भारत सरकार / **GOVERNMENT OF INDIA**
रेल मंत्रालय / **MINISTRY OF RAILWAYS**
रेलवे बोर्ड / **RAILWAY BOARD**

No. 2018/M(N)/951/35Pt.1(E:3394758) **Dated: 16.02.2024**

Principal Chief Mechanical Engineers
All Zonal Railways

Sub: Recommendations of the committee constituted to examine CTRB issues of freight Rolling Stock.

Ref: (i) Railway Board's letter of even no. dated 06.12.2022
(ii) RDSO's letter ho. MW/WAD/ CTRB/GENL dated 07.06.2023.

A committee was formed to examine CTRB issues of Rolling Stock vide letter under reference (i). The report of the committee with their recommendations was submitted vide letter under reference (ii).

The recommendations of the Committee have been approved by Railway Board after duly taking into consideration feedbacks received from Zonal Railways.

It is requested that the recommendations of the Committee be implemented in Zonal Railways.

16.02.24

(Happy Walia)
EDME (Freight)
Railway Board
Tel – 011 23047432
Email: edmef@rb.railnet.gov.in

Copy to:

1. **PED(RS)/RDSO** - for kind information.
2. **PED/CAMTECH**- for kind information.

भारतसरकारGOVERNMENT OF INDIA
रेलमंत्रालयMINISTRY OF RAILWAYS
रेलवेबोर्डRAILWAY BOARD

No. 2018/M(N)/951/35Pt.1 **Dated:05.12.2022**

The Principal Chief Mechanical Engineers
East Central Railway, Hajipur
East Coast Railway, Bhubaneshwar
South Central Railway, Secunderabad
West Central Railway, Jabalpur

The Principal Executive Director
Rolling Stock
RDSO
Lucknow

Sub: Formation of Committee to examine CTRB issues of freight rolling stocks

It has been decided to constitute a Committee comprising of the following officers:

1. Executive Director Standards (Wagon), RDSO – Convener
2. Chief Rolling Stock Engineer (Freight), ECR – Member
3. Chief Rolling Stock Engineer (Freight), ECoR – Member
4. Chief Workshop Manager, Rayanapadu Worshop, SCR- Member
5. Chief Workshop Manager, Kota Worshop, WCR- Member

2.0 The Terms of Reference (ToR) of the Committee would be as under:

I. To assess the efficacy and reliability of upgraded E class CTRB with respect to conventional E class CTRB and accordingly give recommendation for changing of conventional cone assembly having steel cage with that of polyamide cage, along with the low torque grease seal.

II. Detailed analysis of CTRB failures, both online and offline, which are showing increasing trend, duly taking into account rejection of components during POH, and accordingly recommend measures for containment.

III. To review the failure reporting methodology of CTRB failures, including critical alerts flagged by OMRS/HBD, both online and offline, in FMM and suggest measures for capturing all relevant details and making it more user friendly.

IV. To deliberate on any other issue relevant to CTRBs.

3.0 The committee is advised to submit its report within 30 days from its formation.

4.0 Necessary inputs and assistance shall be provided to the committee by all Zonal Railways.

Vivek 06/12/22

(Vivek Mohan)
Director Mech.Engg. (Freight)
Railway Board
Email – dmef@rb.railnet.gov.in

Copy to: PCMEs of all Zonal Railways (Except ECR, ECoR, SCR & WCR)
EDS(Wagon), RDSO
CRSEs(Freight)-ECR & ECoR
CWMs- RYPS/SCR & KTTW/WCR

भारत सरकार –रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – 226011
EPBX (0522) 2451200
FAX (0522) 2458500

Government of India - Ministry of Railways
Research Designs & Standards Organisation
Lucknow – 226011
DID (0522) 2450115
DID (0522) 2465310

सं: MW/WAD/CTRB/GENL **दिनांक:** 07.06.2023

EDME (Freight)
Railway Board
Rail Bhawan
New Delhi – 110 001

विषय: Formation of Committee to examine CTRB issues of freight rolling stocks..
संदर्भ: Railway Board's letter no 2018/M(N)/951/35Pt.1 dated 06.12.2022.

With reference to above, report of the committee as formed by Rly Board along with recommendation on the issues of CTRB of freight rolling stocks is enclosed with this letter for your kind information please.

संलग्न: Report of the committee

Digitally Signed by Manish Thaplyal
Date: 07-06-2023 12:53:10
Reason: Approved

(Dr. Manish Thaplyal)
Exe. Director Stds. Wagon

प्रतिलिपि:

(1) CRSE(Freight), ECR
(2) CRSE(Freight), ECoR
(3) CWM/RYPS, SCR
(4) CWM/KOTA, WCR

सत्यमेव जयते

REPORT OF THE COMMITTEE

on

ISSUES RELATED TO CTRBs OF FREIGHT ROLLING STOCKS

(Dr. Manish Thaplyal) ED/Stds./Wagon RDSO/Lucknow **Convener**	(Ravish Kumar) CRSE(Freight) ECR **Member**	(Amit Sinha) CRSE(Freight) ECoR **Member**	(S. Srinivas) CWM/RYPS SCR **Member**	(Sudhir Kumar Sarvaria) CWM/KOTA WCR **Member**

MAY 2023

1.0 INTRODUCTION:

1.1 Constitution of committee:

Railway Board formed a committee to examine the Freight CTRB related issues as mentioned below. The committee comprises of following officers:

(i) ED/Stds./Wagon/ RDSO/Lucknow, Convener
(ii) CRSE(Freight)/ ECR, Member
(iii) CRSE(Freight)/ ECoR, Member
(iv) CWM/RYPS/SCR, Member
(v) CWM/KOTA/WCR, Member

This report covers the detailed study/ analysis and recommendations of committee as formed by Railway Board on various issues of CTRBs on following Terms of Reference (ToR):

(a) To assess the efficacy and reliability of Upgraded E Class CTRB with respect to conventional E Class CTRB and accordingly give recommendation for changing of conventional cone assembly having steel cage with that of polyamide cage, along with the low torque grease seal.

(b) Detailed analysis of CTRB failures, both online and offline, which are showing increasing trend, duly taking into account rejection of components during POH, and accordingly recommend measures for containment.

(c) To review the failure reporting methodology of CTRB failures, including critical alerts flagged by OMRS/ HBD, both online and offline, in FMM and suggests measures for capturing all relevant details and making it more use friendly.

(d) To deliberate on any other issue relevant to CTRBs.

2.0 BACKGROUND:

(a) As per instructions of Railway Board, procurement of Upgraded Class-E (6”x11”) CTRB to RDSO specification No. AB/RB-40-2016 was started and implemented in Indian Railways w.e.f. 01.12.2019. Accordingly, wagon manufacturers have started fitting Upgraded Class-E in newly manufactured wagons. Railway Board has also advised that all future procurement shall be Low Torque Grease Seal.

(b) There is a need to reduce hot axle cases. RDSO has issued several guidelines/ instructions to Zonal Railways from time to time to control the failures of CTRBs, but the number of online failures is still a matter of concern. Zonal railways are advised to follow all instructions in letter and spirit.

(c) RDSO undertakes online CTRB failure analysis based on data of hot axle cases reported by Zonal Railways in prescribed format. Due to non-availability of corresponding data in prescribed format, some of the cases remain inconclusive

to ascertain the root cause and corrective action by respective maintenance facility.

(d) The issue codal life of CTRBs has been raised during various meetings. This is also considered a contributory factor for some of the failures.

3.0 DETAILED ANALYSIS AND RECOMMENDATIONS:

3.1 Efficacy and reliability of Upgraded Class-E with respect to Conventional Class-E CTRB and changing of polyamide cage and low torque grease seal etc.

(a) Railway Board vide letter no. 2017/M(N)/951/14 dated 18.09.2019 has instructed that Upgraded Class-E (6"x11") CTRB to RDSO specification No.AB/RB-40-2016 shall be fitted in newly manufactured wagons w.e.f. 01.12.2019. It also instructed that all future procurement shall be of low torque Grease Seal. These instructions lay down the intent to proliferate the upgraded CTRB. The up-gradation of existing CTRBs, requires both Low torque grease seal and Polyamide cage.

(b) Conventional Grease Seal which are in vogue in Class-E CTRB is a contact type seals having lip with garter spring. This is an older technology and produces more torque. On the other hand, Low torque Grease seal is non-contact type and provides lower rolling resistance resulting in less fuel consumption, reduces seal torque and has a lower operating temperature resulting in fewer incidences of hot axles.

Polyamide/ polymer cage is light in weight, prevents 'dry breaking' lockup, improved interface with roller surface etc. These are the design expectations. Available data has to be analysed for validation of these expectations as fitment of these components has started from 01.12.2019.

(c) During interaction with OEMs, it is learnt that globally, major Railway systems are using low torque grease seal and polyamide cage due to its advantages over steel cage and conventional grease seal.

