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No. NHI-37 (2)/70 *Dated the 2nd April, 1970*

To

The Chief Engineers of All States P.W.Ds., and Union Territories,
(dealing with roads)

Subject : Plan for the development of National Highway during 1970-71

I am directed to invite attention to para 4 of this office letter of even number datd the 30th March, 1970, wherein it was emphasised that while framing detailed proposals for the current year, care should be taken to see that improvements to geometrics such as the easing of sharp curves, removal of humps, widening and reconstruction of weak and narrow culverts etc. are, to the extent possible and feasible, simultaneously effected with the widening and strengthening of pavements. This was suggested so as not only to ensure smoother and comparatively hazard-free flow of traffic at near about design speed in the widened sections but also to obviate infructuous expenditure which may result on account of any subsequent realignment of these.

2. For guidance in preparing proposals in this respect two Memoranda (one dealing with road works, at Annexure I, and the second dealing with bridges works, at Appendix II) are enclosed herewith. These Memoranda refer to the geometric design standards which should be followed for preparing various proposals and reiterate other points of good engineering practice that have been advocated by this office from time to time.

3. It is requested that the points of guidance spelled out in these Memoranda may be kept in view while framing detailed estimates/proposals in respect of works included in the Annual Plan for 1970-71 and also, till further notice, in respect of any future works to be undertaken on the National Highway system.

1-Superseded vide circular dated 19.01.1989

Appendix I

Enclosure to letter No. NH I-37 (2)/70 dt 2.4.70

MEMORANDUM ON THE PREPARATION OF PROJECTS FOR NEW CONSTRUCTIONS IMPROVEMENTS TO EXISTING SECTIONS OF NATIONAL HIGHWAYS IN RESPECT OF ROAD WORKS :

Introduction

1. Almost all of the present National Highways have graduated from local roads/old trails of pre-automobile area which were grossly deficient in geometrics. These roads were meant essentially for slower traffic and their carrying capacity for fast traffic was limited. With a steep rise in the volume, speed and size of fast moving vehicles over the years, demand on these sections of the National Highways has increased manifold, making it necessary that the inherited deficiencies may be rectified as soon as possible. However, inspite of some improvements already having been made, considerable leeway in this regard still remains to be made.

2. It is envisaged that during the Fourth Plan period a large scale strengthening and widening of the National Highways pavements will be taken in hand. A beginning in this direction has, in fact, already been made with the Annual Plan for 1969-70. It is the objective that on completion of this programme the National Highways would, as far as possible, be able to fully cater to the speed, comfort and safety requirements of the increased traffic. · To achieve this objective it is imperative that improvements to geometrics, where feasible, and to the extent economically practicable, should be planned concurrent with the other improvements like thickening and widening of the crust, raising of the road above flood level etc.

Existing Deficiencies

3. Most of the sections where pavement improvements are contemplated, or are already underway, possess a number of narrow/weak culverts. These will act as hazardous features once the widening and improvement of riding surface has taken place and the traffic volumes and speeds have risen as a result thereof. Therefore, there is much in favour of looking into the culvert requirements at the same time as other improvements are planned and projecting the same simultaneously.

4. Similarly substantial deficiencies of geometrics like substandard radii, insufficient superelevation, lack of transitions at the ends of circular curves, insufficient, sight distances at both horizontal and vertical curves and uneven profile, abound in a majority of length of the National Highways. If any of these lengths is included in the current programme of widening/strengthening without regard to the basic defects of geometrics and alignment, the expenditure could very well turn out to be infructuous as at a later date the alignments may again have to be improved at extra cost. In some cases the previous alignment of the road may have subsequently to be altogether abandoned. Improvement to geometrics will become imperative form traffic safety considerations also when a road is being widened, as after widening speeds of vehicles will tend to rise. In order, therefore, that optimum use is made of the meagre resources available it is very essential that all such deficiencies be carefully located and a complete inventory of these made out. Attempt may then be made to submit estimates for improvement in respect of these geometrics deficiencies in a package alongwith the estimates for widening/strengthening of the existing carriageway. This is a golden opportunity for ridding the National Highway system of its in built deficiencies which must not be allowed to slip.

