

## ***TABLES***

Table I-1 (1/3) Annual Maximum Rainfall Intensities (Observed at Kepala Batas, Alor Star)  
(Unit : mm/hour)

year	Rainfall Duration									
	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	12 hr
1951	122.8	96.6	69.5	53.6	44.5	34.5	28.7	25.3	24.5	13.7
1952	152.4	106.6	80.3	63.0	38.6	26.8	21.3	18.1	15.6	8.8
1953	140.4	99.0	75.2	58.4	40.2	27.7	20.9	16.7	14.4	8.3
1954	102.8	77.8	59.6	44.7	36.5	24.6	19.6	16.1	13.6	7.6
1955	122.8	88.4	65.7	59.2	46.3	34.7	28.1	24.4	21.5	10.8
1956	130.0	100.0	88.7	74.9	40.9	27.7	21.4	18.2	15.9	8.5
1957	101.6	81.2	71.1	58.2	35.2	23.5	19.7	15.8	13.5	7.2
1958	96.4	75.2	64.7	51.3	39.6	27.1	20.3	16.3	13.6	7.2
1959	130.0	95.6	70.1	55.4	31.3	21.1	19.3	18.1	16.1	9.7
1960	142.4	101.6	70.8	54.6	28.1	18.9	14.2	11.5	9.8	8.6
1961	142.4	106.6	91.5	73.7	43.5	34.2	28.3	23.7	19.9	10.1
1962	164.4	93.0	84.7	67.8	40.9	29.0	22.8	18.9	15.8	8.8
1963	122.0	111.8	91.7	80.0	52.7	36.9	28.5	22.8	19.1	9.6
1964	162.4	106.6	74.8	57.4	30.6	21.2	16.5	13.3	11.1	7.0
1965	172.8	134.6	100.5	76.7	38.6	25.7	19.6	15.9	13.3	6.7
1966	147.2	114.2	98.3	82.5	51.1	34.7	26.7	21.9	18.4	9.3
1967	203.2	152.4	130.0	108.0	61.7	43.2	34.4	27.9	23.5	11.7
1968	101.6	66.6	60.9	50.8	27.7	21.2	16.8	13.9	11.6	5.8
1969	105.6	92.0	69.7	64.0	32.9	23.0	22.2	17.9	15.0	7.7
1970	149.2	104.2	84.0	67.3	34.9	23.9	18.1	16.0	13.7	6.9
1971	110.8	101.6	84.7	76.2	45.1	35.7	27.7	24.5	20.5	10.9
1972	129.2	113.8	89.7	68.6	37.6	25.7	19.5	15.8	13.2	7.5
1973	124.8	113.2	91.1	71.9	37.9	26.0	20.0	16.4	13.9	8.8
1974	143.2	110.8	105.6	96.0	58.8	39.6	29.7	23.8	20.0	10.0
1975	165.6	110.4	97.9	80.8	42.5	28.4	21.3	17.1	14.2	7.1
1976	176.0	118.0	83.3	62.7	34.3	25.8	19.9	15.9	14.9	8.3
1977	120.4	93.6	70.3	54.1	27.1	19.6	15.3	12.2	10.2	5.1
1978	104.0	83.8	73.2	61.8	33.0	23.3	17.6	14.1	11.8	5.9
1979	134.0	87.0	70.1	55.6	34.2	24.9	18.7	15.0	12.5	6.3
1980	168.8	114.4	101.7	82.8	42.6	29.5	22.4	17.9	15.0	7.5
1981	117.2	91.4	82.1	75.3	41.1	28.0	21.6	21.1	19.3	9.8
1982	164.4	112.4	81.9	62.3	41.3	35.2	26.9	21.5	17.9	9.0
1983	156.4	133.6	122.4	104.9	59.2	40.0	30.0	24.0	20.0	11.6
1984	166.0	103.2	72.3	54.7	28.1	20.0	15.1	12.2	10.2	5.1
1985	120.8	87.4	63.7	61.6	39.5	26.6	21.7	17.6	15.4	10.1
1986	200.8	113.2	84.7	75.3	50.5	41.2	32.3	27.3	23.3	12.1
1987	130.0	93.0	70.0	56.2	29.0	20.0	16.3	14.2	12.5	6.3
1988	108.4	104.4	100.4	85.3	53.5	40.5	31.2	25.0	21.0	10.6
1989	148.8	85.8	59.9	46.8	32.3	22.1	17.6	14.1	11.8	7.0
1990	154.4	112.8	87.9	67.8	34.2	22.8	22.2	17.9	14.9	7.5
1991	99.6	81.0	67.5	57.0	35.2	24.2	18.4	14.7	12.5	9.9
1992	140.8	95.4	79.1	70.6	37.0	24.6	18.5	14.8	12.3	7.3
1993	119.2	83.2	56.7	48.0	29.9	20.9	15.7	12.6	10.5	5.2
1994	127.2	91.0	78.7	63.3	34.3	23.1	17.4	13.9	11.6	5.8
1995	124.0	99.4	73.5	55.5	28.3	19.1	16.0	12.9	10.8	6.2
1996	129.2	102.0	71.6	54.9	35.7	26.1	19.6	15.7	13.1	6.9
1997	141.2	98.0	75.6	62.4	41.7	32.1	25.6	21.4	18.3	12.6

Table I-1 (2/3) Annual Maximum Rainfall Intensities (Observed at Bayan Lepas, Penang)