(d) As per RDSO specification No. WD-63-MISC-2020, Low torque grease seal shall have maximum steady state torque value of 50% as specified in AAR M-959 for Class-E CTRB. The torque value for conventional grease seal as per AAR is 30 in.lb. The OEMs have submitted test report of low torque grease seal having torque value less than 15 in.lb which meets the requirements of RDSO specification. Torque value of conventional grease seal and low torque grease seal is tabulated below along with test report of torque value of low torque grease seal:

Grease Seal for Upgraded Class-E CTRB

Firm name	Brand name of seal	Part no	Torque value (AAR limit 30 in. lb)			Remarks
			Max	Min	Avg	
M/s NEI/ Brenco	Brenco Efficiency Plus	1107G/ 1107G2	15	--	--	In report min & max values are only in graph. Max value is 15 and min is slightly below 11.
M/s Timken	Timken HDL	K150471	9.027	7.027	8.496	
M/s SKF	SKF LL	SE-BT-28516 D-23	17.170	3.628	10.886	

Grease Seal for Conventional Class-E CTRB

Firm name	Brand name of seal	Part no	Torque value (AAR limit 30 in. lb)			Remarks
			Max	Min	Avg	
M/s NEI/ Brenco	Brenco ST-212	1107B	--	--	--	Not available
M/s Timken	Timken NT	K86861	30.0	20.7	25.4	
M/s SKF	SKF CR	70113	19.294	17.878	18.409	

Torque value test report of M/s SKF design of low torque grease seal

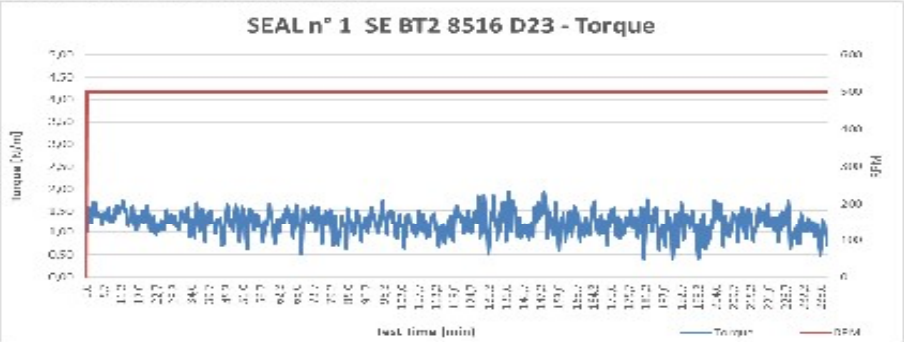
SKF Sealing Solutions –Villanova d'Asti Italy
Testing Laboratory

FRICTION TORQUE TEST RESULTS:

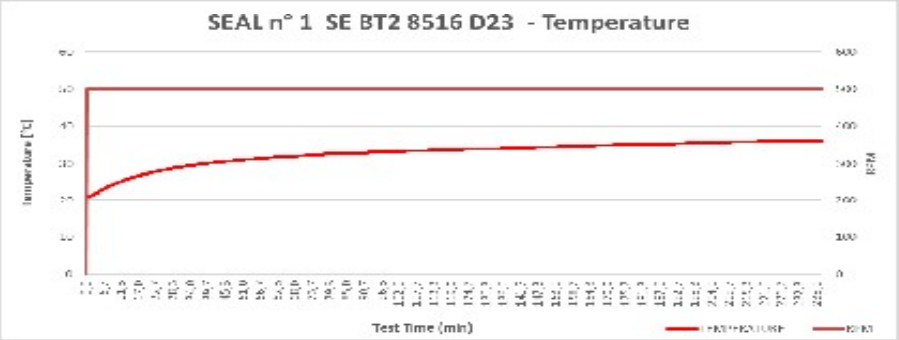
Average Rpm	SE BT2 8516 D23 Torque [N/m]	
		N°1
500	Average value	1.23
500	Min value	0.41
500	Max value	1.94

Looking at the curve, friction shows a slight reduction over time; here average maximum and minimum values are presented.

TORQUE RESULTS (AVERAGES):



TEMPERATURE RESULTS (AVERAGES):



Torque value test report of M/s NEI /Brenco design of low torque grease seal

149193/2020/O/o PED/SW/RDSO

Amsted Rail Company, Inc. | 2550 Frontage Road | Petersburg, VA 23803
(804) 732-0202 tel | www.amstedrail.com

Date: February 8th, 2020

To: Aman Bhargava
General Manager
National Engineering Industries Ltd.

Subject: Brenco® Class E Efficiency Plus® Seal Torque

Mr. Bhargava,

Per your request, we are supplying evidence that the Brenco® Class E Efficiency Plus® seal torque will comply with the RDSO requirement of 15 in-lbf, after four hours running, per AAR MSRP Section H M-959 Appendix A, Section 2.3 Seal Torque. Evidence of this may be seen in the torque data shown in Figure 1.

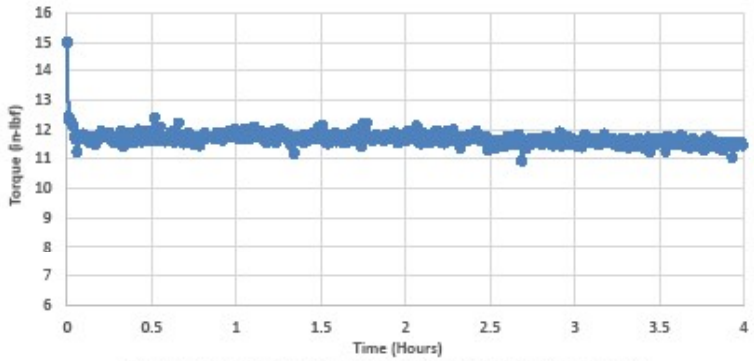


Figure 1: AAR Approved Class E Efficiency Plus® Seal Torque, per AAR MSRP Section H M-959 Appendix A, Section 2.3 Seal Torque

Please let me know if you have any questions about the sample data above.

Best regards,

Michael Mason
Director of Product Development and Digital Factory
mmason@amstedrail.com
+1.804.732.0202 x24289

CC:
Shiv Dutt Sharma – Assistant General Manager, R&D, National Engineering Industries Ltd.
David Thompson – Direction of Supply Chain, Amsted Rail Company, Inc.
James Myers – Vice President, Amsted Seals and Forming

Torque value test report of M/s Timken design of low torque grease seal

AAR Test M-959 – Timken Class E HDL Seal

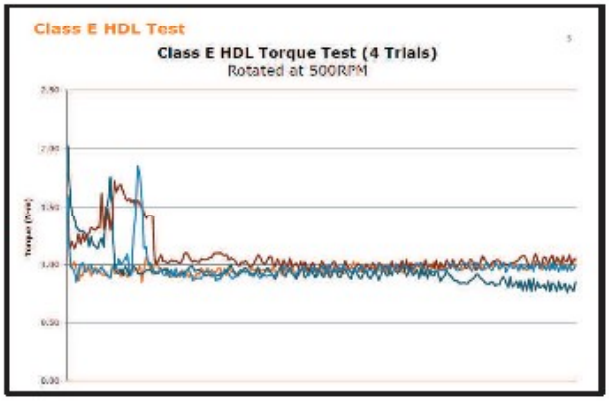
Test Date: June 2018

Grease: Shell GadusRail S3 AAR AL

Abstract: Perform [4] seal only torque tests on standard class E HDL rail seals per AAR 4.1.4 seal torque specification.

Test Results:

Timken Class E HDL Seal Torque Test per AAR M959 - Section 4.1.4		
Sl No.	Seal No.	Average (Steady State) Torque in N-m
1	Seal 1	0.96
2	Seal 2	0.90
3	Seal 3	1.02
4	Seal 4	0.95
Maximum		1.02
Minimum		0.90
Average		0.96
AAR Limit N-m		3.39



Daniel S. Blasko

Daniel S. Blasko

TIMKEN

10

(e) Components of Upgraded Class-E to RDSO specification No. AB/RB-40-2016 are same as Class-E to RDSO specification No. AB/RB-39-2002 except two i.e. Low Torque Grease Seal and Polyamide/ Polymer Cage and fully interchangeable in space envelope requirements. RDSO specification No. AB/RB-39-2002 requires a combination of conventional grease seal & steel cage whereas in specification No. AB/RB-40-2016, combination is Low Torque Grease Seal & Polyamide/ Polymer Cage. However, AAR allows any combination of cage and grease seal. There may be a number of combinations if AAR is

followed but this will create confusion in field as well as violate the provisions of above specifications. Combinations may be as follows:

(i) Cone assembly with steel cage and conventional grease seal or
(ii) Cone assembly with steel cage and low torque grease seal or
(iii) Cone assembly with polyamide cage and conventional grease seal or
(iv) Cone assembly with polyamide cage and low torque grease seal.

(f) At present, during POH in Railway Workshops and refurbishment by OEMs, the cone assembly (consisting steel cage, rollers and inner race) is completely rejected if any abnormality found in cage or rollers or inner race. The average rejection rate of cone assembly over Indian Railways Workshops is 21%, while rejection rate of cone assembly is 22% in NEI and 11% in Timken during refurbishment by OEMs.

