

ID#08-0807-0074-1  
Province: Nangarhar

Khogyani District / Pakh Kanda Village

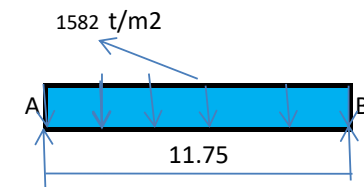
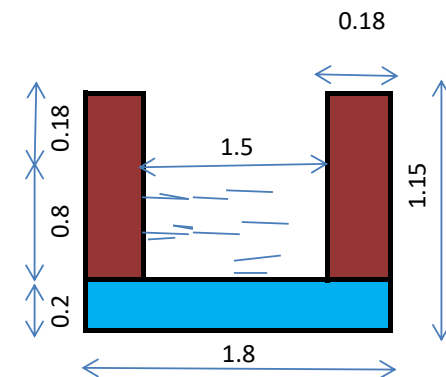
### Aqueduct Hydraulic calculation

No	Q L/sec	2160	L/sec	Fermola we us for Aqueduct
1	V	1.8	m/sec	$Q=VA = 1.8 \times 0.8 \times 1.5 = 2.16 \text{ M3/Sec}$  $J=1-k/3$
2	$G_{cbc}$	70	kg/cm <sup>2</sup>	
3	$G_{st}$	1400	kg/cm <sup>2</sup>	
5	L	11.75	M	
6	J	0.867		
7	K	0.399		
8	R	12.108		
9	$Q_{water}$	1200	kg/m	$Q_{water} = h_{water} \times b_{water} \times 1000$
10	$Q_{slab}$	720	kg/m	$Q_{slab} = h_{slab} \times b_{slab} \times 2400$
11	$Q_{beam}$	993.6	kg/m	$Q_{beam} = (h_{beam} \times b_{beam} \times 2400) / 2$
12	Live Load	250	kg/m	
13	Total Load	3163.6		$Total_{load} = Live + Q_{beam} + Q_{slab} + Q_{water}$
14	one one beam	1581.8	kg/m	Total load/2
15	$R_A = R_B$	109193.6313	kg	$q \times L \times L / 2$
16	$M_{max}$	18586.15		$(q \times L^2) / 8$
17	$d_{ef}$	1.11		$d - (d/2) - a$
18	d	166.23		$m_{max} 100$
				$R \times b$
19	$A_{st}$	23.201	cm <sup>2</sup>	$A_{st} = M_{max} \times 100 / \sigma_{st} \times j \times d$
20	$A_e = 20 = 3.14 \text{ cm}^2$	3.14	cm <sup>2</sup>	$A_e = \pi \times d^2 / 4$
21	Num of Bars	7.39		Num of Bars = $A_{st} / A_e$
Design of slab				
$M_{max}$	$W_H B^2 / 8 + W_S B^2 / 8 - W_H L^2 / 2$		206.86	
$A_{st}$	$A_{st} = M_{max} \times 100 / \sigma_{st} \times j \times d$		0.26	

The area of cross section of steel is 23.201 cm<sup>2</sup> there for we select (8Ø 20mm)

For beam is also calculated 0.08 cm<sup>2</sup> which is less, and we can select steel due to construction condition (Ø 12mm) 20com c/c

And in this condition there will be no need to check the shearing force, if we want to check it



8Ø20mm

213

# DESIGN FOR Dusaraka Village Khigyani TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION

## B. Hydraulic Calculation for Trapezoidal Section of Canal

Reshaping / Cleaning

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m <sup>2</sup> )	(m)	(m)					(m/sec)	(Lit/sec)	(m <sup>3</sup> /sec)
1.00	3.00	0.65	4.30	1.00	2.37	4.84	0.49	0.62	1.48	0.04	0.03	1.03	2433	2.43

$A = b (b + Z \times h)$
$P = b + 2h(n^2 + 1)^{0.5}$
$R = A / P$
$V = (R^{2/3} \times S^{1/2}) / n$
$Q = (A \times R^{2/3} \times S^{1/2}) / n$

Q (m <sup>3</sup> /sec)	2.430
n	0.025
Slope (m/m)	0.0017
Q (L/Sec)	2433

For Economical Section

Stipulation	Calculation	Result
$R / (h/2) = 1$	0.97	OK

FB = (1/3 \* h to 15 or more then that some time)

