

(91/29) HT

General Manager/Engg
North Eastern Railway
Gorakhpur.

BRIDGE CIRCULAR NO.13

INSPECTION AND MAINTENANCE OF BRIDGES

1.0 GENERAL.

1.1 This circular deals with the subject of inspection of bridges and inspection registers and is an amplification of what is given in the Indian Railways Way and Works Manual and, therefore, is to be read in conjunction with it.

2.0 FUNCTIONS AND PROCEDURE:

In supersession of all previous instructions on the subject, the following shall be the responsibilities of the Divisions and Bridge branch for the up-keep and maintenance of the bridges:-

2.1 BY THE DIVISIONS:

Up-keep and maintenance of all bridges including PSC slabs except the steel structures of major bridges of over 12.2 m span shall be the responsibility of the Divisions. All minor defects of PSC girders are to be attended by the Divisions. For major defects Divisions shall place work order on the Bridge branch.

This is to be achieved by various officials of the Divisions as per following:-

2.1.1 BY WORKS INSPECTORS:

Works Inspectors posted on the Divisions shall be responsible for:-

- i) Inspection and maintenance of foundation and sub-structure of all bridges, girders and girder seating including road and foot over bridges and protective works. The inspection shall be carried out once a year during the prescribed month say April/May prior to the monsoon season. The details of the inspection should be recorded in manuscript Bridge Inspection Register maintained by them.
- ii) Execution of all new bridges and repairs and modification of all existing bridges excluding the erection of girders and laying of track.
- iii) Efficient execution of all repair works including painting of girders and oiling greasing of bearings of bridges (sub-structure).
- iv) Inspector of works will ensure pre-monsoon checks over reserve stock of boulders, cinders, empty cement bags and G.I. wire net ~~trungers~~ for bridge protection and will take appropriate steps for its recoupment.
- v) He will accompany the Assistant Engineer on the later annual inspection of bridges.

2.1.2 BY PERMANENT WAY INSPECTORS:

2.1.2.1 Permanent Way Inspectors posted on the Divisions shall be responsible for inspection and maintenance of track on bridges and bridge approaches in a satisfactory and safe condition for traffic. The inspection shall cover the following:-

- a) General inspection of all girders and track structures including all fittings.
- b) PWI will ascertain whether the track is central on the rail bearers and the main girders and in good line and level. Departure from line is caused by in-correct seating of girders, shifting of girders laterally or length-wise, incorrect seating of sleepers on girders or rails on sleepers, varying gauge or creep. Departure from level is caused by errors in level of bed block or careless fixing of sleepers.

The adequacy of guard rail arrangements, clearance of running rails and girder ends from ballast walls and condition of timbers and fastenings on the run-off frames on skew spans should be inspected.

- c) PWI will ascertain that all sleepers are adequately attached to girders, in sound condition and provided with effective means to prevent ends from splitting. Track components should be examined. All hook bolts should be lubricated at least once a year. Camber packings where provided should be in sound condition. Each packing plate should not be less than 8mm thick and be of sufficient length to take the hook bolt.
- d) PWI will ascertain that track on the approaches is in good line and level. Rail joints should be avoided within 3 meters of bridge abutment and on short spans.
- e) PWI will ascertain that the gang ways are properly supported for the convenience of keymen, patrolmen and transportation staff.
- f) PWI will ensure that the precautions against damage by fire are adequate.

2.1.2.2. Bridge timbers should be serially numbered. For this purpose, on the left ends of the sleeper, beyond the rail, an engraving or in painting (in cases of channel sleepers), the number of the sleeper and the year should be put. In the bridge registers, precise serial number of the bridge timbers requiring replacement should be recorded.

2.1.2.3 Irrespective of detailed periodical inspection, the PWI during his routine inspections should watch for any signs of weakness in bridges and structures affecting track and promptly report any matter demanding AEN's attention.

2.1.2.4 The PWI is directly responsible for the safety of the ~~wax~~ track. He shall be vigilant to locate faults in the permanent way and missing/loose fitting and attend them. Track defects which are beyond his power to remedy shall be immediately brought to the AEN's notice.