(g) There is very little data available from Google sheet/ letters reported by Zonal Railways to analyze the performance of Upgraded Class E CTRB. Data provided by OEMs are also very less. The total population of Upgraded Class-E is approx. 5,31,690 Nos. As per available data, there are a total of 356 removals (including defective upgraded CTRB found in ROH) reported by 11 Zonal railways for previous financial year. Wagons fitted with Upgraded Class-E will be due for POH after 4.5 to 6 years of fitment.

RECOMMENDATIONS:

(a) It is recommended that cone assembly with steel cage may be allowed to be used in Class-E CTRB till the time it is rejected/ condemned. On being rejected, cone assembly having steel cage may be replaced with cone assembly having polyamide cage. The following is to be ensured:
  (i) In any assembled CTRB, both the cone assembly shall consist of either cone assembly with steel cage or cone assembly with polyamide cage. Mixing of cone assembly with steel cage and cone assembly with polyamide cage in any one assembled CTRB is not permitted.
  (ii) Both CTRBs on any single wheel sets must comprise of either cone assembly with steel cage or cone assembly with polyamide cage.
  (iii) Any cone assembly with steel cage removed during overhauling and fit for use may be used in other CTRB having similar age profile fulfilling the other conditions of Maintenance manual G-81.

(b) Grease Seal is a must change item. It is recommended that conventional Grease Seal when rejected may be replaced with Low Torque Grease Seal.
  (i) Both the grease seal on any assembled CTRB shall be either conventional grease seal or low torque grease seal.
  (ii) CTRB having same combination of grease seal shall be fitted on any single wheel set.\

3.2 ISSUES OF CTRB FAILURE AND FIXING CODAL LIFE etc.

(a) CTRB is a critical and a high precision component in Wagon. It carries much safety concerns as failure of CTRB may even lead to derailments. Therefore, it is always imperative to closely monitor the health of CTRB and if any abnormality is found, it must be taken out from service.

(b) Bearing health monitoring system is a task which was earlier not given due attention. More focus was always on-line failure of the CTRB in context of Indian Railways. Modern Railway systems have a robust bearing health monitoring system in place and based on the response of these systems, they take out the suspected bearing from service before on-line failure. Recently, Indian Railways have also focused on bearing monitoring systems. Some systems have also been installed but their extensive proliferation on Indian Railways routes is going to take time. Maintenance mechanism of CTRB is also different in Foreign Railways with respect to Indian Railways.

(c) RDSO has undertaken various activities in regards to control the cases of online CTRBs failure. The efforts of OEMs for conducting technical quality audit and seminar in designated workshops and submitting their observations to RDSO and also abundant support of Zonal Railways to OEMs and RDSO officials in conducting the exercise of audit at their premises is noteworthy.

(d) In addition to the instructions/ guidelines issued from time to time, based on the observations put up by OEMs after technical quality audit and technical seminar, RDSO has added and re-iterated some instructions to be followed like checking of shoulder diameter with snap gauge of digital micrometer, suitable instruments such as dial, digital snap gauges etc. for measurement of dimensions having three digit after decimal, revised quantity of grease i.e. 390± 20 gram in both CTRBs i.e. Class-E and Upgraded Class-E during overhauling in Railways workshop etc.

(e) Due to frequent failures of CTRBs on-line, issue raised by Railway Mechanical officers during various meeting that why the codal life of CTRB not be fixed. One such exercise had been undertaken in 2009 based on failure data of two workshops (placed as Annexure-1). Recently, some Zonal Railways raised the issue again during video conferencing with Railway Board and RDSO on 12.01.2022. Railway Board has instructed to take input from Zonal Railways and undertake this issue. Accordingly, RDSO has asked Zonal Railways to submit CTRB components rejection data to undertake detailed study to work out feasibility/ possibility for fixing codal life of bearings.

(f) Available data for on-line CTRB failure is also studied and placed as Annexure-3. It can be seen that 17.03% and 16.81% of online failures are of CTRB between 6 to 9 years and 9 to 12 years aged group respectively. An assessment of the population of CTRB with this age profile is not available.

(g) The submitted failure data from major Workshops on a total rejection of 519994 Cups against 2426731 received Cups and a total rejection of 1019153 Cones against 4835445 received Cone are studied age wise and a detailed exercise undertaken. The comprehensive study is placed as Annexure-2(A) and 2(B). From rejection graph at Annexure-2 (B), it can be seen that bearing failure increase gradually but not sharply. Rejection of Cup and Cone is 35.1% and 35.04% respectively up to 20 years age group of bearing. Again, Rejection of Cup and Cone is 46.78% and 50.6% respectively after 20 years age group of bearings. In view of sharp increase in rejection of cup and cones in bearings which have attained life of 20 years, it would be prudent to consider life of 20 years to achieve fair degree of reliability of the bearings.

(h) Clause 5.8 and 5.9 of ARI report shows removal of bearing from 1992 to 2010. In abroad also, failure of bearing in unavoidable. Removal of bearing has increased due to change in way side detection method. Concerned pages of ARI report is as below:

American Railcar Industries

Design and Analysis of the 25 t Axle Load Gondola for Indian Railways Service

Developed for RDSO

ARI Report 1505

Revision 5a1

12 December 2013

This document contains the design and analysis information for the gondola that transports coal at a gross load on rail of 100,000 kg. This information was developed exclusively for the RDSO under the WD01/2010, "Design and Development of 25 t and 32.5 t axle load Wagons (Freight Cars) for Indian Railways" contract.

5.8 Bearing Technical Evaluation

Failure history of bearings in AAR service has been rigorously collected and analyzed for the period 1992 – 2010. During this period, the predominant gross rail load was 263 or 286. Figure 5.14 presents the absolute number of bearing removals for each year in this period. The top line in the figure shows that the number of bearing removals has steadily increased from less than 600,000 in 1992 to over 800,000 in 2009. The reason for the increase is two-fold. First, the data is not normalized by mileage. One would expect the number of bearings to increase as mileage increases. As seen in figure 5.15, when normalized by billions of net ton miles (BNTM), the number of bearing removals dropped from 1992 – 2004. The increase in bearing removals per BNTM following 2004 however points to the second reason, changes in the AAR detection methods. The wheel impact load detectors (WILD) and acoustic bearing detectors (ABD) were implemented in the second half of the 2001 – 2010 decade. As bearings must be removed when a wheel is turned, the number of bearings increased as more wheels were pulled from service due to high impact readings. Pull-outs due to acoustic detection of vibration in the bearings were also a contributor although not as great.

The figures also present two other data lines. The middle line represents the bearings that were removed that were either bad or had to be removed because the wheel-set was in a derailment. The bottom line represents just those bearings that were removed for a defect cause. As the data shows, of the 800,000 + bearings removed in 2010, less than 80,000 were removed for a defect cause. When normalized by BNTM, of the nearly 500 bearing removals, less than 50 were defective.