(Unit : mm/hour)

year	Rainfall Duration									
	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	12 hr
1951	137.2	102.2	94.1	97.5	59.8	41.1	31.9	25.7	21.4	10.7
1952	116.0	95.0	77.2	69.1	48.0	33.8	26.7	22.4	19.5	10.3
1953	142.4	102.2	69.5	55.9	31.0	24.1	20.6	17.4	15.0	8.4
1954	93.6	58.0	44.7	38.6	31.9	21.8	20.0	16.8	14.0	7.6
1955	122.0	81.8	74.5	66.3	54.6	39.5	29.9	23.9	19.9	10.0
1956	113.6	89.4	72.5	61.0	33.8	23.3	18.5	15.1	12.7	6.8
1957	101.6	87.8	72.1	58.9	46.3	36.7	32.5	26.2	22.0	11.5
1958	104.8	104.2	100.9	98.8	62.6	52.7	40.1	32.7	27.9	19.1
1959	135.2	98.6	75.9	59.7	38.3	25.7	20.5	18.2	15.8	9.0
1960	111.6	85.4	64.4	52.6	32.8	22.9	18.2	15.2	13.0	6.9
1961	101.6	94.0	76.1	60.5	30.6	21.4	17.1	16.7	19.0	11.2
1962	113.6	93.4	73.2	70.6	53.9	39.4	31.3	25.5	21.2	11.7
1963	167.6	104.2	79.2	59.4	31.0	21.5	16.4	13.5	11.6	6.9
1964	132.0	106.6	88.4	70.9	40.5	28.8	24.1	22.4	20.1	15.2
1965	132.0	105.6	85.3	74.2	41.9	28.5	22.0	17.7	14.8	7.5
1966	167.6	122.0	86.7	66.8	41.6	31.1	23.8	19.9	16.6	11.8
1967	124.8	104.2	88.7	72.4	39.0	28.0	22.0	17.8	15.0	7.5
1968	116.8	94.0	73.9	66.0	37.0	24.7	18.7	15.2	13.6	7.1
1969	132.0	119.4	111.7	113.8	70.4	50.0	38.9	31.4	26.9	13.7
1970	106.8	94.4	84.7	68.6	47.0	31.8	25.5	21.7	20.1	10.3
1971	116.8	106.6	92.1	75.2	41.0	30.8	24.1	20.0	17.7	11.5
1972	116.8	96.6	80.9	78.7	49.7	34.4	26.3	21.3	17.9	9.0
1973	147.2	114.2	93.9	83.3	44.7	33.4	26.8	21.7	18.4	9.3
1974	111.6	95.6	68.1	55.1	31.8	25.7	26.0	21.7	18.8	9.5
1975	144.0	108.4	79.6	67.7	39.7	29.4	22.1	17.7	14.7	7.6
1976	172.0	108.0	92.0	72.5	41.5	27.8	20.8	16.7	13.9	6.9
1977	152.8	109.6	88.0	76.3	41.8	28.9	22.3	17.8	14.9	7.9
1978	154.0	132.0	106.7	95.0	54.0	36.7	28.9	24.0	20.2	10.1
1979	124.0	112.0	82.8	63.2	32.7	22.6	21.5	18.5	16.0	8.1
1980	124.4	99.2	86.7	66.4	42.0	28.0	21.0	16.8	14.0	7.4
1981	128.0	100.0	93.3	84.5	49.5	33.5	25.3	20.3	18.2	9.4
1982	180.0	136.8	100.1	78.1	45.8	31.4	24.0	19.4	17.5	10.0
1983	118.0	100.6	97.6	81.2	57.4	39.8	29.9	23.9	20.0	10.0
1984	128.8	94.4	68.8	58.6	41.0	28.0	23.2	18.7	15.9	9.3
1985	141.2	117.2	106.4	102.0	76.4	51.2	38.4	30.7	25.6	16.1
1986	130.0	111.8	92.5	81.1	50.2	33.6	25.2	20.2	16.8	8.4
1987	120.0	97.8	70.5	58.9	45.3	30.5	23.2	18.5	15.5	7.7
1988	214.4	157.0	118.7	91.3	50.0	36.0	27.0	21.6	18.0	9.0
1989	-	101.2	89.5	77.5	56.2	39.5	30.6	24.6	21.0	11.1
1990	170.0	111.6	79.3	67.6	34.8	23.6	18.4	14.7	12.2	7.8
1991	144.8	128.6	100.5	81.6	42.0	29.2	31.7	27.4	24.5	13.5
1992	114.4	103.6	92.1	72.9	37.7	28.7	25.2	20.4	17.2	8.7
1993	157.6	121.2	96.9	81.6	58.6	39.8	29.9	23.9	19.9	10.0
1994	124.0	110.4	114.5	97.7	59.5	40.8	30.9	24.7	20.6	10.3
1995	121.6	92.8	82.3	66.5	43.1	30.9	23.6	18.9	15.8	11.8
1996	146.4	130.0	120.3	103.2	64.8	44.6	34.1	27.4	22.9	11.4
1997	136.8	103.6	93.2	80.1	43.5	29.2	21.9	17.5	14.6	7.3

Table I-1 (3/3) Annual Maximum Rainfall Intensities (Observed at Lanpangan Terbang, Melaka )  
(Unit : mm/hour)