Geometric Design Standards

5. As an aid to the planning of gemoetric improvements, a summary list of the currently applicable geometric design standards for use on National Higwhay projects has been compiled and is enclosed an Annexure to this Memorandum for information.

6. The standards indicated are intended to be utilised more or less as general design controls. Where conditions are favourable and costs not excessive it will usually be worth while to go in for even some what more liberal values of the design parametres than the ruling values specified. It is realised, however, that in constrained situations, problematic terrain and like circumstances, more so when the case is of improving an existing highway, it may not always be found economical to adopt the standards recommended to the full extent and proper judgement will require to be exercised after careful study of the survey and investigation data.

7. The guiding principle should, however, be that economy may be practised on some feature other than the principal geometric features. In a pavement of flexible construction it is always possible to carry out strengthening at a future date when finances permit. Improvement of surface type or provision of hard shoulders are also features with which the designer can play. Like-wise widening of comparatively light trafficked roads should be deferred for some time or substituted by hard shoulders without any great loss to the road-users. All these features permit stage construction and could be attended to progressively according to the availability of funds. But the geometric features of the alignment, grade and sight distance defy such a treatment. When once moulded into the landscape and tied down by the right-of-way and surfacing these are most difficult and expensive to correct except at an exorbitant cost later. The problem comes most sharply into focus in the case of exiting highways, more specially the National Highways.

8. A careful study of the existing alignments and their geometric features, therefore, merits high priority so that an attempt could be made, within reasonable limits, to provide for improvements conforming as for as practicable and feasible to the geometric standards listed in the Annexure. The standards should be applied like-wise to construction of missing links, byepasses, realignments, under-or over-bridges replacing level crossings etc. where limitations as in the case of existing sections would not be present.

Points to be especially kept in view

9. The following points may be especially kept in view during investigations and preparation of the detailed estimates for proposed imporvements to the different National Highway sections :

(a) *Horizontal Alignment*

(i) Where it is planned to improve radii of the curves this should not be done on a piecemeal basis but by proper study of

the whole alignment. In this way not only large-scale reconstruction will be avoided but an overall smoothness of the alignment brought about.

(ii) It should usually be possible to eliminate minor kinks in a seemingly straight road by suitable adjustments of the centre line of the road, without going in for a major realignment. Extra cost involved in these corrections will not be more than marginal.

(iii) Where it is not practicable for any reason to improve sharp radii it should in any case be ensured that the superelevation provided is as per standards.

(iv) It has been generally noticed that circular curves lack in requisite transitions at their ends. It should be possible to remedy this at little extra cost while improving the appearance and utility of the Naitonal Highways many times.

(v) Sight distance on the inside of curve has often been found insufficient because of presence of a variety of obstructions. All possible attempts should be made to remove these obstructions so that the visibility conditions are adequate for fast traffic.

(b) *Vertical Profile*

(i) Where properly designed vertical curves have not been provided at changes of vertical alignment a careful study should be made to find out the most economical solution so that the standards laid down are satisfied.

(ii) It is appreciated that it may not always be possible to design curves for overtaking sight distance but efforts must be made to achieve designs fit for at least the safe stopping distance.

(iii) Correction of minor undulation in the road surface and provision of shock-free entry at humps and dips can usually be accomplished at marginal costs.

(c) *Raising of road on account of Flooding/Water-logging Conditions*

(i) There are instances where an existing section gets submerged owing to flood waters or is located in water-logged conditions so that its performance is not satisfactory. Before framing proposals for strengthening/widening of such sections it will be necessary to consider raising the formation so that the sub-grade is atleast 2 ft. above the Higher Flood Level, or in the case of water-logged conditions to consider raising the formation to suitable level above the subsoil water level/ adopting other recommended measures against waterlogging.

(ii) While formulating raising proposals consideration should be given to the effect of raising on the adjoining sections of the highway. It will be advisable to work out an integrated Plan for long continuous sections than devising piecemeal proposals for short lengths.

