GOVERNMENT OF INDIA
MINISTRY OF ROAD TRANSPORT & HIGHWAYS

Indian Academy of Highway Engineers,
A-5, Sector-62, Noida – 201301.

सत्यमेव जयते

No. RW/NH-34072/1/2015-S&R(B) **Dated: August 18, 2016.**

To:

1. The Chief Secretaries of all the State Governments / UTs.
2. The Principal Secretaries / Secretaries of all States / UTs Public Works Department dealing with National Highways, other Centrally sponsored schemes.
3. The Engineers-in-Chief and Chief Engineers of Public Works Department of States / UTs dealing with National Highways, other Centrally sponsored schemes.
4. The Director General (Border Roads), Seema Sadak Bhavan, Ring Road, Delhi 110 010.
5. The Chairman, National Highways Authority of India, Plot G-5 & 6, Sector-10, Dwarka, New Delhi 110 075.
6. The Managing Director, NHIDCL, PTI Building, Sansad Marg, New Delhi 110001.

Sub: Adoption of best practices for economical, durable, speedy and aesthetic construction of "Bridge Structures" – reg.

Sir,

National Highway network is expanding at a robust pace requiring the construction of bridge structures which will not only safe, economical, durable, serviceable, aesthetically pleasing, and environmentally friendly during its service life but also involve lesser construction time and lesser maintenance over its service life. It has been therefore decided that the following practices shall be made as part of planning, design, and construction stages for bridge structures to be constructed on National Highways in future, as far as possible, in order to bring optimization in terms of structural strength/capacity, durability, higher performance/serviceability, environment-friendly and economy.

1. There is a need for the use of innovative and alternative design process, materials, construction methodologies and construction techniques that can provide safe, economical, durable and fast construction of bridges. Therefore, use of

   a. concrete comprising cementitious additives and admixtures e.g. blast furnace slag, fly ash pozollanas, plasticizers, super-plasticisers etc.,
   b. High Performance Concrete,
   c. Self-Compacting Concrete, and
   d. High Strength Structural Steel

   needs to be encouraged. Henceforth, the use of all above listed materials has been allowed in new construction, repairs and rehabilitation of bridge structures and may be made part of the contract agreements. Similarly, use of corrosion resistant bars such as weathering steel and "Ready to use Rebar" technology need to be promoted subject to their compliance with IRC:SP:80 and relevant IS specifications. Connections with high strength friction grip bolts should be used, when welding is not possible for the type of steel used or when connections have to be effected at site.

2. 'Spherical Bearings' may be used in place of POT bearings where possible/appropriate which are not only more efficient in load transfer but also occupy less space on the pier cap.

3. Fibre Reinforced Polymers (FRP) composites (e.g. laminates, wraps etc.) may be used in new construction, repairs and rehabilitation of bridge structures subject to submission of adequate details (e.g. specifications, applicable codes/ guidelines, laboratory results, field experience, literature on the matter etc.) for justifying their use substantiated with proven records of performance reports, if any.

4. Waterproofing of concrete decks, particularly when segmental construction is adopted, is important as second line of defense because water may seep through the joints between segments giving rise to corrosion of the prestressing steel.

5. Span arrangements and span length should be selected to evolve a most economical bridge structure. Repetition of shapes and sizes of elements reduces costs and therefore standardization is a key element in the economical design and construction of bridges. Therefore, precast and prestressed products like deck slab, T-beam girder, box girders and box structures for culverts etc. can be procured from precast concrete products factories.

6. Continuous and/or jointless bridge superstructure span may preferably be provided instead of simply supported spans in order to ensure structural optimization, higher durability, lesser numbers of bearings & expansion joints, better riding quality and consequently less work cost unless in those situations which do not favour adoption of such bridges (e.g. yielding type of strata susceptible to large differential settlements etc.).

7. For wide decks (greater than 15m), it is advisable to use single cell box girders with struts supporting the tips of the deck cantilevers (fig. a) or single cell box girders with internal struts for reducing the deck slab span (fig. b) are useful tools that can obviate the necessity of multi-cell box girders which are more difficult to construct. Such design geometry should be encouraged in design of wide deck bridges.

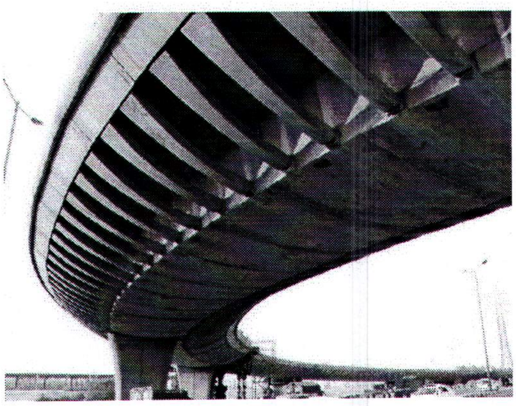

Fig. a Cantilevers of wide deck supported by struts

Fig. b Deck slab span reduced by internal struts

8. Steel and steel-concrete composite bridges can be advantageously used in many instances such as Road over bridges (ROBs).