year	Rainfall Duration									
	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	12 hr
1951	110.8	97.6	79.6	63.0	39.6	27.4	21.7	18.4	15.6	7.8
1952	171.6	134.2	115.9	101.9	56.2	38.9	33.4	28.2	24.9	12.9
1953	101.6	86.8	75.5	64.3	35.1	26.7	23.0	18.7	15.7	7.9
1954	87.2	82.8	64.4	55.9	40.0	28.8	21.6	17.3	14.4	10.9
1955	116.0	103.2	77.2	57.9	38.6	30.6	26.7	24.3	20.8	10.4
1956	111.6	83.8	63.7	56.6	36.9	25.5	19.7	16.2	14.0	7.1
1957	111.6	80.2	69.5	58.7	49.6	37.7	30.9	25.3	21.1	10.6
1958	176.8	162.6	135.5	120.7	65.9	44.0	33.1	26.5	22.1	11.0
1959	142.4	122.0	112.4	108.7	60.4	41.1	31.1	24.9	20.8	10.4
1960	82.4	77.2	63.3	54.1	32.3	22.8	17.9	14.8	13.1	15.0
1961	101.6	71.2	64.7	48.8	29.4	25.0	24.8	20.6	17.3	8.7
1962	101.6	81.2	63.3	50.8	26.9	19.0	14.2	11.4	9.5	5.0
1963	114.8	101.0	87.1	66.5	33.4	22.3	16.7	13.4	11.1	5.6
1964	134.0	84.4	69.5	62.5	42.3	28.2	21.2	17.3	14.4	7.2
1965	116.8	94.0	72.5	60.2	36.2	25.4	19.8	16.0	14.2	7.1
1966	142.4	112.8	83.3	63.5	32.2	21.7	17.3	15.5	13.3	6.7
1967	111.6	83.8	66.7	51.6	33.0	24.4	19.0	15.8	13.6	8.6
1968	111.6	72.2	64.0	54.6	29.6	21.3	16.5	13.5	11.3	5.7
1969	122.0	96.6	70.4	59.7	41.9	28.2	23.4	19.7	16.8	9.0
1970	156.4	114.2	95.2	79.0	41.4	27.9	21.0	16.8	14.0	7.0
1971	104.4	95.6	75.2	65.0	40.7	32.8	26.7	22.7	19.2	9.6
1972	127.2	89.4	67.7	54.9	33.3	22.9	17.2	13.8	11.5	5.7
1973	149.2	120.4	95.5	91.4	54.0	37.5	29.4	23.6	19.7	9.9
1974	122.0	77.8	62.9	50.8	30.8	21.3	16.6	13.3	11.2	6.3
1975	156.0	112.0	84.0	71.0	39.7	26.5	19.9	15.9	13.3	7.0
1976	156.0	128.4	104.7	85.5	45.7	31.7	24.5	19.7	16.4	8.2
1977	114.0	92.2	81.5	74.6	46.1	31.8	24.7	20.3	18.7	13.3
1978	152.8	107.2	78.4	60.2	43.5	29.3	22.1	18.2	15.6	8.7
1979	142.4	129.2	111.2	105.8	97.7	81.4	66.1	53.2	44.7	22.4
1980	167.2	117.6	90.4	78.9	53.2	37.0	28.1	22.5	18.8	9.4
1981	158.0	122.6	94.0	85.8	55.9	37.8	31.6	26.9	22.4	11.2
1982	110.0	79.0	70.9	56.2	33.4	30.5	23.0	18.4	15.3	7.7
1983	118.0	96.6	83.6	72.4	41.2	27.6	21.3	17.1	14.9	9.3
1984	136.4	100.8	73.2	61.1	39.2	33.1	25.9	20.8	17.3	9.3
1985	168.0	102.0	78.8	65.4	42.8	30.7	24.6	20.5	18.0	9.2
1986	125.2	87.8	62.0	48.3	30.4	21.7	18.2	16.0	13.6	6.8
1987	184.4	145.6	104.1	78.6	40.5	27.3	21.7	18.1	15.3	7.7
1988	171.6	124.4	97.3	76.6	48.8	35.8	26.9	21.6	18.0	9.0
1989	140.8	117.2	107.5	97.1	52.0	34.9	26.2	21.0	17.5	8.7
1990	102.8	68.2	52.1	40.8	28.1	19.9	14.9	11.9	10.6	5.6
1991	128.8	108.6	83.5	64.4	33.6	23.3	17.8	14.2	11.9	6.4
1992	170.4	127.6	103.7	84.8	44.2	29.6	22.2	17.8	14.8	7.4
1993	114.4	104.6	77.3	59.3	45.0	34.6	26.5	21.9	18.7	9.5
1994	162.8	131.0	106.1	84.9	52.0	45.2	41.8	34.3	28.9	14.5
1995	150.8	112.4	84.7	66.7	40.2	27.0	20.2	16.2	13.5	6.8
1996	132.0	92.8	78.8	71.4	42.7	30.7	24.1	19.4	16.1	8.3
1997	124.8	119.2	96.0	77.9	47.2	31.5	23.6	18.9	15.7	7.9

Table I-2 Probable Point Rainfall Intensities

Kepala Batas, Alor Star

(Unit : mm/hour)

Return Period	Rainfall Duration									
	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	12 hr
2	132.8	98.4	78.4	64.0	37.8	26.7	21.0	17.3	14.7	8.1
3	144.8	105.8	85.6	70.6	41.7	29.8	23.4	19.4	16.5	9.0
5	158.0	114.0	93.7	77.9	46.2	33.2	26.0	21.6	18.6	10.1
8	169.6	121.0	100.7	84.2	50.0	36.2	28.3	23.6	20.3	11.0
10	174.8	124.4	103.9	87.1	51.8	37.5	29.4	24.5	21.1	11.5
20	190.8	134.4	113.6	96.0	57.2	41.6	32.5	27.2	23.5	12.8
25	196.0	137.4	116.7	98.8	58.8	42.9	33.5	28.1	24.3	13.2
30	200.0	140.0	119.2	101.0	60.2	44.0	34.4	28.8	24.9	13.5
50	211.6	147.2	126.3	107.4	64.1	47.0	36.7	30.7	26.6	14.4
100	227.2	156.8	135.7	115.9	69.3	51.0	39.8	33.4	29.0	15.7
200	242.4	166.4	145.1	124.5	74.4	55.0	42.8	36.0	31.3	16.9

Bayan Lepas, Penang

(Unit : mm/hour)