(iii) Where raising of the formation is proposed attention will have essentially to be paid to the provision of requisite cross-drainage facilities for cross flow of flood waters.

(d) *Byepasses/Realignments*

In the case of byepasses/realignments it should be ensured that no kinks results at the two ends where these sections rejoin the existing highway. This is easily possible by an over all study of the plans and preplotting so that a smooth flowing alignment results.

(e) *Culverts*

(i) It has been emphasised above that while planning improvements to existing sections cases of weak and narrow culverts should be given due consideration. Proposals sent by the States may, therefore, include widening of such culverts as are narrower than 32 ft. or so and of strengthening those which are weaker than for Class 18 loading.

(ii) Humps over the existing culverts should be evened out by providing shock-free transition curves. Deficiencies of sight distance should also be corrected.

(iii) Where culverts occur on a gradient or horizontal curve their top levels should be so fixed that the culverts fit in with the profile of the flanking portions of the road and there is no resulting hump.

Flexible Pavement Design

10. As regards design of flexible pavements, the basis of proposals should be the 'Guidelines for Design of Flexible Pavements', now in final stage of adoption by the Indian Roads Congress a copy of which has been circulated to all the State Chief Engineers in connection with the Indian Roads Congress Council meeting to be held at Darjeeling from the 5th to 7th April, 1970. All relevant data such as the existing traffic, depth of water table, type of sub-grade soil and its C.B.R. value, thickness and composition of the existing crust etc. should invariably accompany the estimates in case of strengthening scheme.

Estimates

11. As far as possible detailed estimates should be prepared for convenient sections about 20 to 25 miles in length or less if so defined in the list of works for Annual Plan. Under each estimate there should be detailed sub-estimates for :

(i) Improvements to geometrics:

(ii) reconstruction/widening of existing culverts; and

(iii) widening and/or strengthening of the carriageway.

Annexure to Appendix I

Geometric Design Standards for the Design of National Highways

Note : Not reproduced as IRC standard on geometric design has since been published. Refer to Ministry's Circular letter No. NH III/P/31/77 dated 31.5.78 and IRC : 73-1980

1- Amended to 1m vide circular dated 10.09.1976

Appendix II

MEMORANDUM OF THE PREPARATION AND SUBMISSION OF BRIDGE ESTIMATES

The preparation of estimates for Major Bridges and their design is dependant on the collection of required hydraulic and other data, selection of suitable bridge sites, soil investigations including boring data at the most suitable and finally selected bridge site etc. It is expected that the necessary steps in this direction will be taken immediately in case of bridge works included in the Annual Plan 1970-71, wherein these investigations have not so far been carried out.

2. While selecting the most suitable bridge site, the economic aspects of the proposal as a whole i.e. the bridge including its approaches, may be kept in view. Further, due importance may be given to the geometrics and other features of the approach road in the selection of the bridge site and the orientation of the bridge axle.

3. While forwarding the bridge project, separate detailed estimates for bridge proper and of connected road approaches may kindly be sent together to enable this Ministry to take steps to accord sanction simultaneously for the bridge proper and its approaches. This will enable the State Governments to take up the construction and to fix targets of completion accordingly so that both the bridge and approaches get completed at the same time. This is very necessary for obvious reasons.

4. In respect of bridges with individual span lengths of 25 metres (80 ft.) or less and overall length of the bridge not more than 5 spans of 25 metres (or 400 ft. length approx.) tenders will have to be only on item rate basis on departmental designs as per decision arrived at in the Chief Engineers meeting held in October, 1969 at Kulu. Hence, for such bridges, apart from detailed estimates, detailed designs will also have to be submitted along with the estimate. As standard designs of superstuctures of various span lengths prepared in this Ministry are available with the State Chief Engineers, these may be adopted as far as possible.

5. For other bridges also detailed estimates will have to be prepared, but tenders for these can be invited on lumpsum basis, both for the departmental outline design as well as the tenders on alternative design.

6. Further, it will be helpful if all the estimates of minor bridges for a particular section of the road, included in the Annual Plan, are prepared and sent together. This will facilitate their handling and processing in this Ministry as these can be sanctioned with advantage against one Job No.