



Indian Roads Congress
Special Publication 18

**MANUAL FOR
HIGHWAY
BRIDGE
MAINTENANCE
INSPECTION**

NEW DELHI



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Special Publication 18

MANUAL FOR HIGHWAY BRIDGE MAINTENANCE INSPECTION

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I

Introduction

CHAPTER 1

INTRODUCTION

Bridge inspection is not merely a routine but an art, wherein special techniques and exacting knowledge have to be applied to ascertain the physical condition of the structure and recommend suitable remedial measures for portions adversely affected.

At present the maintenance practice in various States varies and only a handful of them have compiled the requirements of periodic inspection and maintenance of highway bridges, for the use of their staff. It is with the aim of providing uniformity throughout the country and to serve as guidelines to the maintenance engineers that this Manual on Highway Bridge Maintenance Inspection has been prepared embracing all vital aspects like status of inspecting staff, periodicity of inspection, records to be maintained, complete list of items to be inspected, etc.

The utility of such a manual will go a long way in not only maintaining our old obsolete structures, by undertaking timely repairs/strengthening measures where necessary but also keeping a constant watch on our new sophisticated bridges constructed with critical designs and optimum use of materials.

Records

5

2

Records

CHAPTER 2

RECORDS

2.1. General

The prime need for any bridge maintenance inspection operation is a complete accurate and up-to-date record of the bridge. The utility of field investigations is little served without the maintenance of proper records. The records should thus provide a complete up-to-date history of the structure right from the stages of construction.

2.2. Bridge Register

For maintenance of records of bridges, a bridge register as indicated at *Appendix I*, shall be used. One bridge register may include the reports in respect of several bridges. However, for each bridge there must be two reports *i.e.* (i) Original Bridge Report, and (ii) Inspection Report. The reports prepared embracing all the important points as detailed under paras 3 and 4 should be complete, clear and concise so that they could be easily understood without any ambiguity. These reports shall be maintained by the concerned Works Division so as to make these available to the inspecting officers.

3

**Original Bridge
Reports**

CHAPTER 3

ORIGINAL BRIDGE REPORTS

3.1. General

In case of newly constructed bridges, the original bridge report shall be prepared on the basis of completion drawings supplemented wherever necessary by site inspection. But in case of old bridges where sufficient data is not available, an investigation should be undertaken for compiling the same. The items to be covered in the Original Bridge Report shall be those listed in the Proforma for Original Bridge Reports at pages 29—31 of the Bridge Register at *Appendix 1*.

Some of the items are elucidated here under for clarification and guidance.

- (i) **Soil particulars** :—Under this item indicate the type of soil at the founding strata, its safe bearing capacity, whether the soil is scourable or not (based on past records), etc. For major bridges indicate the different type of soil strata based on bore hole data for the entire width of the river at the bridge site.
- (ii) **Foundations** :—Under this item indicate the type of foundations like well, piles, open, etc., below abutments and piers separately and give broad dimensions like well diameter, steining thickness, pile diameter, spacing and arrangement of piles, dimensions of open foundations, etc. Also indicate whether endangering of foundations due to excessive scour or settlement has taken place in the past, any other special feature like sulphate attack, degradation/aggradation of bed, etc.
- (iii) **Sub-structure** :—Under this item indicate the type of substructure, e.g., masonry, plain cement concrete, reinforced cement concrete, prestressed cement concrete, etc. and give broad dimensions of the substructure components as well as of the wing walls and RCC returns, etc. Mention any special features like past incidents of corrosion and remedial measures thereof, damage due to impact of floating bodies, etc.
- (iv) **Bearings** :—Under this item indicate the type of bearings, give brief details like the design load, broad dimensions of the bearings, location of lifting points, procedure for lifting, replacement of the bearings if done and the date, last date of greasing for metallic bearings, etc.

