

**AGENDA OF CBEs' SEMINAR TO BE HELD AT IRICEN ON
13TH & 14TH SEPTEMBER, 2007**

(A) New Agenda Items

1. Proposed by ECoR

- (a) In connection with running of CC+6+2, CC+8+2 and 25T axle load wagons, there had been an alround effort for clearing the existing bridges by restricting the tractive effort to 30T per loco in case of span where there were problems in the bearings. These clearances have been accorded accordingly. However, it needs to be decided as to whether Railways should go for programmed replacement of the existing bearings or making the required modifications in the bearings to make them fit for MBG and higher loadings (as required) so as to remove this restriction/stipulation of restricting the tractive effort to 30T per loco in future in a fixed time frame. This is considered desirable in view of the fact that the stipulation adds to the vulnerability of the bridges in the event of non-observance of the stipulation by drivers and specially so because it will cause operational problems which will lead to a tendency of non-observance of the same by drivers to avoid calling for a banker if required.
- (b) In view of the existing stipulation for the driver to observe restriction of tractive effort to 30T per loco on identified bridges, it is desirable that a standard warning board should be designed and approved for uniform adoption and should be included in the P.Way Manual.
- (c) CRS/SE Circle has raised the issue of adopting 1.8m as the minimum vertical opening generally even in case of minor bridges like RCC boxes for enabling inspection and repairs to slab in future. He has also held that in no case vertical opening should be less than 1.2 m even if the existing bank height restricts the same. It is proposed that this may be adopted as a policy for all bridges except in case of Hume pipes where the minimum diameter should be 1.2 m.
- (d) The Railways had identified and approved that the obsolete type of bridges such as stone slabs, cast iron pipes, earthen wire pipes, laterite stone bridges etc. should be rebuilt and rail clusters/small girders up to 6.1 m span should be replaced by slabs. Directions were issued that these works shall be carried out in phases. So far these were being taken up on condition basis. In view of the increased loading on the existing bridges, it is proposed that a policy needs to be framed up for reconstruction in a fixed time frame like SRSF works and the time frame should also discussed and decided. In absence of a fixed time frame based policy/instructions, this issue comes under adverse attack by Audit/Public/Parliament time and again.

2. Proposed by NCR

- (a) Approval of GADs of bridges of Doubling/New Lines of Construction Organisation

As per Para 317 of IRBM, in case of doublings/gauge conversion, General Arrangement Drawings for all major bridges where linear waterway is being reduced or vertical clearances are inadequate and where construction is likely to affect any of the existing bridges shall be approved by the CBE. Besides this, GAD for bridge constructed on new lines which affect the existing bridges, shall also require the approval of CBE.

But when construction department applied for CRS' sanction, CRS insisted for approval of GADs of minor bridges also by the CBE. Railway Board should frame a detailed policy in this regards and advice to CRS accordingly.

- (b) Commonly designed bridge structures in Railways – Preparation of Data bank in RDSO

RCC Box, FOBs, Retaining Walls, Non-standard PSC slab/girders, Steel Girders are commonly designed bridge structures in Zonal Railways. These bridge structures are designed in various Zonal Railways through in-house resources or through outsourcing. As one Zonal Railway has no information regarding availability of drawing/design of a particular type of structure in other railways, it is essential to prepare a data bank by each zonal railway regarding availability of drawing/design of commonly designed structures to avoid repetitive design of the same structure. This information should be sent to RDSO who will prepare a data bank of commonly designed structures for whole of the railways. It will save the time and money and avoid the wastage of human resources on such repetitive work.

- (c) Incentive to Design Assistants

At present, there are different policies for posting of Design Assistant in different Railways. In most of the Railways, especially in new Zonal Railways, willing staff to work in design cell are few. Staff from different cadres, even from P. Way are posted as Design Assistants. The work of Design Assistant is very important and strenuous. To make the work of Design Assistants attractive, there should be the provision of one/two grade higher in ex cadre or a special allowance of 15% of Basic + DP as in case of faculty members in training centers. It will attract more and more willing staff to work as Design Assistants.

