETE JOINT FINISHES

SHEET 1 OF 1

PROJECT SUSITNA HYDROELECTRIC

OPERATION No.

REF.

BY HEK.

CONTRACT DEVIL CANYON - ARCH DAM

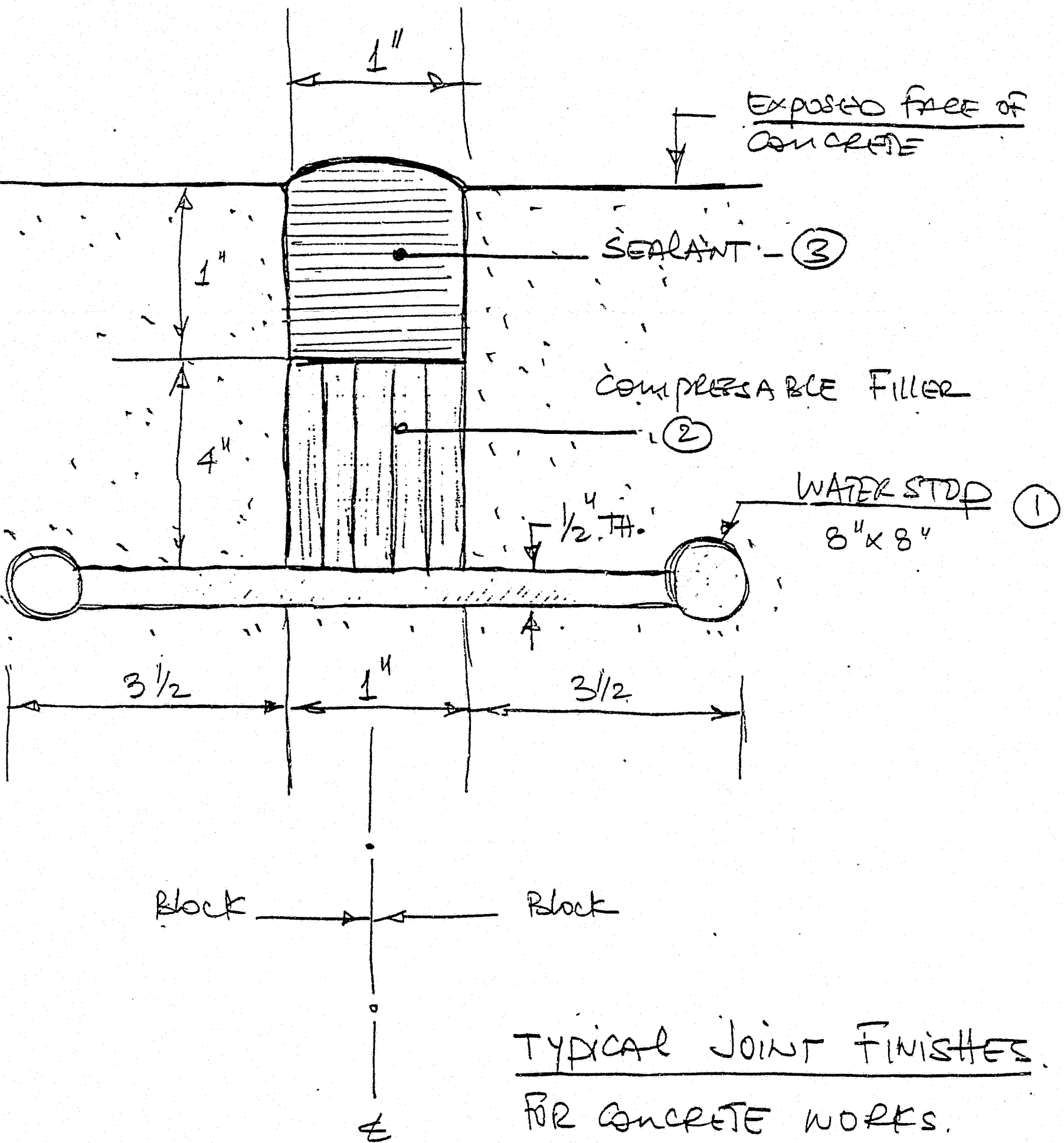
DESCRIPTION

CKD DATE FEB 23/82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION		Equiv UNIT	TOTAL AMOUNT
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT		
<u>CONCRETE JOINT FINISHES</u>																
1. WATERSTOPS				498,500		1,990,000		-		-		57,500		-		2,546,000
2. COMPRESSIBLE FILLER				300,600		103,300		-		-		105,600		-		509,500
3. SEALANT				300,600		530,000		-		-		105,600		-		936,200
TOTAL	1,676,000	C.Y.	0 ⁶⁶	1,099,700	1 ⁵⁶	2,623,300	-	-	-	-	0 ¹⁶	268,700	-	-	2 ³⁸	3,991,700

D97

#1/7



TYPICAL JOINT FINISHERS
FOR CONCRETE WORKS.

P.J.S. 22 FEB/82.



