REKABENTUK SISTEM SALIRAN PERMUKAAN

KAWALAN REKABENTUK – Kemudahan Penyenggaraan

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MSMA2.0 Section 1.7

KAWALAN REKABENTUK – Keselamatan Awam

Typical measures to improve public safety include the followings:

- Railings on crossings, headwalls, steep slope or other locations where the public could fall into drains or waterbodies;
- Grates over open drains and manholes;
- Limiting the depth of open drains and ponds;
- Gentle side slopes on engineered waterways and on the sides of ponds, wetlands and lakes;
- Maximum flow velocity criteria for engineered waterways;
- Maximum velocity-depth criteria for flow on or across roads; and
- Landgrading criteria for different storm water structures.

MSMA2.0 Section 1.2.1

KAWALAN REKABENTUK – *Peak Discharge Control*

Runoff quantity control requirements for any size of development or re-development project is "Post development peak flow of any ARI at the project outlet must be less than or equal to the pre-development peak flow of the corresponding ARI $(Q_{post} \leq Q_{pre})$*".*

MSMA2.0 Section 1.2.3.3

KAWALAN REKABENTUK – *Minimum Drainage Slope*

Effective pavement drainage is essential to the maintenance of road service level and to traffic safety. The potential for hydroplaning at high speeds as well as the potential for vehicles to float or be washed off roads at lower speeds shall be given due considerations in designing pavement drainage. Recommended minimum values of roadway longitudinal slope shall be used for safe pavement drainage. Desirable gutter grades shall not be less than 0.5 percent for curbed pavements with an absolute minimum of 0.3 percent. To provide adequate drainage in sag vertical curves, a minimum slope of 0.3 percent shall be maintained within 15 metres of the low point of the curve.

KAWALAN REKABENTUK – Rekabentuk ARI

Types of Structure	ARI (years)		
	U2 / R2 and lower	U3 - U4 / R3 - R4	U5 - U6 / R5 - R6
Bridge	50 25*	100 50*	100** 100*
Culvert	20	25	50*
Road Surface Drainage	5	5-10	10
Interceptor Drain	10	10-25	25

Notes: *The above ARI can be used by the designer if one or any combination of the following conditions applies:-

a) if the structure is located in a flood plain
b) if the structure requires a high embankment
c) poor soil condition making high embankment uneconomical

Under the above conditions, the structure must be designed as a submersible structure. Special consideration however must be given against accumulation of debris or impact by logs etc.

** For major bridges, the probability of the design flood being exceeded should not be more than 5% in the design life.

MSMA 2.0 Section 14.2.4

KAWALAN REKABENTUK – *Velocity*

14.2.4.3 Velocities and Longitudinal Slope

To prevent sedimentation and vegetative growth, the minimum average flow velocity for minor drain shall not be less than 0.6 m/s. The maximum flow velocity in open drain should be restricted to a maximum of 2 m/s. However, for flow velocities in excess of 2 m/s and less than 4 m/s, drains shall be provided with a 1.2 m high handrail fence, or covered with metal grates or solid plates for the entire length of the drain for public safety.

As longitudinal slope increase the velocity increases proportionally. Open drains longitudinal slope should be constant and no steeper than 0.2%. Drop structures may be required to reduce the longitudinal slope in order to control flow velocities.

MSMA2.0 Section 14.2.4

KAWALAN REKABENTUK – Aras *Freeboard*

14.2.4.2 Freeboard

The depth of an open lined drain shall include a minimum freeboard of 50 mm above the design storm water level in the minor drain.

