HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 4 (During logging activity)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 4.53 sq. km
Length of mainstream, L = 3.21 km
Percentage developed, = 75.00 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
3.21	120.00	3.74	6.21
3.21	120.00	3.74	6.21

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{6.21\ ^2}{3.21\ ^2}$$
$$= 3.74\ \%$$

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

$$= \frac{\{1.286 \times 3.21\}}{\{4.53^{0.223} \times 3.738317757^{0.263}\}}$$
$$= 2.08 \text{ hours}$$
$$= 125.02 \text{ mins}$$

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, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

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

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

x (T , 0.5) = 75.00 mm
x (T , 3) = 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 = 2.08 hours
and T = 2 years.
x (2, 2.08) = 71.86 mm
x (20, 2.08) = 125.76 mm
x (T , 2.08) = 110.85 mm

8. Confidence limits

D = x (20) - x (2)
= 125.75993 - 71.862816
= 53.897112
0.43 D = 23.175758 mm

9. Max x 2) = x (T) + 0.43 D
[T = 2] = 110.84567 + 23.175758
= 134.02 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (2) = 134.02143 mm
Therefore, i (2) = x (100) = 134.02143

Tc = 2.0836379

= 64.32 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 = 75 %

Land use factor, F = 1.2

THEREFORE

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

= 26.30 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 > 26.299 cu.m

Therefore OK

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 4 (During logging activity)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 4.53 sq. km
Length of mainstream, L = 3.21 km
Percentage developed, = 75.00 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
3.21	120.00	3.74	6.21
3.21	120.00	3.74	6.21

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{6.21\ ^2}{3.21\ ^2}$$
$$= 3.74\ \%$$

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

$$= \frac{\{1.286 \times 3.21\}}{\{4.53^{0.223} \times 3.738317757^{0.263}\}}$$

$$= 2.08 \text{ hours}$$

$$= 125.02 \text{ mins}$$

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, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

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

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

x (T , 0.5) = 98.94 mm
x (T , 3) = 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 = 2.0836379 hours
and T = 5 years.

x (2, 2.08) = 71.86 mm
x (20, 2.08) = 125.76 mm
x (T , 2.08) = 160.80 mm

8. Confidence limits

D = x (20) - x (2)
= 125.75993 - 71.862816
= 53.897112
0.43 D = 23.18 mm

9. Max x 5) = x (T) + 0.43 D
[T = 5] = 160.79515 + 23.175758
= 183.97 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (5) = 183.9709 mm
Therefore, i (10) = x (100) = 183.9709
Tc 2.0836379
= 88.29 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 = 75 %
Land use factor, F = 1.2

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 44.62 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 4 (During logging activity)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 4.53 sq. km
Length of mainstream, L = 3.21 km
Percentage developed, = 75.00 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
3.21	120.00	3.74	6.21
3.21	120.00	3.74	6.21

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \left(\frac{6.21}{3.21} \right)^2$$
$$= 3.74\ \%$$

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

$$= \frac{\{1.286 \times 3.21\}}{\{4.53^{0.223} \times 3.738317757^{0.263}\}}$$

$$= 2.08 \text{ hours}$$

$$= 125.02 \text{ mins}$$

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, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

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

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

x (T , 0.5) = 114.79 mm
x (T , 3) = 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 = 2.0836379 hours
and T = 10 years.

x (2, 2.08) = 71.86 mm
x (20, 2.08) = 125.76 mm
x (T , 2.08) = 193.87 mm

8. Confidence limits

D = x (20) - x (2)
= 125.75993 - 71.862816
= 53.897112
0.43 D = 23.18 mm

9. Max x (10) = x (T) + 0.43 D
[T = 10] = 193.86605 + 23.175758
= 217.04 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (10) = 217.0418 mm
Therefore, i (10) = x (100) = 217.0418
Tc 2.0836379
= 104.16 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 = 75 %
Land use factor, F = 1.2