Return Period	Rainfall Duration									
	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	12 hr
2	129.2	102.6	84.5	71.7	44.0	31.0	24.6	20.2	17.3	9.4
3	140.4	110.0	91.5	78.7	49.0	34.6	27.3	22.3	19.1	10.6
5	152.4	118.4	99.2	86.6	54.6	38.6	30.3	24.6	21.1	12.0
8	163.2	125.4	105.9	93.3	59.4	42.1	32.8	26.6	22.8	13.1
10	168.0	128.6	109.1	96.4	61.6	43.7	34.0	27.6	23.6	13.6
20	182.8	138.6	118.4	105.9	68.3	48.5	37.5	30.4	25.9	15.3
25	187.6	141.8	121.3	108.9	70.5	50.1	38.7	31.3	26.7	15.8
30	191.6	144.4	123.7	111.3	72.3	51.3	39.5	32.0	27.3	16.2
50	202.0	151.6	130.5	118.1	77.1	54.8	42.1	34.0	29.0	17.3
100	216.4	161.2	139.6	127.3	83.6	59.5	45.6	36.7	31.3	18.9
200	230.8	170.8	148.7	136.5	90.2	64.2	49.0	39.4	33.6	20.4

Lapangan Terbang, Melaka

(Unit : mm/hour)

Return Period	Rainfall Duration									
	15 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr	12 hr
2	128.4	100.0	80.1	66.8	40.7	29.1	22.9	18.8	15.9	8.5
3	140.0	109.8	88.4	74.9	46.3	33.7	26.8	21.9	18.5	9.9
5	153.2	120.6	97.6	83.9	52.5	38.8	31.1	25.4	21.5	11.4
8	164.8	130.0	105.5	91.7	58.0	43.1	34.8	28.4	24.0	12.8
10	170.0	134.2	109.1	95.3	60.5	45.2	36.5	29.8	25.2	13.4
20	186.0	147.4	120.1	106.2	67.9	51.3	41.7	34.0	28.7	15.3
25	190.8	151.6	123.6	109.6	70.3	53.3	43.3	35.4	29.9	15.9
30	195.2	155.0	126.5	112.4	72.3	54.8	44.7	36.5	30.8	16.3
50	206.4	164.4	134.4	120.3	77.8	59.3	48.4	39.5	33.3	17.7
100	222.0	177.0	145.2	130.8	85.1	65.2	53.4	43.6	36.8	19.5
200	237.6	189.8	155.9	141.3	92.3	71.2	58.4	47.6	40.2	21.3

Table I-3 Equations Developed for Rainfall Intensity – Duration Curves  
(Applicable Range of Rainfall Duration : Less Than 12 hours)

Kepala Batas, Alor Star

Return Period	(1) Talbot Type	(2) Sherman Type	(3) Kuno Type	(4) Horner Type
2	$I = 5719.47/(T+28.42)$	$I = 1212.90/T^{0.74}$	$I = 272.77/(T^{0.5}-2.49)$	$I = 3569.93/(T+19.25)^{-0.92}$
3	$I = 6410.72/(T+30.09)$	$I = 1280.76/T^{0.73}$	$I = 305.16/(T^{0.5}-2.41)$	$I = 4082.37/(T+21.17)^{-0.93}$
5	$I = 7196.47/(T+31.83)$	$I = 1351.07/T^{0.72}$	$I = 341.64/(T^{0.5}-2.34)$	$I = 4414.01/(T+22.02)^{-0.92}$
8	$I = 7866.35/(T+33.01)$	$I = 1417.97/T^{0.72}$	$I = 372.95/(T^{0.5}-2.29)$	$I = 4851.77/(T+23.24)^{-0.92}$
10	$I = 8191.49/(T+33.65)$	$I = 1443.26/T^{0.71}$	$I = 387.88/(T^{0.5}-2.27)$	$I = 4846.13/(T+22.97)^{-0.91}$
20	$I = 9126.38/(T+34.96)$	$I = 1538.15/T^{0.71}$	$I = 431.32/(T^{0.5}-2.22)$	$I = 5319.37/(T+23.88)^{-0.91}$
25	$I = 9424.59/(T+35.35)$	$I = 1567.32/T^{0.70}$	$I = 445.26/(T^{0.5}-2.20)$	$I = 5494.82/(T+24.27)^{-0.91}$
30	$I = 9666.16/(T+35.66)$	$I = 1592.66/T^{0.70}$	$I = 456.53/(T^{0.5}-2.19)$	$I = 5743.29/(T+24.94)^{-0.92}$
50	$I = 10332.88/(T+36.33)$	$I = 1666.00/T^{0.70}$	$I = 487.61/(T^{0.5}-2.16)$	$I = 6202.79/(T+25.79)^{-0.92}$
100	$I = 11264.13/(T+37.37)$	$I = 1753.85/T^{0.69}$	$I = 530.82/(T^{0.5}-2.12)$	$I = 6623.50/(T+26.36)^{-0.91}$
200	$I = 12158.67/(T+38.11)$	$I = 1849.78/T^{0.69}$	$I = 572.35/(T^{0.5}-2.09)$	$I = 7245.66/(T+27.35)^{-0.92}$

Note : I=Rainfall Intensity (mm/hour)  
T=Rainfall Duration (minute)