2.1.2.5 He will accompany the Assistant Engineer on the latter's annual inspection of bridges.

3.0 RECORD OF INSPECTION.

3.1 RECORD OF IOW/PWI. Inspection will record the results of their inspection in a manuscript register which will contain:

1. Date of inspection.
2. Bridge Number, type, spans, Kilometrage.
3. Condition of bridge at the time of inspection.
4. Repairs carried out during the year.

3.1.1 By 15th June the Inspector should send to the AEN/DEN in duplicate:-

a) a compliance certificate to the effect:-

"I certify that:

i) I have complied with all the orders issued to me by AEN/DEN/Sr.DEN vide

A) letter No. _____ dt. _____

B) letter no. _____ dt. _____

except the following:-

ii) I have carried out bridge inspection of my section for the year ending _____ and I append herewith a list of important defects, not in t exceptions under para(i) of this certificate".

b) the list of important defects.

3.1.2 i) The AEN/DEN will issue such orders as necessary to the IOW/PWI and forward one copy of certificate of inspection alongwith the list of defects to the DEN/Sr.DEN with remarks, if any.

ii) DEN/Sr.DEN will study the list of defects accompanying the certificate of inspection. He will issue orders necessary to maintain safety of trains. In case of any doubt, he should consult his colleagues, the co-ordinating Sr.DEN and the territorial CE, as he thinks necessary.

4.

BY ASSISTANT ENGINEERS:

The Assistant Engineer is generally responsible for the maintenance and safety of all way and works in his charge for the accuracy, quality and progress of new works.

- i) The Assistant Engineer shall inspect every bridge on the sub-division including road & foot-over-bridge once a year after the monsoon during the prescribed months (preferably from the month of October just after monsoon and should be completed by December, positively) and record results in ink in the bridge inspection register. Bridge register shall cover all bridges and track, ROBs and RUBs or any other bridges across the track and contain all details with sketches as prescribed in the Register.

ROBs will however, be included in the steel structures register.

He will record the result of his inspection in narrative form as per existing practice and indicate numerical rating about the overall condition of the bridge in red ink within a circle.

- ii) In case of bridges which are distressed or require further observations of the AMN/DM/Sr. DM, these should be inspected between Jan. & June again to ensure that adequate protection measures have been taken and also inspection notes complied with.
- iii) For important bridge and river-training works relating thereto a separate flood and bridge inspection register should be maintained. Bridges, the condition of which warrant special attention, should be inspected more frequently.
- iv) The track on girder bridges should be inspected as a part of the annual bridge inspection, besides normal track inspections.
- v) During his monthly inspection of track on trolly should inspect the track on bridges also, the entire sub-division being inspected once a month.
- vi) The inspection shall be detailed and cover all aspects. In regard to steel-work, the general condition of the girders and bearings should be examined paying special attention to places liable to corrosion and the condition of paint.
- vii) The Assistant Engineer should make an extract of all remarks concerning replacement or repairs etc. and send these to the Way/Works Inspectors with explicit instructions and ensure expeditious compliance. Arrangements should be made to carry out repairs as soon as the defects are noticed without waiting for the completion of the inspection of other bridges.

- viii) On completion of the annual inspection the AEN shall certify at the end of the register, as follow:-
- "I certify that I have personally examined all bridges shown in this register ~~xxx~~ during the year ending December. 199.....and have issued detailed orders in writing to the Inspectors concerned, except the following on which the Divisional Engineer's orders are solicited".
- These registers should be in the Divisional Engineer's office by 31st December every year.
- ix) After heavy floods, the AEN should carry out a special inspection of the structures, particularly of the flooring and foundations of such bridges as are liable to damage and promptly carry out repairs, if any, required.
- x) When the AEN/DEN is in doubt regarding the safety of any bridge, he should consult his DEN/Sr.DEN who in turn may consult their colleagues in the Division and territorial CE's. Distressed bridges must be carefully inspected and reasons for declaring distress specifically recorded. These bridges should be reviewed regularly till the cause of distress is removed.
- xi) Whenever any bridge is rebuilt or a new bridge is constructed or an existing bridge is strengthened/modified or any special works is done on that a bridge such details should be recorded in the bridge inspection register and through a D/Men, Bridge list in the HQ should be got modified/updated accordingly, Details of foundations, type of foundation may be engraved on the coping of abutment in case of all bridges.