- (v) **Superstructure** :—Under this item indicate the type of superstructure like reinforced cement concrete, prestressed cement concrete, steel, masonry arch, etc. Give brief details of the various components (explain by sketch), method of prestressing, cross prestressing used or not, any other special features, etc.
- (vi) **Protective Works** :—Under this item indicate the type of protective works and briefly give the broad dimensions of the layout, height, slope and thickness, etc. (explain by sketch). For bed protection details indicate the type of bed protection and the thickness of bed flooring, depth of cut off walls, width and thickness of launching aprons on upstream and downstream.

3.2. Modified Reports

In case of bridges which have been substantially altered by widening or strengthening or by some other manner extensively modifying the existing conditions, these should be incorporated in the original report in red indicating clearly the modifications thereon with date.

4

Inspection

CHAPTER 4

INSPECTION

4.1. Time of Inspection

It is desirable to undertake inspections in those periods of the year which offer the most critical evaluation of the performance of the structure, *e.g.* items such as foundations, protective works, scour effects, maximum flood levels etc. during and after the monsoons, high structures affected by strong winds during those seasons when such winds are prevalent bearings and joints during temperature extremes when there is likelihood of maximum movement, etc. Apart from above, special inspections shall also be undertaken for unusual occurrences like earthquake, passage of abnormal loads, etc., to ascertain the performance of the structure. To assess whether repairs have been carried or not, inspections should generally be undertaken after the monsoons.

4.2. Status of Inspecting Officer and Frequency of Inspection

All bridges shall be inspected by a competent qualified engineer *once a year*. However, bridges located in hilly terrain and prone to effects of slips, etc., shall be inspected twice a year *i.e.*, once before the monsoons and then after the monsoons are over. In addition, all major and special type bridges like prestressed concrete continuous structures, suspension bridges, cable stayed girder bridges, etc. should also be inspected by a senior engineer.

4.3. Inspection Report

The inspection reports should cover the items listed in the proforma for inspection report at pages 33 to 39 of the Bridge Register given in *Appendix I*. The inspecting officer must observe and report any structural deficiency, assess its seriousness, recognise and indicate areas of the bridge where any problems can be expected and suggest suitable preventive maintenance measures. Items needing urgent attention must be brought immediately to the notice of the Competent Authority for undertaking necessary remedial measures. The items of inspection as listed in the proforma for inspection report are briefly elucidated below for the guidance of the inspecting officer.

(i) Approaches

The inspecting officer shall inspect the approaches in the vicinity of the bridge and check for unevenness, settlements if any, cracking of the pavement, camber, longitudinal gradient, proper functioning of the drainage facility, damages to the guard rails, condition of approach slabs, erosion or damages to the embankment, settlement or disturbance of the slopes, etc. The approach slabs shall also be examined for any untoward cracking, movement away from the dirt wall and to see that no portion rests on the wing walls/cantilever returns.

(2) Protective Works

The protective works like guide bunds, spurs, pitching around abutments, etc., shall be inspected during the floods to ascertain the HFL, scour depth, launching of apron, etc. and after floods to examine the condition of existing slopes and slope pitching and adequacy of the apron. The inspecting officer must look for aspects like launching of the apron, settling of the slope, piping action, improper drainage of the rain water causing the slope to be disturbed, impact of waves carrying away the smaller particles and thus disturbing the slope, any undue scour at the nose of the bund and/or at the toe of the pitching and give his recommendations to ensure that the protective works function adequately. The quantity of reserve stones available at site for meeting emergent situations shall be checked before floods, against specified quantity and duly reported.

The floor protection shall also be inspected both during and after the floods to ascertain the extent of scour, cracking and damage of the floor if any, adequacy of the cut off walls and apron, etc. Specific recommendations for augmentation of the existing provisions if any shall also be given.

(3) Waterway

The inspecting officer shall inspect the waterway under the bridge during the floods and report about the following:

- (i) The maximum flood level observed and how it compares with the design HFL.
- (ii) The maximum observed afflux.
- (iii) The maximum observed scour, its location and how it compares with the design scour values.

- (iv) Any abnormal change in the flow pattern both on the u/s. and d/s. of the bridge ; (explain by sketch).
- (v) Any obstruction in the waterway like presence of undergrowth blocking a span or projection of the hard bank deflecting the stream resulting in only part of the waterway being effective, etc.
- (vi) Whether the waterway provided is adequate or not ?

