HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 6 (Existing)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 37.06 sq. km
Length of mainstream, L = 9.60 km
Percentage developed, = 0.00 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
8.86	100.00	1.13	9.41
0.74	200.00	27.03	3.85
9.60	300.00	28.16	13.26

s = SQR{ E (li * SQRT si) / E (li) }
= 13.26 ^2
9.60 ^2
= 1.91 %

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 2 years (HP # 1)

2. Tc = {1.286 x L} / {A^0.223 x S^0.263}

= {1.286 x 9.6 }
{ 37.06 ^0.223 x 1.907803827 ^0.263}

= 4.65 hours

= 279.27 mins

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 3) = 40 mm
x (20, 3) = 70 mm
x (2, 24) = 80 mm
x (20, 24) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 2 years.

x (T , 3) = 75.00 mm
x (T , 24) = 120.00 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 4.65 hours
and T = 2 years.
x (2, 4.65) = 48.45 mm
x (20, 4.65) = 84.78 mm
x (T , 4.65) = 84.50 mm

8. Confidence limits

D = x (20) - x (2)
= 84.784935 - 48.448534
= 36.336401
0.43 D = 15.624652 mm

9. Max x 2) = x (T) + 0.43 D
[T = 2] = 84.504601 + 15.624652
= 100.13 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (2) = 100.12925 mm
Therefore, i (2) = x (100) = 100.12925

Tc = 4.6544238

= 21.51 mm/hr

2. From Figure 4 with,

Region = 4

T = 2 years.

C10 = 0.38

Ct / C10 = 0.712

Therefore Ct = 0.27

3. Percentage developed = 0 %

Land use factor, F = 1

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A

= 59.97 cu. m /s

E. DETERMINATION OF THE FLOOD WATER LEVEL AND VELOCITY

1. Plot cross-section of the river.
2. consider the recorded flood level as our first trial
3. Divide into sub-section
4. Stream slope at bridge site,

From the river survey plan :

Number of Part = 4 Section

Part	BedL1	BedL2	Length	Slope
1	6.880	6.544	60.000	0.006
2	6.544	6.067	25.000	0.019
3	6.067	6.037	25.000	0.001
4	6.037	5.604	20.000	0.022
5				
6				
7				

Average Slope, So 0.0118825

5. Calculation of Vm and Qc

Vi = Ri^(2/3) x So^(1/2) / ni

TRY Flood Level = 7.700 m OK

Sc.	Level (m)	Chng. (m)	Roughness ni	Area, A Sq.ft	Wetted perimeter (pi)(m)	Hydraulic Radius Ri=Ai/Pi (m)	Velocity vi (m/s)	Q=Vi Ai (cu.m)
0	9.200	0.000	0.045					
1	7.000	4.000	0.045	-1.600	4.565	-0.350	#NUM!	
2	6.741	18.000	0.045	11.613	14.002	0.829	2.138	24.832
3	5.857	23.100	0.045	7.145	5.176	1.380	3.003	21.458
4	5.792	27.000	0.045	7.314	3.901	1.875	3.684	26.944
5	5.272	33.600	0.045	14.309	6.620	2.161	4.049	57.941
6	6.344	38.000	0.045	8.325	4.529	1.838	3.635	30.261
7	6.659	42.500	0.045	5.393	4.511	1.196	2.729	14.717
8	7.000	50.500	0.045	6.964	8.007	0.870	2.207	15.370
9	9.200	54.000	0.045					
10								
			TOTAL	59.4634			TOTAL	191.52328

Type of bed material (Code) = 7 Rock

CODE	BED
1	Clay
2	Sandy Clay
3	Very fine sand
4	Fine sand
5	Fine Gravel
6	Rocky soil
7	Rock
8	Grass-lined

Therefore,

Mean velocity, Vm = E (Vi Ai)/ E (Ai)

= 191.523277 / 59.4634

= 3.220859839 < 5.18 m/sec

Therefore OK

Discharge capacity, Qc = Vm x E (Ai)