5.0 BY DIVISIONAL ENGINEERS

- i) The Divisional Engineer shall carefully scrutinise the Assistant Engineer's bridge inspection registers and inspect such bridges which call for his inspection and all important bridges. He shall record his orders regarding the points which require a decision by him and ~~knkk~~ initial against every bridge in the registers in token of scrutiny. He should record a certificate on each register below the Assistant Engineer's certificate as follows:-

" I have personally scrutinised this register and have issued orders regarding all essential points requiring decision by me. The following points are submitted to the Dy.Chief Engineer(FCW)/Territorial Chief Engineer for orders.".

He should then list out his instructions/order and send them to Assistant Engineer for complying his orders, by a reasonable target date.

The Assistant Engineer should then intimate orders to the Way/Works Inspectors concerned and ensure expeditious compliance.

6.0 ACTION BY HQ OFFICE :

The register should then be forwarded by a specific date but not later than 15th Feb. to the Dy.CE(FCW)/Territorial Chief Engineer who will examine each register, issue orders regarding matters referred to him, endorsing the registers to this effect * and return them to the Divisional Engineer. Subsequent action taken on the Dy.Chief Engineer/Territorial Chief Engineer's notes should be entered in the register by the Assistant Engineers.

7.0 BRIDGE BRANCH:7.1 BRIDGE INSPECTORS:

7.1.1. Bridge Inspectors shall be responsible for:

- i) Detailed periodical inspection of steel work of all girder spans over 12.2m clear and of foot over and road over bridges once in 5 years, about 20% of the inspection being carried out each year.
The bridges in which the girders are overstressed and have to be kept under observation shall be inspected once a year and a special report submitted to all concerned.
- ii) Erection of girders for all major bridges including turn-table girders.
- iii) Maintenance of steel works of such girders and of steel structures as may be specified.

7.1.2 Besides the annual inspection by the AEN detailed inspection of PSC girders of spans above 12.2m shall be done by the Bridge Inspector. However the PSC slabs will continue to be with the Divisions. All minor defects of PSC girders are to be attended by the Division,

However, major defects can be ~~xxxx~~ attended to by the Bridge branch against specific work orders from the Divisions.

7.1.3 He should take every pre-cautions that works under traffic such as repairs and renewals of girders are safe and in accordance with the rules for protection of the line.

7.1.4 The BRI shall carry out as and when required such works as measurement of stress under load, verification of impact and oscillation effects and proper necessary sketches for girders and all other classes of steel work.

7.1.5 TECHNICAL INSPECTION:

All technical inspections should be carried out by BRI/Technical on a programmed basis once in 5 years, about 20% of the inspection being carried out each year by March end. BRI/Incharge shall test check at random 20% of all inspections carried out by BRI/Tech. A special instruction on inspection reports of steel girder bridges as per Annexure-I may be followed.

7.1.6 OILING AND GREASING OF BEARINGS:

Oiling and greasing of bearings of all bridges of more than 12.2m spans being maintained by the BRIs is to be done once in 3 years by them on programmed basis.

7.1.7 PAINTING OF BRIDGE GIRDERS:

Painting of all steel girders of over 12.2m span is to be done once in 5 years or as and when necessary to avoid corrosion. Bridge girders of 12.2m and below spans will be got painted by the IOs of the Divisions.

7.1.8 TROLLEY AND MAN REFUSES:

BRIs will ascertain that these are in structurally sound condition and maintained well.

7.2 BY ASSTT. BRIDGE ENGINEERS:

The Assistant Bridge Engineer shall inspect the steel work of:-

- i) Such bridges as call for his inspection after thorough personal scrutiny of the BRI's registers.
- ii) Such bridges as the Bridge Engineer may direct him to inspect and enter his notes and ensure prompt action thereon.
- iii) Asstt. Bridge Engineer will personally be responsible for all Technical inspection reports annually and pass orders as deemed fit.