(4) Foundations

The foundations being usually below the bed level shall be inspected during high floods to ascertain adequacy of the foundations by comparing the observed maximum scour with the design values and suggest suitable remedial measures if the foundations are likely to be endangered. This can be achieved by taking soundings around the foundations. In case of deep well foundations, to ascertain the maximum depth of scour, soundings at regular intervals during the flood, will have to be taken. Where sophisticated sounding techniques are not available the desired data may be collected by resorting to approximate gauging methods like a weight hung from a wire. Further, special attention be laid on foundations resting in rock with the overburden having a tendency to get scoured and endangering the foundations. The scour depths in such cases be recorded regularly during the floods with a view to ensure the safety of foundations. After the floods, the inspecting officer shall inspect the general condition of the foundations to ascertain aspects like cracking, disintegration, decay, erosion, cavitation, damage due to impact of floating bodies in the river, etc. A remark shall be added in the inspection report if the foundations cannot be inspected due to presence of water.

(5) Sub-structure (Piers, abutment and wing walls)

The inspecting officer shall inspect the sub-structure usually during dry weather when the flow in the river is the minimum, and report in respect of the following :

- (i) Concrete or RCC piers, abutments and wing walls for damages due to impact, cracks, spalling or disintegration of concrete particularly at construction joints and at the top where the superstructure rests. The spalled or cracked sections shall be checked to ascertain upto what extent guniting or reintegration by rich cement mortar or epoxy mortar could be done to restore the structure to a safe condition.
- (ii) Exposed faces of abutment for presence of any moisture indicating inadequate drainage of the backfill, proper functioning of weep

holes and filter media forming the backfill, etc. In cases of the backfill surcharged with moisture examination shall be made to suggest other suitable drainage methods to drain the accumulated water immediately.

- (iii) Masonry piers, abutments and wing walls for cracks due to settlement of foundations, the condition of the pointing or plastering and the condition of the stone or bricks ; any possible bulging or movements, etc.
- (iv) The face of the dirt wall of the abutments for any tilting, requisite expansion gap for movement, etc.

Remarks shall be added in the inspection report if the sub-structure cannot be inspected due to presence of water in the river.

(6) Bearings

All bearings shall normally be inspected during temperature extremes and after the floods have passed. They should however, also be inspected for unusual occurrences like earthquakes, passage of excessive traffic loads, unprecedented floods and battering on account of the same. While inspecting different types of bearings the following shall be kept in mind :

(i) Metallic Bearings :

The metallic bearings shall be inspected to ascertain :

- (a) the general condition like cleanliness, rusting, ceasing of plates, etc. ;
- (b) the proper functioning of bearings by observing excessive movements if any, unusual tilting of the rollers, rollers jumping off the guides, etc. ;
- (c) the condition of the grease/oil, when last greased and whether it needs to be replaced or not ;
- (d) whether any structural cracks in supporting members like abutment cap, pier cap, pedestal, etc. ; and
- (e) whether the anchor bolts are in position and not loose.

As regards the normal practice for changing grease it should be done once in every 3 years and only neutral grease conforming to IS : 1002 shall be used.

(ii) Elastomeric Bearings :

The elastomeric bearings shall be inspected to ascertain the following :

- (a) The physical condition of the pads like oxidation, creep, flattening, bulging, splitting, etc.
- (b) the cleanliness of the bearing and its surroundings particularly to avoid contact with grease, oil, petrol, etc.

