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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

No.2012/Proj/37/12 New Delhi, Date: 11.12.2013

To

Members of Sub-Committee on
Track Structure/Bridges/Tunnels.
(As per list attached)

Sub: **Sub-Committee on Track Structure/Bridges/Tunnels.**

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Minutes of the Sub-Committee meeting on the above subject, held on 19.11.2013 in Rail Bhawan, is sent herewith (also sent by e-mail) for information and necessary action at your end.

Kindly acknowledge receipt. You are also requested to send the Action Taken Report along with further comments if any in the matter at the earliest, so that the ATN is finalized and deliberated in the next meeting for further course of action.

Encl: 1

O/C 11/12/13

(K.K.Aggarwal)
ED/Works Planning
Railway Board &
Co-Convenor/Sub-Committee
Tele: 011-23386944
FAX: 011-23303275
e-mail: edwprb@gmail.com

Copy for kind information and necessary action to:

1. Managing Director, Mumbai Metro Rail Corporation Ltd. MMRDA Building, Bandra Kurla Complex, Mumbai-400051.
2. Chief Engineer, Metro Railway, Kolkata.
3. ED/Structure, RDSO, Lucknow.

PL. ISSUE 11-12-13

Email sent to all the addressees on 11/12/13.
V Suman
TS/EDWP
12/12/13

13/12/13

Minutes of the first meeting of Sub Committee on Track/Bridge/Tunnel of Metros held in Railway Board on 19/11/13.

List of the participants is enclosed as Annexure 1.

Item wise discussions are as under:

		Items and discussion	Action by
A.	Study of various fastening systems and their supporting base on established metro system.		
	1	A *Performance Criteria* was issued in May, 2011 by Railway Board empowering metro railways to use fastening system without getting approved from MoR. Any fastening system meeting stipulation of the Performance Criterion with a proven record of 5 years can be used. In addition to this as a facility to Metro Railways, Four fastening systems for ballastless track have also been approved till date. It was agreed that the provision of performance criteria of fastening systems as given in Metro Manual may be required to be revisited in view of the following proposals of the members of the sub-committee: I. Tolerances of installation/maintenance of track to be reviewed. II. Guard rail should be permitted both inside as well as outside. III. Provision of derailments guards is at variance with the provision in C1. This may be reviewed. IV. Provision of toe load is also at variance with the provision in C1 (1045 kg in C1 and 18 KN per rail seat in C2). The anomaly should be corrected. V. BMRCL stated that, in general metro are designed for an operation speed of 80 kmph. Designing and fastening system for 110 kmph as stipulated in C2 need to be reviewed. However, RDSO stated that it will not make any change in design of fastenings as their designs are for a wide range of speed. VI. There is need to review supporting base compatibility with different fastening systems. VII. Codes other than EN should also be considered for design of fastening systems. VIII. Dir/B&S stated that provision of UIC 773R with regards to longitudinal rail resistance should be considered.	
	2	It was decided to form a working group comprising of Sh Vipul Kumar, ED/Track-II/RDSO (Convener), and representative(s) from DMRC, BMRCL and HMRL (L&T) to deliberate and review the standards and performance criteria of fastening systems. • Shri A. K. Singhal, CE/Track DMRC will represent DMRC. • BMRCL has nominated Shri D. M. Ramtekkar CE, BMRCL and Sh. S. P. Iyer, Track Expert, GC/BMRCL. • Shri Satish Chandra Ayla, JGM –Track work will represent HMRL (L&T) The sub group may meet as soon as possible and give draft recommendation / suggestion in fifteen days. Convener also stated that, while reviewing, it should be ensured that no critical parameter is left out. Metros shall suggest parameters which require change/ modifications.	Sh Vipul Kumar, ED/Track-II/RDSO to coordinate.
B.	Study of various types of turnouts and related fixtures and study of layouts along with their speed potential including supplier based in India and elsewhere.		
	3	Based on experience of DMRC, following standards are stipulated in Technical Standard For Track Structure for Metro/MRTS.	

	Line	Angle	Switch Entry Angle	R (m)	X- over length (m) With 4.2 m TC	Speed Potential (kmph)
1	Main Line	1 in	0°20'00"	300	72.74	45
2	Main Line	1 in	0°20'00"	190	58.24	35
3	Depot	1 in	0°20'00"	190	58.24	35

Bangalore Metro stated that sometimes use of above turnouts, may not be feasible due to space constraints. Turnouts of much lesser radius and lengths are in use and same should be permitted as are being used in other Metros. Present standards may be retained as desirable standard. CMRL endorsed views of BMRCL.