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 59.82 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 4 (During logging activity)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 4.53 sq. km
Length of mainstream, L = 3.21 km
Percentage developed, = 75.00 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
3.21	120.00	3.74	6.21
3.21	120.00	3.74	6.21

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{6.21\ ^2}{3.21\ ^2}$$
$$= 3.74\ \%$$

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

$$= \frac{\{1.286 \times 3.21\}}{\{4.53^{0.223} \times 3.738317757^{0.263}\}}$$

$$= 2.08 \text{ hours}$$

$$= 125.02 \text{ mins}$$

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, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

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

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

x (T , 0.5) = 130.00 mm
x (T , 3) = 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 = 2.0836379 hours
and T = 20 years.

x (2, 2.08) = 71.86 mm
x (20, 2.08) = 125.76 mm
x (T , 2.08) = 225.59 mm

8. Confidence limits

D = x (20) - x (2)
= 125.75993 - 71.862816
= 53.897112
0.43 D = 23.18 mm

9. Max x (20) = x (T) + 0.43 D
[T = 20] = 225.58845 + 23.175758
= 248.76 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (20) = 248.76421 mm
Therefore, i (20) = x (100) = 248.76421
Tc 2.0836379
= 119.39 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 = 75 %
Land use factor, F = 1.2

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 77.34 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 4 (During logging activity)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 4.53 sq. km
Length of mainstream, L = 3.21 km
Percentage developed, = 75 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
3.21	120.00	3.74	6.21
3.21	120.00	3.74	6.21

s = SQR{ E (li * SQRT si) / E (li) }
= 6.21 ^2
3.21 ^2
= 3.74 %

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 x L} / {A^0.223 x S^0.263}

= {1.286 x 3.21 }
{ 4.53 ^0.223 x 3.738317757 ^0.263}

= 2.08 hours

= 125.02 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, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

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

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

x (T , 0.5) = 149.68 mm
x (T , 3) = 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 = 2.0836379 hours
and T = 50 years.

x (2, 2.08) = 71.86 mm
x (20, 2.08) = 125.76 mm
x (T , 2.08) = 266.65 mm

8. Confidence limits

D = x (20) - x (2)
= 125.75993 - 71.862816
= 53.897112
0.43 D = 23.175758 mm

9. Max x (50) = x (T) + 0.43 D
[T = 50] = 266.64984 + 23.175758
= 289.83 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (50) = 289.8256 mm
Therefore, i (50) = x (100) = 289.8256
Tc 2.0836379
= 139.10 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 = 75 %
Land use factor, F = 1.2

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= **103.52 cu. m /s**

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 4 (During logging activity)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 4.53 sq. km
Length of mainstream, L = 3.21 km
Percentage developed, = 75 % (Land use factor)

Weighted mean slope, s

li (km)	^h (m)	si =^h/li (%)	li*SQRT si
3.21	120.00	3.74	6.21
3.21	120.00	3.74	6.21

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{6.21\ ^2}{3.21\ ^2}$$
$$= 3.74\ \%$$

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

$$= \frac{\{1.286 \times 3.21\}}{\{4.53^{0.223} \times 3.738317757^{0.263}\}}$$

$$= 2.08 \text{ hours}$$

$$= 125.02 \text{ mins}$$

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, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

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

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

x (T , 0.5) = 164.43 mm
x (T , 3) = 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 = 2.08 hours
and T = 100 years.
x (2, 2.08) = 71.86 mm
x (20, 2.08) = 125.76 mm
x (T , 2.08) = 297.42 mm

8. Confidence limits

D = x (20) - x (2)
= 125.75993 - 71.862816
= 53.897112
0.43 D = 23.18 mm

9. Max x (100) = x (T) + 0.43 D
[T = 100] = 297.41958 + 23.175758
= 320.60 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (100) = 320.60 mm
Therefore, i (100) = $\frac{x\ (100)}{T\ c}$ = $\frac{320.59534}{2.0836379}$
= 153.86 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 = 75 %
Land use factor, F = 1.2

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= **129.00 cu. m /s**