

(36) 1823

NE Railway
Gorakhpur
W/29/0/A/5
12.11.2014

Bridge Circular No. 16

The Divisional Railway Manager (Engg)
N.E.Railway,
Izzatnagar, Lucknow, Varanasi

The Chief Workshop Manager/Bridge
N.E.Railway
Gorakhpur

Sub: Inspection of Road Over Bridges

At present, there are 51 nos ROB's in N E Railway and 54 nos new ROB's are sanctioned for construction. Therefore, it is very necessary that these assets should be inspected in a planned manner and as per the guide lines of IRBM so that their maintenance and rehabilitation are planned accordingly. To streamline the regular inspection, general guidelines are as under:

1. Inspection:

1.1 By Assistant Divisional Engineer:

As per para 102 of Indian Railways Bridge Manual, the Assistant Engineer shall inspect every Road over bridge in his jurisdiction once a year after monsoon.

1.2 By Section Engineer/Junior Engineer Bridge:

As per para 107 of Indian Railways Bridge Manual, the Section Engineer/Junior Engineer Bridge shall inspect Superstructure including bearings of all Steel girders of span 12.2 m and above, RCC, PSC and composite girder bridges once in five years on planned basis.

1.3 By Section Engineer/Junior Engineer, Permanent Way & Works:

As per para 117 of Indian Railways Bridge Manual, Section Engineer/Junior Engineer, Permanent Way or Works shall inspect every bridge including ROB/RUB in his section once a year during prescribed months prior to monsoon.

2. Types of inspection:

2.1 Routine Inspection: It is the periodic examination of the general conditions of the structure and in particular the prestressed components of the bridges.

2.2 Detailed inspection: This is a more intensive and thorough inspection than the routine inspection. All parts must be closely

182

examined and if necessary, special equipment should be used to facilitate this inspection.

- 2.3 **Special Inspection:** Special inspections are to be done in the event of unusual occurrence such as seismic activity, accidents etc.

3. **GUIDELINES FOR INSPECTION:**

- 3.1 **Sequence of Inspection:** Inspection should follow a predetermined manner so as to minimize the possibility of any bridge component being overlooked. The sequence may be as follows: -

Foundation, Abutments, Wing/Return walls, Piers, Bed blocks and bearings, Superstructure including soffit of the deck, Drainage, Parapets, Expansion joints.etc.

- 3.2 **Means of Access:** In order to have an efficient inspection, it is essential to have access to all elements of the bridge structure. The means of access should not only ensure convenience of inspection but should also ensure safety of inspecting officials.

- 3.3 **Signs of deterioration in concrete structure:** The reasons for deterioration are either physical or chemical process, which cause visible signs of damage. Following signs of deterioration may, therefore, be looked into while inspecting the bridge:

- 3.3.1 **Texture or colour of concrete:** Concrete surface may indicate the possibility of a chemical attack. Rust stains may indicate the corrosion of reinforcement/prestressing steel.

- 3.3.2 **Cracking:** Cracks can be classified according to the primary cause as follows: -

Cracks in fresh concrete, Thermal cracks, Shrinkage cracks, Durability cracks, Cracks caused by loading and other cracks due to faulty construction, differential settlement of structure etc.

- 3.3.2.1 **Structural and non-structural cracks:** Cracks caused by loading and other cracks mentioned above are structural cracks, which may lead to failure. While cracks in fresh concrete, thermal cracks, shrinkage cracks and durability cracks are non-structural cracks that may not have immediate effect on the load carrying capacity of the structure but will have influence on the durability of the structure leading to failure before the design life.

3.3.3 **Spalling:** A spall may be defined as the depression resulting to separation/detachment of a fragment from the parent concrete.

3.3.4 **Delamination:** Delamination is separation along a plane parallel to the surface of the concrete.

3.3.5 **Scaling:** It is gradual and continuing loss of mortar and aggregate over an area.

3.3.6 **Rust Streaks:** Presence of rust/stain marks on side surface and bottom surface of prestressed concrete girders, closely following the pre-stressing cable profile indicates corrosion of prestressing cable and should be considered as a serious threat to the structure.

3.3.7 **Erosion:** Mechanical action caused due to usage, weather and water.

3.3.8 **Dampness:** Dampness is an indication of improper drainage. It may be due to blockage of drainage spouts.

3.3.9 **Leaching:** Leaching is the accumulation of salts or lime deposits (white in colour) on the concrete surface. These indicate porous or cracked concrete.

3.3.10 **Loss of camber:** The camber of prestressed concrete girders should be recorded and compared with the previously recorded values.

3.3.11 Faults in design, material and workmanship.

3.4 **Location to be specially looked for defects:**

Table below lists out the salient defects, which should be specially looked for during inspection of various elements of concrete superstructure: -

LOOK		
Sl. No.	AT	FOR
1	All over	• General condition of structure and prestressed components in particular. • Condition of concrete. • Cracks. • Corrosion signs.
		• Scaling of concrete. • Spalling of concrete. • Efflorescence. • Condition of construction joints.

3.3.2.2 Recording of cracks:

Whenever, cracks are noticed the following should be recorded: -

- (i) Location
- (ii) Width, depth and length of crack
- (iii) Type and pattern of crack, viz. longitudinal, transverse, diagonal, vertical and random or map cracking
- (iv) Whether active or dormant and
- (v) Behaviour under live load.