MSMA2.0 Section 2.3.1.2

KRITERIA REKABENTUK

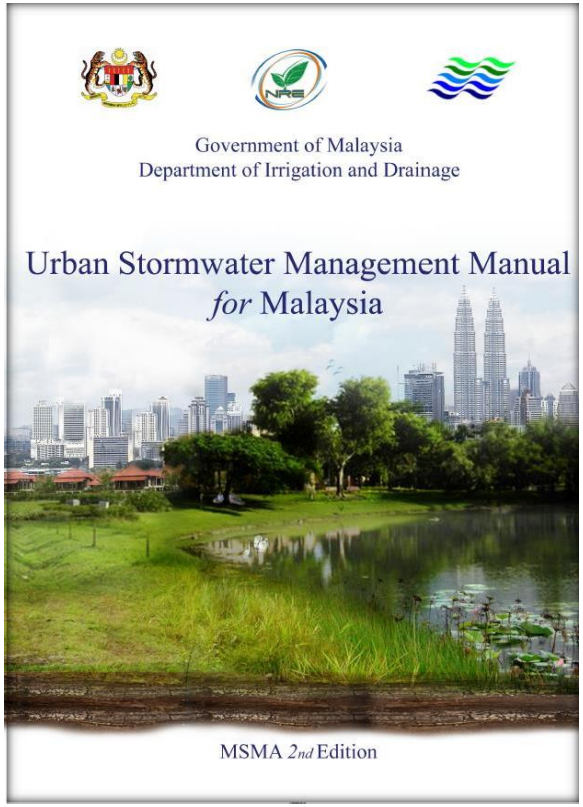
- Keluasan kawasan tadahan
  - A > 80 ha – rekabentuk menggunakan Hydrological Procedure
  - A < 80 ha – rekabentuk menggunakan MSMA
- Kaedah analisis hidrologi yang digunapakai untuk merekabentuk sistem saliran adalah kaedah *Rational Method*

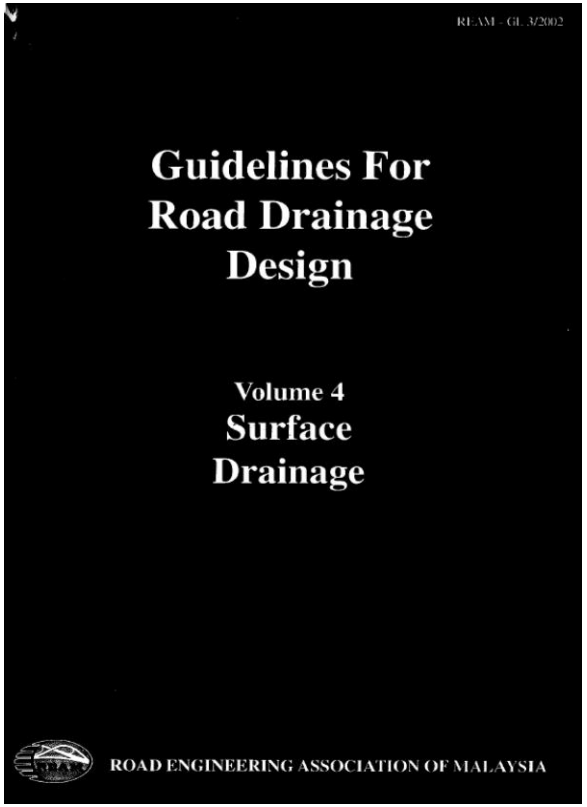
Where estimation of runoff has to be done using statistical methods, the designer should refer to the Hydrological Procedures (HP) published by Drainage and Irrigation Department Malaysia (D.I.D.).

Four Methods have been established by D.I.D.:-

a. Regional Flood Frequency Method (HP No.4).
b. Rational Method for Rural Catchment (HP No.5).
c. Flood Hydrography Method for Rural Catchment (HP No.11).
d. Modified Form of Rational Method for Urban Area (HP No.16).

GARIS PANDUAN REKABENTUK





REKABENTUK KONSEP

- Desk study
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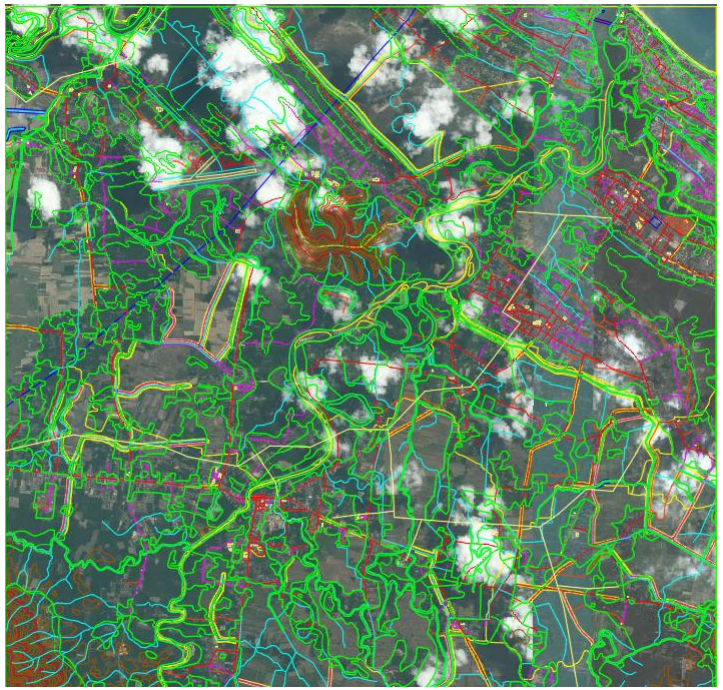

