

Section 6
Roadside drainage

SECTION 6

ROADSIDE DRAINAGE**6.1 General**

6.1.1 The design and construction of surface and sub-surface drains for highway drainage shall be carried out in accordance with the requirements of this Section.

6.1.2 Efficient drainage system shall be provided for the entire Project Highway including structures and facilities.

6.1.3 For quick disposal of precipitation on the road surface, the carriageway, shoulders and median shall have the requisite camber/crossfall and longitudinal gradient as per the values specified in Section 2 of this Manual.

6.1.4 The natural drainage of the area shall not be disturbed.

6.1.5 The design of drains shall be carried out in accordance with IRC:SP:42 and IRC:SP:50.

6.1.6 Construction of surface and sub-surface drains shall be carried out in accordance with the requirements of Clause 309 of the MOSRTH Specifications.

6.1.7 Efficient drainage arrangements for road sections in cuttings and at underpasses shall be made. Where it is not possible to drain out water using gravity flow, necessary arrangements for pumping shall be made.

6.2 Surface Drainage

6.2.1 The water from road and adjacent areas shall be intercepted and carried through road side drains to natural outfalls.

6.2.2 The drains shall have sufficient capacity to carry normal peak run-off without overflowing.

6.2.3 The selection of type of roadside drains shall be based on the magnitude and duration of flow. The roadside drains shall be designed on the principles of flow in open channel.

6.2.4 The estimation of design discharge (peak run off) and design of drain sections shall be made in accordance with the procedure given in IRC:SP:42.

6.2.5 The open drains shall be located sufficiently away from the toe of embankment. When the drain is unlined it shall be beyond 4H:1V imaginary line drawn from the edge of the roadway.

6.2.6 The road side drains shall not pose any danger to traffic, slopes of cuttings, embankment, pavement or structures.

6.2.7 As far as possible, longitudinal slope shall not be less than 0.5 percent for lined drains and 1.0 percent for unlined drains.

6.2.8 The side slopes of the unlined drains shall be as flat as possible and shall not be steeper than 2H:1V.

6.2.9 The drains shall be provided with CC lining in the following situations:

- (a) When due to space constraint, the drains are located near the toe of the embankment or near structures.
- (b) Drains located in paved areas.
- (c) Flow velocity is more than 0.3 m/s to 1 m/s in silt and sand and more than 1.5 m/s in stiff clay.

6.3 Median Drainage (where dual carriageway is provided)

6.3.1 Proper arrangement for drainage of median shall be provided. The median drain should have adequate longitudinal slope to the nearest culvert to drain off transversely.

6.3.2 Earthen surface in the median shall not be sloped towards carriageway to drain on the pavement, to avoid washed away soil getting deposited on the pavement making it slippery and accident prone.

6.3.3 Turfed/paved median of up to 5 m width with kerbs could be crowned for drainage across the pavement.

6.3.4 In superelevated sections, proper arrangement for drainage of raised carriageway and median shall be made without allowing water to drain on the other carriageway.

6.4 Drainage of High Embankment

6.4.1 In high embankment and approaches to bridges, proper arrangement for drainage of carriageway shall be made in order to ensure that no damage is caused to pavement, shoulders and embankment slopes.

6.4.2 Drainage arrangement may include provision of kerb channel at the edges of the roadway to channelize the water and CC lined chutes along the slopes at about 10 m intervals or at designed spacing to discharge the water into side channels at the bottom.

6.4.3 The chute drains and drains at toe of the embankment shall be of Plain Cement Concrete (M15 grade) over proper bedding.

6.5 Catch Water Drains

6.5.1 Suitable catch water drains shall be provided on the hill slopes above a cutting to collect and remove surface water run-off from upper reaches. These drains should be of trapezoidal shape and stone lined and cement pointed.

6.5.2 The catch water drains shall be designed to carry the intercepted water to the nearest culvert or natural drainage channel.

6.5.3 It shall be ensured that the catch water drains are provided in stable hill slopes outside the periphery of slide/unstable areas.

6.5.4 Where required, lined chutes shall be provided to lead the discharge to the catch pit of culvert or to a natural drainage channel.

