

Annexure-VII-5**RAILWAY CROSSING AND SPECIAL SPAN DESIGN PHASE****Employer's requirements in Design Phase of Railway Crossings****1. Purpose of this Document**

This document describes the Employer's Requirements to be considered during the Detailed Design of Viaduct across Indian Railway tracks.

The requirements / procedures mentioned in this section are additional and applicable to the viaduct portion across the Indian Railway tracks, in addition to the requirements mentioned elsewhere in the tender document. This shall be read in conjunction with other requirements mentioned in the tender documents and this section does not absolve the contractor from the responsibility to comply to the contractual requirements mentioned elsewhere in the tender document.

DESIGNER as referred herein means

- (i) the designer appointed by the contractor, in case of Design & Construct contracts. CONTRACTOR and DESIGNER are responsible as per the applicable contract conditions.
- (ii) the designer appointed by the Employer, in the case of contracts wherever designer is appointed by the Employer.

2. Additional Requirements**1.1. Extent of Services:**

- 1.1.1. Preparation of General Arrangement Drawing (GAD).
- 1.1.2. Preparation of a separate Design Basis Note (DBN) for the Railway Crossing in line with the DBR for Viaduct approved by Railway Board.
- 1.1.3. Detailed Structural Design of the Railway Crossing.
- 1.1.4. Preparation of Construction Sequence/Scheme in consultation with the contractor.
- 1.1.5. Preliminary and Detailed estimates of the structure based on the proposed/approved detailed structural design. This is required to deposit the charges to Railways.
- 1.1.6. Interface with The Employer, GC to KRIDE, Proof Consultant (PC), Railways and/or Third Party Consultant (TPC) on regular basis during the entire period of the services.
- 1.1.7. Interface with the Railway officials/staff during the course of construction, as required.
- 1.1.8. Details of existing and proposed Railway infrastructure will be made available by The Employer.

1.2. Services During Preparation of GAD:

- 1.2.1. GAD shall be prepared considering
 - a) Detailed Design.
 - b) Construction feasibility.
 - c) Requirements/parameters of the railways.
- 1.2.2. All dimensional clearances required from the Indian Railway Infrastructure i.e. railway track, OHE traction, etc. shall be ensured (applicable circulars of Railway Board, latest Railway Codes with Addendum & Corrigendum Slips of Railway Codes and other practices followed at Divisional and Zonal levels shall be considered).

1.3. Services During Detailed Structural Design:

- 1.3.1. Detailed Structural Design shall be carried out based on the approved GAD and the relevant applicable standards and codes.

- 1.3.2. Detailed Design Basis Note shall be submitted before carrying out the design, which shall be in line with the DBR for Viaduct approved by Railway Board.
- 1.3.3. Sequence of construction shall be finalised in consultation with the Contractor, which shall also be considered in the detailed design.
- 1.3.4. Dimensions of the superstructure (length, width and other aspects) shall be finalised in consultation with the Contractor and their Consultants for the design of launching/ erection/ construction scheme.
- 1.3.5. Files of detailed structural analysis and design (software input files and reports) shall be submitted to The Employer.

1.4. **Services During Deliberations with Railways:**

- 1.4.1. CONTRACTOR/DESIGNER shall interact with Railways on regular basis to make sure that the requirements of Railways are noted for incorporation and approval process is expedited.
- 1.4.2. CONTRACTOR/DESIGNER shall attend meetings at Divisional and Zonal offices of the Railways as and when required for early conclusion of their observations and expediting the approvals.
- 1.4.3. As per the requirements of the Railways, detailed design and drawings shall be checked by Railways and/or Third Party Consultant. CONTRACTOR/DESIGNER shall attend to the queries of the Railways and/or Third Party Consultant apart from the Proof Consultants appointed by The Employer.
- 1.4.4. Assistance in preparation of documents required for obtaining CRS sanction for the work.

1.5. **Services During Construction:**

- 1.5.1. Effect of temporary structures/erection system on the permanent structures shall be checked by the DESIGNER.
- 1.5.2. Method statements of different items of work for the structure to be reviewed by the DESIGNER.
- 1.5.3. Protection arrangement for the Railway embankment during excavation for foundations, if required, as proposed shall be designed or reviewed by the DESIGNER as the case may be.
- 1.5.4. Recommendations shall be provided during the piling for terminating the piles as per the geological strata encountered at the site.
- 1.5.5. During the progress of the work, DESIGNER shall provide recommendations, if any, for the safety of the structure.
- 1.5.6. The DESIGNER shall visit the site to provide his expert opinion on the performance, quality, progress, etc. of the work and to report whether the work is progressing generally as per the assumptions of design. The result of such visits shall be reported to The Employer immediately, if urgent actions are required.
- 1.5.7. DESIGNER shall check the stressing sheets/camber/launching progress and associated reports from site during the execution of work.

3. **Deliverables**

- 3.1. GAD of the Metro Rail Crossing Structure on Tracing Sheet for submission to Railways.
- 3.2. Design Basis Note in line with the DBR for Viaduct approved by Railway Board.
- 3.3. Detailed Design of the entire substructure and superstructure including foundation, pier, pier-cap, superstructure, etc.
- 3.4. Detailed Design of protection arrangements, if any.
- 3.5. Detailed design of other miscellaneous elements viz. seismic arrestor, forces on the bearings, etc.
- 3.6. Detailed design of miscellaneous structures for nallah diversion, etc., if any.
- 3.7. All other requirements of the Railways as stipulated in the Circulars and Guidelines issued by Railways (Enclosed as Annexure-A1).
- 3.8. Instrumentation scheme.
- 3.9. Inspection and Maintenance Manual.