	4	Justification forwarded by Metros: i. Crossover, while carrying passengers, is only for emergency movements. Otherwise, Crossovers are used only for entry /exit to depots, rake turn round at terminals which are non-passenger movements. . ii. Due to various restrictions on the location of turnouts is not permitted in vertical curves, transition portion of horizontal curves, etc. and also since alignment in congested cities is full of horizontal and vertical curves, it is difficult to find suitable locations. iii. Modern designs with lesser lengths are available, satisfying other requirements. iv. 1:5/R100, 1:6/R140, 1:6/R150, 1:7/R140 Turnouts are also in use in other metros worldwide. (Viena, Singapur, Thailand, Greece, Iran etc) v. Metros rolling stocks are generally fit to negotiate curve of radius upto 100 m. Hence turnouts with radius upto 100 m radii should be permitted.	
	5	General consensus was arrived to consider turnouts with shorter radius for Metros subject to safety parameters are satisfied. Metros shall submit more details to ED/Track-II/RDSO within fifteen days, so as to examine this issue in detail and enable further discussion in next Sub-Committee meeting.	MMOPL, BMRCL, DMRC and HMRL ED/Track-II, RDSO
	6	Indigenization of systems was also discussed. Shri A. K. Singhal, DMRC stated that DMRC has taken steps in this direction. He will put forward DMRC's experience in this regard within 15 days and suggest items where there is a possibility to go for indigenization.	Sh. A. K. Singhal, DMRC
C.	Method of track and bridge interaction analysis		
	7	i. In metros, computer Programs like LARSA, Midas etc are being used. Analysis is modeled based on UIC-774-3R. Some of the Metros stated that numerical analysis based on charts of UIC774-3R should be permitted. ii. Committee discussed the issue in details. It was felt that there is need to formulate essentials parameters to be checked, while doing RSI. It would be preferable to use proven software for interaction analysis.	
	8	It was decided that a working-group consisting of experts from Metros and RDSO will develop a standard procedure for doing such analysis in	ED/Tk-II/RDSO

		association with a renowned institute /expert working in rail technology. • Sh V.B. Sood, Dir/SB-II/RDSO will be the convener of this sub group. DMRC and CMRL and BMRC have nominated their representatives for this group as below. • DMRC has nominated Shri Rajan Kataria, CE/Design • CMRCL has nominated Shri V. Somasundaram, Chief General Manager (Construction) • BMRCL has nominated Shri N. P. Pandey CE/Design, BMRCL and Shri P. Sameer Pasha, Structural Expert, GC to BMRCL The sub group may meet as soon as possible and give draft recommendation / suggestion in fifteen days.	
D.	Impact of various rail inclination on the negotiability, rail stress and rail wheel interaction		
	9	i. There is no specific mention of rail inclination in metro certification manual. However in turnout portion, it has been mentioned that *"All turnout should be laid with cant with a rail slope of 1 in 20 towards centre of track".* ii. Based on recommendation of rolling stock supplier, M/S. Hyundai Rotem, the rail profile adopted by Hydrabad Metro is 1:40 with wheel profile S 1002. HMRL has submitted a study report of AECOM India Pvt Limited in this regard which have been studied in RDSO and found to be inconclusive. iii. Issue was discussed in the meeting in detail. It was proposed by various metros that 1: 20 being a proven system, only that should be allowed. Convener, however opined that there should be no hesitation in trying new system and technology, as long as safety is not compromised.	HMRL, ED/Track/I /RDSO,
	10	It was decided that rail inclination of 1:40 adopted by HMRL should be considered by RDSO on technical considerations. HMRL will provide reports and contents in this regards to RDSO within fifteen days to RDSO. In case found safe, it will give some first-hand experience and information about a different rail inclination. It is however desirable to standardize one inclination only after the subject is studied in detail.	
E.	Study of guidelines regarding check rail in India and elsewhere		
	11	I. Present provisions stipulate "Check Rail should be provided on curves where radius is 218 m or less on BG and radius 190m or less on SG". II. Metros were of opinion that these are to relaxed in view of the following facts a. Metro coaches are normally design to negotiate curve upto 100 m radius. Vehicle tested w/o check rail and results found satisfactory. b. Check rails causes enormous noise due to incessant rubbing of inner rails. Check Rails clearance may also be modified upwards for sharper curves. c. In depot, trains runs at a restricted speed, hence no check rails are needed. III.	
	12	To further examine the issue, BMRCL and other metros will submit reports of rolling stock manufactures in this regard as suggested in (a) above within 15 days to ED/Track-I/RDSO. Being a safety issue, the provisions in this regards will be examined in detail by RDSO, including provisions in relevant UIC codes and relevant reports. The option of restraining rail instead of check rail shall also be examined by RDSO and be submitted to subcommittee..	BMRCL, MMOPL CMRL, DMRC, Kochi Metro ED/Track-I