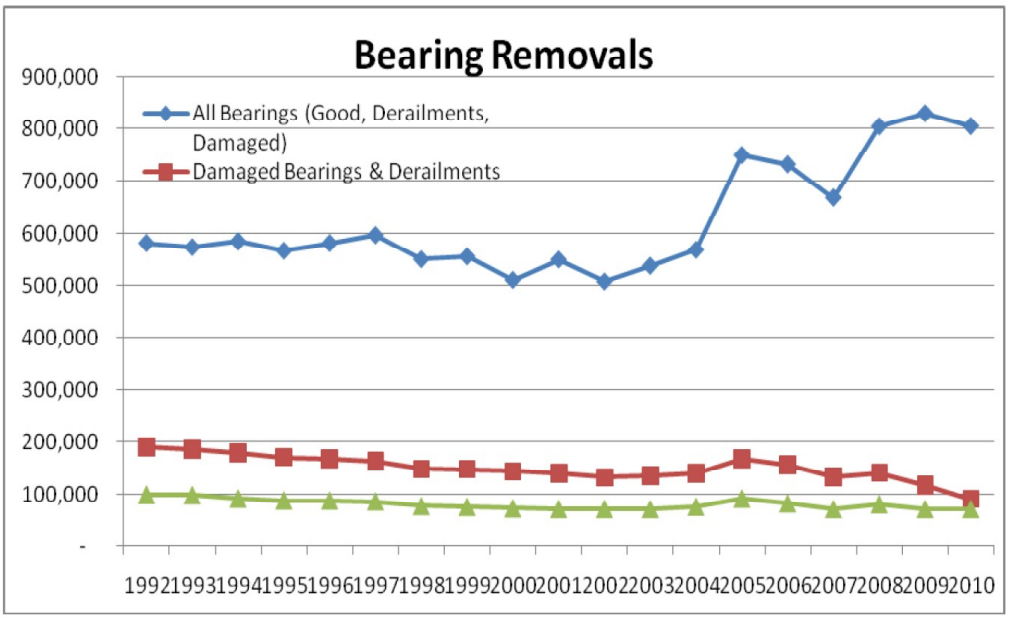


Figure 5.14 Bearing Removals from 1992 – 2010

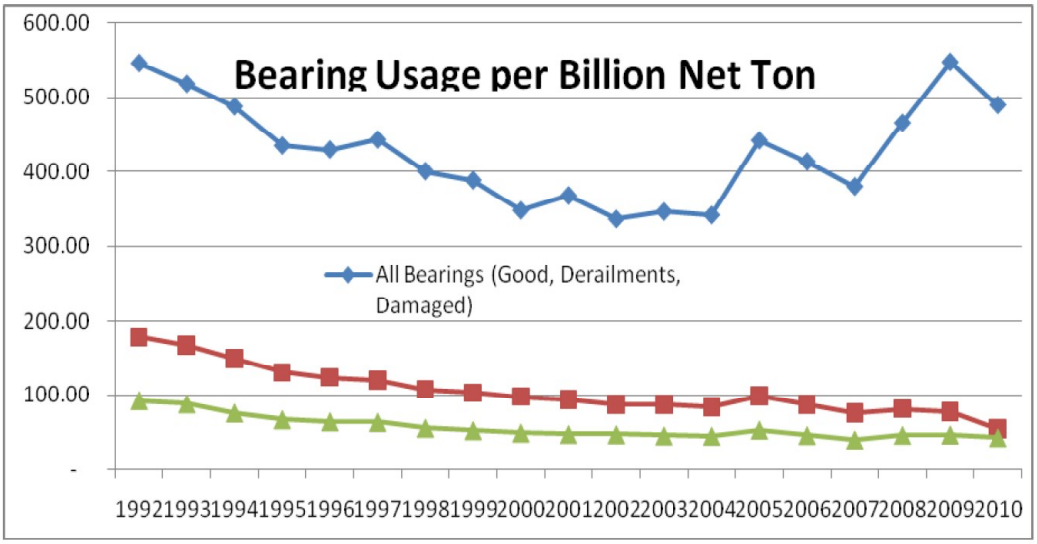


Figure 5.15 Bearing Removals Normalized by Billions of Net Ton Miles

When defects were found, the predominant failures were loose backing rings, damaged seals or defective internal parts. Of the roughly 72,000 defective bearings removed in 2010, 26,000 had loose backing rings, 7,000 had damaged seals, and 16,500 had defective internal parts. The four internal defects most typically cited are spalling (from metal fatigue), Brinelling (form high impact loads), water etching (from flooding or pressurized cleaning) and cone slippage (from loss of clamping). So since M-934 defines the L-10 life as failure due to spalling, this data supports the conclusion that just 2% of all bearing removals in 2010 were due to fatigue. The other 98% of the removals were due to wheel wear, derailments and bearing housing damage. A review of data from 1999 shows a similar result. It shows that the defective internal part percentage or fatigue removals were about 4%. The other 96% were due to wheel wear, derailments and bearing housing damage.

One factor why so few bearings are removed for fatigue damage is the extensive use of equipment detectors. With the introduction of hot box detectors in the early 1990's and the acoustic bearing detectors and high impact wheel detectors in the late 2000's, the potential for running a bearing to failure (seizure) was greatly reduced. For this gondola design, ARI found one study [5] that tracked the bearing related accident rates from 1997 to 2010. This data shows that the rate in 1997 was 0.08 main train accidents per million freight train miles (MFTM). In 2010, this rate had dropped in half to 0.04. The reduction was attributed to the increased use of wayside detection technology.

A summary of research reviewed by ARI for this gondola design is presented in table 5.7.

Table 5.7 Survey of Bearing Research

Item	Paper	Organization	Date	Content
1	RBMEC report to AAR	Roller Bearing Manufacturers Engineering Committee	2006	Review of bearing removals from 2001 – 2005 in AAR service
2	Neural Pattern Identification of railroad wheel bearing defaults …	Texas A&M	1999	Acoustic signal detection methods were evaluated.
3	Railway Investigation Report R05Q0033	Canadian Transportation Safety Board	2005	A 25 year old bearing seized, burned off the axle journal and caused a derailment. More frequent hot box detectors could have prevented catastrophic failure.
4	Railway investigation Report R11T0016	Canadian Transportation Safety Board	2011	A 2010 rebuilt bearing seized, burned off the axle journal and caused a derailment. Reuse of a worn raceway and failure of CN to notify CP at interchange were causes.
5	The Safety Impact of Wagon Health Monitoring in North America	TTCI	2011	Review of derailment/accident avoidance as a result of implementing wayside detectors.
6	Tapered Roller Bearing Damage Analysis	Timken	2003	Visual recognition of typical modes of bearing failure
7	High Quality Railway Bearing Service at RBI	SKF	2002	Reconditioning method explained.
8	The Successful Use of Non Contact Acoustic Bearing Condition Monitoring	Pacific National – Australia	2007	Acoustic bearing detectors are effective and cost less than derailment cleanup. Data on Australian heavy haul routes.
9	Improving Bearing Reliability	Timken	2003	Bearing life and causes of removal
10	Bearing Life Calculations – 25 t axle load class E, L & K bearings	Timken	2011	Theoretical L10 fatigue life and fretting index for E, L and K bearings

5.9 Bearing Selection

The E class bearing is the standard bearing for 25 t axle load service in the North American Rail network. This bearing was used extensively since the 1950's on all types of freight cars accumulating billions of net ton miles of relatively trouble free service. Although its current use is limited due to the use of heavier axle loads, the E bearing demonstrated its suitability for 25 t axle load service.

Although the E class is suitable, its L10 life of 750,000 miles and the fretting index of 1.00 no longer represent the best in class. The alternative to the E bearing is the new shorter L bearing which is also intended for 25 t axle loads. By upgrading to the shorter L bearing, the fretting index is reduced by a factor of two. The L10 lives however of the L and E bearings are roughly the same. This L10 limitation is not generally a factor in AAR service as only 2 – 4% of all bearings are replaced for surface defects related to fatigue. The overwhelming majority of these bearings are rebuilt before fatigue damage occurs when the wheel-sets are turned. The prevalent use of wheel impact, hot box, and acoustic bearing detectors has clearly contributed to early detection and pro-active rebuilds.

ARI understands that Indian Railways does not use wayside detection monitors to identify bad bearings. Of course any bogie selected for this project must provide the access necessary should the IR adopt wayside detection in the future. Consequently, the bogie and bearing should be designed in such a way to enable wayside detection of damaged bearings through either “hot box” or acoustic detection.

The Indian Railways maintenance of bearings also differs from the AAR practice. In AAR service, when wheels are re-profiled, the bearing must be removed and rebuilt. In IR practice, even though the wheels are re-profiled after every 18 to 24 months, the bearings are not removed and inspected. Instead, bearings are inspected and rebuilt every six years. Consequently as a result of not using wayside detection and of rebuilding on a six year interval, the IR may need to adopt a higher capacity bearing to achieve this “six year without failure” standard of reliability.

The K class bearing has an AAR specified minimum L10 life of at least 1,000,000 miles. Some manufacturers however are promoting that their K class bearings have an L10 life over 2,000,000 miles under 32.5 t axle loads. However, the IR experience with the E bearings of 1,000 set-outs annually has as its primary root causes poor bearing fitment to the axle after rebuild, or poor fitting adapters that pinch the E class bearing. Consequently, service life improvement of the K over the E based solely on lowering the fretting index from 1.0 to 0.5 and increasing the L10 life from 750,000 to 1,000,000 miles may be overstated if these root causes carry over to the K class service.

Given that the Indian Railways desires to increase their axle loads to 25 t, that the IR does not currently use wayside detection, that the bearings are rebuilt after six years, and that the IR wants to eliminate bearing failures to improve utilization, ARI recommends that the K class bearing be used. However, to evaluate the significance of a service life improvement, ARI recommends that 1 rake of 25t axle load gondola be run with E bearings; the other with K bearings. This side by side comparison running for two years will quantify the failure rate difference.

RECOMMENDATIONS:

(a) Railway Workshops may be advised to give special attention to CTRB overhauling during 1st POH to avoid high rate failure of bearings. This analysis is based on technical and statistical inputs from Zonal Railways. From study of above data of online failure and failure data of major workshop, it is recommended to consider the codal life of Cup & Cone assembly as 20 years on age cum condition basis.

(b) Manner of phasing out may be decided by workshops.

(c) Recommendation of 20 years codal life of CTRB should be reviewed periodically, duly taking cognizance of trend of failures of CTRB.

(d) During overhauling, Integrity of Cup & Cone assembly of CTRB to be maintained to the extent possible and only in case of rejection of cup or cone, similar age profile cup & cone assembly to be fitted.