- (d) Speed Restriction for temporary staging/shuttering of cast-in-situ slab/girder of ROB for span across the Railway

Different practices have been adopted by the different Railways for speed restriction to be imposed for temporary staging/shuttering of cast-in-situ slab/girders of ROB for the span across the railway. Detailed discussion is required on this issue to formulate uniform policy.

(e) Training programme for Design Assistants / Officers

There is only one training course for Design Assistants / officers at IRICEN conducted annually. The course is for three weeks. There should be at least two such courses each year so that staff could be spared conveniently for these courses on programmed basis. It is very essential for new Zonal Railways as sufficient trained staff are not available in new Zonal Railways. In addition to this, two weeks special course on bridge design covering various topics such as checking of heavy axle load operation, arch bridge, well foundation, STAAD Pro etc should be organized in IRICEN for Design Assistants / Officers.

3. Proposed by NWR

(a) Digitization of Bridge Drawings

Completion Plans of bridges, if stored in digital form, will not only help in enhancing the life of drawings but also help in quick retrieval for reference whenever required. It will also be possible to have feasible database. It is proposed that policy decision is taken and searchable instructions are issued for digitization of bridge drawings in a manner similar to digitization of land plans.

(b) RDSO's standard drawing, reports to be made available on website

It is proposed that all RDSO's standard drawings pertaining to Bridge and Structures are made available on RDSO website. It is also suggested that all available BS Reports, Technical Papers, Minutes of BSC are put on RDSO's website for reference and dissemination of knowledge.

(c) Cracks in PSC BOX Girders and Bearings

A recently built 6 x 30.5 m PSC BOX girder bridge is showing sign of cracks in three girders above the bearing. Elastomeric bearings are also showing signs of crack and bulging. The bearing and PSC BOX girder are as per RDSO's standard drawings.

What can be the reasons of these distresses and what methodology be adopted to repair it?

4. Proposed by SR

(a) Inspection of PSC Girders

There are 1767 nos. of PSC girders in Southern Railway, out of which 1320 spans belong to the Mass Rapid Transport System (MRTS)/Chennai itself. Day by day, the number of PSC spans are on the rise and therefore there is an urgent need to systematize the Inspection Procedure of PSC Girders. It is observed that the Clause , dealing with the Inspection of RCC/PSC Girders, is not exhaustive as it contains references to Camber measurement, crack locations and other minor items. The guidelines do not mention anything regarding Rehabilitation of Distressed PSC Girders on account loss of Prestress. Clause , dealing with the aspect of measurement of Camber, does not bring out as to how to Infer, from the

camber readings, the Loss of Pre-stress. Thus, there is a need to Review and Issue comprehensive Guidelines for Inspection of PSC Girders.

(b) NDT Equipments

Various non-destructive test (NDT) equipments are being procured which would be useful in conducting inspection of Steel/RCC/PSC girders in future. These are new equipments and require considerable knowledge/experience to use them effectively. A good example to illustrate the point is the perhaps costliest and most sophisticated Acoustic Emission Testing Equipment, which is easy to use i.e., to Log Data, but extremely difficult to interpret the data to arrive at any conclusions regarding cracks/any other defect. Thus, unless a proper training is imparted by engaging an expert (training given by the supplier was grossly inadequate), the utilization of such expensive equipment will remain a distant objective/goal.

(c) Provision of RCC boxes in lieu of pipes and stone decks, etc.

RCC boxes are increasingly being provided in place of small openings like RCC pipes etc. However, in most cases the bottom of RCC Box is found to be much below the natural ground level (NGL) as the minimum opening of RCC Boxes incorporates a vertical clearance of 1.00 m (in order to enable inspection). At many places; particularly in Southern Railway, the level difference between Rail - level and Bed - level is quite less, more so in the coastal regions. This results in bottom of RCC box going below the Bed Level by a minimum of 400mm, which is not only non-functional and redundant but also results in unnecessary expenditure, as in any case, the RCC box will ultimately get silted up to the Natural Ground Level (NGL) leaving the reduced vertical ventway. Hence, there is a need to evolve a considered design for a Siphon Arrangement that allows water to flow below the ground level and at the same time the higher velocity of flow, coupled with provision of Silt-Trap, would ensure that no silting takes place, unlike the conventional RCC Boxes. RDSO, therefore, is requested to develop a suitable drawing of Siphon Arrangement for uniform and convenient adoption.