Bayan Lepas, Penang

Return Period	(1) Talbot Type	(2) Sherman Type	(3) Kuno Type	(4) Horner Type
2	$I = 6914.21/(T+37.80)$	$I = 1088.20/T^{0.70}$	$I = 320.89/(T^{0.5}-2.22)$	$I = 5412.60/(T+32.20)^{-0.96}$
3	$I = 7744.47/(T+40.00)$	$I = 1140.26/T^{0.69}$	$I = 358.41/(T^{0.5}-2.13)$	$I = 5690.45/(T+32.83)^{-0.95}$
5	$I = 8684.35/(T+42.27)$	$I = 1195.64/T^{0.68}$	$I = 400.43/(T^{0.5}-2.05)$	$I = 5883.11/(T+33.07)^{-0.94}$
8	$I = 9466.34/(T+43.66)$	$I = 1252.50/T^{0.67}$	$I = 435.83/(T^{0.5}-1.99)$	$I = 6355.40/(T+34.15)^{-0.94}$
10	$I = 9837.21/(T+44.34)$	$I = 1277.30/T^{0.67}$	$I = 452.50/(T^{0.5}-1.96)$	$I = 6646.12/(T+34.93)^{-0.94}$
20	$I = 10956.11/(T+46.13)$	$I = 1351.46/T^{0.66}$	$I = 502.55/(T^{0.5}-1.90)$	$I = 6875.00/(T+34.86)^{-0.93}$
25	$I = 11319.69/(T+46.67)$	$I = 1376.00/T^{0.66}$	$I = 518.95/(T^{0.5}-1.88)$	$I = 7136.61/(T+35.48)^{-0.93}$
30	$I = 11590.83/(T+46.91)$	$I = 1399.13/T^{0.66}$	$I = 531.24/(T^{0.5}-1.87)$	$I = 7255.88/(T+35.54)^{-0.93}$
50	$I = 12384.09/(T+47.86)$	$I = 1457.29/T^{0.65}$	$I = 566.79/(T^{0.5}-1.83)$	$I = 7845.10/(T+36.71)^{-0.93}$
100	$I = 13474.26/(T+49.09)$	$I = 1532.49/T^{0.65}$	$I = 615.58/(T^{0.5}-1.79)$	$I = 8320.09/(T+37.27)^{-0.92}$
200	$I = 14539.68/(T+50.01)$	$I = 1613.28/T^{0.64}$	$I = 663.43/(T^{0.5}-1.75)$	$I = 9067.29/(T+38.41)^{-0.93}$

Note : I=Rainfall Intensity (mm/hour)  
T=Rainfall Duration (minute)

Lapangan Terbang, Melaka

Return Period	(1) Talbot Type	(2) Sherman Type	(3) Kuno Type	(4) Horner Type
2	$I = 6286.23/(T+33.69)$	$I = 1127.17/T^{0.72}$	$I = 295.65/(T^{0.5}-2.33)$	$I = 5325.36/(T+30.13)^{-0.97}$
3	$I = 7397.20/(T+38.05)$	$I = 1156.48/T^{0.70}$	$I = 345.36/(T^{0.5}-2.16)$	$I = 6403.39/(T+34.88)^{-0.98}$
5	$I = 8644.48/(T+42.12)$	$I = 1200.56/T^{0.68}$	$I = 401.23/(T^{0.5}-2.01)$	$I = 8020.95/(T+40.55)^{-0.99}$
8	$I = 9737.88/(T+45.18)$	$I = 1241.78/T^{0.66}$	$I = 449.95/(T^{0.5}-1.89)$	$I = 8955.49/(T+43.42)^{-0.99}$
10	$I = 10247.09/(T+46.51)$	$I = 1261.44/T^{0.66}$	$I = 472.65/(T^{0.5}-1.84)$	$I = 9748.74/(T+45.60)^{-0.99}$
20	$I = 11781.12/(T+49.94)$	$I = 1327.00/T^{0.65}$	$I = 540.83/(T^{0.5}-1.72)$	$I = 11531.68/(T+49.83)^{-1.00}$
25	$I = 12287.83/(T+51.08)$	$I = 1345.52/T^{0.64}$	$I = 563.18/(T^{0.5}-1.67)$	$I = 12279.62/(T+51.53)^{-1.00}$
30	$I = 12666.54/(T+51.64)$	$I = 1369.13/T^{0.64}$	$I = 580.31/(T^{0.5}-1.65)$	$I = 13382.21/(T+53.58)^{-1.01}$
50	$I = 13794.83/(T+53.74)$	$I = 1417.10/T^{0.63}$	$I = 630.06/(T^{0.5}-1.58)$	$I = 14776.15/(T+56.11)^{-1.01}$
100	$I = 15304.40/(T+56.09)$	$I = 1487.99/T^{0.62}$	$I = 697.00/(T^{0.5}-1.49)$	$I = 17248.60/(T+59.97)^{-1.02}$
200	$I = 16800.95/(T+58.04)$	$I = 1562.65/T^{0.62}$	$I = 763.32/(T^{0.5}-1.42)$	$I = 19740.59/(T+63.19)^{-1.02}$

Note : I=Rainfall Intensity (mm/hour)  
T=Rainfall Duration (minute)

Table I-4 (1/3) Conformity of Equations Developed for Rainfall Intensity – Duration Curves  
(Kepala Batas, Alor Star) (Applicable Range of Rainfall Duration : Less Than 12 hours)