## C. Design X-Sections at Different Locations

**Table A1**

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Start Point Shery Khil	0+000	5+40	5040	0.00170	3.00	0.50	0.67	1.03	2433	4.30
Total Length (m)			5040							

**Table A2**

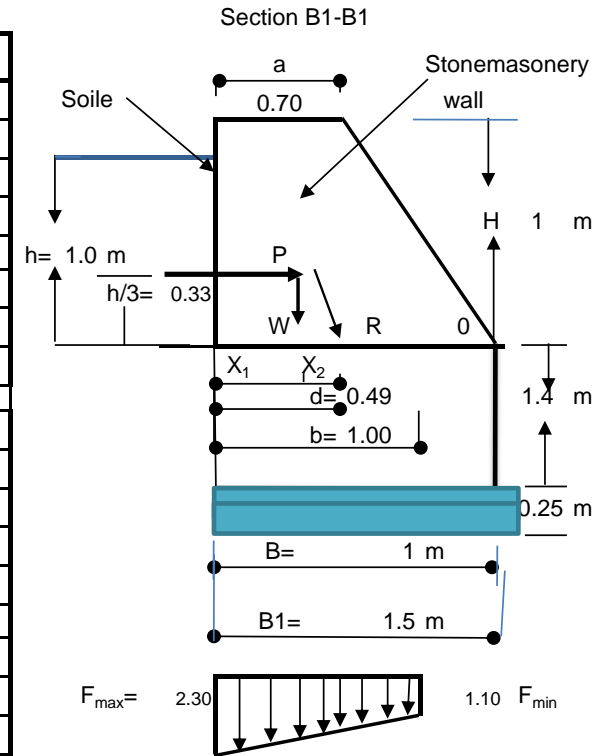
Table of Roughness Coefficient "n" for Small Channels					
Description		Minimum	Maximum	Recommended	
Unlined Earthen Channels					
1. new- straight and uniform		0.020	0.025	0.025	
2. aged and vegetated with;					
a. Short grass		0.030	0.040	0.035	
b. Long grass		0.050	0.080		
Lined Channels					
1. concrete		0.012	0.018	0.014	
2. brick plastered		0.012	0.018	0.013	
3. brick unplastered		0.016	0.020	0.018	

1/ Source : Engineering Design Standards Soil Conservation Service, USDA.

2/ Source : Irrigation Canal Lining, FAO and Water Development Series No.1 1977, Table 9

**Designing of Under Ground Wall of Ahmad Khil Canal Intake**  
Wing Wall of Culvert of Sherzad District / Mama Khil , Lawar Village

Item	Data	Formula	Calculation	Formula	Calculation	Result	Remarks
a=	0.7	$P = (w_s \cdot h^2) / 2 \cdot (1 - \sin\phi) / (1 + \sin\phi)$	0.30	Checking of stability			
b=	1			1-Against sliding			
h=	1.0	h= From Bed of River		$P < \mu W =$			
W wall=	2000	$W = W_{wall} \cdot (a+b) / 2 \cdot H$	1.7	P=	0.30		
$\phi =$	30			$\mu \cdot W =$	1.02		
$\sin\phi =$	0.5			$S_f = \mu W / P =$	3.40	>1.5	Ok,
W soil=	1800	$X_1 = (a^2 + ab + b^2) / 3(a+b)$	0.43	2-Against over turning			
1-sin $\phi =$	0.5			$MP \leq MW$			
1+sin $\phi =$	1.5			MP=	0.10	$MP < MW$	$MP = (P \cdot H) / 3$
h2=	1			MW=	0.73		$MW = W \cdot X_1$
$a^2 + ab + b^2 =$	2.190			$S_f = (MW / MP \geq 1.5)$	7.30	>2	Ok,
3(a+b)=	5.10	$X_2 = (p \cdot h) / 3w$	0.06	3-Against Crushing			
ph=	0.30	$d = x_1 + x_2$	0.49	R be in middle third			
3w=	5.1	b/3=	0.33333	2b/3 =	0.67		
$\mu =$	0.6	$b/3 \leq d \leq (2b/3)$		$0.4 < 0.6 < 0.8$		Ok,	
hw=	1.7						
(a+b)/2 =	0.85	$e = (x_1 + x_2) - b/2$	-0.012	4- Against settlement			
b/6	0.167	$e \leq b/6$				Ok,	
B	1						
Wstone	2.8	$W_{stone} = (W_{wall} \cdot B \cdot \text{depth}) / 1000$		Total w foundation=	3.475	T/M	
Wpcc	0.675	$W_{pcc} = (W_{wall} \cdot B \cdot \text{depth}) / 1000$		W pcc=	1800	$\Sigma W = w_{stone}$	5.175
$\mu \cdot W =$	1.02	$1 + (6 \cdot e) / b =$	1.35	$F_{max} = W / b (1 + 6 \cdot e / b)$	2.30		
6*e=	0.353	$1 - (6 \cdot e) / b =$	0.65	$F_{min} = W / b (1 - 6 \cdot e / b)$	1.10	Ok,	