(d) Limited Use Subway

There are large no. of ROBs/RUBs coming up and provision of limited use subways are becoming part of ROB/RUB Projects since it is not possible for pedestrians/cycles to use the ROB which has a steep gradient. Southern Railway has accordingly initiated to provide limited use subways of heights 2.75m for the use of pedestrians and Light Motor Vehicles (LMV) and 4.50 m for heavy motor vehicles (HMV – in case of replacement of unmanned LCs). Not only this, Southern Railway, in view of increasing accidents at unmanned level crossings, has decided to provide limited use subways in lieu of all unmanned level crossings. As large number of limited use subways are going to be constructed, **it is requested that RDSO may standardize and issue drawings for Limited use Subways.** Even though there are standard drawings available for water-way bridges, the same cannot be adopted for vehicular movements since the behaviour/pattern of BMSF Stresses will be entirely different.

(d) Waterway for Railway Bridges

The water-way provided for the Railway bridges, whether in cases of GC/New Lines, Rebuilding, Doubling, or otherwise, are based on the computations of Design Discharge (clause 4 of IRS Bridge sub-structure & foundation code). The Design Discharge, in turn, is based on either the actual records of water flow available or the probabilistic calculation of 'Q' of Catchment area.

- (i) It is felt that differential treatment should be given for various parameters like, vertical clearance, free board, etc. for cases where the Records/history of water flow/HFL is available for either equal to or more than the recurrence period compared to the cases where design discharge is based on the probabilistic calculation Q25/Q50 etc. As certainty involved in the former case is much higher, a reduced value of VC, FB etc. should be allowed and vice – versa. Accordingly, it is proposed to deliberate on the subject.
- (ii) The required water-way depends on two factors – the design discharge (Q) and velocity of flow (V). There is a provision to reduce the existing waterway (clause 4 of IRS Bridge sub-structure & foundation code), however, on many occasions, the waterway that can practically be provided (in view of constraint in lifting the track or otherwise) becomes much less than the existing waterway. It is felt that in such cases Pucca Floorings, in the form of stone masonry/Concrete may be provided to enhance/increase the velocity of water-flow(V), thereby reducing the requirement of the water way/cross-sectional area drastically. It is seen that the velocity gets enhanced Three - Fold by providing concrete flooring on the bed – level. This would result in very less requirement of water-way, thereby not only bringing the cost down but also providing effective protection against scour.
- (iii) The IRS Bridge sub-structure & foundation code, makes no differentiation to account for different velocities of water-flow under different bed slope site conditions. The required waterway and VC has been kept same in all conditions. This requires deliberation regarding reduction of required waterway in cases where the velocity of flow is higher, like in case of provision of Pucca Flooring for sufficient length on U/s and D/s sides. RDSO may arrange to issue suitable reductions in the waterway, duly incorporating the same in the Bridge Manual.

(e) Waterways in bridges located in backwaters

Large no. of bridges are located in the backwaters of Arabian sea on the Western Ghats of Palghat and Trivandrum divisions of Southern Railway. Since at such locations there are only Tidal variations and the velocity of water flow depends upon the upstream and downstream hydrological details, no typical flood as such takes place as happens in normal rivers, streams etc. The concept of Q.50/Q.100 discharge, at such locations, becomes redundant. Hence a Guideline is required to be issued for carrying out calculation of required waterway, vertical clearances, scour, free board etc by RDSO.

(f) Instrumentation of bridges

The main objective of conducting instrumentation of bridges; apart from determination of bending stresses, shear stresses (which can also be calculated quite conveniently) is to determine the dispersion of longitudinal forces (TF/BF) which is the key activity. The theoretical dispersion of longitudinal forces cannot be properly appreciated/compared with the observed values unless Numerical Model Analysis is carried out to study the interaction between track and bridge. Board as well as RDSO may issue guidelines regarding this aspect so that the Railways can take up this exercise as part of the Pilot Project of CC+8+2. This would facilitate to draw conclusion regarding dispersion of the longitudinal forces, thereby serving the very purpose for which the Pilot Project of carrying out Instrumentation has been taken up.

