

No. NHIII/P/3/76

Dated the 26th July, 1976

To

Chief Engineers/Additional Chief Engineers of
State PWDs and Union Territories
(dealing with roads)

Subject : Collection and presentation of soil investigation data for pavement design

Design of pavement for a new section, or for widening/strengthening of an existing stretch, is a major activity on the National Highways. *Vide* Ministry's letter No. NHI-37 (2)/70, dated the 2nd April, 1970, instructions had been issued that pavement design proposals should be based on IRC : 37-1970 "Guidelines for the Design of Flexible Pavements" and that all relevant data should invariably accompany the estimates. However, general experience has been that the required data are not enclosed with the estimates or are not collected to the requirements or are not presented in a form permitting proper appreciation of the proposals. In certain cases, this has resulted in protracted correspondence with the States causing unnecessary delays.

2. To obviate such difficulties and ensure uniform practice, a memorandum bringing out points of guidance relating to collection and presentation of soil data for pavement design is enclosed. It is requested that the contents of the memorandum may be kept in view while collecting and presenting soil data for pavement works on National Highways. It may also please be ensured that the required data in proper form invariably accompany such proposals in future.

[Enclosure to Roads Wing letter No. NHIII/P/3/76 dated the 26th July, 1976]

MEMORANDUM ON THE COLLECTION AND PRESENTATION OF SOIL INVESTIGATION DATA FOR PAVEMENT DESIGN FOR NEW ROADS/WIDENING AND STRENGTHENING EXISTING ROADS

1. General

On National Highways, flexible pavements for new sections or for widening and/or strengthening of existing stretches are to be designed in accordance with IRC : 37-1970, "Guidelines for the Design of Flexible Pavements". This publication recommends the CBR method of design and sets out guiding principles in this regard. For pavement design, among other things, soil investigation data are required to be collected. Guidelines on the collection and presentation of these data are given in the following paragraphs.

2. Collection of soil investigation data for new roads

2.1 Roads in embankment

2.1.1 Before taking up soil investigations for pavement design, it is expected that sources for embankment material are determined and demarcated in the field. These may be roadside borrow areas and/or roadway cuttings. Good engineering practice requires that the best material available from these sources be earmarked for use in the top 500 mm portion of the embankment constituting the subgrade. Directions about demarcation of borrow areas and suitability of material for use in embankment/subgrade are contained in IRC : 10-1961 "Recommended Practice for Borrowwits for Road Embankments constructed by Manual Operation" and IRC : 36-1970 "Recommended Practice for the Construction of Earth Embankments for Road Works" respectively.

2.1.2 For purposes of pavement design, the material earmarked for use in subgrade should be tested and data collected in the proforma at Annexure I. Frequency of testing should be at least two locations per km i.e. at every half kilometre of road. However, where the type of soil changes frequently, the rate of testing should be suitably stepped up at the discretion of the Engineer-in-Charge so that at least one set of test results is available for each type of soil.

2.2 Road sections in Cutting

2.2.1 Soil data for road sections in cutting should also be collected in the proforma at Annexure I. Samples for tests should be taken along the centre line of the road at an elevation corresponding to the design subgrade level of the pavement. Frequency of testing should be once every half kilometre. Where the type of soil is found to vary frequently, the rate of testing should be increased so that at least one set of test results is available for each soil type.

2.2.2 Where, both in the case of roads in embankments as also road sections in cutting, the water table in the worst condition may be high leading to water-logging conditions. In those situations while designing the pavement, the IRC Recommendations for Road Construction in Water-logged Areas vide their publication IRC:34-1970 should be referred to and given necessary consideration.

3. Collection of soil investigation data for cases involving widening and/or strengthening existing pavement

3.1 Soil data for widening and/or strengthening of existing pavements should be collected in the proforma given in Annexure 2. Data should be for samples of subgrade soil under the existing pavement at a distance of about 0.6 to 1 m from the edge of the carriageway. Similar data should be collected at the subgrade level below the flanks where the pavement is to be widened. Frequency of testing should be such that all the varying soil types are covered by the tests. An indirect indication for demarcating the extent of different soil types can be had from the performance of the existing road. For this purpose, the existing road should be broadly divided into sections having more or less similar performance and pavement composition. One set of tests should be conducted for each demarcated section subject to a minimum of one set for every half kilometre.