The Bridge Engineer may also direct the ABE's to carry out independent inspection of the steel work of certain bridges.

- iv) Asstt. Bridge Engineer will carry out 20% test check of the inspections done by BRI's annually and record results of inspection in the bridge register maintained by BRI's.

7.3 BY CEN/Br/Open Line.

- i) Scrutinise all technical reports of bridges prepared by BRI's/ABE's during a year and give his comments before forwarding the same to C.W.M.(Bridges).
- ii) He will carry out inspection of distressed bridges and important bridges in his jurisdiction once a year and submit a report to CWM(Bridges)/CBE.

7.4 BY CWM(BR)

- i) He will scrutinise all bridge registers maintained by the BRI and submit the same to HQ office by May end of every year.
- ii) He shall inspect such bridges as CBE may direct him to inspect and submit report to CBE.
- iii) He will ensure that all Technical inspection reports of triangulated ~~skidged~~ girders and distressed bridges are submitted to HQ office by May end of every year.

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7.5 BY HQ OFFICE:

The bridge registers maintained by the BRIs and the Technical inspection reports of triangulated girders and distressed bridges shall be ~~forw~~ forwarded by May end to the Dy.CE/Br/HQ who will examine each register, issue instructions with the approval of CBE regarding matters referred to him.

8.0 RESPONSIBILITY:

8.1 The primary responsibility for proper maintenance and up-keep of the bridges for the safe running of the trains rests with the Inspectors of the Division & Divisional Engineer/Asstt. Engineers of the Division. Therefore, they must carry out their inspections as frequently as possible and at the same time ensure repairs where necessary. By 15th June, every Inspector must send a certificate to the AEN/DEN/Sr. DEN reporting compliance of the instructions issued by the superior officer during the bridge inspections carried out by them.

8.2 The Bridge Engineer and his staff who are responsible for periodical inspection of steel work of bridges of spans more than 12.2m shall give advice and render assistance in other cases as are referred to them. The Bridge Organisation under C.W.M.(Br) will be fully responsible for inspection and maintenance of steel girders of over 12.2m spans including PSC girders.

8.3 The Divisional Engineer and his staff shall arrange to execute all repairs to sub-structure, bed blocks bearings guard rails and painting except in cases where after consultation with the Bridge Engineer it is settled that the bridge staff will carry out what is necessary. Heavy repairs as cannot be undertaken by the Divisional Engineer's staff will be executed by the Bridge & Inspectors.

9.0 TIME SCHEDULE FOR BRIDGE INSPECTION AND MAINTENANCE OF BRIDGE REGISTERS.

9.1 Inspection must be done in time. As one AEN/DEN will have more than one register, he should send each register as soon as it is completed to DEN/Sr. DEN without waiting for completion of inspection of all bridges on his sub-division. The last register must be sent latest by 31st December.

9.2 DEN/Sr. DEN should receive the Bridge registers from 1st October to 31st December (AEN/DEN closes the bridge inspection from 1st Oct. to 31st Dec.) He should ensure with the help of Control records that the registers are sent by AENs/DENs in time and in regular flow. For this purpose in the Division and also in the HQ office there should be a Bridge Register Movement Index Register which should be in the following proforma:-

DIVISION

Register No.	Section	Date on which received.	Date on which sent.
1	2	3	4

9.3 DEN/Sr.DEN should scrutinise the AEN's/Sr.AEN's bridge register and inspect (a) bridge which call for his inspection and (b) all important and distressed bridges. After dealing with the registers, DEN/Sr.DEN should send it to Dy.CE/FCW/Territorial Chief Engineer from 1st Nov. to 15th Feb. This arrangement allows one month to DEN/Sr.DEN for dealing with each register. DEN/Sr.DEN should endorse his orders on the registers. These will be reproduced on 3 copies of AEN/Sr.AEN's Bridge extracts and send one copy to AEN/Sr.AEN and one to Territorial C.E.