(7) Superstructure

The inspecting officer shall inspect the superstructure and report in respect of the following :

(i) Reinforced concrete members

- (a) The stems of concrete girders shall be examined for spalled, disintegrated, cracked or honey-combed areas, specially over the bearings ;
- (b) Webs of box girders shall be inspected for cracks which may occur due to temperature stresses ;
- (c) The soffit of the lower slab in box girder structures and outside faces of girders shall be examined for any significant cracks ;
- (d) The articulation of concrete girder bridge being a vulnerable part shall be examined for cracks. In case cracks are noticed suitable tell-tales shall be put up to observe them minutely and to ascertain whether the cracks are developing further or not ;
- (e) For over-bridges, the under-side of the girders shall be examined for any damage due to loads of excessive height passing under the over-bridge ;
- (f) Any unusual deflection or vibration observed shall be recorded ;
- (g) The concrete decks shall be examined for cracking, leaching, scaling, pot-holing, spalling and other signs of deterioration ; each of these items shall be evaluated to assess the overall effects on the structure and the restoration work required to be done shall be clearly specified. Signs of deterioration in reinforcing steel

shall be examined to ascertain the extent of deterioration, specially in areas where deck is affected by saline water or sea breeze.

In cases of asphaltic wearing surface, real condition of the deck may not be visible. In such cases large cracks in the wearing surface are often indications of deck damage. Efforts shall be made to examine such areas by removing the asphaltic wearing coat. Often the inside of the deck in such cases also reveals the area of distress or deterioration and thorough examination of the same should be resorted to. Any evidence of water passing through the cracks of the deck shall be recorded. As a remedial measure, it is normal practice to repair cracks or honey-combed areas by grouting or guniting with epoxy mortar.

(ii) **Prestressed concrete members.**—The prestressed concrete members shall be examined for loss of camber, excessive deflection, distress due to buckling, cracking and deterioration of concrete, cracking or spalling in the area around the bearings and at cast-in-place diaphragms where creep and humping of the girders may have an effect must be looked for. Where cracking is found, location and size shall be noted and tell-tales installed to watch their future development. The end anchorages shall be examined for water tightness and corrosion of prestressing wires.

(iii) **Structural steel members.**—The structural steel members like trusses, girders, stringers, railings, etc. shall be checked for corrosion cracking, condition and looseness of any bolts, rivets and welds in connections, etc. The flanges and webs of all sections shall be checked for damage, misalignment and the web stiffness for buckling. All joints shall be checked for their worthiness. The bolted joints of new bridges shall be got tightened after one year of service. All components of the truss members must be checked in respect of alignment and any kinks and bow in the members. Any eccentricity in the connecting details be recorded. The bracing shall be examined for any traffic damage and whether they are properly adjusted and functioning satisfactorily. Any loss of camber in the main girders assessed from comparative readings shall be recorded.

The condition of paint shall be examined and the extent of corrosion if any recorded. The paint shall never be allowed

to deteriorate to the extent that rusting occurs. Since the connecting details are more susceptible to corrosion more detailed examination of these units shall be done specially looking for deformation in reveted or bolted multiplate sections where moisture may have entered and corroded the plates. Earth, leaves and any debris at the members/joints shall be indicated for removal, as they hasten the corrosive action. In old bridges, with trusses, deck system shall be examined to ascertain their adequacy to carry present day loads. Often, the existing deck load can be removed to allow for higher traffic loads. All these aspects shall be examined keeping the overall safety and the serviceability of the structure. Unusual vibrations if observed shall be recorded.

(iv) **Masonry arches.**—The drainage facilities at the spandrel walls of earth filled arch bridges shall be inspected to ascertain whether moisture is locked up in filling. The spandrel walls shall be checked to ascertain that they do not separate from the arch rings and they do provide lateral support to the fill above the arch rings.

The condition of the masonry arch ring and mortar joints, presence of cracks, condition of plaster, etc. shall be recorded. Cracks, shall be marked by red paint for their entire lengths and dated tell-tales placed at their extremities and in between and numbered. The pattern of the cracks and their location be recorded. The flattening of the profile of the arch, if any, shall be recorded.

All vegetational growth shall be recorded and steps suggested for their removal.

(v) **Timber components.**—As timber components are more susceptible to deterioration than concrete and steel, they should receive more careful inspection and maintenance. All timber members must be examined for decay, rot, splits, evidence of failure, etc., which impair the strength and serviceability of the member.