While reporting the presence of cracks, the details should be described by sketches and photographs.

3.3.2.3 Crack pattern: When concrete is cracked, crack pattern can be quite informative. It is given below:

Structural element	Location	Crack pattern/Direction	Possible cause
Soffit of slab or girder	End of span	Longitudinal	• Bursting stress • Lack of anchorage block reinforcement • Alkali-silica reaction in concrete
	Mid span	Longitudinal	• Alkali-silica reaction in concrete • Broken tendons
		Transverse	• Loss of prestress • Excess of live load
Web	End of span	Diagonal	• Shear stress • Loss of prestress
Web(Cantilever/Continuous girders)	Over support	Vertical	• Loss of prestress
Top flange(I-girder or Box girder)	Mid span	Transverse	• Differential shrinkage
	Over support	Longitudinal	• Alkali-silica reaction in concrete • Broken tendons
		Transverse	• Differential shrinkage • Loss of prestress • Excess of live load

		(i) Hardening/cracking in case of bitumen filler. (ii) Splitting, oxidation, creep, flattening and bulging in case of elastomeric sealing material. • Condition of sliding plates- check for corrosion, damage of welds, etc. • Debris in joints. • Alignment checking. • Distortion.
13	Bearing: General for all type of bearings	• Check whether the bearing is free to move/rotate in different directions as envisaged in design. • Check whether the bearings are fully and evenly seated. • Check whether all the bearings are at same level. • Physical condition. • Cleanliness.
13(I)	Metallic bearings	• Rusting/corrosion. • Unusual tilting of rollers. • Rollers jumping off the guides. • Condition of grease, when last greased/whether needs replacement. • Condition of anchor bolts, whether in position and not loose.
13(II)	Elastomeric bearings	• Flattening. • Splitting/tearing. • Bulging. • Oxidation. • Non uniform thickness other than that which may be the result of normal rotation. • Displacement (longitudinal or lateral) from original position.

3.5 Inspection Tools:

Tools normally required for visual inspection are as under: -

Sl. No.	Item
1	Clip Boards, chalks, markers etc.
2	Tapes.
3	Feeler gauge
4	Straight edge, plumb bob, spirit level.
5	Thermometer.
6	Inspection mirror.
7	Magnifying glass.

2	Anchorage Zone (at both ends)	• Cracks. • Rusting. • Condition of cable end sealing.
3	Top and bottom of deck slab	• Cracks. • Delamination. • Blocking of drainage. • Worn out wearing coat (once in 5 years). • Damage by abrasive action of ballast (once in 5 years). • Seepage. • Corrosion signs. • Leaching. • Scaling. • Damage due to accident or any other causes.
4	Support point of bearings	• Whether the seating of girder over bearing is uniform. • Condition of anchor bolts, if any. • Spalling/crushing/cracking around bearing support • (Bottom of girder immediately above bearing should also be inspected for such effects)
5	Top and bottom flange of I-girder	• Spalling/scaling. • Rust streak along reinforcement/cable. • Cracks.
6	Bottom slab in box girder	• Cracks • Spalling/scaling. • Corrosion signs. • Drainage.
7	Webs	• Cracks. • Corrosion signs.
8	Diaphragms	• Cracks of junction. • Diagonal cracks at corners. • Diagonal/vertical cracks around opening. • Conditions of diaphragm opening.
9	Junction of slab and girder in case of I-girders	• Separation.
10	Drainage spouts	• Clogging. • Physical condition. • Adequacy of projection of spout on the underside
11	Joints in segmental construction	• Cracks. • Physical appearance. • Corrosion signs.
12	Expansion joints	• Check whether the expansion joint is free to expand and contract. • Condition of sealing material.

8	Pocket knife, wire brush.
9	Inspection cum chipping hammer.
10	Calipers.
11	Chisel.
12	Torch light.
13	Screw drivers, pliers, hammer, torque wrench.
14	Helmet, safety belt.
15	Piano wire with clamps and weights.
16	Microscope.
17	Camera.
18	Crack meter.
19	Binocular.

4. Inspection Report:

- 4.1. **Routine inspection:** Observation of general inspection should be recorded in the Bridge Inspection Register as is being done as per para 1101 and annexure 11/3 of IR Bridge Manual.
- 4.2. **Detailed Inspection:** Observation of detailed inspection should be recorded in a separate register called "Register for detailed inspection for Road Over Bridge."

(For detailed inspection, maintenance and rehabilitation, refer to RDSO report No. BS-48: Guidelines for inspection, maintenance and rehabilitation of concrete bridges)

[Signature]
(M S Kutiyal) 12/11/201
Chief Bridge Engineer
[Signature]

Distribution:

- Secretary to PCE for kind information of PCE.
- CAO/Con for kind information.
- CGE, CTE, CE/TMC & CPDE for information.
- Dy CE/Br/HQ, Dy CE/Track, Dy CE/P & D, Dy CE/TP, Dy CE/TMS, Dy CE/TMC, Dy CE/G, Dy CE/LC & ROB and Dy. CE/GA for information.

[Signature]
21-11-14