6.6 Sub-surface Drains

6.6.1 The sub-surface drainage shall be provided:

- (i) for lowering the level of water table for drainage of subgrade,
- (ii) to intercept or drain out free water in cut slopes,

- (iii) for drainage of pervious sub-base in situations where it may not be practicable to extend the sub-base across the shoulder.

6.6.2 Sub-surface drains shall not be used for surface drainage.

6.6.3 The sub-surface drains shall be:

- (i) Close jointed perforated pipes or open jointed unperforated pipes in trenches with backfill material around pipes.
- (ii) Aggregate drains consisting of free draining material in the trench without any pipe.

6.6.4 Perforated pipes and unperforated pipes shall meet the requirements of Clause 309.2 of MOSRTH Specifications.

6.6.5 The internal diameter of the pipe shall not be less than 150 mm.

6.6.6 The sub-surface drains shall be located not less than 0.5 m below the subgrade.

6.6.7 *Backfill Material*

- (i) Backfill material shall be free draining sand, gravel or crushed stone designed on inverted filter criteria for filtration and permeability or of an appropriate grading conforming to the requirements of Table 300.3 of MOSRTH Specifications.
- (ii) Thickness of backfill material around the pipe shall not be less than 150 mm. The minimum thickness of material above the top of the pipe shall be 300 mm.

6.6.8 Sub-surface drains not located below the road pavement shall be sealed at the top.

6.6.9 *Use of Geo-textile*

- (i) The sub-surface drains may be designed using appropriate geo-textile to serve the functions of filtrations and separation.
- (ii) The sub-surface drains can be provided with geo-textile either along the trench or around the pipe or both.
- (iii) The geo-textile shall satisfy the requirements of Clause 702 of MOSRTH Specifications.

6.6.10 Trench excavation, laying of pipe, backfilling, and use of geo-synthetics shall conform to the requirements of Clauses 309.3.3, 309.3.4 and 309.3.5 of MOSRTH Specifications

6.6.11 The drain outlet shall be a free outlet and shall be prepared as per Clause 309.3.6 of MOSRTH Specifications.

6.6.12 *Aggregate Drains*

- (i) The trench for aggregate drain shall be of minimum 300 mm width and cut to a depth to expose the granular pavement courses to be drained.
- (ii) Aggregate for the drain shall be gravel, stone aggregate or slag of grading as per Table 8 of IRC:SP:42.
- (iii) The aggregate drain shall be provided with a geo-textile wrap to act as filtration and separation layer.

6.6.13 Design of subsoil drainage shall be

based on a rational basis. Reference may be made to IRC:SP:42

6.7 Internal Drainage of Pavement Structures

- (i) Boxed type construction in which pavement is housed in earthen shoulders shall not be provided.
- (ii) The sub-base shall be extended across the shoulders for efficient drainage of pavement.
- (iii) The granular sub-base shall be of proper design and grading to perform satisfactorily as a drainage layer. The drainage layer shall not have material finer than 75 micron size.
- (iv) A suitable filter of granular material or geo-textile to act as filtration and separation layer shall be incorporated between the subgrade and sub-base to prevent clogging. Reference may be made to Section 5 of this Manual.

6.8 Survey, Investigations and Design Report

The Concessionaire shall carry out proper surveys and investigations for detailed design of the drainage system. The proposal for drainage system supported with survey investigation report and detailed design report shall be submitted to the Independent Engineer for review and comments, if any.

6.8.1 Survey and Investigations - Drainage Studies

The survey and investigation and drainage

studies shall include:

- (i) Alignment plan, longitudinal and cross-sections, contour map.

- (ii) Hydrological data

Drainage area, water shed delineation, direction of flow, location of outfalls, existing surface drains, ground surface condition, rainfall, flood frequency, etc.

- (iii) Data for hydraulic design of drains.

- (iv) Geo-technical investigations for sub-surface strata, level of water table, seepage flow etc.

- (v) Identification of areas requiring sub-base drainage.

- (vi) Any other relevant information.

IRC:SP:19, IRC:SP:42, IRC:SP:48 and IRC:SP:50 may be referred to.

6.8.2 Design Report

The design report shall include:

- (i) Estimation of design discharge

- (ii) Design of surface drains

- (iii) Design of sub-surface drains

- (iv) Drainage arrangement plan

- (v) Specifications of drains

- (vi) Any additional information as required by the Independent Engineer for review of the drainage system.