All splice points shall be checked for soundness in shear connections. All bolts must be checked to see that they are tight and in good condition. Components submerged under water shall be checked to see whether they have decayed or not so as to establish the need of applying a suitable protective layer. The timber

flooring in timber and steel bridges shall be inspected for loose and rotten members.

(vi) **Suspension bridges.**—The main suspension cables shall be examined to see whether their protective covering or coating is in sound condition. Items like cable bands holding the suspenders in proper position, condition of saddles and anchorages at the towers, specially against corrosion shall be carefully examined.

The anchor shall be checked for any signs of movement.

All steel parts shall be checked as per instructions contained under 'Structural Steel Members'. The towers shall be checked for their structural soundness, vertical position and adequate lateral support. Any unusual vibrations shall be recorded.

(8) Expansion Joints

The inspecting officer shall inspect the expansion joints and report in respect of the following :

- (a) Whether the joints are functioning properly and the expansion gap is adequate for thermal movement ;
- (b) Cracks if any in the deck in the neighbourhood of the expansion joints ;
- (c) Condition of sealing materials, secureness of the joints, the condition of top sliding plate and whether corroded or not ;
- (d) Locking of joints especially for finger type expansion joints ;
- (e) Debris in open type joints, resulting in lack of expansion gap ;
- (f) Rattling of joints if any.

(9) Wearing Coat

The inspecting officer shall inspect the wearing coat and report in respect of the following :

- (a) The surface condition, *i.e.*, whether there are any cracks, spalling of concrete, disintegration, pot-holes, etc. ;
- (b) Riding quality and the road worthiness with respect to slipperiness bumps, unevenness, etc. ;
- (c) Evidence of wear, by providing tell-tale rings and checking the existing thickness of the wearing coat against the designed thickness.

(10) Drainage Spouts

The inspecting officer shall inspect the entire drainage system to ascertain its proper functioning and whether some additional facilities have to be provided. The drainage spouts shall be checked for deterioration and damage. The projection of the drainage spouts on the inside of the structural members shall also be checked to see that the structural members are not damaged.

(11) Hand Rails

The RCC hand rails shall be inspected for cracks, spalling, scaling, deterioration in the concrete and any damage due to traffic. Examination shall also be made of the reinforcement in areas where they are exposed due to damage or spalling of the concrete. Often rust stains on the concrete are indicative of corrosive action on the steel inside the concrete and shall be noted. Expansion gaps and alignment shall be checked and any missing parts reported. In case of submersible bridges, collapsible hand rails shall be removed before floods.

(12) Footpath

Concrete footpaths/side walks, shall be inspected for cracks, spalling, scaling or pot-holes. The condition of joints where pre-cast slabs are used resting on the kerbs shall be examined to ascertain that no slabs fall off the support and the joints open to the extent of becoming a pedestrian's hazard and to ensure at the same time that adequate expansion gap is also available. Any missing footpath slabs shall be reported.

(13) Utilities

The inspecting officer shall report leakage of water and sewage pipes, damage to telephone and electric cables, the condition of lighting facilities as well as any other damages to other utilities.

(14) Bridge Numbering

The bridge numbering shall be inspected for the condition of the painting of numbers and the clear visibility of the numbering to traffic. The numbering shall generally

conform to the IRC : 7-1971. Recommended Practice for Numbering Bridges and Culverts ”,

(15) Aesthetics

The inspecting officer shall report any visual intrusion of bill-boards, paints on structural members, etc.

4.4. Follow-up Action on Inspection Report

The inspecting officer shall inspect the works before floods and also report in detail the follow-up action that has been taken on the recommendations arising out of the last inspection. Remedial measures not carried out but warranting urgent consideration shall be brought immediately to the notice of the Competent Authority.

The Inspection Report shall be forwarded to the Competent Authority within a fortnight of the inspection, for appropriate follow-up action.