3.10. De-launching scheme.

4. Documents for submission to Railways

- 4.1. Design Basis Note.
- 4.2. Design documents shall be submitted duly signed on every page in copies as required by Railways.
- 4.3. Detailed Design Drawings approved by Proof Consultant appointed by The Employer and Railways and/or Third Party Consultant- tracing sheets/white sheets in copies as required by Railways.
- 4.4. Construction Sequence/ Launching Scheme in Tracing Sheet.
- 4.5. Detailed estimate of the structure based on which the charges to be deposited to Railways would be finalised.
- 4.6. Soft copy of all design documents, analysis files, drawings, etc. in DVD.

5. Detailed requirements of the Work

5.1. Available Information:

DESIGNER shall study all the available information, geotechnical investigation data and drawings issued or made available to him in the Scope of Services, carry out all necessary analyses, and request any further information or data which is necessary for its design development from The Employer or the CONTRACTOR as the case may be.

5.2. Additional Information:

DESIGNER shall study all subsurface data made available to them. DESIGNER shall be responsible for requisitioning all additional borings, geophysical survey and field and laboratory tests that it may require for carrying out detailed design and all such data shall be obtained by the DESIGNER from The Employer or the CONTRACTOR as the case may be. GC will assist in interpreting the reports of GT investigation and conclusions thereafter.

5.3. Structural Design:

DESIGNER shall perform the structural design, including, the preparation of calculations, drawings, specifications, cost estimates and other documents, as required but not limited to:

- 5.3.1. Overall stability of the structures in both the short and long term conditions.
- 5.3.2. Integrity of structural members and structure as a whole.
- 5.3.3. DESIGNER shall attend the review meetings conducted by The Employer from time to time as and when directed by The Employer.
- 5.3.4. Site visits as and when required by The Employer for design verification and make available the services as and when required during the construction contract.
- 5.3.5. EDMS (Electronic Document Management System), platform for submission of documents and drawings, shall be utilised effectively.
- 5.3.6. 3-D BIM modelling of the structure and submission of drawings in 5D BIM compatible format as the requirements mentioned in the tender documents.
- 5.3.7. DESIGNER shall perform analysis of structures and submit their design documents and drawings (in 5D BIM format).
- 5.3.8. Submission of
 - a) Numeration details and drawings based on design norms, methods, loading definitions, etc. as per codal provisions. DESIGNER has to carry out independent analysis of the respective components of all Civil works including Preliminary Analysis and Dimensioning.
 - b) Pile layout and details.
 - c) Detailed design and drawings for Pile Cap and pier.
 - d) Stage analysis and design for various construction sequences.

- e) Detailed Longitudinal analysis including DL, Pre-stressing, SIDL, LL, Differential Settlement, Temperature, Second Order Effects, Fatigue, etc.
 - f) Transverse analysis and design.
 - g) Design and drawings of superstructure including associated components.
- 5.3.9. The Consultant shall ensure durability, serviceability, structural adequacy, conformance to the design standards, aesthetic, ease of construction for each structural component and other allied works.
- 5.3.10. To check and certify the revisions in design and drawings of any structure due to change in site condition or any other reason, whatsoever it may be.
- 5.3.11. To assist The Employer in any related technical matter as and when required and give their specific opinion/comments.
- 5.3.12. The design and drawings shall be in conformity with the latest IRS/IRC/IS codes and international codes of practices as per requirement.
- 5.3.13. DESIGNER will also analyse soil investigation test data and comment on report and submit detailed pile capacity/open foundation capacity calculations.
- 5.3.14. DESIGNER shall propose suitable type of expansion joint and bearings along with load data and ensure their adequacy including installation details and provision for their replacement/maintenance.
- 5.3.15. DESIGNER shall check and approve the design and drawings of bearings, expansion joints, etc.
- 5.3.16. DESIGNER shall closely interact with the detailed design consultant for the adjacent spans of the viaduct and also with the contractor.
- 5.3.17. DESIGNER needs to design the viaduct as per the parameters of the Technical Specifications, Employer's Requirements, Design Basis Report and Schedule of Dimensions (SoD). Any change in the design parameters will be conveyed to the DESIGNER.
- 5.3.18. DESIGNER will incorporate changes in design resulting from design reviews by Proof Consultant, The Employer/GC, Railway and/or Third Party Consultant's.
- 5.3.19. DESIGNER will plan, design, detail, control, co-ordinate and execute the design phase of the work for production of drawings, documents and reports to meet the key schedule dates indicated and as directed by The Employer.
- 5.3.20. DESIGNER is required to approve the scheme for construction and erection of structural members in respect of the design proposed by them. If it is found that the scheme is not feasible to be adopted due to site condition or due to any other reason the DESIGNER would give his detailed remarks.
- 5.3.21. DESIGNER will advise the requirements for ensuring quality control during construction of the structure.
- 5.3.22. DESIGNER would be required to prepare notes regarding quality of construction work observed by them during their periodical joint site visits and make necessary suggestions to The Employer.
- 5.3.23. DESIGNER will be fully responsible in their capacity for the soundness of the design.
- 5.3.24. DESIGNER shall provide support during construction on design related issues.
- 5.3.25. The Quality Assurance Plan (QAP) submitted by the contractor shall be vetted by the DESIGNER and suggestions/recommendations, if any, are to be communicated to The Employer for approval. It shall identify the personnel, procedures, instructions, records and forms necessary to implement the plan.
- 5.3.26. DESIGNER shall extend full co-operation and assistance in proof checking the layouts, detailed design and other design data developed by him. The proof checking shall be done

by the Proof Checker/GC appointed by The Employer and further checking will be done by Railways and /or Third Party Consultant.