3.3 ISSUES RELATED TO FAILURE REPORTING ETC.

(a) RDSO undertakes online CTRB failure analysis based on data of hot axle cases reported by Zonal Railways in prescribed format. Due to non-availability of corresponding data in prescribed format, some of the cases remain inconclusive to ascertain the root cause and corrective action by respective maintenance facility. In order to improve the reporting of hot axle cases, a Google sheet was prepared and shared with Zonal Railways for timely reporting. This sheet was also shared with CRIS. Although all the rows & columns of this sheet is incorporated in FMM but it is not user friendly. Hence, CRIS needs to be advised that same format and data feeding methodology be opted as in Google sheet to make it more user friendly (format as in Annexure-4).

(b) Procedure adopted by RDSO for analysing online CTRB failure has already been circulated to Zonal Railways vide RDSO letter NO. MW/WAD/CTRB/GENL dated 30.05.2022.

(c) Suspected CTRBs are being pulled out based on OMRS alerts. Investigation of such suspected CTRBs due to OMRS alert should be done by all Zonal Railways, its findings should be shared on FMM platform as this data can give a fair idea of causes of failure initiation.

(d) Detachment of Wagon due to Cap Screw missing is reported by Zonal Railways. This may be due to insufficient torque as specified. Also, effective diameter of screw thread might be improper. Pitch, thread angle, major and minor diameter of the screw might have been deteriorated due to prolonged use. Re-use of Cap screw after POH may damage axle end threads which may lead to detachment of wagon.

(e) Faulty adapters are also reported as cause of CTRB failures due to pinching effect. Zonal Railways have been advised to check 100% adapters in ROH/POH through gauges. The drawings of the gauge have been circulated.

RECOMMENDATIONS:

(a) Zonal Railways may be advised to furnish/ provide complete information of hot axle cases as per prescribed proforma on FMM so that complete analysis can be done.
(b) CRIS may be advised and instructed to make feeding of failure data in a more user friendly manner. The google sheet format should be replicated on the FMM portal because feeding is very easy in that and also data mining is very simple and all other units directly monitor their cases.
(c) Detailed analysis of CTRB pulled out due to OMRS and HABD alerts be put on FMM.
(d) As several cases of failure of CTRB are attributed to adapter, adapter be made must change item in POH. This decision may be reviewed in due course duly considering the performance of modified Adapter which is under development.
(e) It is recommended that Axle End Cap Screw may be made must change item during POH.

MANISH THAPLYAL Digitally signed by MANISH THAPLYAL DN: cn=MANISH THAPLYAL, c=IN, st=UTTAR PRADESH, o=MINISTRY OF RAILWAYS, ou=MINISTRY OF RAILWAYS, serialNumber=D35B9AD9431EBA6FD3045C5ECFF1B47C2533D296F844022D1D292CD67704089F Date: 2023.05.31 18:42:38 +05'30'	RAVISH KUMAR Digitally signed by RAVISH KUMAR Date: 2023.06.04 09:58:40 +05'30'	AMIT SINHA Digitally signed by AMIT SINHA Date: 2023.06.06 20:27:44 +05'30'	SRINIVAS SADHANAKARI Digitally signed by SRINIVAS SADHANAKARI Date: 2023.06.05 13:08:14 +05'30'	SUDHIR KUMAR SARVARIA Digitally signed by SUDHIR KUMAR SARVARIA Date: 2023.06.02 17:54:40 +05'30'
(Dr. Manish Thaplyal) ED/Stds./Wagon RDSO/Lucknow **Convener**	(Ravish Kumar) CRSE(Freight) ECR **Member**	(Amit Sinha) CRSE(Freight) ECoR **Member**	(S. Srinivas) CWM/RYPS SCR **Member**	(Sudhir Kumar Sarvaria) CWM/KOTA WCR **Member**

फैक्स/Fax : 91-0522-2452494
तार : 'रेलमानक' लखनऊ
Telegram : 'RAILMANAK' Lucknow
टेलीफोन/Tele: 2451200 (PBX)
2450567 (DID)

भारत सरकार –रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – 226011
Government of India - Ministry of Railways
Research Designs & Standards Organisation
Lucknow - 226011

S.N.1246

सं0 एमडब्ल्यू/सीटीआरबी/डी

दिनांक: 01.05.2009

का0 निदेशक यांत्रिक इंजी0 (फ्रेट),
रेलवे बोर्ड, रेल भवन,
नई दिल्ली–110001

विषय: Roller Bearing Failure Cases on Freight Stock
संदर्भ: Your letter No. 2007/M(N)/951/53 dt. 18.02.2009 — S.N.1245

As desired vide your letter referred above, Quality Audit of Bearing Overhauling section of Jagadhari and Kharagpur Workshop was carried out on 2nd March'09 and from 07th March to 8th March'09, respectively, by a team of Director Standards Wagon-III/RDSO and Director I&L/RDSO. Workshop-wise observations are as under:-

a. Main deficiencies noticed/observations made during the Quality Audit - **Annexure-A**
b. Detailed report of the Quality Audit of JUDW - **Annexure-B**
c. Detailed report of the Quality Audit of KGPW - **Annexure-C**

1. Both the workshops have been advised for taking necessary action to make up the deficiencies noticed during Quality Audit.

2. Following important points were also noted during Quality Audit:-

i) Rejection of M/s NEI make bearing is 10.8 % and that of M/s Timken make is 3.6% for the period 2006-07 to 2008-09 (upto Feb'09) in KGPW. M/s NEI has been advised to visit the KGPW workshop and ascertain the reasons for higher rejection of CTRB of their make.

ii) Marking (manufacturing month and year) was not legible in number of cases (approx. in 10% of cups and 30% of cones) in KGPW. Both the manufacturers, M/s NEI and M/s Timken, have been advised to visit KGPW to study this problem and give feedback.

iii) There have been cases of bearing damage due to electric burn (approx. 7%)

iv) There have been cases of damage to Grease Seal due to mishandling and loosening of cap screws.

v) All the Zonal Railways have been advised to pay attention to areas mentioned in Points (iii) & (iv) above and other related areas during POH, ROH and Yard examination of bearings (copy enclosed at **Annexure-D**).

3. Following points in connection with Bearing Performance & failure investigation are highlighted:-

   i) **Codal Life of the bearing** - currently there is no codal life prescribed for bearings. From the data of KGPW and JUDW (**Annexure-E & F**), it can be seen that percentage of bearing failures increases sharply after 15 years. From analysis of age-wise bearing failures also (**Annexure-G**), it can be observed that failure rate of bearings increases with age and there is sharp increase after 12 years. In view of this, it is proposed the fix the Codal life of Bearing as 15 years. Hence, **Board may consider approving 15 years as the Codal Life of Bearing.**

   ii) Currently, while reporting bearing failures, Zonal Railways are not providing all the relevant information required by the workshops for investigation at their end and by RDSO. To overcome this problem a unified format **"RDSO/CTRB/D/Rev.0"** has been prepared and circulated to all the Zonal Railways (copy enclosed as **Annexure-H**).

