

No. PL-30(147)/74

Dated 26th July, 1976

To

**The Chief Engineers of all State Public Works Departments and Union Territories dealing with roads****Subject: Special measures for the design of roads in cut sections**

In rolling or hilly terrain, roads have frequently to be in cutting, whether the cut is only on one side or both the sides. For trouble-free service of such stretches, it is essential that appropriate design measures may be taken right at the beginning so as to ensure stable cut slopes and obviate problems arising from tricky drainage.

2. Inter alia, this Ministry has been emphasising the need for caution in such situations in its circulars issued from time to time, particularly letters No. NHI-37(2)/70 dated the 2nd April, 1970 and PL-50(13)/74-SP dated the 10th September 1974. In view of the importance of the problem, special attention is drawn to the following points of good engineering practice :-

- (i) The cut slopes should be stable for the material met with, as laid down in the Ministry's circular No. NHI-37(2)/70 dated the 2nd April, 1970. Where necessary, the slopes should be benched by introducing horizontal berms at appropriate levels. If need be, breast walls of suitable design may be provided in addition for improving the stability of the sloping ground;
- (ii) Road cuts usually upset the natural drainage of the area. With the removal of vegetation and creation of artificial steep slopes, surface water if left unchecked would create serious problems of erosion besides flooding of the road bed. It is, therefore, vital that the surplus water is intercepted and disposed of safely, quickly and efficiently. For this purpose, a suitable system of drainage must be designed for each site which may consist of catch water drains above the top of the cut slopes, interceptor drains on the surface of the slopes, and side drains at the toe of the cut sections. To be effective the drains must be of adequate capacity and appropriately joined to the normal drainage channels serving the area;
- (iii) Seepage water moving through subterranean channels is sometimes encountered in rolling or hilly terrain, especially where a layer of permeable soil overlies an impermeable stratum. Where encountered, such water must be intercepted either by means of deep side drains (French type or open with open deep road side drains, where used, guard stones must be provided on carriageway side.) and/or transverse subdrains running underneath the pavement, idea being to relieve the excess hydrostatic pressure and lower the water table. Buried transverse drains are of particular value at points of transition between the cut and fill sections for intercepting the seepage water which would otherwise flow along the road bed assisted by the down gradient. At such locations of transition between the cut and fill sections, the subgrade at the start of the fill section for say 10 metres length and for the full formation width extending upto the side drains/embankment slopes, should be made with compacted coarse sand/granular material non-plastic in character having a depth of about 1 metre;
- (iv) Because of generally adverse drainage conditions in the cut sections, greater vigilance than normal is called for when finalising the design of the pavement. The subgrade in the cut section where found to be inadequately dense or having cavities, minor hollows, etc. should be excavated and recompacted to meet the expected requirement of 100% Proctor density for 18" (45 cms.) compacted thickness, being achieved through laying of three compacted layers of 15 cm. each. Where this subgrade material may be found to be poor in strength in worst moisture conditions even compacted to 100% Proctor density, consideration should be given to better soil for making the subgrade for 18" (45 cm.) compacted thickness, being brought from an outside, but as economical as possible, source, such soil desirably being granular/gravelly in nature of a non-plastic or close to non-plastic and very low plasticity character. Crust thickness in these stretches should be invariably based on the strength of the subgrade under worst moisture conditions likely during the entire service life of the road. Essential principles for this stand highlighted in IRC: 37-1970 "Guidelines for the Design of Flexible Pavements". Therein the requirements of drainage measures essentially allied to the pavement design have been particularly dealt with in paragraphs 5.1 to 5.4. Where water table in the worst conditions in the cut section road bed below or in the subgrade is expected to be high the requirements of construction of road pavements in water-logged conditions dealt with in IRC publication No. 34-1970 get attracted and desirably a capillary cut-off layer in coarse sand/granular and material like gravel, sand gravel non-plastic in character for a requisite depth, should be used as an essential part of the pavement requirement. The layer of such a material should extend over the full formation width right upto the side drains; and

- (v) Many a time poor soils are met with on the cut formations, which are susceptible of easily becoming slushy and slippery when in contact with water. In such cases, consideration deserves to be given to the paving of the entire shoulder area between the carriageway edge and the toe drain so that the vehicles can move with greater safety.

3. It is requested that this circular may be brought to the notice of all officers in your department.