- 5.3.27. Detailed calculations shall be prepared and submitted according to the best professional standards and compiled into sets that relate to particular aspects of design.
- 5.3.28. Any other deliverables as required for approval from The Employer/Railways.
- 5.3.29. DESIGNER shall be responsible for managing and adjusting its manpower to accommodate variations in schedule during the estimated design period, and such variations shall not constitute a claim for extended design services.
- 5.3.30. The Employer shall provide the DESIGNER with the relevant data for the track alignment.

6. Duties and Responsibilities of the DDC

- 6.1.1. The DESIGNER shall initiate and actively pursue and involve themselves in all investigations and enquiries, consultations, studies, collection and compliance with pertinent information and data, convening of and attendance at meetings, and in any other activities as are or may be necessary for producing the detailed design, drawings and documents to the specified requirements.
- 6.1.2. The DESIGNER shall carry out the services in accordance with its own methods, in compliance with the provisions contained herein. Any and all changes necessary to ensure that the DESIGNER's design, drawings and documents conform to the intent and purpose set out in the agreement, shall be made at the DESIGNER 's own expense.
- 6.1.3. The DESIGNER represents that it is a professional and experienced consultant providing full consultancy services, and hereby agrees to bear full responsibility for the correctness and technical merit of the services performed.

7. Organization of the DDC

7.1. General:

- 7.1.1. The DESIGNER shall establish an efficient organization for carrying out all services according to programme requirements. The organization shall provide effective management of the tasks of the contract including those that must be carried out concurrently by separate disciplines and teams. The organization shall also ensure that all information that becomes available during the design period is directed to the appropriate design teams and effective checking procedures are continuously maintained to ensure that required standards are met.
- 7.1.2. Engineers having experience of 20 years in the similar work shall be mobilized for the work as lead design engineer.
- 7.1.3. Team Lead having relevant experience of 30 years in the projects of this nature shall be mobilised to oversee the work that all the technical and timeline requirements of the project are being met and shall approve all the design and drawings submitted.
- 7.1.4. Designer's association shall be ensured by the DESIGNER during the execution of the work as a part of construction support and site visits shall also be made by the designers having experience of minimum 12 years.

7.2. Performance:

Notwithstanding any review of its organization structure, staff or manning schedules, the DESIGNER shall remain wholly responsible for providing the services. If, in the opinion of The Employer, the progress or performance of the design work is seen to be at any time inadequate to meet those requirements, the DESIGNER shall take the necessary steps to improve them on being so notified.

If within a reasonable period the DESIGNER has not improved its progress or performance, the Employer may by written notice require it to take additional measures, including changes in its organization, at no additional cost to The Employer. Such notice shall be in no way deemed to constitute a waiver of The Employer's rights to terminate the appointment of the DESIGNER. Failure by the Employer to issue such a notice shall not relieve the DESIGNER of its obligation to achieve the required rate of progress and quality of work.

8. Standard of Services

8.1. General:

- 8.1.1. The DESIGNER shall be responsible for the correctness and technical merit of its designs, calculations, drawings and all other documentation prepared by it in carrying out the services.
- 8.1.2. The DESIGNER shall ensure that qualified and experienced staff are employed in sufficient numbers, so that all drawings and documents are produced in time including timely achievement of all key-dates and activities. This is essential for proper co-ordination, control and interfaces of the work.
- 8.1.3. The DESIGNER shall comply with the provisions and procedures covering standards and codes, drawings and calculations outlined in Section 8.3 below. The DESIGNER shall also comply with the checking procedures in Section 9 hereof.

8.2. Extent of Information:

- 8.2.1. All designs and documentation produced by the DESIGNER shall provide sufficient information and detail to determine accurately the extent of the work during construction, execution, operation and maintenance.
- 8.2.2. The drawings and other information produced by the DESIGNER for construction, or revisions of such documents, shall be submitted to the PC /GC / The Employer and Railways and/or Third Party Consultant, in time for review and further issuance to the contractor. The DESIGNER shall ensure that these documents are produced in a timely manner such that the construction contractor is able to plan and execute their works in accordance.
- 8.2.3. Drawings for construction shall be in such detail as not to require further design or detailing to be carried out by the construction contractor except as provided under Section 8.4 hereof. The DESIGNER's drawings shall show or include details of any unusual features of construction and shall include all necessary detailing.

8.3. Calculations:

Detailed Calculations shall be prepared and preserved according to the best professional standards and compiled into sets that relate to particular aspects of design.

- 8.3.1. Each set of calculations for a structure shall include but not be limited to:
 - a) A brief description of the structure and its assumed mode of action;
 - b) The loads that will act upon the structure;
 - c) The allowable stresses of the structure;
 - d) A brief statement/description of the method of analysis used;
 - e) A brief statement/description of the method of design;
 - f) Details of the computer program used with analysis files and reports of the analysis;
 - g) Key to symbols used;
 - h) Design summary.

- 8.3.2. Each set of calculations shall be bound and shall include a cover sheet, index and signature block.
- 8.3.3. A statement certified by the DESIGNER's authorized and approved Project Manager, that 'the accepted checking procedures, as defined in Section 9.0, have been carried out and attached with the set of calculations submitted to the Employer'.
- 8.3.4. Original calculations shall be submitted to the Employer for proof checking. Each sheet shall be signed in accordance with the requirements of Section 9.0.

8.4. **Drawings Prepared by DESIGNER:**

All drawings shall be prepared in A-1 size and shall be produced by AutoCAD graphic system compatible with the Employer system and as approved by the Employer. DESIGNER shall deliver the drawings and documents as directed by The Employer.

Submission of the drawings of the complete structure shall be as per Section 4.0. All the drawings shall be submitted by DDC on tracing sheet and on white sheets with copies as required.