9. In addition to shock transmission units, high damping rubber (HDR) bearings may also be used to act as seismic isolators during earthquakes subject to conformity with relevant Eurocodes or other similar International standards/specifications.

10. Large diameter piles (2.0 m or above) as mono or in groups may be used where appropriate for speedy and reliable construction.

11. Besides the structural safety and functionality, the type of bridge will be governed by aesthetic aspects. Henceforth, all these three factors shall decide the final type of bridge structure. Accordingly, the construction of arch bridges (in reinforced concrete, prestressed concrete or steel) need to be encouraged in general and specifically where they fit into the landscape or urban environment. Similarly, Extradosed Bridges may be a suitable option for span range of 75 to 150 m. For further longer spans, Cable Stayed Bridge is most promising and aesthetically pleasing option as evidently visible from long distance.

12. Due to assured quality, inherent economy, durability and low maintenance, precast and prestressed concrete may be used for various bridge components like box structures for culverts, deck slab, T-beam girder and box girders etc. These components may be procured by contractors or concessionaires from pre-casting factories, to be set up in all major states. Standard designs and drawings of any bridge components and their connections based on Limit State Design philosophy as per IRC:112 (or other applicable international specifications/standards) should be got approved by each factory owner from Ministry of Road Transport & Highways (M/o RT&H) before their usage in the construction of culverts and bridge structures on National Highways. Necessary fee (as decided by M/o RT&H) would need to be paid by precast factory owners. Pre-casting factory owner will provide the construction working drawings to the contractor or concessionaire along with all necessary instructions for handling, transporting, and in-situ construction as required for successful completion of bridge/culvert structure at site. They will also provide detailed working drawings as well as construction sequences & methodology of all joints, splices and connections necessary to create interfaces among precast concrete components (like decks, walls, girders, columns, spandrels etc.) as well as with other materials as required to construct the desired structural element of foundation or sub-structure or superstructure of the bridge structure. After approval from Ministry (M/o RT&H), the bridge component can be used in construction of culverts and bridge structures on National Highways without further scrutiny of structural design by either Independent Engineer or Authority's Engineer. However, Independent Engineer or Authority's Engineer will be fully responsible for strict adherence for all construction connections, sequences and activities for successful completion of culverts and bridge structures.

13. The concept of bridge design and construction is rapidly evolving due to advancements in new materials, design process, construction procedure, high-capacity materials and new management methods. These advancements have led to the development of Accelerated Bridge Construction (ABC) techniques. ABC incorporates innovative planning, design, materials, and construction methods to reduce onsite construction time when building, replacing, or rehabilitating bridges. ABC provides the ability for the construction of various sub-components of bridge structure in controlled environment and assemble/erect them into their final position. Accelerated Bridge Construction may preferably be considered for all bridge, flyover or viaduct construction projects at locations with traffic congestion. On using ABC technique, total construction period may be reduced suitably in comparison to normal construction period. For further details, page 78-85 of the Report of the Expert Committee on "Best Practices in Road Construction" available on Ministry's website (http://morth.nic.in/) may be referred.

14. Cross drainage and Animals Crossings are required to be provided at frequent intervals along highway construction. Such crossings may be provided at about 500 m, so that a crossing is available in a distance of 250 m from any point. Crossings for smaller vehicles are also required to be provided at some places.

15. Innovative technologies such as Corrugated Steel Plate Arches (thin steel plate arches) with the use of galvanized steel and/or protective coating or thin precast concrete arches may be used for small bridges or cross drainage structures due to their economy and speedy construction subject to conformity with relevant AASHTO guidelines or ASTM specifications or other similar International standards/specifications.

16. Safety and security during construction needs special attention as most accidents, collapses and casualties happen at this stage. Therefore, the entire design process during all stages of construction/erection of bridge structure, construction sequences and methodologies, and equipments used thereof need to be checked by the proof consultants for their strict compliance with existing Ministry's specifications/IRC guidelines or manuals/IS codes etc.

17. This circular will come in to effect with issue date of this circular. The content of this circular may be brought to the notice of all concerned in your organization. Feedback on these guidelines may be submitted on yearly basis.

18. This issues with the approval of competent authority.

Yours faithfully,

18/08/2016

(Sanjay Garg),
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For Director General (Road Development) & SS.
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Copy to:

1. All Technical Officers in the Ministry of Road Transport & Highways.
2. All Joint Secretaries in the Ministry of Road Transport & Highways.
3. All ROs & ELOs of the Ministry of Road Transport & Highways.
4 The Secretary General, Indian Roads Congress.
5. The Director, IAHE.
6. Technical circular file of S, R&T (B) Section.
7. NIC for uploading on Ministry's website under "what's new".

Copy for kind information to:

1. PS to Hon'ble Minister (SRT&H) / PS to Hon'ble MOS (SRT&H).
2. Sr. PPS to Secretary (RT&H).
3. PPS to DG (RD) & SS.
4. PPS to SS & FA.
5. PPS to ADG-I / AD-II / Coordinators – I/II/III.

18/08/2016

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******* **End** ********