REKABENTUK KONSEP

- Penyiasatan tapak
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REKABENTUK KONSEP

- Cadangan rekabentuk konsep
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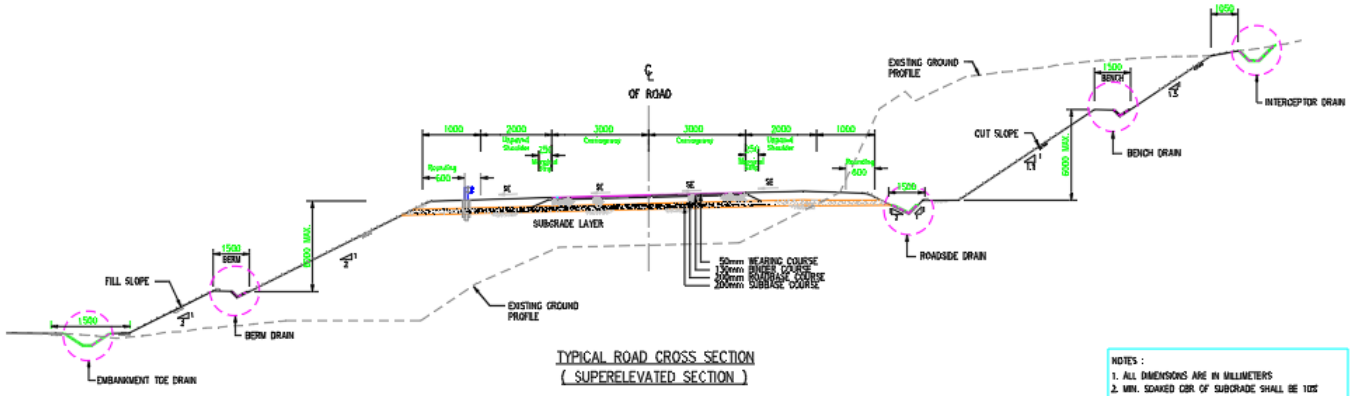

REKABENTUK AWALAN

- Penyediaan laporan penilaian terhadap sistem saliran sediada di tapak
- Mengenalpasti kriteria rekabentuk
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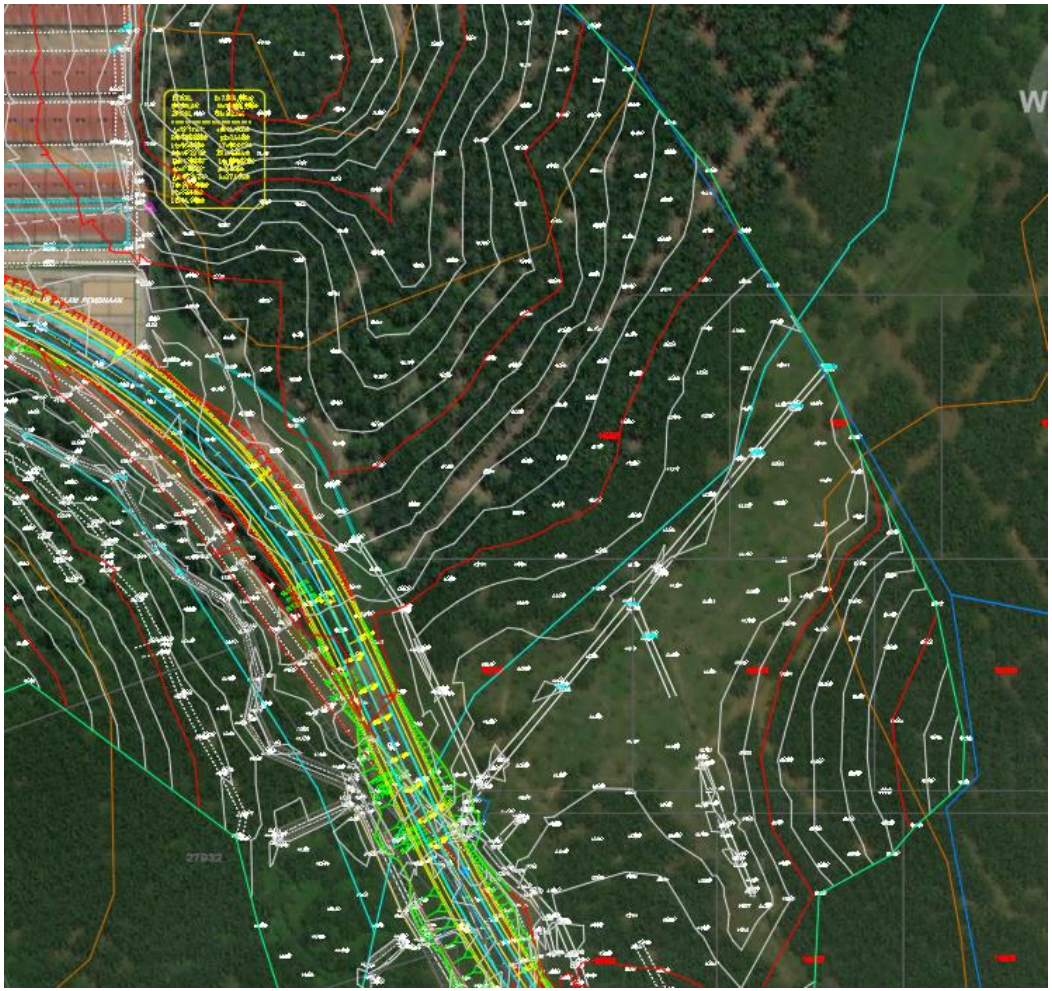
REKABENTUK AWALAN