Soft copies of the drawings as well as documents shall be submitted in suitable digital format to The Employer as and when required. This shall be in addition to the drawings as well as documents in physical format. DDC shall also be required to deliver the drawings in 5D BIM compatible format on the 5D-BIM Platform as suggested by the Employer's BIM EIR.

8.5. **Computer Programs:**

Only proven computer programs appropriate for the subject work shall be used by DESIGNER.

9. **Checking Procedures**

9.1. **General:**

- 9.1.1. DESIGNER shall establish a Quality Assurance Plan (QAP) and a system of internal checking and approval of all designs, including calculations, drawings and other documents prepared and submitted to The Employer.
- 9.1.2. The purpose of the checking shall be to ensure accuracy and consistency, as well as compliance with current requirements, standards, codes, etc. Certification of such check shall be carried out with documentation for acceptance of submissions.
- 9.1.3. Internal checks shall be carried out by personnel who have experience and competence equal or superior to the originator.

9.2. **Design Calculations:**

Each page of design calculations, including any amendments thereto, shall be endorsed as checked and approved, prior to submitting to The Employer by signing with date.

9.3. **Drawings and Documents:**

Each document and drawing, including any revisions thereto, shall be endorsed as checked and approved prior to submitting to The Employer by signing with date.

9.4. **Quality Assurance Plan:**

- 9.4.1. The DDC shall have a QAP which shall identify the personnel, procedures, instructions, records and forms necessary to implement the plan with the following minimum requirements:
 - a) Certification process of drawings and documents for issue;
 - b) Organizational structure;
 - c) Design control - including study and design input/analysis;
 - d) Checking of documents;
 - e) Document control;
 - f) Subcontractor control;
 - g) Internal quality audit; and

- h) Corrective action.
- 9.4.2. A certificate signed by the Team Lead of the DESIGNER stating that all drawings and documents have been checked and approved in accordance with the DESIGNER's QA Plan shall accompany all documents and drawings submitted.

9.5. **Digital Delivery of project:**

Digital Delivery shall be ensured as per the relevant sections of the tender documents

9.6. **Responsibility:**

Notwithstanding acceptance by the The Employer, the DESIGNER shall remain responsible for the quality of the documents.

10. **Design Submission and Reviews**

10.1. **Design Review Procedure:**

DESIGNER shall prepare and submit the designs and drawings along with all documents to The Employer. The Employer then shall handover the submissions to Proof Consultant (PC) for independent analysis and complete review of all the details submitted and furnish The Employer with their review comments either in writing or on marked up drawings. After receiving the comments from PC, The Employer, after due review, shall forward the review comments to DESIGNER for incorporating the same.

After completing the review among PC and The Employer, submissions shall be made to Railways by The Employer. The submissions will be checked by Third Party Consultants of Railways and provide their report to Railways. Based on the report of Third Party Consultants, Railways will provide comments for incorporation. DESIGNER shall incorporate all the comments and submit the same to The Employer for final approval, post this The Employer shall submit the submissions to Railways.

Note:

Above said procedure is applicable for all formal submissions of designs and drawings only. Direct interactions, discussions, correspondence and deliberations in the course of proof checking by PC, Indian Railways and/or Third Party Consultant shall be made for clarifications and expediting approvals, duly copying to The Employer.

10.2. **Progress/Design Review Meetings:**

The DESIGNER shall attend progress/design review meetings as and when required.

11. **Submission of Document**

- 11.1 The DESIGNER shall deliver the drawings and documents as listed to The Employer/PC/GC, as directed by The Employer.

12. **Employer's Obligation**

The Employer shall provide full information regarding their requirements for the project. If The Employer becomes aware of any fault or defect in the design or non-conformance with the Drawings and Specifications, it shall give prompt written notice thereof to the DESIGNER, but failure to do so by The Employer, shall not constitute any waiver for the responsibility of the DDC to perform under the contract.

Annexure-A1

Circulars and Guidelines of Railways

1. Railway Board Circular No. 2011/Proj./SCR./9/8 dated 13.08.2013 with subject "Uniform Policy for Metro Rail Crossing across Existing Railway Tracks".
2. Central Railway's Guidelines for getting the Design Drawings on Bridges developed from Design Consultants issued vide letter no. W.294.BR.Proof Checking dated. 27.08.2018.
3. Central Railway's letter no. W.641./BR/Policy dated.10.10.2018 with subject "Safety and Reliability of new ROB/Overhead crossing over Railway System".
4. Central Railway's letter no. W.293.BR.Circular dated 22.05.2018 with subject "Fabrication and erection of steel structures for bridges (including FOBs and ROB)".

**Government of India (Bharat Sarkar)
Ministry of Railways (Rail Mantralaya)
Railway Board**

No. – 2011/Proj./SCR./9/8

13 August, 2013.

To
The General Managers,
All Zonal Railways.

Sub: Uniform Policy for Metro Rail Crossing across Existing Railway Tracks.

Ref: This office letter no. 2011/Proj./SCR./9/8, dated 22.03.2012.