3.2 Besides soil data, details regarding the thickness and composition of the existing pavement should be collected in the proforma at Annexure 3, to the same frequency as for soil tests.

4. Number of CBR specimens to be tested in each set of tests

4.1 In each set of tests, at least three samples should be tested and their average given in the relevant columns of the prescribed proforma. However, where variation between samples is beyond the limits given below, the average should be based on at least six samples and not three.

CBR	Maximum variation in CBR value between samples
Up to 10	... 3
Above 10 to 30	... 5
Above 30 to 60	... 10
Above 60	... Not significant

5. Presentation of soil investigation data

5.1 The soil investigation data for pavement design should be presented in a manner permitting proper appreciation of the proposals. These should be compiled in a separate folder comprising the following parts :—

- (i) Brief note on soil data collection.
This should discuss broadly the manner of data collection and bring out clearly the deviations from the guidelines contained in this Memorandum with reasons thereof.
- (ii) Index map of the road to a suitable scale.
- (iii) Soil data in the proforma, *vide* Annexure 1 or 2 as applicable.
- (iv) Details of existing pavement (in the case of existing roads) in the proforma at Annexure 3.

Annexure 1**SOIL INVESTIGATION DATA FOR NEW ROADS**

Average annual rainfall :

State :

Route :

Section :

Date of sampling	Location		Nature of soil	Sieve analysis : % by weight passing			Sand content (col. 5-col. 7)	Atterberg limits			Max. dry density (Proctor) gm/cc	OMC %
	Km	cut/fill		4.75 mm sieve	4.25 micron sieve	75 micron sieve		LL %	PL %	PI		
1	2	3	4	5	6	7	8	9	10	11	12	13
Field dry density at subgrade level (for road in cutting) gm/cc			**CBR of remoulded soil sample of Proctor density and OMC or at field density and moisture content			CBR of soil sample remoulded as in col. 15 and soaked in water for 4 days		Depth of water table below subgrade under worst conditions metre			Remarks	
14			15			16		17			18	

Note : **For road in cutting where the field density at subgrade level is 95% Proctor or more, the moulding density and moisture content should be the same as those existing in the field. However, where the field density is less than 95% Proctor, the subgrade would require to be recompacted for 500 mm thickness to Proctor density and as such the moulding condition should be Proctor density and OMC.

Annexure 2**SOIL INVESTIGATION DATA FOR WIDENING/STRENGTHENING EXISTING ROADS**

Average annual rainfall :

State :

Type of work involved : *Strengthening widening and strengthening widening*

Route :

Section :

Date of sampling	Location		Nature of soil	Sieve analysis : % by weight passing			Sand content (col. 5-col. 7) %	Atterberg limits			Moisture content	
	Km	Under pavement or flank		4.75 mm sieve	4.25 micron sieve	75 micron sieve		LL %	PL %	PI	Worst field moisture %	OMC %
1	2	3	4	5	6	7	8	9	10	11	12	13
Dry density		CBR of remoulded soil sample at Proctor density and OMC	CBR of remoulded soil sample at Proctor density after 4 day soaking	**CBR of remoulded soil sample at field density and worst field moisture content	Depth of water table below subgrade under worst conditions metre	Riding quality Good/Fair/Poor V. poor	Remarks					
Field gm/cc	Proctor gm/cc											
14	15	16	17	18	19	20	21					

** Column 18 applies only to samples from below the existing pavement.

DETAILS OF EXISTING PAVEMENT

State :

Route :

Section :

Location km	Pavement		Details of Road Crust								Remarks
	Width m	Type BT/CC/ WBM etc	Sub-base			Base			Surfacing		
			Material	Thick- ness mm	Soaked** CBR %	Material	Thick- ness mm	Material	Thick- ness mm	Total thickness	
1	2	3	4	5	6	7	8	9	10	11	12

Note : **This test should be conducted if the material is of stabilised soil/granular material like moorum, gravel etc. Samples should be remoulded at field density and moisture content and tested after four day soaking.