REKABENTUK AWALAN

- Analisis hidrologi
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- Analisis hidraulik
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REKABENTUK AWALAN

LOCATION		DRAIN		AREA			TIME OF CONC.			DRAIN DESIGN PARAMETERS						DRAIN DETAILS								CHECK
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)			(18)	(19)	(20)	(21)	(22)
Sub-area Node Number		Drain Section No.	Length	Area	Coefficient of Runoff	Equivalent Area (C × A)	Overland Time t_o	Drain time t_d	Sub-area Time of Concentration	Design ARI	Total Equivalent Area $\Sigma(C\times A)$	Critical Time of Concentration t_c	Total Time in Drain	Rainfall Intensity I	Discharge $Q=\Sigma(C\times A)\times I$	Channel Gradient	Channel or Pipe Size			Capacity	Velocity	Time Flow in Section	Invert Level	Check Discharge for 100 year ARI
u/s	d/s		(m)	(ha)		(ha)	(min)	(min)	(min)	(year)	(ha)	(min)	(min)	(mm/hr)	(m^3/s)	(%)	w	d	z	(m^3/s)	(m/s)	(min)	m, LSD	(m^3/s)
6F1-10		1.01	380	7.94	0.81	6.43	20			5	6.43	20.00	0.00	145.71	2.60	0.20	1.20	1.10	0.50	3.30	1.71	3.7	48.46	3.69
6F1-9		1.02	200	8.62	0.79	6.81		3.69		5	6.81	23.69	3.69	132.52	2.51	0.20	1.20	1.10	0.50	3.30	1.71	1.9	46.31	3.56
6F1-8	6F1-7	1.03	250	3.94	0.78	3.07		1.95		5	9.5	25.64	5.64	126.80	3.35	0.20	1.20	1.30	0.50	4.43	1.84	2.3	43.40	4.75
6F2-1		2.01	620	17.71	0.72	12.75	20	2.43		5	12.75	20.00	0.00	145.71	5.16	0.20	1.60	1.30	0.50	5.77	1.97	5.2	46.85	7.32
6F2-2	6F1-7	2.02	400	14.82	0.78	11.56		4.55		5	24.31	24.55	4.55	129.93	8.77	0.20	2.00	1.60	0.50	10.18	2.27	2.9	45.76	12.26
6F1-7		1.04	150	5.76	0.77	4.44		2.93		5	38.25	28.07	8.07	120.54	12.81	0.20	2.50	2.00	0.50	18.46	2.64	0.9	43.86	18.23
6F1-6		10.5	200	13.51	0.77	10.34		0.95		5	48.59	29.02	9.02	118.32	15.97	0.20	2.50	2.00	0.50	18.46	2.64	1.3	41.70	22.73