F.	Study of Metro Railways experience / data regarding wear of rails at sharp curves		
	13	Wear on existing running metro system with sharp curves are relevant. Hence data from DMRC and other Metro Rails like Kolkatta, and BMRCL shall be studied by the committee. DMRC, Metro Rail Kolkata, and BMRCL shall provide to committee the relevant data with recommendations to the committee.	DMRC, BMRCL, Metro Rail, Kolkata
G.	Standardisation of loading envelopes for design codes of bridges covering various aspects for Metro railway in line with Indian railway Bridge rules.		
	14	i. At present, there are no specific provisions in Certification Manual. For IR, EUDL concept is used. Loading envelops are given in the IRC bridge rules. In Metros, analysis by various software is being done by various metros individually and submitted to RDSO for approval. ii. It was mentioned by RDSO that for every new RS of higher axle load or heavier configuration of cars, the structure will required to be checked again for safety. Hence there is a need to develop loading envelops.	
	15	It was agreed that Loading Envelops should be developed for Metro loading. Metros will provide, information regarding axle loads, rake formations, spacing of axles etc. A Detailed list of required data for making loading envelops shall be sent by ED/B & S/RDSO to the representatives of DMRC, BMRCL and CMRL,HMRL and Kolkata Metro within a week. Metro will sent the required information within a period of fifteen days thereafter.	ED/B & S/RDSO DMRC BMRCL CMRL HMRL Kolkata Metro
	16	Three types of loading envelops will be prepared, one for light Metro (15T), one for medium Metro (17t) another for heavy metro (19 t). It will be available to upcoming metros for use.	ED/B&S/RDSO
H.	Standards of various design codes similar to IRS/IS codes for design of concrete		
	17	i) There are no specific provisions in Metro Manual. Only DBR is required to be approved by MoR. BMRCL informed that following codes are being used by them: • IRS –CBC : Pile cap, Pier • IRC-CBC, IRC-18, UIC-772 1R : Super structure • IS-2911: Pile foundation • IS -456: Pier Cap, Station Building • Bearing : IRC -83 & UIC 772-1R Priority: IRS -> IS -> ->IRC –>SP of IRC ->Euro codes and American Codes ii) RDSO (Dir/B&S) stated that: • IRS-CBC shall also be used for pier cap instead of IS:456 • The IRC 18 is based on working stress. A new code IRC 112 has been issued which is in Limit state. • The priority of application of Codes cannot be uniformly decided. It will differ from purpose to purpose.	
	18	It was decided that a detailed guideline with regard to applicability of codes, other important items of Design Basis Report will be prepared by RDSO and will be made available in the form of either as model DBR or and annexure to Metro Manual. A draft may be put up to committee within fifteen days.	ED/ Structures/ RDSO
I.	Standardization of models and software for analysis of bridges		
	19	i. At present there is no model or software has been stipulated by IR in the certification manual. Metros are free to use any software. Analysis of the structure is being done using STAAD Pro, Midas, RM-80, Larsa etc. ii. RDSO mentioned that using computer program like STAAD for	ED/Structures / RDSO

		moving loads, may lead to inadvertent mistakes. Hence these programs should be first validated and then used. iii. The Sub-Committee was of the opinion that, it would not be prudent and feasible to standardize models and software for analysis purpose. It was also concluded that Metros should be permitted to adopt most appropriate software based on structural configuration, geographical terrain, axle loads etc. iv. Committee also decided to include provisions of proof checking by some different software so as to eliminate any inadvertent errors. ED/B&S/RDSO will submit guidelines in this regard.	
J.	Noise and vibration attenuation measures		
	20	No standards and specific measures have been prescribed in the metro manual. No details have been submitted by metros in this regard so far to MoR. Detailed information shall be supplied by all the metros based on their experience. ED/WP shall seek details from the metros in this regard.	All Metro Railways
	21	BMRCL and DMRC were advised to carry out testing of noise generated by metro alone in night time, so as to assess performance of rolling stock and system as a whole in this regards. It may handy, in case such information is needed in future.	BMRCL, DMRC

The meeting ended with vote of thanks to the chair.