Return Period	Rainfall Duration (min)	Rainfall Intensities Estimated From					Difference of Rainfall Intensities			
		(1) Observed Data (mm/hr)	(2) Eq. of Talbot (mm/hr)	(3) Eq. of Sherman (mm/hr)	(4) Eq. of Kuno (mm/hr)	(5) Eq. of Horner (mm/hr)	(1)-(2) (mm)	(1)-(3) (mm)	(1)-(4) (mm)	(1)-(5) (mm)
2	15	132.8	131.7	162.0	196.6	136.8	1.1	29.2	63.8	4.0
	30	98.4	97.9	96.8	91.2	97.8	0.5	1.6	7.2	0.6
	45	78.4	77.9	71.6	64.6	76.5	0.5	6.8	13.8	1.9
	60	64.0	64.7	57.8	51.9	63.1	0.7	6.2	12.1	0.9
	120	37.8	38.5	34.5	32.2	37.5	0.7	3.3	5.6	0.3
	180	26.7	27.4	25.5	25.0	26.9	0.7	1.2	1.7	0.2
	240	21.0	21.3	20.6	21.0	21.1	0.3	0.4	0.0	0.1
	300	17.3	17.4	17.5	18.4	17.4	0.1	0.2	1.1	0.1
	360	14.7	14.7	15.3	16.5	14.9	0.0	0.6	1.8	0.2
	720	8.1	7.6	9.1	11.2	8.0	0.5	1.0	3.1	0.1
	Total Average						5.1 0.5	50.4 5.0	110.4 11.0	8.4 0.8
5	15	158.0	153.7	190.2	223.3	159.0	4.3	32.2	65.3	1.0
	30	114.0	116.4	115.2	109.0	116.2	2.4	1.2	5.0	2.2
	45	93.7	93.7	85.9	78.3	92.1	0.0	7.8	15.4	1.6
	60	77.9	78.4	69.7	63.2	76.4	0.5	8.2	14.7	1.5
	120	46.2	47.4	42.2	39.7	46.1	1.2	4.0	6.5	0.1
	180	33.2	34.0	31.5	30.9	33.3	0.8	1.7	2.3	0.1
	240	26.0	26.5	25.6	26.0	26.2	0.5	0.4	0.0	0.2
	300	21.6	21.7	21.7	22.8	21.7	0.1	0.1	1.2	0.1
	360	18.6	18.4	19.1	20.5	18.6	0.2	0.5	1.9	0.0
	720	10.1	9.6	11.5	14.0	10.1	0.5	1.4	3.9	0.0
	Total Average						10.5 1.1	57.6 5.8	116.3 11.6	7.0 0.7
10	15	174.8	168.4	208.9	241.7	174.1	6.4	34.1	66.9	0.7
	30	124.4	128.7	127.3	120.9	128.4	4.3	2.9	3.5	4.0
	45	103.9	104.2	95.3	87.4	102.2	0.3	8.6	16.5	1.7
	60	87.1	87.5	77.6	70.8	85.2	0.4	9.5	16.3	1.9
	120	51.8	53.3	47.3	44.7	51.8	1.5	4.5	7.1	0.0
	180	37.5	38.3	35.4	34.8	37.6	0.8	2.1	2.7	0.1
	240	29.4	29.9	28.9	29.3	29.7	0.5	0.5	0.1	0.3
	300	24.5	24.6	24.6	25.8	24.6	0.1	0.1	1.3	0.1
	360	21.1	20.8	21.6	23.2	21.0	0.3	0.5	2.1	0.1
	720	11.5	10.9	13.2	15.8	11.5	0.6	1.7	4.3	0.0
	Total Average						15.2 1.5	64.4 6.4	120.9 12.1	8.8 0.9
50	15	211.6	201.3	250.5	284.5	206.9	10.3	38.9	72.9	4.7
	30	147.2	155.8	154.2	146.9	155.3	8.6	7.0	0.3	8.1
	45	126.3	127.1	116.1	107.2	124.8	0.8	10.2	19.1	1.5
	60	107.4	107.3	94.9	87.3	104.6	0.1	12.5	20.1	2.8
	120	64.1	66.1	58.5	55.4	64.3	2.0	5.6	8.7	0.2
	180	47.0	47.8	44.0	43.3	46.9	0.8	3.0	3.7	0.1
	240	36.7	37.4	36.0	36.6	37.1	0.7	0.7	0.1	0.4
	300	30.7	30.7	30.8	32.2	30.8	0.0	0.1	1.5	0.1
	360	26.6	26.1	27.1	29.0	26.4	0.5	0.5	2.4	0.2
	720	14.4	13.7	16.7	19.8	14.4	0.7	2.3	5.4	0.0
	Total Average						24.5 2.5	80.7 8.1	134.1 13.4	18.1 1.8
100	15	227.2	215.1	267.7	302.1	220.9	12.1	40.5	74.9	6.3
	30	156.8	167.2	165.5	157.9	166.5	10.4	8.7	1.1	9.7
	45	135.7	136.7	124.9	115.6	134.2	1.0	10.8	20.1	1.5
	60	115.9	115.7	102.3	94.3	112.7	0.2	13.6	21.6	3.2
	120	69.3	71.6	63.2	60.1	69.6	2.3	6.1	9.2	0.3
	180	51.0	51.8	47.7	47.0	50.9	0.8	3.3	4.0	0.1
	240	39.8	40.6	39.1	39.7	40.3	0.8	0.7	0.1	0.5
	300	33.4	33.4	33.5	34.9	33.5	0.0	0.1	1.5	0.1
	360	29.0	28.3	29.5	31.5	28.7	0.7	0.5	2.5	0.3
	720	15.7	14.9	18.2	21.5	15.7	0.8	2.5	5.8	0.0
	Total Average						29.2 2.9	86.8 8.7	140.9 14.1	22.0 2.2

Table I-4 (2/3) Conformity of Equations Developed for Rainfall Intensity – Duration Curves  
(Bayan Lepas, Penang) (Applicable Range of Rainfall Duration : Less Than 12 hours)