REKABENTUK TERPERINCI

- Penyediaan laporan rekabentuk
  - Rumusan kriteria rekabentuk
  - Rumusan kekangan/masalah semasa rekabentuk
  - Rumusan perubahan rekabentuk
  - Keberkesanan rekabentuk
- Penyediaan pengiraan rekabentuk
- Penyediaan lukisan rekabentuk
- Penyediaan taking-off dan senarai kuantiti (BQ)

KOMPONEN SISTEM SALIRAN PERMUKAAN

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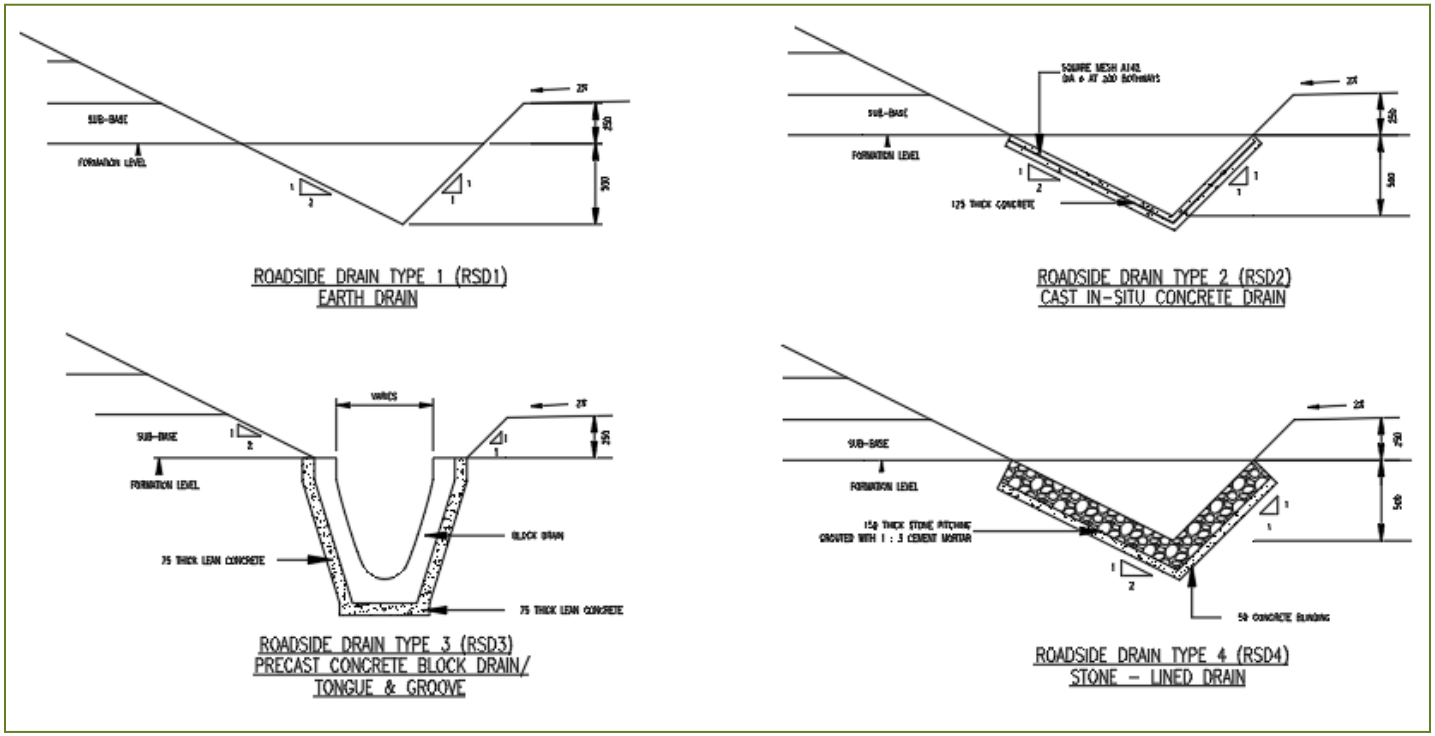
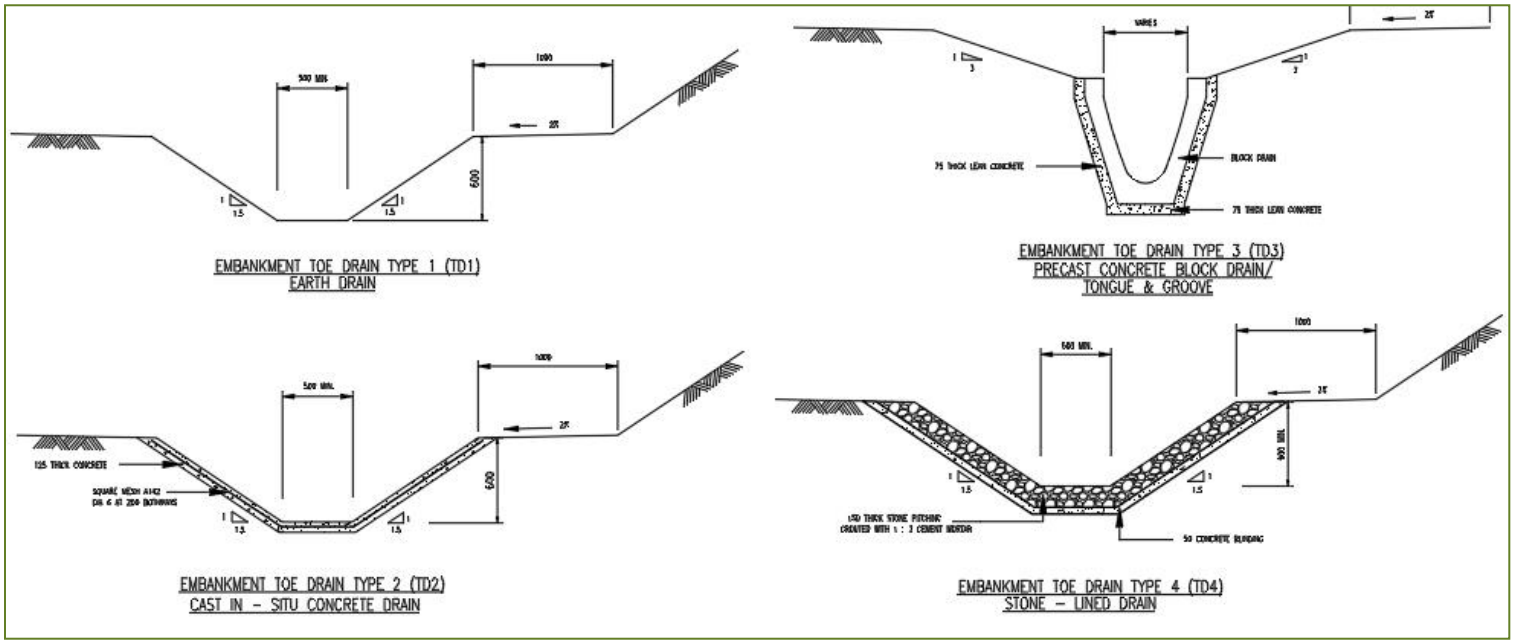