In supersession to the instructions issued vide letter under reference, policy for metro railway crossings has been reviewed and revised as under:

1. Metro Railways are highly capital intensive projects and there is very little flexibility in altering alignments. Hence if a crossing across railway line is proposed by metros, it should be generally agreed to, if it is technically feasible.
2. CBE of the Railways needs to be satisfied with respect to adequacy of design for portion across Railway track. The Railway, if deems capable, may check the design in house. In cases, where Zonal Railway is not in a position to check the design in house, the design, duly accepted by consultant of the Metro Railway administration, needs to be proof checked by a third party, distinct from the designer and the consultant, mutually agreed between Metro Railway and Zonal Railways. The software used for such checking should be different from the one used while designing the structure. The consultant should interact with Zonal Railway during proof checking work. Zonal Railways to advise list of such approved third party consultants to Metro Railways. Launching scheme, wherever required, should invariably form part of the design scheme. Design basis report approved by Rly. Board should form basis for all such designs.
3. Safety at work site during execution, quality of work and its execution as per approved drawings is the prime responsibility of concerned Metro Railway administrations. However, for any crossing over/under Railway Track, concerned Zonal Railway is also duty bound to keep a vigil on activities of Metro Railway over railway land with respect to safety. This can be ensured by deputing Railway staff for inspection depending on the type of work. 100% inspection by Railways may not be desirable since Metro Railways normally have third party inspection and certification agencies in place for quality assurance. It is however for the Railway administration to decide on the extent of inspection depending upon the quality assurance plan of the Metro Railways. Detailed supervision procedure may be finalized by Zonal Railways.
4. Railways should ensure that there are no supporting pillars between the tracks.
5. Following charges should be levied from Metro Railway Administration towards Railway crossings (other than land lease/licensing charges):
 - a. Supervision charges @ 6.25 percent are to be levied for metro railway crossings in line with works of ROBT/RUB executed by other agencies on

Uniform crossing metro policy 05.02.2013

Railway land. However, these charges will reduce to 3.125% if RITES is engaged as supervising agency by the Metro Administration.

- b. Centage charges are to be levied @ 2%. However, if Railway administration considers it appropriate that detailed drawings and designs should be checked by Metro administration through a mutually agreed consultant, these charges may be reduced to 1%.
- c. For works undertaken by Engg. Deptt., Departmental charges @ 12.5 % are levied in terms of para 1137 of Engg. Code. However, if work is not taken up by Engineering Deptt. but by the concerned Metro Railway on their own, applicability of these charges is not warranted.
- d. Maintenance of metro crossing structures is responsibility of Metro Railways hence no charges are to be levied for the same. An MoU should be entered into between Zonal Railway and Metro administration. An annual joint inspection with Metro Railway officials should be carried out to ascertain any abnormality in the structure. However, if any abnormality is found in the structure or otherwise, Metro Railway will quickly chalk out an action plan in consultation with concerned railway. In such cases, the charges as per Engineering Code Para 732 and 733 shall be levied for repairs.

This issues with the concurrence of Finance Directorate of Ministry of Railways.

o/c 
(Mohit Lila)
Joint Dir./Works Plg.
011-23097061

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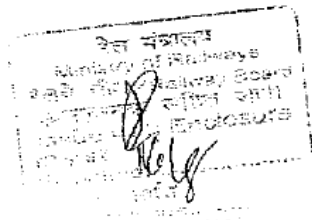
- (i) FA & CAO, All Zonal Railways.
- (ii) Principal Director of Audit, All Zonal Railways.
- (iii) Dy. Controller and Auditor General of India (Railways), Room No. 224, Rail Bhawan, New Delhi.


- For Financial Commissioner/Railways

Copy also to:

1. Secretary, MoUD, Nirman Bhawan, New Delhi for information and necessary action.
2. Principal Chief Engineers All Zonal Railways.
3. Managing Director, DMRC, BMRCL, KMRCL, CMRL, HMRL, MMRDA, JMRC, KMRL.

PT. Issue




Joint Dir./Works Plg.

मध्य रेल
CENTRAL RAILWAY



मुख्यालय
इंजीनियरींग विभाग
छत्रपती शिवाजी महाराज टर्मिनस
मुंबई - 400 001

No. W.294.BR.Proof Checking

Date: 27.08.2018

- | | |
|---|--|
| 1. CAO/C, CSMT, Mumbai | 3. CPM/RVNL, New Administrative Building,
D.N. Road, Mumbai - 400 001 |
| 2. Director/Projects, MRVC,
Churchgate, Mumbai - 400 | 4. CPM/DFCCIL, CSMT |

Sub: - Guidelines for getting the Design Drawings on Bridges developed from Design consultants

- 1.0 No. of works of New lines, doubling, Third line, ROBs etc. are being executed by different agencies on Central Railway system. Most of the drawings are to be approved by concerned Chief Engineer of Construction organization based on the conceptual spanning arrangements approved. The work of developing detailed structural design and structural drawings is mostly outsourced to consultants. Further, proof checking of detailed designs is being done by proof consultants who are mostly from IIT, VNIT and NIIT etc.
- 2.0 Design of Railway Bridges whether minor or major is an important activity involving design parameters which are often site specific and may vary substantially from site to site. Besides the above, there are guidelines issued by RDSO/IRC on various aspects of construction and maintenance which are to be kept in consideration from the concept stage itself to give an efficient and economical design. A need therefore was felt to issue guidelines for getting such design drawings developed properly.
- 3.0 In order to improve the quality of design work and effective monitoring with consultants, guidelines prepared by this office are attached as Annexure - I. The executing organization can make use of the same to streamline their design activities through consultants. Further, improvements may be suggested if considered necessary.

27/08/2018
(R. K. Goel)
Chief Bridge Engineer

DA: As above.