= 191.523277 > 59.9665 cu.m

Therefore OK

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 6 (Existing)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 37.06 sq. km
Length of mainstream, L = 9.60 km
Percentage developed, = 0.00 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si = ^h/li (%)	li * SQRT si
8.86	100.00	1.13	9.41
0.74	200.00	27.03	3.85
9.60	300.00	28.16	13.26

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{13.26\ ^2}{9.60\ ^2}$$
$$= 1.91\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 5 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 9.6\}}{\{37.06^{0.223} \times 1.907803827^{0.263}\}}$$

$$= 4.65 \text{ hours}$$

$$= 279.27 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 3) = 40 mm
x (20, 3) = 70 mm
x (2, 24) = 80 mm
x (20, 24) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 5 years.

x (T , 3) = 98.94 mm
x (T , 24) = 176.59 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 4.6544238 hours
and T = 5 years.

x (2, 4.65) = 48.45 mm
x (20, 4.65) = 84.78 mm
x (T , 4.65) = 115.34 mm

8. Confidence limits

D = x (20) - x (2)
= 84.784935 - 48.448534
= 36.336401
0.43 D = 15.62 mm

9. Max x (5) = x (T) + 0.43 D
[T = 5] = 115.34289 + 15.624652
= 130.97 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (5) = 130.96754 mm
Therefore, i (10) = x (100) = 130.96754
Tc 4.6544238
= 28.14 mm / hr

2. From Figure 4 with,

Region = 4
T = 5 years.

C10 = 0.38
Ct / C10 = 0.88

Therefore Ct = 0.3344

3. Percentage developed = 0 %
Land use factor, F = 1

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 96.94 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 6 (Existing)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 37.06 sq. km
Length of mainstream, L = 9.60 km
Percentage developed, = 0.00 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
8.86	100.00	1.13	9.41
0.74	200.00	27.03	3.85
9.60	300.00	28.16	13.26

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{13.26\ ^2}{9.60\ ^2}$$
$$= 1.91\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 10 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 9.6\}}{\{37.06^{0.223} \times 1.907803827^{0.263}\}}$$

$$= 4.65 \text{ hours}$$

$$= 279.27 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 3) = 40 mm
x (20, 3) = 70 mm
x (2, 24) = 80 mm
x (20, 24) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 10 years.

x (T , 3) = 114.79 mm
x (T , 24) = 214.06 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 4.6544238 hours
and T = 10 years.

x (2, 4.65) = 48.45 mm
x (20, 4.65) = 84.78 mm
x (T , 4.65) = 135.76 mm

8. Confidence limits

D = x (20) - x (2)
= 84.784935 - 48.448534
= 36.336401
0.43 D = 15.62 mm

9. Max x (10) = x (T) + 0.43 D
[T = 10] = 135.76052 + 15.624652
= 151.39 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (10) = 151.38517 mm
Therefore, i (10) = x (100) = 151.38517
Tc 4.6544238
= 32.53 mm / hr

2. From Figure 4 with,

Region = 4
T = 10 years.

C10 = 0.38
Ct / C10 = 1

Therefore Ct = 0.38

3. Percentage developed = 0 %
Land use factor, F = 1

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 127.34 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 6 (Existing)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 37.06 sq. km
Length of mainstream, L = 9.60 km
Percentage developed, = 0.00 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si = ^h/li (%)	li * SQRT si
8.86	100.00	1.13	9.41
0.74	200.00	27.03	3.85
9.60	300.00	28.16	13.26

$$s = SQR\{ \Sigma(li * SQRT\ si) / \Sigma(li) \}$$
$$= \left(\frac{13.26}{9.60} \right)^2$$
$$= 1.91\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 20 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 9.6\}}{\{37.06^{0.223} \times 1.907803827^{0.263}\}}$$

$$= 4.65 \text{ hours}$$

$$= 279.27 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 3) = 40 mm
x (20, 3) = 70 mm
x (2, 24) = 80 mm
x (20, 24) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 20 years.

x (T , 3) = 130.00 mm
x (T , 24) = 250.00 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 4.6544238 hours
and T = 20 years.