Toe Drain (TD)

KOMPONENT SISTEM SALIRAN PERMUKAAN



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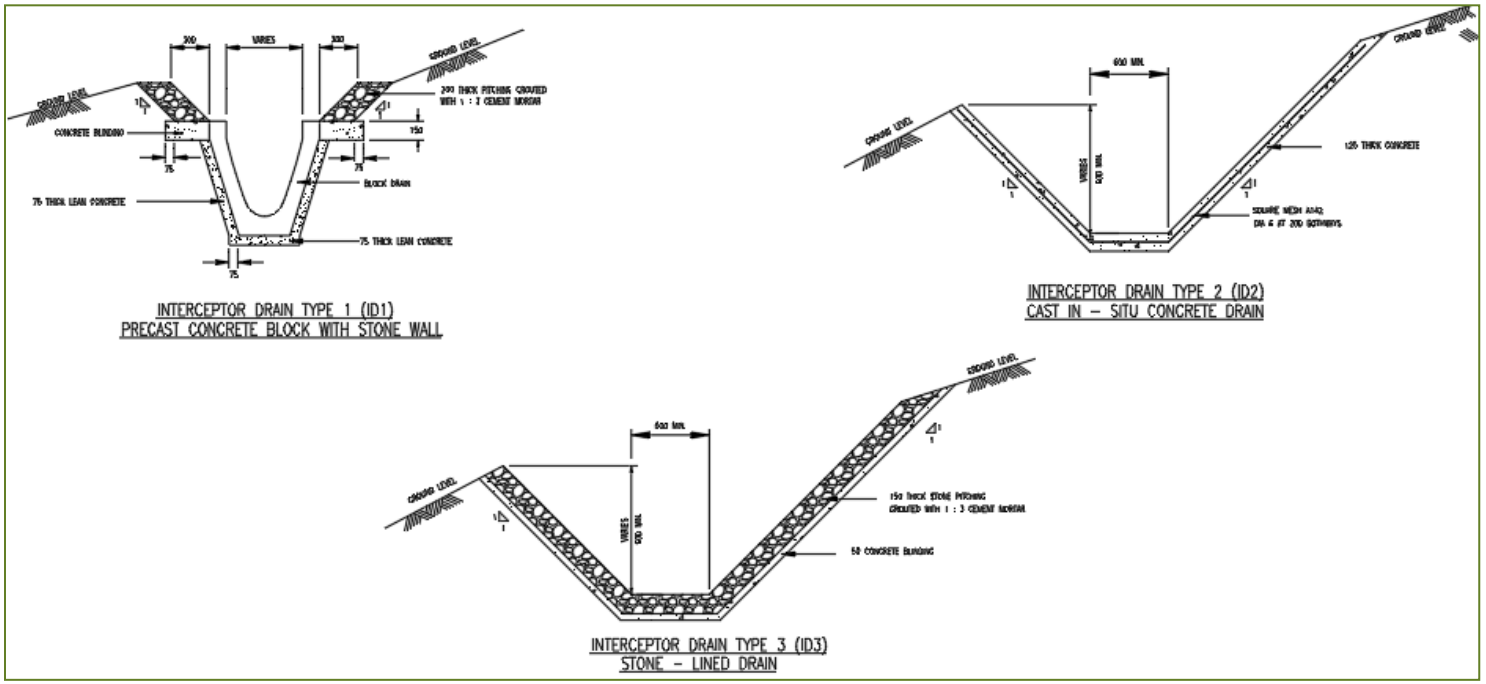