Return Period	Rainfall Duration (min)	Rainfall Intensities Estimated From					Difference of Rainfall Intensities				
		(1)	(2)	(3)	(4)	(5)	(1)-(2)	(1)-(3)	(1)-(4)	(1)-(5)	
		Observed Data (mm/hr)	Eq. of Talbot (mm/hr)	Eq. of Sherman (mm/hr)	Eq. of Kuno (mm/hr)	Eq. of Horner (mm/hr)	(mm)	(mm)	(mm)	(mm)	
2	15	129.2	131.0	164.8	193.8	133.3	1.8	35.6	64.6	4.1	
	30	102.6	102.0	101.7	98.4	102.2	0.6	0.9	4.2	0.4	
	45	84.5	83.5	76.6	71.4	83.1	1.0	7.9	13.1	1.4	
	60	71.7	70.7	62.7	58.0	70.0	1.0	9.0	13.7	1.7	
	120	44.0	43.8	38.7	36.7	43.3	0.2	5.3	7.3	0.7	
	180	31.0	31.7	29.2	28.7	31.4	0.7	1.8	2.3	0.4	
	240	24.6	24.9	23.9	24.2	24.7	0.3	0.7	0.4	0.1	
	300	20.2	20.5	20.4	21.2	20.4	0.3	0.2	1.0	0.2	
	360	17.3	17.4	18.0	19.2	17.4	0.1	0.7	1.9	0.1	
	720	9.4	9.1	11.1	13.0	9.3	0.3	1.7	3.6	0.1	
							Total	6.2	63.9	112.0	9.3
							Average	0.6	6.4	11.2	0.9
5	15	152.4	151.6	191.7	219.1	155.6	0.8	39.3	66.7	3.2	
	30	118.4	120.2	120.0	116.7	120.6	1.8	1.6	1.7	2.2	
	45	99.2	99.5	91.2	85.9	98.7	0.3	8.0	13.3	0.5	
	60	86.6	84.9	75.1	70.2	83.7	1.7	11.5	16.4	2.9	
	120	54.6	53.5	47.0	44.9	52.5	1.1	7.6	9.7	2.1	
	180	38.6	39.1	35.7	35.2	38.5	0.5	2.9	3.4	0.1	
	240	30.3	30.8	29.4	29.8	30.5	0.5	0.9	0.5	0.2	
	300	24.6	25.4	25.3	26.2	25.3	0.8	0.7	1.6	0.7	
	360	21.1	21.6	22.4	23.7	21.7	0.5	1.3	2.6	0.6	
	720	12.0	11.4	14.0	16.2	11.8	0.6	2.0	4.2	0.2	
							Total	8.4	75.7	120.0	12.7
							Average	0.8	7.6	12.0	1.3
10	15	168.0	165.8	209.9	237.1	169.8	2.2	41.9	69.1	1.8	
	30	128.6	132.3	132.2	128.8	132.7	3.7	3.6	0.2	4.1	
	45	109.1	110.1	100.9	95.4	109.2	1.0	8.2	13.7	0.1	
	60	96.4	94.3	83.3	78.3	93.0	2.1	13.1	18.1	3.4	
	120	61.6	59.9	52.5	50.3	58.7	1.7	9.1	11.3	2.9	
	180	43.7	43.8	40.0	39.5	43.2	0.1	3.7	4.2	0.5	
	240	34.0	34.6	33.0	33.4	34.3	0.6	1.0	0.6	0.3	
	300	27.6	28.6	28.5	29.5	28.5	1.0	0.9	1.9	0.9	
	360	23.6	24.3	25.2	26.6	24.4	0.7	1.6	3.0	0.8	
	720	13.6	12.9	15.9	18.2	13.3	0.7	2.3	4.6	0.3	
							Total	14.0	85.4	126.6	15.2
							Average	1.4	8.5	12.7	1.5
50	15	202.0	197.0	249.6	277.9	201.9	5.0	47.6	75.9	0.1	
	30	151.6	159.1	158.9	155.6	159.4	7.5	7.3	4.0	7.8	
	45	130.5	133.4	122.0	116.3	132.1	2.9	8.5	14.2	1.6	
	60	118.1	114.8	101.2	95.9	113.0	3.3	16.9	22.2	5.1	
	120	77.1	73.8	64.4	62.1	72.2	3.3	12.7	15.0	4.9	
	180	54.8	54.4	49.5	48.9	53.4	0.4	5.3	5.9	1.4	
	240	42.1	43.0	41.0	41.5	42.6	0.9	1.1	0.6	0.5	
	300	34.0	35.6	35.5	36.6	35.5	1.6	1.5	2.6	1.5	
	360	29.0	30.4	31.5	33.1	30.5	1.4	2.5	4.1	1.5	
	720	17.3	16.1	20.0	22.7	16.8	1.2	2.7	5.4	0.5	
							Total	27.4	106.2	149.8	25.0
							Average	2.7	10.6	15.0	2.5
100	15	216.4	210.2	266.3	295.2	215.4	6.2	49.9	78.8	1.0	
	30	161.2	170.4	170.2	166.8	170.6	9.2	9.0	5.6	9.4	
	45	139.6	143.2	131.0	125.1	141.7	3.6	8.6	14.5	2.1	
	60	127.3	123.5	108.7	103.3	121.4	3.8	18.6	24.0	5.9	
	120	83.6	79.7	69.5	67.2	77.9	3.9	14.1	16.4	5.7	
	180	59.5	58.8	53.5	52.9	57.8	0.7	6.0	6.6	1.7	
	240	45.6	46.6	44.4	44.9	46.1	1.0	1.2	0.7	0.5	
	300	36.7	38.6	38.4	39.6	38.5	1.9	1.7	2.9	1.8	
	360	31.3	32.9	34.2	35.8	33.1	1.6	2.9	4.5	1.8	
	720	18.9	17.5	21.8	24.6	18.2	1.4	2.9	5.7	0.7	
							Total	33.2	115.0	159.8	30.7
							Average	3.3	11.5	16.0	3.1



Table I-4 (3/3) Conformity of Equations Developed for Rainfall Intensity – Duration Curves  
(Lapangan Terbang, Melaka) (Applicable Range of Rainfall Duration : Less Than 12 hours)