5. Proposed by SECR

(a) Commentary of codes

Codes are having various provisions to deal with anticipated situation to come in working of Railways, but commentary on provisions is not available. RDSO is the nodal body for framing and correction of provisions to take judicious decisions in complicated cases. Commentary on certain provision will help a lot.

For Example, Para 5.16 Of IRS Sub-structure code deals with certification of existing sub-structures. Sub Para 5.16.2.3 states- for mass concrete Abutment / piers up to 50% over stress in bending compressive stress beyond that specified in concrete bridge code can be allowed subject to good condition of mass concrete and close observation as considered necessary by chief engineer.

If over stressing in compression exceeds 50%, the sub structure shall be strengthened / rebuilt to appropriate standard of loading. Where as, in note below this Para states: -

If maximum tensile stress exceeds 100%of values, then only compression zone is considered for stress calculation neglecting tension zone. Why more tolerances are allowed for tensile stress?

Secondly, in case of GC as stated in Para 5.16.3.3:-

- (i)..... no over stressing in compression in concrete substructures.
- (ii) 100% in case of tension in masonry and concrete structures.

Above provisions seems to be contradicting as given in following example:-

In one case, at the time of GC project substructure of a bridge was found safe in above criteria (5.16.3.3). Later on some higher axle load was proposed accordingly it was checked for higher axle load and found not exceeding 50% criteria(5.16.2.3). So as per codal provisions it is ok for running of higher axle load without any work/ strengthening.

On other hand if same load(the higher one) would have been proposed for running at the time of GC project the same substructure might have been required rebuilding as per codal provisions(para5.16.3.3).

The reason behind not allowing over stressing in compression in case of GC projects could not been understood.

There is a need to produce commentary on codes. Moreover, present concrete bridge code is too bulky. It may be in two volumes separately for RCC&PSC.

(b) Centralized Bridge Organisation

Recently Railway Board has issued a letter regarding centralization of Bridge Organisation. Placing bridge organisation in centralized position may not be appropriate to get desired maintenance of bridge. Instead, at division level it should be as follows:

- AEN (Spl)/AEN (Bridge) (Reporting to Sr. DEN (Co-ord), depending on the work load as work charge post for bridge work)
- SSE/SE (Bridge)
- SE/W/Br.

Present position needs review. Existing backlog of bridge maintenance and renewal of bridge structures can be met with proposed organization keeping CBE as nodal body.

(c) Provision of walk way in long bridges

In case of Alarm Chain Pulling (ACP) on long bridges access of loco pilot is restricted, as there is no connection available bet loco and rear coaches. On bridges loco pilot can not detrain to reset the ACP system. Keeping in view running of 24/26 coaches passenger trains; access should be provided by provision of walk way by the side of bridges; as a normal feature.

(d) Provision of live load surcharge for HM loading

IRS sub-structure and foundation code indicates value for live load surcharge for various loadings except HM loading. In table 3 at Para 5.8.1 values to be adopted have been tabulated, but no value for HM loading. RDSO to come forward with value for HM Loading by issuing correction slip.

6. Proposed by WR

Railway workshops are following "**Specification for fabrication and Erection of Steel Girder Bridges and locomotive Turn tables**" Serial No.**B1-2001** issued by RDSO for fabrication of all type of steel bridge girders including open web girders. **Para-8** of the code elaborates for the specification of steels to be used in fabrication, however, it is silent for any approved list of suppliers for steels to be used.

It is observed that following sections in particular are required in fabrication of 30.5 m (through) and 45.7 m (through) open web girders as per RDSO drawings.

1. ISA 75x75x10
2. ISA 75x75x8
3. ISA 100x100x8
4. ISA 125x75x8

All the items are non-commercial items and not being used and demanded in market. Hence integrated steel plants of SAIL, TISCO, JINDAL, RSP are not rolling these non-commercial steel section nor any reputed mini steel plants and reputed re-rollers like M/s. Sun Vijay, M/s. Bajrang Alloys etc.