x (2, 4.65) = 48.45 mm
x (20, 4.65) = 84.78 mm
x (T , 4.65) = 155.35 mm

8. Confidence limits

D = x (20) - x (2)
= 84.784935 - 48.448534
= 36.336401
0.43 D = 15.62 mm

9. Max x 20) = x (T) + 0.43 D
[T = 20] = 155.3456 + 15.624652
= 170.97 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (20) = 170.97026 mm
Therefore, i (20) = x (100) = 170.97026
Tc 4.6544238
= 36.73 mm / hr

2. From Figure 4 with,

Region = 4
T = 20 years.

C10 = 0.38
Ct / C10 = 1.128

Therefore Ct = 0.43

3. Percentage developed = 0 %
Land use factor, F = 1

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 162.22 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 6 (Existing)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 37.06 sq. km
Length of mainstream, L = 9.60 km
Percentage developed, = 0 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
8.86	100.00	1.13	9.41
0.74	200.00	27.03	3.85
9.60	300.00	28.16	13.26

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{13.26\ ^2}{9.60\ ^2}$$
$$= 1.91\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 50 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 9.6\}}{\{37.06^{0.223} \times 1.907803827^{0.263}\}}$$

$$= 4.65 \text{ hours}$$

$$= 279.27 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 3) = 40 mm
x (20, 3) = 70 mm
x (2, 24) = 80 mm
x (20, 24) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 50 years.

x (T , 3) = 149.68 mm
x (T , 24) = 296.52 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 4.6544238 hours
and T = 50 years.

x (2, 4.65) = 48.45 mm
x (20, 4.65) = 84.78 mm
x (T , 4.65) = 180.70 mm

8. Confidence limits

D = x (20) - x (2)
= 84.784935 - 48.448534
= 36.336401
0.43 D = 15.624652 mm

9. Max x (50) = x (T) + 0.43 D
[T = 50] = 180.69648 + 15.624652
= 196.32 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (50) = 196.32114 mm
Therefore, i (50) = x (100) = 196.32114
Tc 4.6544238
= 42.18 mm/hr

2. From Figure 4 with,

Region = 4
T = 50 years.

C10 = 0.38
Ct / C10 = 1.296

Therefore Ct = 0.49

3. Percentage developed = 0 %
Land use factor, F = 1

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= **214.01 cu. m /s**

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 6 (Existing)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 37.06 sq. km
Length of mainstream, L = 9.60 km
Percentage developed, = 0 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si=^h/li (%)	li*SQRT si
8.86	100.00	1.13	9.41
0.74	200.00	27.03	3.85
9.60	300.00	28.16	13.26

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \left(\frac{13.26}{9.60} \right)^{\wedge 2}$$
$$= 1.91\ \%$$

B. LOCATION OF SITE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 100 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 9.6\}}{\{37.06^{0.223} \times 1.907803827^{0.263}\}}$$

$$= 4.65 \text{ hours}$$

$$= 279.27 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 3) = 40 mm
x (20, 3) = 70 mm
x (2, 24) = 80 mm
x (20, 24) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 100 years.

x (T , 3) = 164.43 mm
x (T , 24) = 331.38 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 4.65 hours
and T = 100 years.

x (2, 4.65) = 48.45 mm
x (20, 4.65) = 84.78 mm
x (T , 4.65) = 199.69 mm

8. Confidence limits

D = x (20) - x (2)
= 84.784935 - 48.448534
= 36.336401
0.43 D = 15.62 mm

9. Max x (100)) = x (T) + 0.43 D
[T = 100] = 199.6934 + 15.624652
= 215.32 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (100) = 215.32 mm
Therefore, i (100) = x (100) / Tc = 215.31805 / 4.6544238
= 46.26 mm/hr

2. From Figure 4 with,

Region = 4
T = 100 years.

C10 = 0.38
Ct / C10 = 1.46

Therefore Ct = 0.5548

3. Percentage developed = 0 %
Land use factor, F = 1

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= **264.42 cu. m /s**