11.	Has the design of high embankment for approaches been got approved from Roads Wing on the basis of detailed soil studies?	(Yes/No)
12.	If the approaches are to comprise of viaducts in some portions, has the comparative economy been worked out to justify the provision of viaducts instead of solid embankment?	(Yes/No)
13.	Has the design of approach viaducts (if necessary) been prepared for getting approval from Roads Wing?	(Yes/No)
14.	Has adequate justification been given regarding lumpsum provisions for the ROB portion beyond the Railway line and whether the rates for non-schedule items have been supported by analysis of rates?	(Yes/No)
15.	Whether the latest Schedule of Rates of the State PWD has been followed for preparing the Bill of Cost and if the State PWD Schedule of Rates is not updated, whether letter of Competent Authority permitting percentage premium over and above the old Schedule of rates has been quoted?	(Yes/No)
16.	If the estimate requires EFC clearance, has the economic analysis of the complete project been enclosed with the detailed estimate?	(Yes/No)
17.	Has the phasing of expenditure been clearly indicated in the estimate?	(Yes/No)

1100.22

No. RW/NHVI-50(3)/83-Vol. II *Dated the 4th February, 1988*

To,

1. The Chief Engineers of States and Union Territories Public Works Deptts. dealing with National Highways and Other Centrally Financed Schemes.
2. The Director General (Works), CPWD
3. The Director General Border Roads

Subject: Greater emphasis on adoption of improved technology in site investigation, design, construction, condition assessment, repair and rehabilitation of important bridges on National Highways — Implementation of the Report of the Special Committee.

This Ministry has been deeply concerned over the inadequate performance in service of some major bridges on National Highways and accordingly set up a Special Committee under the aegis of Indian Roads Congress of bridge experts to recommend measures for ensuring greater professionalism in construction practice and security of major bridges. Report of this Committee giving specific and general recommendations has been accepted by this Ministry for its implementation. The only one specific recommendation on supplemental measures for design, detailing and durability of important bridge structures has already been circulated *vide* this Ministry's letter of even no. dated the 13th January, 1988. One of the general recommendation on the subject cited above as given by the Committee is reproduced hereunder:

> "Greater emphasis should be laid on adopting improved technology in site investigation, design, construction, condition assessment, repair and rehabilitation. The capabilities existing in the Highway Departments for conducting technical, economic and financial feasibility studies need to be substantially augmented, by employing specific task specialists".

2. Detailed conceptual approach on "Technology Management" and "Planning" for important bridges as outlined in the Committee's Report is annexed herewith for guidance.

3. It is suggested that suitable action may please be taken immediately based on the above recommendation of the Special Committee and the cost involved, if any, may be met out of the agency charges being paid to the State Govts.

4. The receipt of this communication may please be acknowledged.

ANNEXURE

Enclosure to letter No. RW/NHVI-50(3)/83-Vol. II dt. 4.2.1988

1. TECHNOLOGY MANAGEMENT

1.1 For better quality and performance of important bridges, technology management deserves critical attention as successful application of high technology in large projects would promote cost effectiveness.

1.2 Current technology improvements relevant to bridge applications are :

— site investigation

— design

— construction

— condition assessment

— repair and rehabilitation

Of these, technnologies related to planning and service phases should call for greater attention to serve quality assurance priorities.

1.3 Condition assessment of bridges is a critical element of maintenance management of bridges. Current technology is slow, incomplete, labour and subjective experience intensive and non-diagnostic. For improving perormance of our bridges it will be necessary to explore the new fields like sensor technology and computer based automated assessment methods.

1.4 Practical application in our bridge design should be based on continued comprehensive research and development efforts. On the other hand, design and detailing should be oriented towards easy maintenance, repair and replaceability of bridge components.

2. PLANNING

2.1 Planning phase begins with the first concepts of the project and ends in completion of pre-execution activities. A sequential and uninterrupted flow of events and engineering decision making is essential for improved quality assurance. In present practice a non-systematic approach often prevails and yields gross errors which cannot be corrected in subsequent phases even with best engineering efforts.

2.2 As a first step in systemised approach, feasibility investigation of identified important bridge projects should precede their inclusion in five year plans. Ranking of projects may be done on the basis of results of technical, economic and financial feasibility investigations. Decisions on inclusion in five year plans can thus be rationalised. Detailed project preparation can then be taken up depending on intense priority and inclusion in Annual Plans.

2.3 The framing of a feasibility report should mark the end of the very first segment of planning phase. It should result in decision on ranking of the project, eventual inclusion in the five year plans and priorities in continuing further project development efforts. Feasibility investigation and report should therefore be supported by best technological skills.

2.4. The technical feasibility studies include inter-alia, alternative sites, preliminary site investigation, collection of data, appraisal of alternative design and preliminary cost estimate. As decisions on final siting, identification of the scope of detailed project preparation, environmental impact and aesthetic quality demands are made at this stage, the quality of feasibility investigation is a determining factor in quality assurance of the project in its entirety.

2.5 Economic and financial feasibility studies form a specialised inter-disciplinary area of investigation. Subjective judgement based on a qualitative approach is not deemed valid for important bridge projects. Modern methods of economic analysis, quantifying results in terms of internal rate of return should be used. The analysis needs to be supported by adequate collection of economic data. Data collection, forecasting evaluation and analysis require specialised skills. In case of non-availability of such specialised skills within the highway administration, external agencies with proven competence should be employed.

2.6. The end of feasibility investigation and the beginning of detailed proejct preparation should be separated by a well-defined control check. A check list should be used to ensure sufficiency of project definition. This is critical quality control measure as detailed project preparation activities of ill-defined bridge projects can be vulnerable to low productivity, delayed decisions and consequential gross errors.

2.7 Collection of site data followed by analysis and evaluation of design data is the most crucial step in bridge planning requiring intensive efforts and specialised skills. As diverse areas e.g. topographical, hydrologic, channel characteristics, flood flow, geotechnical/geologic, climatic and environmental data are involved, a planned and efficient technology management is necessary. At no stage should the level of accuracy and comprehensiveness of site investigation be deemed sacrificial in order to save time to commence the execution.

2.8 The aspect of site investigation that suffers most due to lack of motivation is detailed geotechnical investigation. For important bridges it should be mandatory to complete all field exploration at all likely pier and abutment positions, followed by testing analysis, evaluation and reporting during the course of project preparation.

At the technical feasibility stage one or at least two structural systems as alternatives be decided, considering both the functional as well the aesthetic requirements. One of the alternatives should be fully investigated as the departmental design and complete structural design, drawing, quantities and cost, worked out, so that it is comprehensive enough for being taken up for execution.

2.9 The organisation of the highway administration should be reinforced to develop the technological capability adequate to complete all detailed engineering for site investigation. In cases where adequate capability is not available, suitable external consultants with requisite expertise should be entrusted with the complete task of detailed project preparation so as to ensure integration of all activities.