(विंध्याचल सिंह)
कृते महानिदेशक/मालडिब्बा

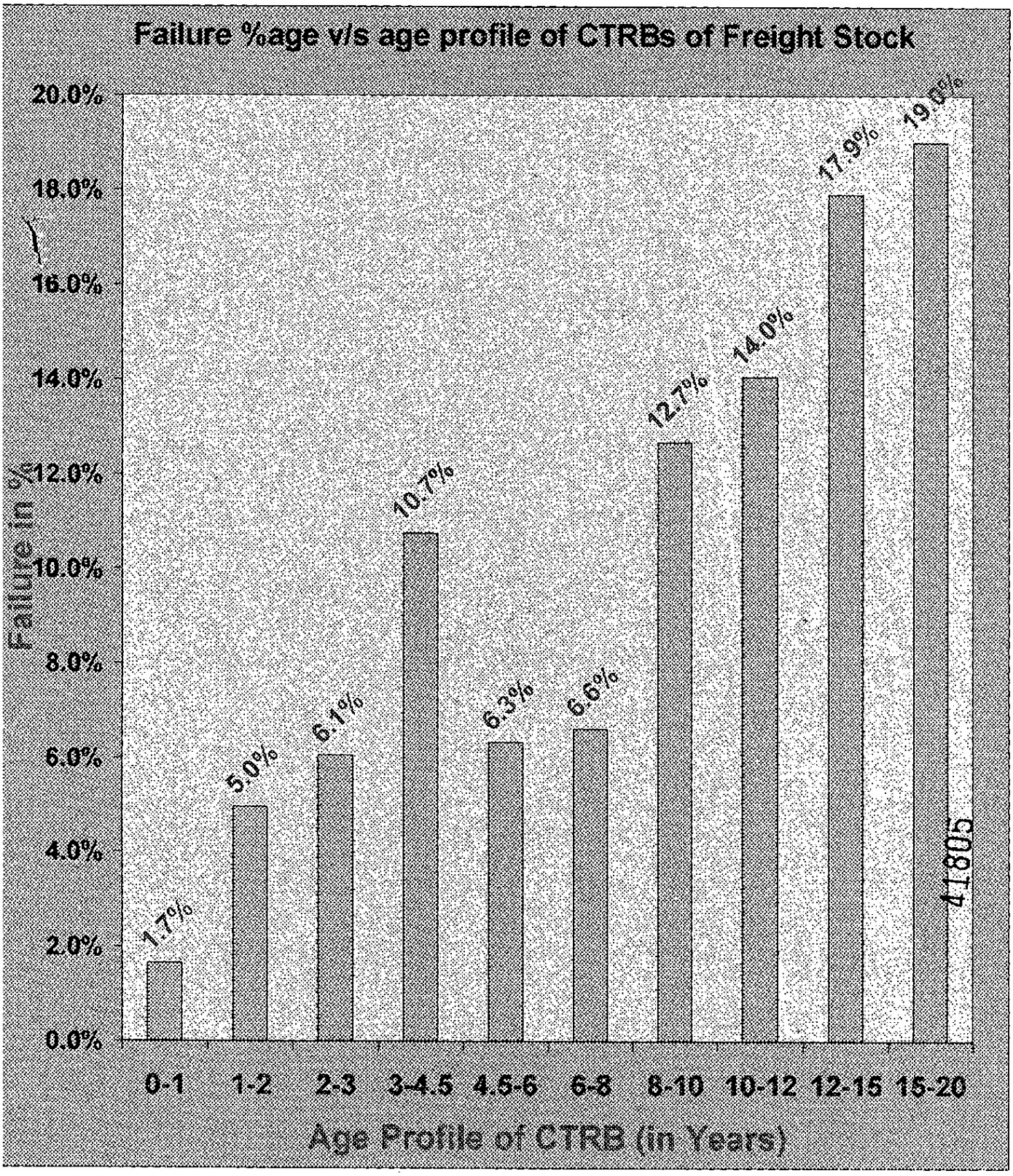
संलग्नक: यथोक्त।

N.O.O

का0 निदेशक/गुणवत्ता एवं आश्वासन (यांत्रिक)

41759

Annexure-G



फैक्स/Fax : 91-0522-2452494
तार : 'रेलमानक' लखनऊ
Telegram : 'RAILMANAK' Lucknow
टेलीफोन/Telc: 2451200 (PBX)
2450567 (DID)

भारत सरकार –रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – 226011
Government of India - Ministry of Railways
Research Designs & Standards Organization
Lucknow - 226011

S.N. 1264

वी. सिंह.
का0 निदेशक मानक/मालडिब्बा

अर्द्ध शा. पत्र सं0 एमडब्ल्यू/सीटीआरबी/डी दिनांक: 16.06.2009

प्रिय श्री अस्थाना,

विषय: Codal life of bearings
संदर्भ: Your D.O. No. 2007/M(N)/951/53 dt. 25.05.2009 — S.N. 1263

In reference to above, desired information is as under:-

i) As per information provided by bearing manufacturers, it is not an international practice to fix codal life of bearings, instead, bearings are condemned/changed on condition basis.

However, in this regard, it is mentioned that as per international practice the bearing overhauling is done by OEMs, where facilities for Crack detection though UST/Magnaflux, Spall relieving, Polishing of components, Roller grading. Race track grinding & Phosphating etc. exist. After overhauling, OEMs gives the warranty of bearing as new.

In case of Indian Railways the overhauling is done in workshops, where complete facilities do not exist and workshops are not able to bring the bearing to the new standard leading to deterioration in performance.

ii) The data of on line failure of 363 nos. bearings with age is attached herewith as Annexure 'A'. It may be seen from this data that failure rate of bearing increases with age.

41688

With kind regards,

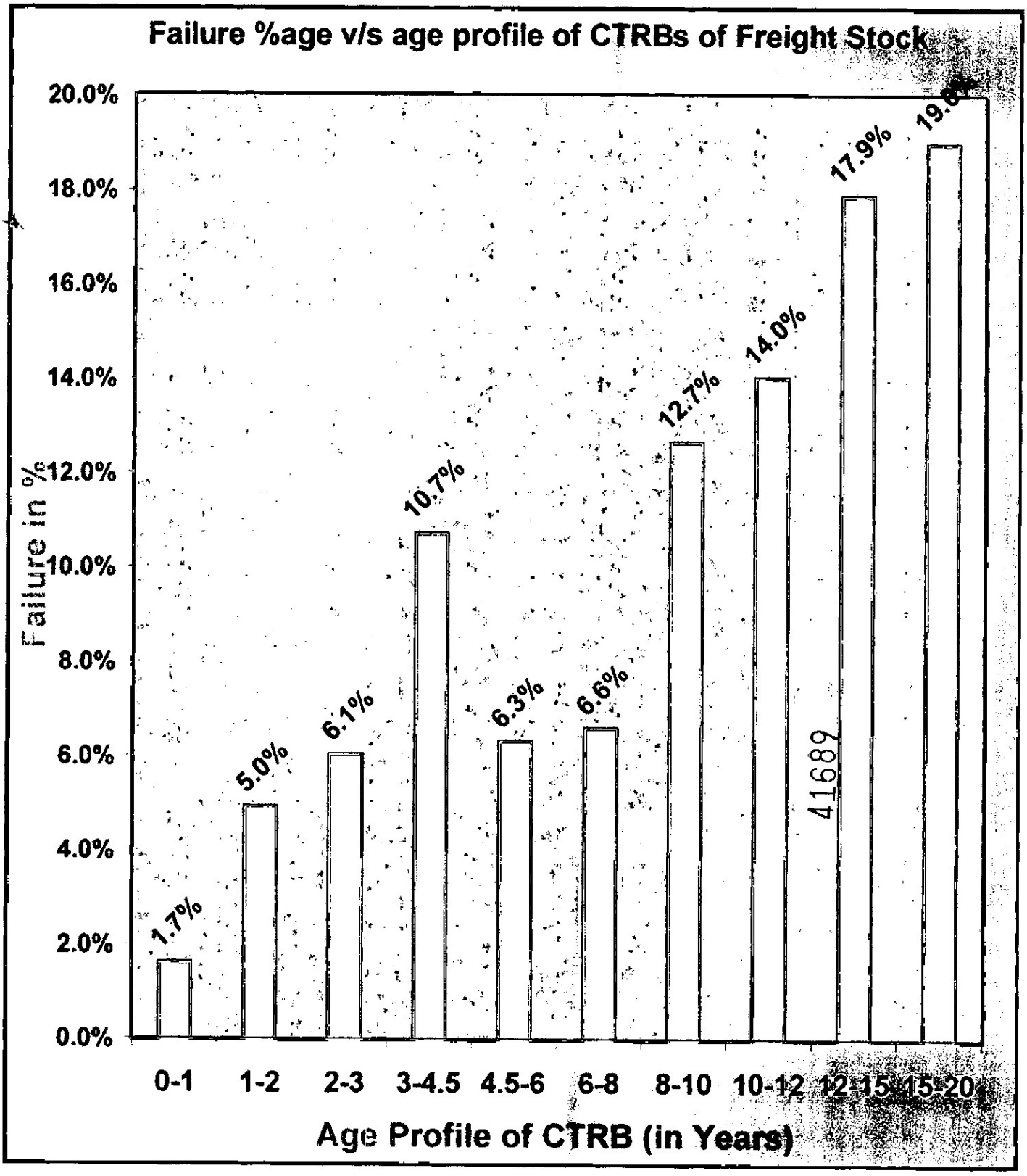
भवनिष्ठ,

(विंध्याचल सिंह)
o/c

संलग्नक: यथोक्त।

श्री जी.एन. अस्थाना,
सलाहकार यांत्रिक इंजी. (डब्ल्यू),
रेलवे बोर्ड,
नई दिल्ली–110001

Annexure-A



सत्यमेव जयते

महिला सशक्तिकरण वर्ष
Women's Empowerment year 2001

भारत सरकार
रेल मंत्रालय (रेलवे बोर्ड)
नई दिल्ली–110 001
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)
NEW DELHI-110 001

G.N.ASTHANA
Adv. Mech.Engg.(W)

01/6

Wagon

S.N.1263

S.N.1264

कार्यालय महाप्रबंधक
पारती एवं प्रेषण अनुभाग
रेलपथ पत्र डाक सं...820
दिनांक.....

D.O.NO.2007/M(N)/951/53 New Delhi dated 25.05.09

My dear Vindhyachal Singh,

Sub : Codal life of bearings
Ref. : Your letter No. M(W)/CTRB/D dt. 01.05.09. — S.N.1246

Vide above mentioned letter it has been recommended by RDSO that Board's approval may be given for fixing the 15 years codal life for CTRBs. Before the case is put up to Board, following information may please be provided:

i) Whether it is an international practice to fix codal life of bearings are condemned only on condition basis.
ii) Position given in the enclosed report is for rejections in workshops during overhaul. Data with regard to actual failure of bearings with relation to age of bearing may please be forwarded. Even if limited date is available the same may be sent.