I

Bridge Register

Bridge Register

Department

Division

Bridge Register

Index

<i>Sl. No.</i>	<i>Name of bridge/Br. No.</i>	<i>Location</i>	<i>Page No.</i>
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PROFORMA FOR ORIGINAL BRIDGE REPORTS

1. .. **General**
 - 1.1. .. Name of the Bridge/No. of the bridge, name of the river
 - 1.2. .. Name, No. of Highway, Bridge Location
 - 1.3. .. Location of Bench Mark with G.T.S. level
2. .. **Details of span** (giving reference to spans for clarity)
 - 2.1. .. No. of spans (length centre to centre of piers)
 - 2.2. .. Length of bridge
 - 2.3. .. Angle of crossing
3. .. **Hydraulic particulars**
 - 3.1. .. Drainage area
 - 3.2. .. Design discharge
 - 3.3. .. Design HFL
 - 3.4. .. Vertical clearance
 - *3.5. .. LWL
 - *3.6. .. Maximum depth of flow
 - *3.7. .. Maximum velocity of flow
 - *3.8. .. Ordinary flood level
 - 3.9. .. Safe scour depths for
 - (a) piers
 - (b) abutments
4. .. **Loadings**
 - 4.1. .. Design live load (if data is not available then rated capacity)
 - 4.2. .. Special forces considered in design
5. .. **Soil particulars**
 - 5.1. .. Founding strata
 - *5.2. .. If available a cross-section of the bed showing the different strata based on bore hole data (necessary for major bridges only).

- 6. .. **Foundations**
 - 6.1. .. Type and brief details (Well or Open or piles, RCC or PCC)
 - 6.2. .. Depth of foundations (measured from bottom of sub-structure)
 - 6.3. .. Report settlements, excessive scour, etc.
- 7. .. **Sub-structure**
 - 7.1. .. Type (PSC, RCC, CC or masonry)
 - 7.2. .. Dimensions of pier
 - 7.3. .. Dimensions of abutment
 - 7.4. .. Details of returns (type and dimensions)
- 8. .. **Bearings**
 - 8.1. .. Type
 - 8.2. .. Brief details
- 9. .. **Superstructure**
 - 9.1. .. Type
 - 9.2. .. Brief details
 - 9.3. .. Carriageway and footpath widths
 - *9.4. .. Details of prestressing
 - 9.5. .. Details of wearing coat
 - 9.6. .. Details of Expansion Joints
 - 9.7. .. Details of Articulation.
- .. **Protective works**
 - .. Type of protective works (guidebund, abutment protection spurs, etc.)
 - *10.2. .. Details of protective works (show by sketch, height, slope, thickness of slope pitching and apron, and for layout refer to the detailed plans)
 - 10.3. .. Details of bed protection
- 11. .. Position of surface utilities (telephone cables, electric line, water vent, sewage, etc.)

- *12 .. Design details & drawings (give reference to the designs and drawings with their comments and the source where available)
- *13 .. Diagrammatic sketch (give LS of bridge showing span arrangement, bed level of the river with the RLs for major bridges, soil profile based on bore data)
- *14 .. Special features (give constructional or design problems, etc. encountered which may be of special guidance for future)
- 15 .. Date when completed and opened to traffic
- 16 .. Cost of the project
- 17 .. Name of the constructing agency
- 18 .. Date of the report
- 19 .. Dated signature of the reporting officer
 Designation of the reporting officer

Note.—Items marked * need not be filled up for Minor Bridges.

Space for sketches, etc.

PROFORMA FOR INSPECTION REPORT

1. .. **General**
- 1.1. .. Name of bridge/No. of the bridge, name of the river
- 1.2. .. Name, No. of Highway, Bridge Location
2. .. **Type of bridge**
3. .. **Date of last inspection**
4. .. **Approaches**
- 4.1. .. Condition of pavement surface (Report unevenness settlement, cracking, pot-holes, etc.)
- 4.2. .. Side slopes (report pitched or unpitched, condition of pitching/turfing any signs of slope failure, etc.)
- 4.3. .. Erosion of embankment by rain cuts or any other damage to embankment
- 4.4. .. Approach slab (report settlement, cracks, movement, etc.)
- 4.5. .. Approach geometrics (report whether it satisfies the standards as in force)
5. .. **Protective Works**
- 5.1. .. Type & mention whether guidebund or protection around abutments or spurs)
- *5.2. .. Report damage of the layout, cross-section profile (check whether the layout and the cross-sections are in order)
- 5.3. .. Report condition of slope pitching, apron and toe walls indicating the nature of damage if any (check for proper slope, thickness of