**Waziru River /Stream Khogyani District**  
**TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION**

**During Flood**

shaping

**B. Hydraulic Calculation for Trapezoidal Section Proposed**

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m <sup>2</sup> )	(m)	(m)					(m/sec)	(Lit/sec)	(m <sup>3</sup> /sec)
1.00	72.00	1.20	75.60	1.50	88.56	76.33	1.16	1.10	97.79	0.15	0.03	6.52	577520	577.52

$$A = h (b + Z \times h)$$

$$P = b + 2h(n^2 + 1)^{0.5}$$

$$R = A / P$$

$$V = (R^{2/3} \times S^{1/2}) / n$$

$$Q = (A \times R^{2/3} \times S^{1/2}) / n$$

Q (m<sup>3</sup>/sec)

577.520

n

0.025

Slope (m/m)

0.0218

Q (L/Sec)

577520

For Economical Section

Stipulation

Calculation

Result

R / ( h/2 ) = 1

0.97

OK

FB = (1/3 \* h to 15 or more then that some time)

**C. Design X-Sections at Different Locations**

**Table A1**

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Waziro Stream	0+000	0+138.81	138.81	0.02180	72.00	1.20	1.37	6.52	577520	75.60
Total Length (m)			138.81							

**Table A2**

Table of Roughness Coefficient "n" for Small Channels

Description	Minimum	Maximum	Recommended
Unlined Earthen Channels			
1. new- straight and uniform	0.020	0.025	0.025
2. aged and vegetated with;			
a. Short grass	0.030	0.040	0.035
b. Long grass	0.050	0.080	
Lined Channels			
1. concrete	0.012	0.018	0.014
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1/ Source : Engineering Design Standards Soil Conservation Service,

2/ Source : Irrigation Canal Lining and Water Development Series No.1 1977, Table 9

**B-PROJECT NAME: KHOGYANI DISTRICT AHMAD KHIL VILLAGE CANAL INTAI**

**SCOUR CALCULATION**

شدت

**Note: Fill the values in yellow highlighted cells**

**INPUT**

Location	Severity factor X شدت	Discharge Q (m3/s)	Bed width B (m)	Flow depth y (m)	Silt factor f
Stream at straight reach	1.3	577.52	72.00	1.20	12

**OUTPUT**

Unit discharge q (m2/s)	Scour R	Factored Scour XR	Scour depth Ds	Apron length Lu and Ld
8.02	2.36	3.07	1.87	3.74

**Lacey's silt factor**

$f=1.76*d^{0.5}$

Material	Average d <sub>50</sub> size (mm)	Silt factor f
Very fine SILT	0.05	0.4
Fine SILT	0.12	0.5
Medium SILT	0.15	0.7
Standard SILT	0.32	1
Medium SAND	0.5	1.2
Coarse SAND	0.72	1.5
Fine GRAVEL	1.3	2
Medium GRAVEL	7.3	4.7
Heavy GRAVEL	26	9
Small BOULDERS	50	12
Medium BOULDERS	72	15
Large BOULDERS	185	24

**Scour depth = X \* R - y**

شدت

X = severity factor  
R = scour, in m  $1.35 * (q^2/f)^{1/3}$   
Y = tail wate level, in m

7200

**Severity factor**

Location	Severity
Upstream of structure	1.25
Downstream of structure	1.5
Nose of spur	2.25
Transition from nose to straight	1.5
Straight reach of guide bank	1.75