With best wishes,

Yours sincerely,

(G.N.Asthana) 25/5/09

Sh. Vindhyachal Singh
ED/Wagon/RDSO
Lucknow.

EDSW 3/6/09

DSW-III

MW-II

Annexure - 2(A)

AGE WISE REJECTION OF CTRB CUP

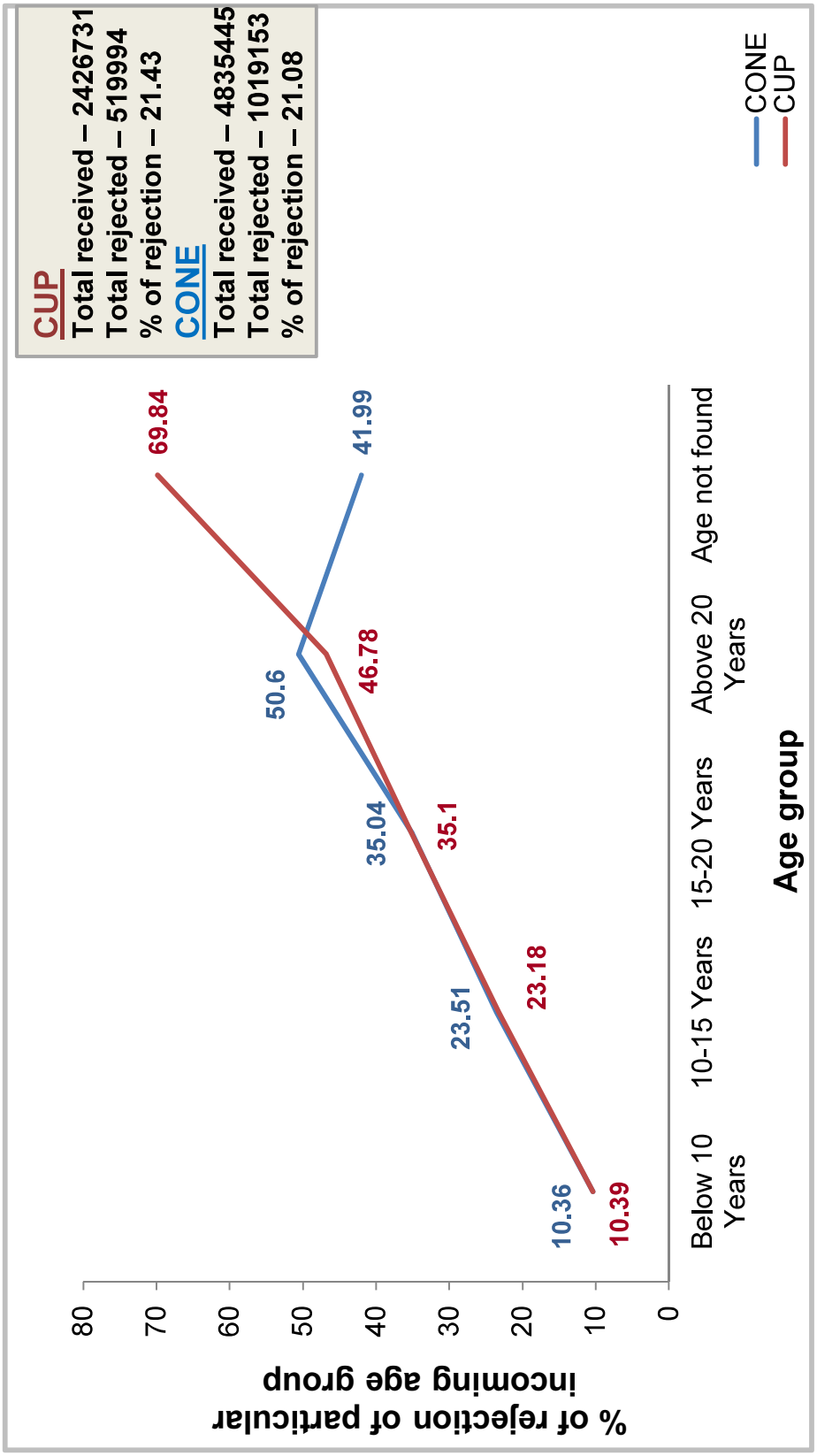
Workshops	Years	Total cup recd.	Age wise Cup recd.					Total cup rejection	%	Age of service (Cup rejection)									
			Below 10 yrs.	10-15 yrs.	15-20 yrs.	Above 20 yrs.	Age not found			Below 10 yrs.		10-15 yrs.		15-20 yrs.		Above 20 yrs.		Age not found	
										No. of rejection	% of rejection	No. of rejection	% of rejection	No. of rejection	% of rejection	No. of rejection	% of rejection	No. of rejection	% of rejection
KGPW	2013-14 to 2021-22 (up to Dec, 2021)	469178	200778	117456	75158	57122	17344	70263	14.98	18422	9.18	15812	13.46	14054	18.70	12799	22.41	9925	57.22
JUDW	2012-13 to 2021-22 (up to Dec, 2021)	408836	237230	78574	41057	42341	9634	89991	22.01	30282	12.76	19476	24.79	14105	34.35	17209	40.64	8919	92.58
RYPS	2012-13 to 2021-22 (up to Dec, 2021)	471017	258123	95140	43638	39978	29613	109908	23.33	22347	8.66	24251	25.49	18251	41.82	23980	59.98	21157	71.44
RWS	2016-17 to 2021-22 (up to Dec, 2021)	301533	175182	66290	24932	31472	3657	54235	17.99	16689	9.53	13509	20.38	7705	30.90	12682	40.30	3657	100.00
JMPW	2012-13 to 2021-22 (up to Dec, 2021)	380358	207447	82751	43951	43756	2453	90774	23.87	22178	10.69	20554	24.84	18307	41.65	27399	62.62	1970	80.31
PWP	2012-13 to 2021-22 (up to Dec, 2021)	272825	133188	63608	39032	31814	5183	84130	30.84	15987	12.00	23474	36.90	20851	53.42	21253	66.80	2595	50.07
AIIW	2016-17 to 2021-22 (up to Dec, 2021)	57031	33340	13853	4913	4925	0	11236	19.70	3551	10.65	3510	25.34	1910	38.88	2265	45.99	0	0.00
KWV	2019-20 to 2021-22 (up to Dec, 2021)	25943	14867	6109	3178	1621	167	7704	29.70	2442	16.43	1939	31.74	1964	61.80	1094	67.49	165	98.80
HUBLI	2015-16 to 2021-22 (up to Dec, 2021)	23006	13609	4703	1602	1243	1799	89	0.39	867	6.37	645	13.71	381	23.78	494	39.74	505	28.07
MYSORE	2015-16 to 2021-22 (up to Dec, 2021)	17004	9629	4624	1352	1036	365	1664	9.79	544	5.65	395	8.54	331	24.48	249	24.03	145	39.73
TOTAL		2426731	1283393	533108	278813	255308	70215	519994	21.43	133309	10.39	123565	23.18	97859	35.10	119424	46.78	49038	69.84

AGE WISE REJECTION OF CTRB CONE

Workshops	Years	Total cone recd.	Age wise Cone recd.					Total cone rejection	%	Age of service (Cone rejection)									
			Below 10 yrs.	10-15 yrs.	15-20 yrs.	Above 20 yrs.	Age not found			Below 10 yrs.		10-15 yrs.		15-20 yrs.		Above 20 yrs.		Age not found	
										No. of rejection	% of rejection	No. of rejection	% of rejection	No. of rejection	% of rejection	No. of rejection	% of rejection	No. of rejection	% of rejection
KGPW	2013-14 to 2021-22 (up to Dec, 2021)	920494	459251	209389	164051	108700	8062	118552	12.88	27822	6.06	26402	12.61	35559	21.68	23391	21.52	5630	69.83
JUDW	2012-13 to 2021-22 (up to Dec, 2021)	802698	474186	136607	78273	85260	18774	188726	23.51	68039	14.35	38770	28.38	29583	37.79	40113	47.05	7282	38.79
RYPS	2012-13 to 2021-22 (up to Dec, 2021)	942134	528350	190034	92556	107825	12058	208272	22.11	37525	7.10	46111	24.26	39276	42.43	80418	74.58	4942	40.99
RWS	2016-17 to 2021-22 (up to Dec, 2021)	603066	346551	129439	48659	77439	978	100237	16.62	29999	8.66	25622	19.79	14821	30.46	29739	38.40	0	0.00
JMPW	2012-13 to 2021-22 (up to Dec, 2021)	772564	415725	168677	85202	95382	7578	190894	24.71	58734	14.13	43517	25.80	31373	36.82	54485	57.12	2785	36.75
PWP	2012-13 to 2021-22 (up to Dec, 2021)	545650	266416	127256	80790	63434	7754	163152	29.90	29791	11.18	45560	35.80	40302	49.88	43966	69.31	3523	45.43
AIIW	2016-17 to 2021-22 (up to Dec, 2021)	116454	70588	26633	8641	10552	0	25177	21.62	10368	14.69	6898	25.90	3249	37.60	4662	44.18	0	0.00
KWV	2019-20 to 2021-22 (up to Dec, 2021)	51627	28582	13377	5040	4215	422	18062	34.99	6889	24.10	4202	31.41	3227	64.03	3473	82.40	281	66.59
HUBLI	2015-16 to 2021-22 (up to Dec, 2021)	46012	26742	9406	3204	2486	3598	0	0.00	1862	6.96	1342	14.27	1073	33.49	1194	48.03	299	8.31
MYSORE	2015-16 to 2021-22 (up to Dec, 2021)	34746	18702	8733	2427	3415	1468	6081	17.50	1918	10.26	1283	14.69	856	35.27	1283	37.57	741	50.48
TOTAL		4835445	2635093	1019551	568843	558708	60692	1019153	21.08	272947	10.36	239707	23.51	199319	35.04	282724	50.60	25483	41.99