- pitching in the slopes, width and thickness of apron, erosion of toe walls, etc.)
- 5.4. .. Report condition of floor protection works, indicate nature of damage if any, (condition of impervious floor, flexible apron, curtain walls, etc.)
 - 5.5. .. Extent of scour (report any abnormal scour)
 - *5.6. .. Reserve stone material (check against specified quantity)
6. .. **Waterway**
- 6.1. .. Report presence of obstruction, undergrowth, etc.
 - *6.2. .. Report maximum observed scour and location and compare with the design values
 - 6.3. .. Report any abnormal change in flow pattern
 - 6.4. .. Report maximum flood level observed during the year and mark the same on the pier/abutment both on the U/S and D/S
 - 6.5. .. Report abnormal afflux if any
 - 6.6. .. Report adequacy of waterway
7. .. **Foundations**
- 7.1. .. Report settlement if any
 - 7.2. .. Report cracking, disintegration, decay, erosion, cavitation, etc.
 - 7.3. .. Report damage due to impact of floating bodies, boulders, etc.
 - 7.4. .. For sub-ways report seepage if any, damage to the foundations, etc.
8. .. **Substructure** (piers, abutments and wing-walls)
- 8.1. .. Report efficiency of drainage of the backfill behind abutments (check functioning of weep holes, evidence of moisture on abutment faces, etc.)

- 8.2. .. Report cracking, disintegration, decay, etc.
- 8.3. .. For sub-ways report condition of side retaining walls like cracking, disintegration, etc., and seepage, if any

- 9. .. **Bearings**
 - 9.1. .. **Metallic bearings**
 - 9.1.1. .. Report general condition (check rusting, cleanliness, ceasing of plates)
 - *9.1.2. .. Functioning (report excessive movement, tilting, jumping off guides)
 - 9.1.3. .. Greasing/oil bath (report date of last greasing/oil bath and whether to be redone or not)
 - 9.1.4. .. Report cracks in supporting member (abutment cap, pier cap, pedestal)
 - 9.1.5. .. Report effectiveness of anchor bolts (check whether they are in position and tight)
 - 9.2. .. **Elastomeric bearings**
 - 9.2.1. .. Report condition of pads (oxidation, creep, flattening, bulging, splitting)
 - 9.2.2. .. Report general cleanliness
 - 9.3. .. **Concrete bearings**
 - 9.3.1. .. Report any signs of distress (cracking, spalling, disintegrating)
 - 9.3.2. .. Report any excessive tilting

- 10. .. **Superstructure**
 - 10.1. .. **Reinforced concrete and prestressed concrete members**
 - 10.1.1. .. Report spalling, disintegration or honeycombing, etc.
 - 10.1.2. .. Report cracking (pattern, location, explain preferably by plotting on sketch)
 - 10.1.3. .. Report corrosion of reinforcements if any
 - 10.1.4. .. Report damages if any due to moving vehicles

- *10.1.5. .. Report condition of articulation (cracks if any)
- *10.1.6. .. Report perceptible vibrations if any
- *10.1.7. .. Report excessive deflections or loss of camber if any (measure at same point each time)
- *10.1.8. .. Report cracks in end anchorage zone (for prestressed concrete members)
- *10.1.9. .. Report deflection at central hinge, tip of cantilever for cantilever bridges
- 10.2. .. Steel members
 - 10.2.1. .. Report condition of paint
 - 10.2.2. .. Report corrosion if any
 - *10.2.3. .. Report perceptible vibrations, if any
 - *10.2.4. .. Report on alignment of members
 - 10.2.5. .. Report condition of connection (adequacy, looseness of rivets, bolts or worn out welds, report specially on connection of stringers to cross girders, cross girders to main girders, gussets or splices, etc.)
 - 10.2.6. .. Report camber and deflection
 - 10.2.7. .. Report buckling, if any
 - 10.2.8. .. Report on the cleanliness of members and joints (check choking of drainage holes provided in the bottom booms)
- 10.3. .. Masonry arches
 - 10.3.1. .. Report condition of joints mortar, pointing, masonry, etc.
 - 10.3.2. .. Profile report flattening by observing rise of the arch at centre and quarter points.
 - 10.3.3. .. Report cracks if any (indicate location, pattern, extent, depth, explain by sketches)
 - 10.3.4. .. Check drainage of spandrel fillings (report bulging of spandrel walls if any)
 - 10.3.5. .. Check growth of vegetation
- 10.4. .. Timber members
 - 10.4.1. .. Report condition of paint