Telephone Nos. & E-Mail addresses of Sub-Committee Members of Track Structure/Bridges/Tunnels

No.	Name & Designation	Telephone No. & e-mail address
1.	Shri Pradeep Kumar, Adv/Project, Railway Board	Off: 23383189 Mob: 9717648943 advproj@rb.railnet.gov.in
2.	Shri K.K.Aggarwal, ED/Works Planning Railway Board	Off: 23386944 Mob: 9910487384 edwprb@gmail.com
3	Ms.Ruth Changsen, Director/MRTS M/o.Urban Development, New Delhi	Off: 23061358 Mob: 9910012705 Email: dy.secy@yahoo.com
4.	Shri A.K.Dadaria ED/B&S/RDSO	Off:0522-2450398 Mob:09794863009 Email: edbsrdso@gmail.com
5.	Shri. S.K.Agarwal, ED/B&S-1, M/o.Rlys., Rail Bhavan, New Delhi	Off: 23386303 Mob: 9810099312 Email agrawalsk61@hotmail.com
6.	Shri Vipul Kumar, ED/Track-II, RDSO, Lucknow	Off: 0522-2465769 M: 09794863182 Email: vktrackrdso@gmail.com
7.	Sh.Satish Kumar Ayla, JGM, Track Work, L&T Metro Rail(Hyderabad) Ltd.	Mob: 07702427778 Email: ASC2LTMETRO.COM
8.	Shri A.K.Singhal, Chief Engineer/Track, Delhi Metro Rail Corporation Ltd., Metro Bhwan, Fire Brigade Lane, Barakhamba Road, New Delhi-1	Off: 23346317 Mob: 8130637111 e-mail: dmrctrack@gmail.com
9.	Shri D.M.Ramtekkar, Chief Engineer/Reac-2,, Bangalore Metro Rail Corporation Ltd. 3rd Floor, BMTC complex, K.H.Road, Shanthinagar, Bangalore-560027.	Off: 080-22969386 Mob: 09448291181 Email: dramtekkar@bmrc.co.in
10.	Shri P.Iyer, Track Expert, General Consultants, Bangalore Metro Rail Corporation Ltd. 3rd Floor, BMTC Complex, K.H.Road, Shanthi Nagar, Bangalore-560027.	Off: 080 Mob: 09449874504 e-mail: spiyer@hotmail.com
11.	Shri R.Ramanathan, Director/Projects, Chennai Metro Rail Ltd., 'Harini Towers, No.7, Conran Smith Road, Gopalapuram, Chennai-600086.	Off: 044-28430021 Extn.320 Mob: 09445868297 Email: dproj.cmrl@tn.gov.in
12.	Shri V.Somasundaram, Chief General Manager (Construction), Chennai Metro Rail Limited, "HARINI TOWERS, No.7, Conran Smit Road, Gopalapuram, Chennai-600086.	Off: 044-28430023 Mob: 09940234333 Email: cgmc.cmrl@tn.gov.in
13	S.K.Pandey, ED/Track-I/RDSO, Lucknow	Off: 0522-2450297 Mob: 09794863014 Email: edtrack1rdso@gmail.com
14.	Shri Pradeep Kumar, Director/Concrete Bridges-2 RDSO, Lucknow	Off: 0522-2465706 M: 09794863214 Email: dbscb2rdso@gmail.com
15.	Shri V.B.Sood, Director/Steel Bridges-2, RDSO, Lucknow.	Off: 0522-2459920 Mob: 09794863247 Email: directorsteel2@gmail.com
16.	Shri S.K.Gupta, Director/Civil/UTHS, RDSO/Lucknow	Off: 0522-2465771 M: 09794863348 Email: duths.civil.rdso@gmail.com