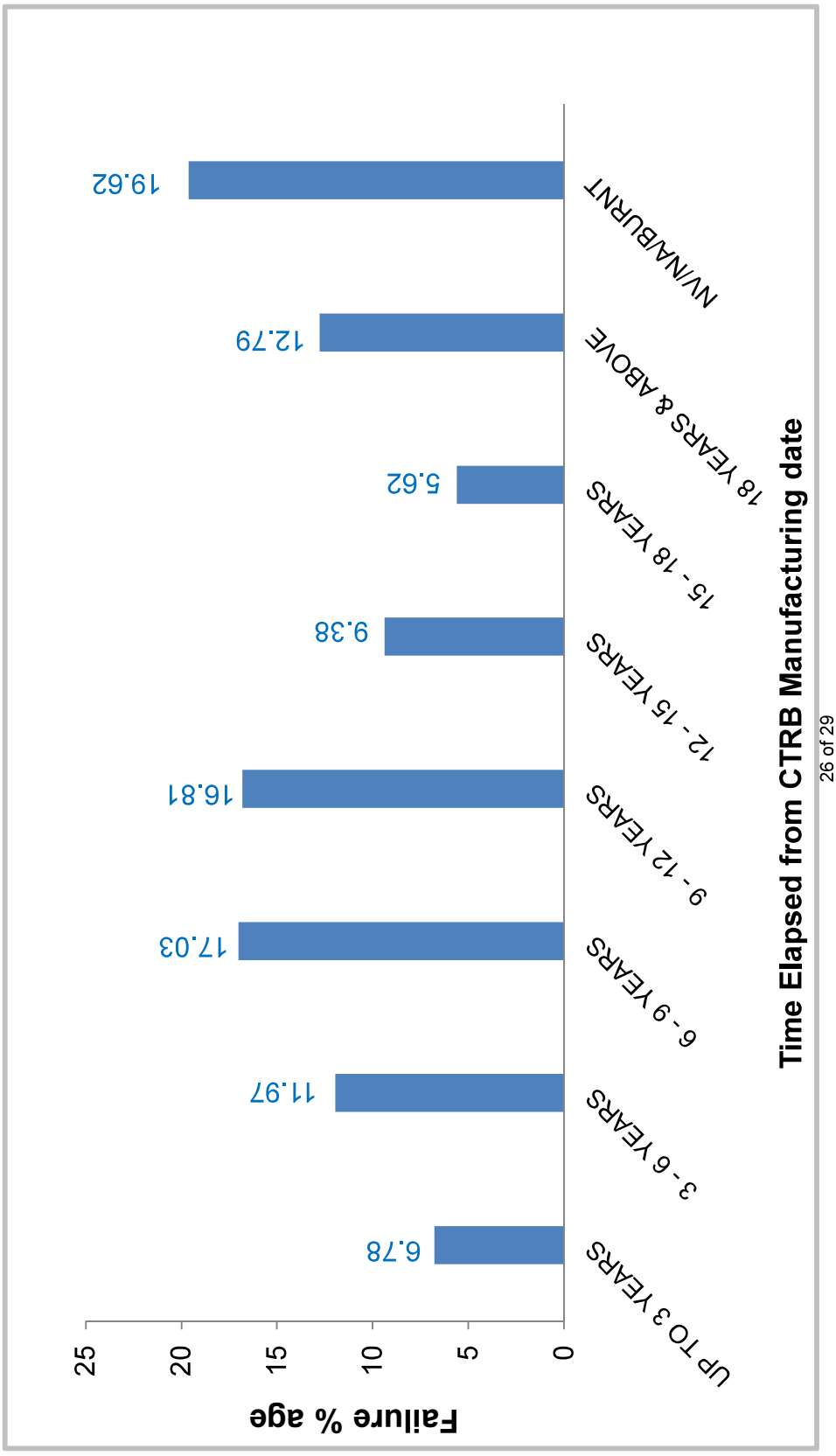
Annexure – 2(B)

Age wise rejection of CTRB Cups & Cones in Workshops - 2012-2022 (up to Dec, 2021)



Annexure – 3

CTRB failure w.r.t time elapsed from CTRB manufacturing date – 2016-2022 (up to Dec, 2021)



Annexure-4

Proforma to be filled in case of CTRB failure of Freight			
1	Occurrence particulars	Case- 1	Case- 2
(a)	Date of failure		
(b)	Station		
(c)	Section		
(d)	Division		
(e)	Rly.		
2	Train particulars		
(a)	Train No.		
(b)	Load		
(c)	Type of Rake		
(d)	Last Examination station		
(e)	Last Examination Date		
(f)	BPC No.		
3	Failure Particulars		
(a)	Place of failure detection		
(b)	Whether failure resulted in derailment?		
(c)	How failure detected?		
(d)	Prima facie cause of failure		
4	Wagon Particulars		
(a)	No.		
(b)	Type		
(d)	Name of Wagon builder		
(e)	Built Year		
(f)	Last POH Date		
(g)	Last POH shop		
(h)	R/Date		
(i)	Last ROH Date		
(j)	Last ROH Depot		
(k)	Whether overdue POH/ROH		
(l)	Position of affected wagon (from loco)		
(m)	Tare/CC of wagon		
(n)	Loaded/ Empty		
(n)	Commodity loaded		
5	Bearing Particulars		
A	Affected End		
(a)	Type of Bearig		
(b)	Bearing cup make		
(c)	Sr. No. of Cup		
(d)	Mfg. date of Cup		
(e)	Type of Grease Seal		
(f)	Grease Seal make		
(g)	Grease Seal Mfg. date		
(h)	(i) POH particulars marked on backing ring or (ii) Grease seal manufacturing date, if (i) is illegible		

(i)	Marking of mounting particulars on outer Cup of CTRB if mounted by ROH depot		
(j)	Whether colour of End Cap is Aircraft Blue		
B	Other End		
(a)	Type of Bearing		
(b)	Bearing Cup Make		
(c)	Sr. No. of Cup		
(d)	Mfg. date of Cup		
(e)	Type of Grease Seal		
(f)	Grease Seal Make		
(g)	Grease Seal Mfg. date		
(h)	(i) POH particulars marked on backing ring or (ii) Grease seal manufacturing date, if (i) is illegible		
(i)	Marking of mounting particulars on outer Cup of CTRB if mounted by ROH depot		
(j)	Whether colour of End Cap is Aircraft Blue		
6	Bearing Condition		
(a)	Rollers/cone Assembly		
(b)	Cup		
(c)	Grease		
(d)	Grease Seals		
(e)	End Cap Screws		
(f)	Locking plate & Tabs		
7	Condition of Adapter		
(a)	Whether canted/displaced		
(b)	Availability of adapter retaining bolt in wide jaw		
(c)	Whether in service limit		
(d)	Name of manufacturer		
(e)	Manufacturing Date		
8	Bogie Particulars		
(a)	Wide jaw/ Narrow jaw		
(b)	Name of manufacturer		
(c)	Manufacturing Date		
(d)	Sr. No.		
9	Wheel set Particulars		
(a)	Date of failure		
(b)	Date of intimation to POH/ROH depot (as applicable)		
(c)	Date of wheel set sent to POH/ROH depot		
(d)	Marking on wheel disc by red paint (both side)		
(e)	Investigation done by POH/ROH depot		
(f)	Any flat place in wheel		
(g)	Wheel tread diameter		

(h)	Whether affected wheel changed in sick line after POH/ROH		
(i)	Position of affected wheel in wagon		
(j)	Journal Stamping particulars		
(k)	UST particulars		
(l)	Name of Axle manufacturer		
(m)	Axle No.		
(n)	Axle journal diameter		
10	Failure Analysis		
(a)	Whether warranty claim lodged? (if applicable) if yes, details to be given		
(b)	Whether CMT/ joint investigation done? If yes, details to be given		
(c)	Concluded Cause of failure		
11	Responsibility		
12	Responsible Workshop/Depot & Rly / Manufacturer etc		
13	Action Taken		
14	Reporting Officer		