- 10.4.2. .. Check decay, wear and tear, structural defects needing immediate replacement if any
- 10.4.3. .. Report condition of joints, splices, spikes, etc.
- 10.4.4. .. Report excessive sag, if any
- *10.5. .. Suspension bridges
- *10.5.1. .. Report condition of cables
- *10.5.2. .. Report condition of suspenders and their connectors
- *10.5.3. .. Report condition of structural steel
- *10.5.4. .. Report condition of painting
- *10.5.5. .. Report excessive oscillations if any requiring need of guy ropes
- *10.5.6. .. Report looseness of joints, bolts, rivets, welds
- *10.5.7. .. Report condition of anchors (evidence of movement)
- *10.5.8. .. Report condition of towers and saddles (verticality, lateral support)
- 11. .. **Expansion joints**
- 11.1. .. Functioning (Report cracks in deck in the existing gap and approximate temperatures)
- 11.2. .. Report condition of sealing material (for neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check for hardening, cracking, etc.)
- 11.3. .. Report secureness of the joints
- *11.4. .. Top sliding plate (report corrosion, damage to welds, etc.)
- *11.5. .. Locking of joints (report locking of joints especially for finger type expansion joints)
- 11.6. .. Check for debris in open joints
- 11.7. .. Report rattling, if any
- 12. .. **Wearing Coat** (concrete/bitumen)
- 12.1. .. Report surface condition (cracks, spalling, disintegration, pot-holes, etc.)

- 12.2. .. Report evidence of wear (tell-tale rings, check for thickness as against actual thickness, report date of last inspection)

- 13. .. **Drainage spouts**
 - 13.1. .. Check clogging, deterioration and damage, if any
 - 13.2. .. Check the projection of the spout on the underside (see whether structural members are being affected)
 - 13.3. .. Report adequacy, thereof
 - 13.4. .. For sub-ways report about adequacy of pumping arrangements, etc

- 14. .. **Handrails**
 - 14.1. .. Report general condition (check expansion gaps, missing parts, if any, etc.)
 - 14.2. .. Report damage due to collision
 - 14.3. .. Check alignment (report any abruptness in profile)

- 15. .. **Footpaths**
 - 15.1. .. Report general condition (damage due to mounting of vehicles)
 - 15.2. .. Report missing footpath slabs

- 16. .. **Utilities**
 - 16.1. .. Report leakage of water and sewage pipes
 - 16.2. .. Report any damage by telephone and electric cables
 - 16.3. .. Report condition of lighting facilities
 - 16.4. .. Report damages due to any other utilities

- 17. .. **Bridge Number**
 - 17.1. .. Report condition of painting.

18. .. **Aesthetics**
- 18.1. .. Report any visual intrusion (Bill-boards, paints on structural members, etc.)
19. .. Report whether maintenance recommended during last inspection has been done or not (give details).
20. .. Maintenance and improvement recommendations

<i>Sl. No.</i>	<i>Item needing attention</i>	<i>Action recommended</i>	<i>Time when to be completed</i>	<i>Remarks</i>
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21. .. Certificate to be accorded by the inspecting official.

Certified that I have personally inspected this bridge.

Date :

*Signature
Designation of the
inspecting officer.*

Note : Items marked * need not be filled up for Minor Bridges.