Secondly, quantity required for these items by Railways is also too less i.e. less than 40 MTs for inclusion in Railway Board's contract for procurement of steel section from integrated steel plants and reputed mini steel plants or their approved re-rollers.

As such, these sections are being procured by inviting tenders through COS and following are the main suppliers situated in Chhattisgarh and West Bengal.

1. M/s. CRM Steels Private Ltd – Kolkata
2. M/s. Mahadeva Steel Mills Pvt. Ltd. – Hooghly
3. M/s. Kontinental Steel Corporation – Kumhari, Durg, Chhattisgarh
4. M/s. Ganpati Industrial Pvt. Ltd – Kolkata

These re-rollers are rolling the required steel sections with the billets as blooms i.e. raw material of SAIL though they are not approved re-rollers of Integrated steel plants. However, the suppliers provide test certificates for

- a. Physical properties
- b. Chemical composition of steel section for batch/cast of rolling for the material rolled and supplied along with
- c. RITES Inspection Certificate incorporating above two test certificates.

The materials are accepted based on certificates in case it conforms to prescribed specific limits of properties and chemical composition as prescribed in IS-2062 according to Para 8.12 of IRS B1-2000.

However, RDSO official attending Railway workshops for inspection of fabricated components are expressing their inability for inspection of the components of OWG, fabricated with the steel sections supplied by above such re-rollers stating that the materials are not procured from the specific steel plants.

RDSO should either issue guidelines for practicable acceptance criteria for such steel sections to avoid difficulties during **procurement, use and inspection** or **issue list of approved vendors** for such steel section for arranging procurement from the suppliers appeared in such list only in future.

7. Proposed by IRICEN

(a) Corrosion in the top flange plate/stringer angle of steel girders is a major problem with sleeper seat painting being overdue most of the time. The extent of corrosion permissible in the top flange plate/stringer angle at which the same is to be planned for replacement and limit at which speed restriction is required to be imposed is required to be specified.

(b) The Indian Railway Bridge Manual does not give any periodicity for painting of steel girders under sleeper seat. This area is most susceptible to corrosion due to accumulation of water, dust and debris and due to various members coming close together. This work affects track and the sleepers are to shifted.

On Western Railway, the periodicity for this painting was fixed at one in 2 ½ years as against once in five years for the complete girder. The responsibility for this painting was given to SSE/P.Way and Sr.DEN/Open line. The standard guidelines regarding periodicity and methodology is required to be laid down for various types of corrosion protection schemes (i.e. ordinary painting, metallizing, epoxy painting etc.) and various types of track arrangements. There are lot of problems in this work and the work is mostly in arrears.

8. Proposed by CR

(a) Yardstick for Bridge Organisation

Over a period of time due to increase in axle load, ageing of bridges, creation of additional assets and induction of PSC bridges, acute shortage of supervisors and skilled staff is felt for inspection and maintenance activities. At present there is no yardstick of the workload on officers, supervisors and staff in Bridge Organisation due to which lot of problems are being faced for creation of additional posts.

It is suggested that a suitable formulae for bridge gangs may be evolved similar to track for which a Committee of PCEs/CBEs may be formed. To begin with, bridge gang strength and yardstick for work load on XEN/DEN (Bridge line), ABE and BRIs may be evolved for inspection and maintenance activities.

Moreover, there are different categories of bridge gang staff on different railways. For example, some railways have designation as Sarang and others as Erectors, for the same category. Riveters are called Fitters on some railways or the fitter category is not at all available on some railways. As such Committee may decide to have uniformity in categories/designations of skilled staff.

(b) Delegation of power for consultancy services

The availability of complement design assistant has been a continuous cause of concern. With the boom in infrastructure, availability of competent design assistant and draftsman has further deteriorated. Most of the available staff is unable to adapt to modern design techniques.

Present powers of consultancy contract with PCE are very restrictive (Rs.5 lakh per case with annual ceiling limit of Rs.10 lakh) and thus practically we have to go

to GM for sanction. Moreover, JAG has no power for conducting TC and minimum level of Tender Committee is at SAG.