Copy to -

1. EDCE/ B&S, Railway Board, New Delhi for information please.
2. ED/ B&S/ RDSO, Lucknow for information.

3. Sr.DEN(101) SUR, NGR, PA, B&S, CSMT.

ANNEXURE – I**GUIDELINES FOR GETTING THE DESIGN DRAWINGS OF BRIDGES DEVELOPED FROM
DESIGN CONSULTANTS**

1. **Design Basis Note:** The Design Basis Note (DBN) will consist of standard of loading adopted, standard codes of practices and specification to be followed, materials to be used and their specifications, method of analysis, standard software proposed, authority and method of proof checking, manufacturing tolerances, design parameters to be used with respect to specific locations of the structure and the authority thereof. Any design input parameter proposed to be used beyond standard practice will be brought out specifically. The Design Basis Note shall be got prepared from consultant and approved by competent authority.
2. **Geotechnical investigation:** A standard Geotechnical investigation as per IS code as applicable will be undertaken covering the locations of all the piers and abutments. Bore logs shall be taken and bearing capacity of the soil shall be assessed based on C, ϕ parameters as determined by bore log detail or standard penetration Test. A comprehensive report shall be prepared and submitted.
3. **GAD:** The conceptual GAD as initially prepared may be modified, if required based on above investigations and got approved. The GAD shall be prepared with proper dimensions of the structural components after detailed design is approved.
4. **Start of Design work:** A meeting will be held between the consultants, Dy. CE/C/Design and concerned Dy. CE/C in-charge to finalize the Design Basis Note and GAD. Design work shall be undertaken only after finalization of all the issues of GAD and design input parameters.
5. **Periodical Review:** Consultant shall give fortnightly report on status of Design and a monthly meeting will be held with Dy. CE/C/Design to review the design document under preparation and resolve the issue if any. At every stage of design, the design document should give references of relevant clauses of standard codes of practice, loading standards as agreed in DBN. The hand sketches should be given to bring out the concept used in analyzing the structure. Similarly, the hand sketches should be given to suggest the design details proposed to be adopted. The stages for monitoring the design work have been indicated in Annexure -II.
6. **Design Drawings:** Design drawings shall be developed simultaneously and reviewed by Dy. CE/C/Design during the monthly meeting held. All the notes as per RDSO practice will be incorporated in the design drawings. The parameters, specifications, manufacturing tolerances etc. with relevant codes/standards adopted for design shall be mentioned on the drawings. The summary sheet of stresses under various load combination shall be prepared to show that the same are within the permissible stresses. All Design drawings shall be cross checked with respect to the design document for correctness of dimensions.

27/01/2018
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- 6.1 Steel girders and composite girders:** Fabrication drawings, sequence of welding, welding technique and tests, which are required to be conducted, shall be given by the consultant. The acceptance criteria for welds, concreting & testing including the inspection of raw material and consumables shall also be specified with relevant IS/IRS/IRC codes.
- 6.2 PSC/Composite girders or slabs:** Pre-stressing sequence, design of formwork and on site supervision during critical stages shall be done by the consultant. Verification of steel reinforcement/ pre-stressing provided/given during the construction as per the design shall be the responsibility of consultant and a certificate of verification shall be given.
- 6.3 Sub-structure and Foundation:** The designs should be with respect to latest provision of RDSO/BIS taking full advantage of the flexibility and ductility of the proposed structure. Design should be done keeping in view the economy and faster construction techniques available in the industry. The approach slab and transition systems on approaches are to be provided as per RDSO practice. Design should cater for the adequate seating widths at pier top and other maintenance requirements of the structure during its service.
- 7. Selection of proof consultant:** - IIT/NIT/JTI or other such govt. institute of repute shall be considered for appointment as proof consultant. The other proof consultant shall be approved by Head Quarter office of Central Railway, Construction Organization or Chief Bridge Engineer.
- 8. Role of Proof Consultant:** Proof consultant shall be supplied with one set of design drawings and Design Basis Note. Analysis and design of components shall be done independently with reference to DBN and the adequacy to design as given by consultant shall be verified. The method of analysis / software used and the design calculations in this regard shall be produced by the proof consultant in his report. The report shall also have a summary sheet of stresses under various load combinations and comments about adequacy of design submitted by the prime consultant. The proof consultant shall ensure the consistency of dimensions of various details in plans, elevations and cross sections. The check prints, showing the evidence that such a check, has been exercised, shall be submitted by proof consultant.
- 9. Approval of Drawings:** Dy. CE/C/Design shall verify the designed drawings and satisfy themselves by exercising random checks. Comparison will also be made with standard/Non-standard drawings of similar type already approved. Design document shall be verified with respect to DBN approved and by conducting sample checks on vital calculations before putting the same for approval.

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ANNEXURE - II**STAGES FOR MONITORING AND MODEL TIME SCHEDULE FOR THE DESIGN WORK
OF MAJOR / MINOR BRIDGES**

- 1 Submission of Preliminary / Conceptual GAD
- 2 Draft Design Basis Note by Consultant
- 3 Approval of Preliminary / Conceptual GAD
- 3 Geo-tech investigation (as per requirement)
- 4 Approval of Design Basis Note By Railway
- 4 Finalization of GAD with selection of proof consultants and Start of Design work
- 5 Submission of Design Document as per approved DBN to HQ only
- 6 Comments of HQ (if any) and preliminary approval.
- 7 Design drawings 1st submission on check print to HQ Design cell and field unit for feasibility (one set each)
- 8 Remarks/comments by HQ Design cell / field unit
- 9 Submission of Design Drawings to Proof Consultant
- 10 Report of proof consultant with comments on drawings
- 11 Examination of report by Dy. CE/Design and meeting with Consultant / Design consultant (if required)
- 12 Final approval of Design Document and Design Drawings.

Note: The above stages may overlap with each other. The actual time taken will actually depend upon the competence & experience of the consultant & the officials involved in the process of approval.


27/08/2018
CBE



मध्य रेल
CENTRAL RAILWAY

No.W.641/BR/Policy



भारत सरकार / Govt. of India
रेल मंत्रालय / Ministry of Railways

C-183

प्रमुख मुख्य इंजीनियर कार्यालय,
छत्रपति शिवाजी टर्मिनस,
मुम्बई - 400 001

PRINCIPAL CHIEF ENGINEER'S OFFICE
CHHATRAPATI SHIVAJI TERMINUS,
MUMBAI-400 001.