Calculations

SUBJECT
DEVIL CANYON
ARCH DAM

By HEK. Date 8/2/23
Checked _____ Date _____

Project No. P5700

Calculation No. _____

Page 2 of 7

Rev	By	Checked

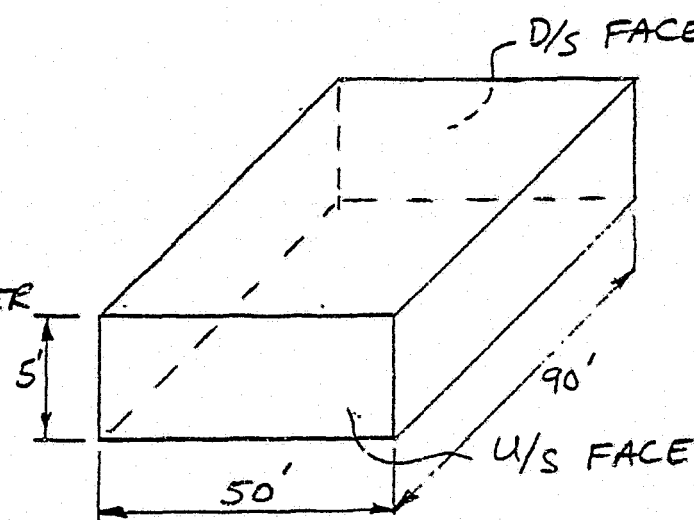
CONCRETE JOINT FINISHES

1. WATERSTOPS

BLOCK SIZE = 50' x 90' x 5'

No. OF BLOCKS = 1200

- WATERSTOPS REQUIRED AROUND PERIMETER OF ALL FACES EXCEPT U/S & D/S FACES



- EACH FACE CONNECTS TO ONE OTHER BLOCK FOR TYPICAL LOCATION OF BLOCK.
∴ USE 1 SIDE FACE AND TOP FACE FOR QUANTITY CALCULATION PER BLOCK.

$$\begin{aligned} \therefore \text{LENGTH OF WATERSTOP PER BLOCK} &= [2(90) + 2(5) + 4] + [2(90) + 2(50) + 4] \\ &\quad \uparrow \text{OVERLAP} \\ &= 194 + 284 \\ &= 478 \text{ FT.} \end{aligned}$$

$$\begin{aligned} \therefore \text{TOTAL LENGTH} &= 478 \times 1200 \\ &= 573,600 \text{ FT.} \end{aligned}$$

ACRES

Calculations

SUBJECT

By P. J. S. Date _____
Checked _____ Date _____

Project No. _____
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Rev	By	Checked

1. WATER STOP.

QUANTITIES = 573,600 ft.
TIME = 2500 Hr.

LABOUR.

FORMAN.	1 NO.	36.50	=	36.50	
CARPENTER	2 NO.	34.51	=	69.02	
LABOUR	2 NO.	30.54	=	61.08	
DRIVER.	1 NO.	32.80	=	32.80	
					\$
					199 ⁰⁰ x 2500 = 498,500

Equipment.

Pickup	1/4 NO.	=	4.00		
SKID SAW.	4 NO.	=	10.60		
HAND SAW.	4 NO.	=	5.00		
SMALL TOOLS.	L.S.	=	2.00		
MISC.	L.S.	=	2.00		
					\$
					23 ⁰⁰ x 2500 Hr = 57,500

MATERIALS.

WATER STOP.	=	3 ⁰⁰ x 573,600	=	1,720,000	
LUMBER.	=	250,000.	=	250,000	
CONSUMABLE	=	10,000	=	10,000	
MISC	=	10,000.	=	10,000	
					\$
					1,990,000



Calculations

SUBJECT

By HEK

Date 8/2/23

Project No. P5700

Checked _____

Date _____

Calculation No. _____

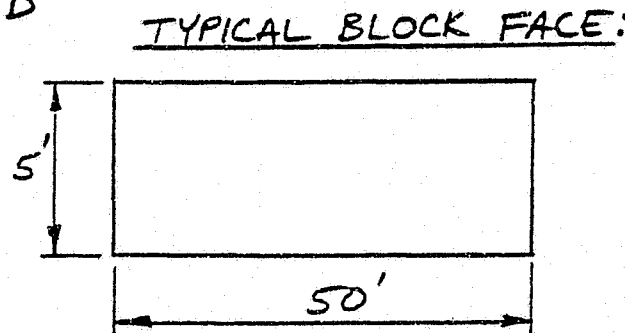
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Rev	By	Checked

2. COMPRESSIBLE FILLERS

- REQUIRED IN JOINTS AT EXPOSED CONCRETE FACES.

PERIMETER OF BLOCK = 110 FT.



- FILLER REQ'D ON BOTH W/S & D/S FACES

- EACH BLOCK SHARES FILLER WITH SURROUNDING BLOCKS.

No. OF BLOCKS = 1200

TOTAL LENGTH = 110 FT. x 1200 BLOCKS x 2 FACES ÷ 2

↓
DUPLICATION
DUE TO SHARED
JOINTS.