9.4 Territorial CE, after having examined the registers will return them to Sr.DENs by 30th April.

10.0 MISCELLANEOUS

10.1 NUMBERING OF BRIDGE INSPECTION REGISTERS/INDEX REGISTERS.

All bridge registers in a Division are to be serially numbered for easy reference. The numbering should, as far as possible, progress in the direction of increasing kilometrage and the numbering should be continuous in one section although sub-division may change. The main line register should have lower number and the branch line register, the higher number. An Index Register for the Bridge Inspection Registers is to be maintained in sub-division, division and also in the HQ office.

10.2 Experience has shown that if bridge register is not available at site at the time of inspection or if the basic information such as last year's notes or defects observed in the previous year's etc. are not gone through before starting the inspection, important points for inspections are very often lost sight of during inspection. It is therefore, necessary that the Bridge Inspection Registers required for the day's inspection are carried by AEN/DEN. Before getting off the trolley for inspection, instructions printed in the Bridge Register should be perused. Also, previous notes should be carefully perused. Observations made during the inspection must be entered in the register on the spot complete in all respects.

- 10.3 Under each head, the first entry should state whether the previous year's notes have been attended to.
- 10.4 In the column 'Action taken' the remarks should be in the form that orders have been issued, e.g.
- i) PWI ordered to renew sleepers.
 - ii) IOW/BRI ordered to carry out painting.
- 10.5 Bridge registers should not be used as medium of correspondence. Clear and definite remarks should be entered in the remarks columns against each bridge and not at the end of the register.
- 10.6 Both the work of inspection and the work of recording the result of such inspection will always be done personally by an officer.
- 10.7 In no case, mere reference to previous year's remarks be given and when necessary, the information must be written each year.
- 10.8 It has been observed that very sketchy remarks are being made by AENs in the bridge inspection registers. Remarks should be specific. It is reiterated that wherever the AENs are not able to decide as to the cause of distress of the bridge and measures for its rectification, they should immediately bring this to the notice of DEN/Sr. DEN.
- 10.9 On first appointment to the post of AEN on open line, whether by promotion or by direct recruitment, the DEN/Sr. DEN should personally take the AEN and carry out inspection of a few major and minor bridges along with him, to guide the AEN in the art of bridge inspections.
- 10.10 All certificates by the officers at the end of registers should be recorded by the officers in their own handwriting.
- 10.11 AENs/DENs should follow up with IOW/PWI/BRI for compliance of bridge inspection notes regularly and ensure that orders given once are complied ~~as~~ promptly. Repetition of remarks in subsequent years should be taken up suitably.
- 11.00 These instructions apply to all bridges and are issued with the approval of Chief Engineer.
- 12.00 Please acknowledge receipt.

No. W/29/O/A/Pt. II/W-5

(V.K. Madhukar)
Dy. CE/Br/HQ.

Dated. 25.01.96.

CC:

- 1) DRM (Engg)/IZN, LON, BSB, SEE & SPJ.
- 2) All SAG Officers of Engg. Deptt. including construction.
- 3) CWM/Bridge/GKP, XEN (Bridge/Open Line)/Gorakhpur.
- 4) All Engineering Officers of HQ.

(V.K. Madhukar)
Dy. CE/Br/HQ.

For General Manager/Engg.

SPECIAL INSTRUCTIONS ON INSPECTION REPORTS OF STEEL GIRDER BRIDGES.

1. For proper recording of Technical Inspection Reports of Steel Girder Bridges over 12.2m spans, ROBs and FOBs the following procedure shall be observed in supersession to all procedure orders issued so far.
2. Technical Inspection Reports as per existing practice and proforma shall continue to be prepared by BRIs Incharge of the section on the Major Bridge Register after thorough inspection of the bridge by the Inspection parties. The schedule of inspection shall be once in 5 years except for the girders which are overstressed and have to be kept under observation where Technical Inspections shall be made every year. Each bridge will have a separate Technical Inspection Report.
3. B.R.I.'s Bridge Inspection registers shall be maintained by the Bridge Inspectors, which will be properly numbered. The registers will be maintained separately as per the following:-
 - a) One register for each triangulated girder bridge.
 - b) One or more registers for plate girder bridges.
 - c) One or more registers for BORS and FOBs.
 - d) One register for turntables.