Date 10.10.2018

1. Principal Secretary (Transport),
Govt. of Maharashtra,
Room No.29, Mantralaya,
Mumbai - 400 032.
2. Principal Secretary,
Urban Development (I),
Mantralaya, Room No.424,
Govt. of Maharashtra,
Mumbai - 400 032.

**Sub : Safety and reliability of new ROB's/overhead crossings over
Railway system.**

It has been observed that number of overhead track crossings are being proposed by various organizations for carrying the municipal roads, Metro Lines, Mono Rail, Highways or other utilities. New innovative types of designs are proposed to bridge the long spans for which no experience of maintenance is available with the engineers. In many cases, crossings are in skew which makes the designs more complex and it becomes difficult to understand the stress distribution. The inspection and maintenance manual is not prepared by the designers as their responsibilities are often limited only upto the execution. Thus, the inspection and maintenance issues cannot be taken care of adequately. Besides it, proper arrangements are required to be made at the design and construction stage itself to inspect, repair or strengthen the structure during service.

It is therefore necessary to fix norms for consultants /Executing agencies for ensuring long service life and reliability of the structures being constructed. The maintenance needs and the frequency of Inspection of vital connections/components can only be specified by design consultants with appropriate procedures for repairs/strengthening. Accordingly, their responsibilities at different stages of Design and execution for ensuring safety and subsequent needs of inspection and maintenance are required to be defined which are briefly described in Annexure-I.

It is requested that the terms of reference for the design consultants/proof consultants/executing agencies are to be prepared keeping in view the long term durability and maintenance needs. This will help to develop a robust design requiring least maintenance, with appropriate safeguards for ensuring safety and reliability which is so vital for a structure over the railway track carrying passenger traffic.

(Signature)
(R.K. Goel)

Chief Bridge Engineer

DA : As above.

C/- EDCE(B&S), Railway Board, New Delhi for information.

....Contd. on Page No.2

-2-

- C/- Metropolitan Commissioner, MMRDA, Bandra-Kurla Complex, MMRDA office Building, C-14 & 15, E Block, Bandra (E), Mumbai - 400 051.
- C/- Vice Chairman & Managing Director, MSRDC, Nepean Sea Road, Priyadarshini Park, Mumbai- 400 036.
- C/- Municipal Commissioner, MCGM, 2nd Floor, Annex Building, Mahapalika Marg, CST, Mumbai - 400 001.
- C/- Commissioner, TMC, Almeida Road, Panch Pakhadi, Near Nitin Colony, Chandanwadi, Thane (W), Thane - 400 602.
- C/- Commissioner, KDMC, Beside Dena Bank, Shankarrao Chowk & Shivaji Chowk, Kalyan City, Thane - 421 301.
- C/- Commissioner, NMMC, Head office Plot No. 1, New Killegaathan, Palm Beach Junction, Sector 15A, CBD Belapur, Navi Mumbai - 400 614.
- C/- Chairman, CIDCO, CIDCO Bhavan, Sion-Panvel Road, CBD Belapur, Opposite Kokan Bhavan, Navi Mumbai- 400 614.
- C/- Chief General Manager (Tech) & Regional Officer, NHAI, 4th Floor, Plot No.22, Sector- 1, Opposite Belapur Station, CBD Belapur, Navi Mumbai - 400 0614.
- C/- CMD, MRVC, Station Building, 2nd Floor, Maharshi Karve Road, Mumbai- 400 020.
- C/- CPM, DFCCIL, 7th Floor, C.Rly.'s New Administrative Building, D.N. Road, Mumbai - 400 001.
- C/- CMD, Maharashtra Metro Rail Corporation Ltd., Metro House, 28/2, C.K. Naidu Marg, Anand Nagar, Civil Lines, Nagpur - 440 001.
- C/- MD, MRIDL, 2nd Floor, Hoechest House, NCPA Road, Nariman Point, Mumbai - 400 021.
- C/- Chief Engineer, MSRDC, Nepean Sea Road, Priyadarshini Park, Mumbai - 400 036.