= 132,000 FT.

D101



Calculations

SUBJECT

By P. J. S. Date _____

Project No. _____

Checked _____ Date _____

Calculation No. _____

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Rev	By	Checked

2. COMPRESSIBLE FILLER.

$$\begin{aligned} \text{TOTAL QUANTITIES} &= 132,000 \text{ ft} \times 1" \text{ THICK.} \times 4" \text{ WIDE} = 3,666 \text{ SF.} \\ \text{TIME} &= 1320 \text{ Hr.} \end{aligned}$$

LABOUR.

$$\begin{aligned} \text{FORMAN} &= 1 \text{ NO} &= 36.50 \\ \text{CARPENTER} &= 2 \text{ NO} &= 69.02 \\ \text{LABOUR} &= 4 \text{ NO.} &= 122.16 \\ &&\hline &&\$ 227.68 \times 1320 \text{ Hr} \\ &&\hline &&= \$ 300,538 \end{aligned}$$

EQUIPMENT.

$$\begin{aligned} \text{AIR COMP.} &= 35^{\text{hr}} \\ \text{TOOLS.} &= 10^{\text{hr}} \\ \text{HOSE \& NOZZLES.} &= 10^{\text{hr}} \\ \text{WATER PUMPS.} &= 15^{\text{hr}} \\ \text{MIS.} &= 10^{\text{hr}} \\ &\hline 80^{\text{hr}} \times 1320 \text{ Hr} &= \frac{\$}{105,600} \end{aligned}$$

MATERIAL.

$$\begin{aligned} \text{FILLER} &= 3,666 \times \frac{\$}{20 \text{ / SF}} = 73,300 \\ \text{CONSUMABLE} &= &= 20,000 \\ \text{MISC} &= &= 10,000 \\ &\hline &&\$ 103,300 \end{aligned}$$

D102

ACRES

Calculations

SUBJECT

By HEKDate 8/2/23Project No. P5760

Checked _____

Date _____

Calculation No. _____

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Rev	By	Checked

3. SEALANT

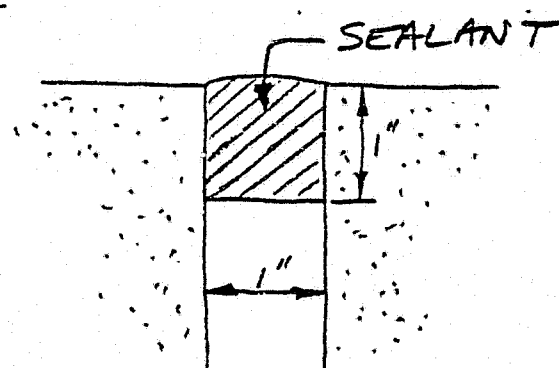
BLOCK SIZE = 50' x 90' x 5'

No. OF BLOCKS = 1200

- SEALANT IS REQUIRED AROUND PERIMETER OF U/S & D/S FACES
- ASSUME HALF THE WIDTH OF THE JOINT IS USED FOR ANY BLOCK
- ∴ EQUIVALENT TO TAKING FULL WIDTH ON ONE FACE.

$$\begin{aligned} \text{X-SECT. AREA} &= 1 \text{ IN.}^2 \\ &= 0.00694 \text{ FT.}^2 \end{aligned}$$

$$\begin{aligned} \text{PERIMETER} &= 2(50) + 2(5) \\ &= 110 \text{ FT.} \end{aligned}$$



$$\begin{aligned} \therefore \text{VOLUME} &= 110 \times 0.00694 \times 1200 \text{ BLOCKS} \\ &= 917 \text{ FT.}^3 \end{aligned}$$

$$\begin{aligned} \text{TOTAL LENGTH} &= 110 \times 1200 \\ &= 132,000 \text{ FT.} \end{aligned}$$

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D 103



Calculations

SUBJECT

By P.J.S. Date _____

Checked _____ Date _____

Project No. _____

Calculation No. _____

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Rev	By	Checked

3. SEALANT - 1" THICK

QUANTITY = 132,000 FT x 1" TH.

TIME = 1320 Hr.

LABOUR

FORMAN.	= 1 NO.	= 36.50	= 36.50
CARPENTER.	= 2 NO.	= 34.51	= 69.02
LABOUR	= 4 NO.	= 30.54	= 122.16
			= 227.68 x 1320 Hr.
			= \$300,538

EQUIPMENT

- AIR COMPRESSOR.	= 35 ⁰⁰
- TOOLS.	= 10 ⁰⁰
- HOSE & NOZZLE	= 10 ⁰⁰
- WATER PUMPS	= 15 ⁰⁰
- MISC	= 10 ⁰⁰
	80 ⁰⁰ x 1320 = \$105,600

MATERIAL

SEALANT.	= 12000 cu.ft @ 40	= 480,000
CONSUMABLE	=	30,000
MISC	=	20,000.
		\$530,000

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