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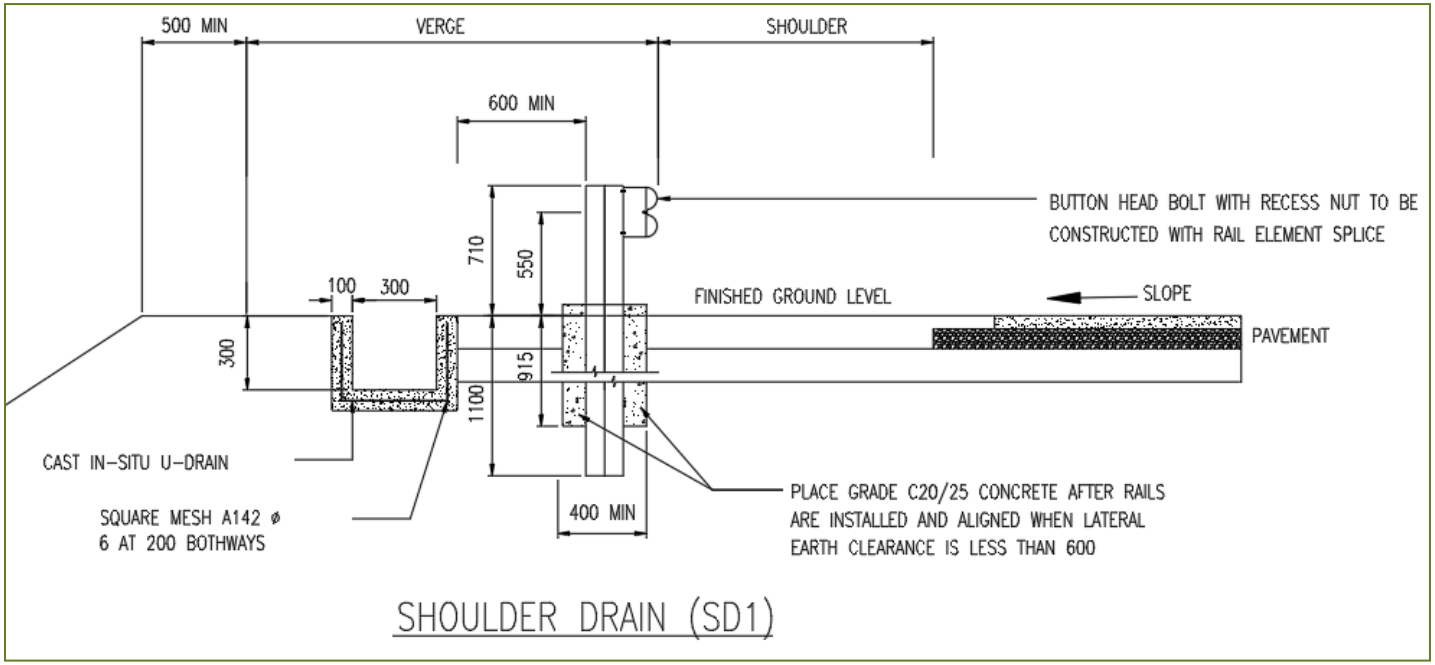
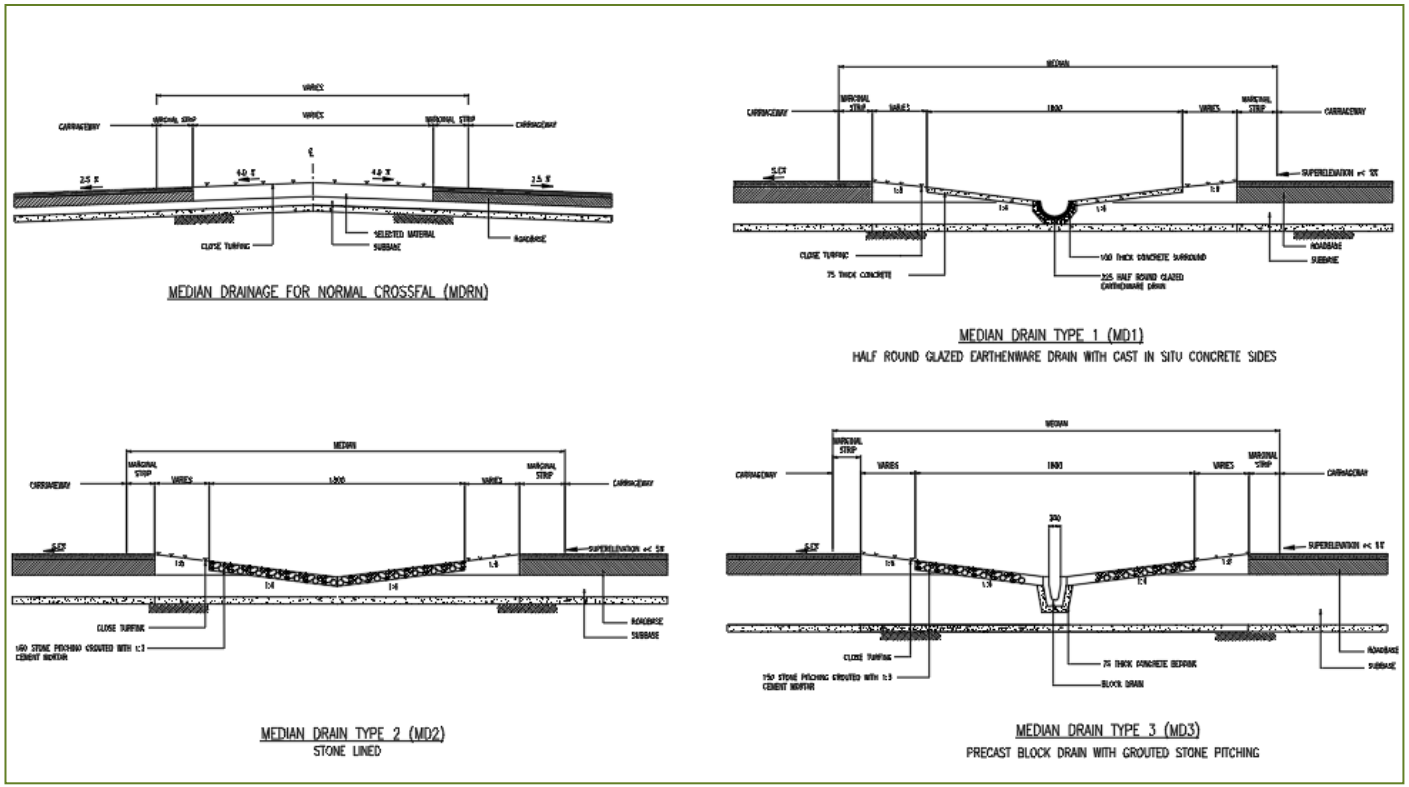


Median Drain (MD)

KOMPONEN SISTEM SALIRAN PERMUKAAN



Outfall Drain (OD)

KOMPONENEN SISTEM SALIRAN PERMUKAAN