Annexure-I
File No. W.641/BR/Policy

SAFETY & RELIABILITY PLAN FOR NEW ROBS & OTHER CROSSINGS OVER RAILWAY SYSTEM

SN	Activity & Responsibility	Record/Reference	Remarks
1	DESIGN 1) Overall Responsibility Design Cell of Metro Railway or Road Authority 2) Secondary Responsibility Consultant/Proof Consultant	1) Design Basis Note 2) Design Documents 3) Drawings having certificates 4) Reports of Proof Consultants 5) Certificates on adequacy of sections/detailing on the Design Drawings 6) Procedure of Design Approval	1) Design Basis Note will outline the complete philosophy of design, applicable codes, durability, construction methodology, maintenance issues including strengthening and de-launching. 2) The Designs/Drawings are to be accepted and issued for execution by Authorized Engineer of Design Cell of Metro Railway/Road Authority. 3) The Design consultants shall remain associated during the execution of project and maintenance for which an Inspections & maintenance manual will be developed and given.
2	EXECUTION METHODOLOGY 1) Overall Responsibility Design Cell of Metro Railway or Road Authority 2) Secondary Responsibility Consultant/Proof Consultant	Method statements, Quality plans, safety plans, Hazard Identification and Risk Analysis (HIRA) Reports, Safety Responsibility Matrix.	1) It shall detail the list of resources such as Man, Material & Machinery required for proper execution. 2) Competency of men to be jointly certified by Authorized Safety Officer and other competent engineer. 3) Quality Plan shall detail the processes to be controlled for safe and reliable structure, with procedures, checks and records of testing/verification.
3	EXECUTION AT SITE 1) Overall Responsibility Construction Agency, MD/CEO & Project Manager 2) Secondary Responsibility Design Consultants & Authorized Safety Officer	1) Method statements for the particular work. 2) Record of instructions given at site and its compliance reports. 3) Safety Responsibility Matrix.	The Authorized Safety Officer shall be well conversant with the hazards associated with the construction activity and shall be duly equipped to deal with it.
4	INSPECTION & MAINTENANCE 1) Overall Responsibility Metro Railway or Road Authority 2) Secondary Responsibility Design Consultants & Authorized Agency for maintenance	1) Inspection & maintenance Manual. 2) Agreements for maintenance. 3) Inspection & compliance reports. 4) List of authorized persons for undertaking maintenance. 5) Procedures for various maintenance activities.	1) The Inspection manual shall also give requirement of different categories of manpower and supervisors for various maintenance activities besides tools and plants and other equipments. 2) Inspection & Maintenance manual will be approved by Design Consultants. 3) Metro Railway/Road Authority will ensure that competent personnel are employed and adequate resources as per the maintenance needs are arranged before commissioning the operations. The original design shall be done such that the strengthening measures can be taken safely without asking for long traffic blocks.
5	STRENGTHENING MEASURES DURING SERVICE 1) Overall Responsibility Design Cell of Metro Railway/Road Authority 2) Secondary Responsibility Consultants/Proof Consultants	1) Strengthening Drawings 2) Design documents 3) Execution Methodology 4) Hazards & risk mitigation	
6	DISMANTLING & DE-LAUNCHING 1) Overall Responsibility Design Cell of Metro Railway Road Authority 2) Secondary Responsibility Consultants/Proof Consultants	1) Dismantling plan 2) Method statement 3) Requirement of crane, machinery & traffic block etc.	Specialized Agencies capable & undertaking the dismantling work to be listed.

CENTRAL RAILWAY

HEADQUARTERS OFFICE,
ENGINEERING BRANCH,
MUMBAI C.S.M.T

No. W.293.BR.Circular

Date :- 22.05.2018

Sr. DEN (Co) BB, BSL, NGP, PA & SUR,

**Sub : Fabrication and erection of steel structures for Bridges
(including FOBs & ROBs).**

Ref: 1. Joint Procedure Order No.W.294/BR/Circulars dt. 26.2.2014.(copy attached)
2. CRS's L No. C-21(5)/2018/88 dated 31.01.2018(copy attached)

Please refer Joint Procedure Order issued on 26.2.2014 (Ref.1) with the approval of CAO/C & PCE to address the serious problems observed at site during the construction of FOB & ROBs. Even though guide lines have been issued, it is seen that quality issues are still coming up at work sites. CRS, vide L.No. C-21(5)/2018/88 dated 31.01.2018 (Ref. 2), has also raised his concern regarding quality of fabrication of FOBs.

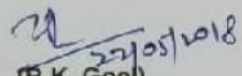
In order to improve the quality of fabrication, it is reiterated that fabrication work should be done as per IRS B-1. The following instructions are further issued to ensure quality of fabrication:

1. **Quality Assurance plan (QAP) and Fabrication Drawings:-** These should be prepared before taking up fabrication and assembly & got approved by the Competent Authority i.e. Dy.CE(C) and Sr.DEN(Co) for ROBs & FOBs being constructed by them respectively. For ROBs being constructed by other bodies such as NHAI, State Govts, Municipal Corporations etc., the QAP shall be approved by Dy.CE/Bridge Line. No deviation from approved drawing or approved QAP should be permitted. Changes if unavoidable should be made with the approval of competent authority.
2. **Procurement of materials:-** Structural steel shall be procured from primary manufacturers only, like SAIL, TISCO, RINL, JSPL. Welding consumables shall be of RDSO approved Brands.
3. **Workshops for fabrication:-**
 - a) **ROBs:-** Fabrication of steel girders for ROBs should be done invariably at RDSO approved Workshops. Girders must be inspected & certified by SSE(Br.) / ABE before dispatch to site.
 - b) **FOBs/COPs and other sheds:-** Fabrication should be done at workshops which are either approved by RDSO or approved by Sr. DEN or Dy.CE / Const. The steel work shall be inspected at Workshop by ADEN/AXEN(C) before painting.
4. **Competency of people employed:-** Execution of specialized work like welding and bolting connections including HSFG bolts must be done by the authorized vendor/agency having valid competency certificate issued by the concerned authority. The contractor doing the work shall give a certificate from the authorized vendor that the work has been done by the competent persons duly indicating their names & competency details.

5. **Welding:-** WPSS i.e Welding Procedure Specification Sheet and WPQR i.e Welding Procedure Qualification Record should be approved before taking up the welding work. Welding in the girders should be done by Submerged Arc Welding only. Inspecting official, while inspecting the fabricated material in Workshop, shall ensure that the welding has been done in complete length as specified in the drawing.
6. **HSFG Bolts:-** Work shall be done as per RDSO's Guidelines- BS-111 (Rev. 5 or latest). DTI washers shall invariably be used. Mating surfaces of the connections shall be metalized for getting the designed slip factor.
7. **Splicing:-** Splicing shall be provided as per the approved fabrication drawing. No splicing other than the approved splicing in the fabrication drawing shall be allowed.
8. **Metalizing & Painting:-** All the steel work of ROB's and components of FOB's shall be metalized.

It issues with the approval of PCE.

D.A - As above.


(R.K. Goel)
Chief Bridge Engineer

- C/-
- (1) CAO/C, CSMT for kind information.
 - (2) Director/Projects, MRVC, for information & ensuring compliance for the Works being undertaken by MRVC.
 - (3) CPM/RVNL, CSMT for information & necessary action.
 - (4) CPM/DFCCIL, CSMT for information & necessary action.