Return Period	Rainfall Duration (min)	Rainfall Intensities Estimated From					Difference of Rainfall Intensities			
		(1) Observed Data (mm/hr)	(2) Eq. of Talbot (mm/hr)	(3) Eq. of Sherman (mm/hr)	(4) Eq. of Kuno (mm/hr)	(5) Eq. of Horner (mm/hr)	(1)-(2) (mm)	(1)-(3) (mm)	(1)-(4) (mm)	(1)-(5) (mm)
2	15	128.4	129.1	161.5	191.3	130.6	0.7	33.1	62.9	2.2
	30	100.0	98.7	98.2	93.9	98.8	1.3	1.8	6.1	1.2
	45	80.1	79.9	73.4	67.5	79.5	0.2	6.7	12.6	0.6
	60	66.8	67.1	59.7	54.6	66.6	0.3	7.1	12.2	0.2
	120	40.7	40.9	36.3	34.3	40.5	0.2	4.4	6.4	0.2
	180	29.1	29.4	27.2	26.7	29.2	0.3	1.9	2.4	0.1
	240	22.9	23.0	22.1	22.5	22.9	0.1	0.8	0.4	0.0
	300	18.8	18.8	18.8	19.7	18.8	0.0	0.0	0.9	0.0
	360	15.9	16.0	16.5	17.8	16.0	0.1	0.6	1.9	0.1
	720	8.5	8.3	10.0	12.1	8.5	0.2	1.5	3.6	0.0
	Total Average						3.4 0.3	57.9 5.8	109.5 11.0	4.6 0.5
5	15	153.2	151.3	191.7	215.2	151.6	1.9	38.5	62.0	1.6
	30	120.6	119.9	119.8	115.7	119.7	0.7	0.8	4.9	0.9
	45	97.6	99.2	91.1	85.4	99.0	1.6	6.5	12.2	1.4
	60	83.9	84.7	74.9	69.9	84.4	0.8	9.0	14.0	0.5
	120	52.5	53.3	46.8	44.9	53.1	0.8	5.7	7.6	0.6
	180	38.8	38.9	35.6	35.2	38.8	0.1	3.2	3.6	0.0
	240	31.1	30.6	29.3	29.8	30.6	0.5	1.8	1.3	0.5
	300	25.4	25.3	25.2	26.2	25.3	0.1	0.2	0.8	0.1
	360	21.5	21.5	22.3	23.7	21.5	0.0	0.8	2.2	0.0
	720	11.4	11.3	13.9	16.2	11.4	0.1	2.5	4.8	0.0
	Total Average						6.6 0.7	68.9 6.9	113.5 11.3	5.6 0.6
10	15	170.0	166.6	211.8	232.8	166.4	3.4	41.8	62.8	3.6
	30	134.2	133.9	134.2	130.1	133.7	0.3	0.0	4.1	0.5
	45	109.1	112.0	102.7	97.1	111.7	2.9	6.4	12.0	2.6
	60	95.3	96.2	85.0	80.1	96.0	0.9	10.3	15.2	0.7
	120	60.5	61.5	53.8	51.9	61.4	1.0	6.7	8.6	0.9
	180	45.2	45.2	41.2	40.8	45.2	0.0	4.0	4.4	0.0
	240	36.5	35.8	34.1	34.6	35.8	0.7	2.4	1.9	0.7
	300	29.8	29.6	29.4	30.5	29.6	0.2	0.4	0.7	0.2
	360	25.2	25.2	26.1	27.6	25.3	0.0	0.9	2.4	0.1
	720	13.4	13.4	16.5	18.9	13.5	0.0	3.1	5.5	0.1
	Total Average						9.5 1.0	76.0 7.6	117.7 11.8	9.3 0.9
50	15	206.4	200.7	256.5	274.4	199.0	5.7	50.1	68.0	7.4
	30	164.4	164.7	165.6	161.5	164.0	0.3	1.2	2.9	0.4
	45	134.4	139.7	128.2	122.8	139.5	5.3	6.2	11.6	5.1
	60	120.3	121.3	106.9	102.1	121.3	1.0	13.4	18.2	1.0
	120	77.8	79.4	69.0	67.2	79.6	1.6	8.8	10.6	1.8
	180	59.3	59.0	53.5	53.2	59.2	0.3	5.8	6.1	0.1
	240	48.4	47.0	44.6	45.3	47.1	1.4	3.8	3.1	1.3
	300	39.5	39.0	38.7	40.0	39.1	0.5	0.8	0.5	0.4
	360	33.3	33.3	34.5	36.2	33.4	0.0	1.2	2.9	0.1
	720	17.7	17.8	22.3	24.9	17.8	0.1	4.6	7.2	0.1
	Total Average						16.3 1.6	95.9 9.6	131.1 13.1	17.6 1.8
100	15	222.0	215.3	275.5	292.4	212.9	6.7	53.5	70.4	9.1
	30	177.0	177.8	178.9	174.8	176.9	0.8	1.9	2.2	0.1
	45	145.2	151.4	139.0	133.6	151.2	6.2	6.2	11.6	6.0
	60	130.8	131.8	116.2	111.4	131.9	1.0	14.6	19.4	1.1
	120	85.1	86.9	75.4	73.6	87.3	1.8	9.7	11.5	2.2
	180	65.2	64.8	58.6	58.4	65.1	0.4	6.6	6.8	0.1
	240	53.4	51.7	49.0	49.8	51.9	1.7	4.4	3.6	1.5
	300	43.6	43.0	42.6	44.0	43.1	0.6	1.0	0.4	0.5
	360	36.8	36.8	38.1	39.9	36.9	0.0	1.3	3.1	0.1
	720	19.5	19.7	24.7	27.5	19.6	0.2	5.2	8.0	0.1
	Total Average						19.5 1.9	104.3 10.4	137.0 13.7	20.7 2.1