Kailash Singh
कैलाश सिंह

Executive Director/Structures
कार्यकारी निदेशक/संरचना

भारत सरकार - रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ - २२६०११
Government of India-Ministry of Railways
Research Designs & Standards Organization
Lucknow- 226011
Rly. : 032-42126 Phone / Fax : 0522-2465704
Email : edstructures@gmail.com

No. CBS/DBC

Dated: 27/04/2017

Chief Bridge Engineer/

Sub: Suitability of RCC Boxes for major bridges.

Ref: CRS/Western Circle, Mumbai letter No. 16-5/460/289 Dated: 06.04.2017 addressed to CAO/Const/NW Railway, Jaipur.

CRS/Western Circle, vide above reference has raised the question of technical suitability of series of boxes in construction of major bridges with respect to slab/girder bridges.

The following guidelines may be followed while constructing bridges with RCC boxes:

(i) Box being a culvert should be used for construction of a minor bridge only as far as possible.

(ii) Box should rest on firm/ non-erodible strata.

(iii) In case of Boxes founded on erodible strata, the required floor protection works as per Article 20 of IRC: SP: 13-2004 shall be ensured. A copy of Article 20 is enclosed herewith.

(iv) In case of use of series of box units in a bridge, same should be designed accordingly.

(v) In case of existing major bridges built with series of box units, the bridge shall be checked for scour as per provisions given in Sub-structure and Foundation code and provisions of floor protection works as per Article 20 of IRC: SP: 13-2004 shall be ensured.

Encl: As above

27.04.17

(Kailash Singh)
Executive Director/Structures

Copy to: CAO/Cons, all railways
:ED/B&S, Railway Board for kind information.

ARTICLE 20

PROTECTION WORK AND MAINTENANCE

20.1. Floor Protection Works:

In case structures founded on erodible soil are protected against scour by floor protection works, the following is considered as sound practice.

20.1.1. For structures where adoption of shallow foundations becomes economical by restricting the scour, floor protection may be provided. The floor protection will comprise of rigid flooring with curtain walls and flexible apron so as to check scour, washing away or disturbance by piping action, etc. Usually performance of similar existing works is the best guide for finalizing the design of new works. However, the following minimum specification for floor protection shall be followed while designing new structures subject to the general stipulation that post protection works velocity under the structures does not exceed 2 m/s and the intensity of discharge is limited to $2m^3/m$.

20.1.2. Suggested Specifications:

20.1.2.1. Excavation for laying foundation and protection works shall be carried out as per specifications under proper supervision. Before laying the foundation and protection works the excavated trench shall be thoroughly inspected by the Engineer-in-Charge to ensure that:

(a) There are no loose pockets, unfilled depressions left in the trench.
(b) The soil at the founding level is properly compacted to true lines and level.
(c) All concrete and other elements are laid in dry bed.

20.1.2.2. **Rigid flooring :** The rigid flooring shall be provided under the bridge and it shall extend for a distance of at least 3 m on upstream side and 5 m on down stream side of the bridge. However, in case the splayed wing walls of the structure are likely to be longer, the flooring shall extend upto the line connecting the end of wing walls on either side of the bridge.

The top of flooring shall be kept 300 mm below the lowest bed level.

Flooring shall consist of 150 mm thick flat stone/bricks on edge in cement mortar 1:3 laid over 300 mm thick cement concrete M15 grade laid over a layer of 150 mm thick cement concrete M10 grade. Joints at suitable spacings (say 20 m) may be provided.

20.1.2.3. **Curtain walls :** The rigid flooring shall be enclosed by curtain walls (tied to the wing walls) with a minimum depth below floor level of 2 m on upstream side and 2.5 m on downstream side. The curtain wall shall be in cement concrete M15 grade or brick/stone masonry in cement mortar 1:3. The rigid flooring shall be continued over the top width of curtain walls. In this context,

relevant provision in "Guidelines for design and construction of river training and control works for road bridges", IRC: 89-1997 is also referred.

20.1.2.4. **Flexible apron :** Flexible apron 1 m thick comprising of loose stone boulders (weighing not less than 40 kg) shall be provided beyond the curtain walls for a minimum distance of 3 m on upstream side and 6 m on downstream side. Where required size stones are not economically available, cement concrete blocks or stones in wire crates may be used in place of isolated stones. In this context, relevant provision in IRC:89-1997 is also referred.

20.1.2.5. Wherever scour is restricted by provision of flooring/flexible apron, the work of flooring/apron etc., should be simultaneously completed alongwith the work on foundations so that the foundation work completed is not endangered.

20.2. Maintenance :

20.2.1. The bridge structures are more susceptible to damages during monsoon. It is generally observed that following factors contribute mainly to damage.

(a) Choking of vents
(b) Wash outs of approaches
(c) Dislodgement of wearing course and cushion
(d) Scour on D/S (downstream)
(e) Silting on U/S (upstream)
(f) Collection of debris on approaches in cutting

20.2.2. To minimize the occurrence of above phenomena, it is necessary to take adequate steps as below:

(1) The vents should be thoroughly cleaned before every monsoon.

(2) The bridge vents should be cleared after the first monsoon flood as the flood carries maximum debris with it.

(3) Keep approaches almost matching with existing bank, i.e., cutting or embankment should be minimum to avoid wash outs of approaches.

(4) Disposal of water through side gutters shall be properly planned so that it does not damage the cross-drainage work proper.

(5) The wearing coat with cushion should be sufficiently stable and it should not get dislodged during floods.

(6) In the event of approaches being in cutting there is a tendency of whirling of water at the approaches. This leads to collection of debris in the approaches. After the floods recede, huge heap of debris is found on the approaches. This should be quickly cleared.