73	1.7	1.75	217.175	651525
73	6.53	0.3	143.007	2288112
73	0.6	2	87.6	245280
73	3.5	0.5	127.75	357700
500	3.5	0.15	332.5	1496250
600	0.8	0.6	358	1038200
600	0.65	1.1	499	1447100
				7524167
				105974.2

4320

Design of Culverts with clear span -3.7m			For	
Khogyani / Laghru Village				
1	Clear span	4	M	
2	Width of road	5	M	Bar used
3	Per.Stress of conc.in comp.	100	kg/cm <sup>2</sup>	16 mm
4	Per.stress of steel in ten.	1450	kg/cm <sup>2</sup>	M250
5	Thick.of slab	0.3	M	
6	Thick.of wearing Coat	0.01	M	
7	Theoritical span of culverts	4.3	M	
8	Density of concrete	2.4	t/m <sup>3</sup>	
9	Density of wearing coat	2.2	t/m <sup>3</sup>	
#	Live load	7.25	tons	HS20

Step2 LOADS AND MOMENTS				
1	Dead load	0.742	t/m <sup>2</sup>	OK
2	Binding moment from dead loa	1.7	t-m	
3	Effective width of tire because	1.478	M	
4	Live Load per meter width	4.905	t	
5	Binding moment for live load	5.273	t-m	
6	Impact factor	0.3		
7	Binding moment due to impact	1.582	t-m	
8	Sum of binding moment	8.555	t-m	

Step3 design of bars			
Moment resisting factor®	14.5		
Neutural Axis factor(k)	0.408		
Lever Arm factor(j)	0.864	m	
Min. eff.depth of slab	22.03	cm	
Actual eff.depth	26.2	cm	OK
Area of steel	26.064	cm <sup>2</sup>	
d of steel bars #(mm)	16	No.	13
Area of bar for short direction	7	cm <sup>2</sup>	
d of steel bars #(mm)	12	No.	6

**Kerb Design**

S.	Dimensions		
1	Height of kerb	0.5	m
2	width of kerb(down side)	0.3	m
3	Width of kerb(up side)	0.3	m

S.	Loads and Moments		
1	Dead load	0.36	t
2	Live load	0.725	t
3	Binding moment due to dead lo	0.832	t-m
4	Binding moment due to live loa	3.118	t-m
5	Concrete Sectienseon resistense	13.219	No need tension steel
Total binding moment		3.95	t-m

Area of bars			
Steel area	6.306		cm <sup>2</sup>
d of steel bars #(mm)	12	No.	6

#### Shear Force

Shear in Colvert slab		
Dead lod reaction	1.595	t
Live load reactiuon	4.96203488	t
Impact reaction	1.48861047	t
Tot.reaction in colvert slab	8.046	t

Check of Shear in slab		
Permissible sherar(AASHTO)	6.3	kg/cm <sup>2</sup>
Shear of slab section	3.554	Kg/cm <sup>2</sup>

section OK in Shea

#### Abutment design

##### Requaired information

Density of stone	2.4	t/m <sup>3</sup>
Density of soil	1.6	t/m <sup>3</sup>
Density of Concrete	2.4	t/m <sup>3</sup>
Height of wall	1.5	m

Depth of foundation	0.8	m
Width of foundation	1.00	m
Top width of the wall	0.6	m
Friction factor	0.6	
Refuse Angle( $\phi$ )	30	degree
Ka	0.333	
Bearing capacity	10	t/m <sup>2</sup>

Stabilizing Force and Stabilizing Moment			
Vertical forces	Quan.(t)	Lever Arm(m)	oment(t-m)
Vertical reaction from slab	8.046	0.4	3.2184
Vertical stabilaizing force of the	4.416	0.5	2.208
Sum of stabilizing load and Mo	12.462		5.4264

Lever Arm 0.435 m

Horizontal Force and overturning Moment			
Horizontal forces	Quan.(t)	Lever Arm(m)	oment(t-m)
Horizontal forec(P)	0.599	0.5	0.2995

Lever Arm 0.5 m

Check of section

S.F.in over turning 18.118 OK

S.F.in Sliding 12.483 OK

Position of resltant force from A 0.3869 m

Eccentricity(e) 0.1131 M

Max.pressure in foudation 20.9 Tons

Min Pressure in foundation 4 Tons

Diagram