It is suggested that the power for appointing consultants for design are liberalized and TC power is further delegated to SG/JAG level HQ/Division. Alternatively, design and drawing contract may be classified as Work Contracts and to be dealt accordingly.

(c) Sr.DEN(Br.) / DEN(Br.) in Division

In the present day working environment, Sr.DEN/DEN find it difficult to devote required time and attention for bridge inspection and its maintenance. Moreover, bridge works are of specialized nature. With the introduction of faster and heavier trains combined with age of bridges, in future we will have to pay more attention to bridges. It is suggested that there should be one Sr.DEN (Br.) / DEN (Br.) in each division exclusively for all bridge works irrespective of span, length and type of bridge.

(d) Strengthening of arch bridges by non-conventional methods

There is large percentage of arch bridges in Indian Railway and most of these bridges are more than 100 year old. In large number of such bridges, sign of distress has been observed.

Besides epoxy / cement grouting, strengthening of arch bridges are being done by jacketing of abutment/piers and inturning of arch portion. This leads to reduction in waterway. Recently in few cases, strengthening of arch bridges has been carried out using special stainless reinforcement ('HELIFIX' method), which is much faster and does not lead to reduction of waterway. In Central Railway 14 stone masonry arch bridges have been strengthened with this method in last five years and their behaviour is satisfactory.

It is suggested that this method is made a standard method of strengthening with suitable guidelines for ascertaining the strength of arch before and after strengthening.

(B) Review of Recommendations of the last CBEs' Seminar held at IRICEN on 30th Nov. & 01st Dec. 2006

Item 1(a) Underwater Inspection – Presentation by CBE/CR.

Recommendations

Manual on Underwater Inspection prepared by M/s. Ramboll should be circulated to all Zonal Railways by CR in soft copy and should be posted on IRICEN web-site.

Item 1(b) Non Destructive Testing of Existing Briges

Recommendations

- (i) Manual for NDT prepared by M/s. Ramboll should be circulated to all Railways by CR in soft copy and should be posted on IRICEN web-site.
- (ii) CBE of each Railway should identify few vulnerable bridges and these should be inspected using NDT method.
- (iii) All equipments received for NDT inspection should be kept under custody of one nominated officer, who should ensure its upkeep and utilisation.

Item 1(c) Determining of Unknown foundations and integrity assessment of foundations and condition assessment of brick masonry structures by NDT methods

Recommendations

CBE/NR shall send proposal to Railway Board for procurement of equipment and training of staff.

Item 1(d) Acoustic Emission testing of Steel & Concrete Bridges

Recommendations

- (i) CBE/NR shall send proposal to Board for training of supervisors for acquiring knowledge for interpretation of data.
- (ii) In the meantime, all 4 Zonal Railways who have got the equipment should capture data and try to develop in-house expertise. Staff who have been trained as part of the Pilot Project may be used for this work.

Item 1(e) Strain gauging and instrumentation and load rating of Bridges

Recommendations

RDSO should keep track of all the methods being used for instrumentation of bridges and should come up with some standardization for IR when sufficient data is available from various projects.

Item 1(f) Fatigue Testing and Residual Life Assessment of Steel Bridges

Recommendations

- (i) RDSO should test residual fatigue life of same 2 bridges on NWR where M/s Shama Associates have done the Pilot Project. The results should be compared with that of M/s Shama.
- (ii) The method as given by M/s Shama Associates should be used on more number of bridges and results compared where RDSO has calculated residual fatigue life in last 3-4 years. RDSO should send a report to Board after the above testing for taking decision for adoption of this method.

Item 4(a) Limited Use Subway

Recommendations

RDSO should prepare standard drawing for "Limited use Subway" and circulate to Zonal Railways.

Item 4(d) Standard size of bridge drawings.

Recommendations

RDSO should send its formal recommendations for standard size of drawings for various types of bridge works based on practices being followed in RDSO. Based on the same, Railway Board may consider to issue corrigendum to the concerned para No.903 of IRWM (Table 9.1)

Item 5(a) & 6(g) Steel Channel Sleepers

Recommendations

RDSO shall come up with modification/alteration to the standard drawing to eliminate these problems.