Each register will accommodate at least 5 subsequent reports of each structure.

- 3.1 After recording the inspection details in B.R.I.'s Bridge Inspection Register, one extra copy of the same will be made by the BRI on the loose sheet and will be submitted to Asstt. Bridge Engineer. The Bridge Inspection Register shall be kept by the Bridge Inspector in his office and will be available at the time of inspections by superior officers. The BRI will underline portions where action is required or has been taken so as to make important points prominent. BRI should start action on points noted by him without waiting of anyone's orders.

4.0 ACTION TO BE TAKEN BY ABE.

- 4.1 On receipt of technical inspection reports from the BRI, ABE will scrutinise the entries made by the Inspector specially those underlined. He will also make test check of some of the important items of inspection such as paint condition, camber, distortion on triangulated girders, corrosion etc. He will make test check entries in his own hand writing and indicate action to be taken by BRI. He will also write separately to the Division for items requiring their attention. The scrutiny of the reports including test checks will be completed within 30 days from the date of its receipt. ABEs will also issue instructions to BRIs regarding additional items where action is to be taken.

- 4.2 Loose technical inspection reports after scrutiny and necessary remarks by ABE shall be sent to the XEN/Br/OL for review. The important points ~~xxx~~ shall be underlined and points referred above must be brought out in the covering letter.

- 5.1 On receipt of technical inspection report from ABE, XEN/Br/OL will scrutinise the entries and remarks of BRI/ABE and issue orders on points specially referred by ABE, in addition to other points. He will also carry out inspections where ever considered necessary. He shall then convey the extract of such orders to ABE and BRI. He will also refer the points to Division requiring their attention.
- 5.2 The technical inspection reports of all open web girders shall be sent to Dy.CE/Br/HQ alongwith specific points requiring attention of the Design wing. The reports will be retained and kept in folders by Design Wing. A separate folder will be maintained for each bridge. Specific references shall be made by XEN/Br/OL to Dy.CE/Br/HQ in case of other structures, where Assistance of design wing is needed.
- 6.0 ACTION TO BE TAKEN BY DY.CE/BR/HQ.
Dy.CE/Br/HQ will scrutinise the points specially referred for consideration of the Design Wing and take necessary action and advise the action to be taken by XEN/Br/OL. In case of bridge requiring major strengthening/modification/re-girding, Dy. Br/HQ will arrange to open a case for development and finalisation of the proposal.
- 7.0 CUSTODY OF TECHNICAL INSPECTION REPORTS.
For structures other than triangulated girders, the technical inspection reports shall be kept in record by ABE/Line. For triangulated girders, the technical inspection reports shall be kept in record by design cell under the control of Dy.CE/Br/HQ.
- 7.1 Technical Inspection report movement register shall be maintained by the office of BRI, ABE and XEN/Br/OL to ensure expeditious disposal of reports.
- 7.2 For taking the follow up action, Bridge Girder Maintenance Register shall be maintained by each BRI and ABE. This register will have one or more pages earmarked for each bridge and will contain items requiring action to be taken either by Bridge Main Branch or by the Division. The register will also record compliance of each item. The register will be handy to ensure early compliance of the items observed during technical inspection of the structure. This register will be scrutinised by Bridge Officers during the time of their inspection of the office of ABE/BRI. ABEs would submit their register every quarter (in the first week of January, April, July and Oct.) to XEN/Br/HQ concerned for scrutiny of out-standing items.
- 7.3 Bridges having defects/deficiencies will be inspected by the every year till these defects/deficiencies are rectified/removed. In this annual inspection BRI may limit his inspections to defective/deficient portions only and need not inspect the entire bridge.
- 7.4 BRIs will promptly attend to all the defects/deficiencies in bridges under their charge, ensure that they are maintained in an excellent condition and will in no case allow unsafe conditions to exist.