READINGS ON REPORT OF

HIGH LEVEL SAFETY REVIEW COMMITTEE, 2012

(KAKODKAR COMMITTEE REPORT, 2012)

COMPILED AND COMMENTED BY

Hari Shankar Verma, IRTS

Director General, IRITM



भारतीय रेल परिवहन प्रबंधन संस्थान

INDIAN RAILWAYS INSTITUTE OF TRANSPORT MANAGEMENT

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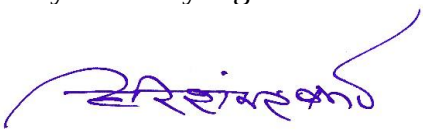
The report of High-Level Safety Review Committee, popularly known as Kakodkar Committee, 2012 is the reading material to the faculty and trainee officers, who are undergoing training in safety related courses at IRITM. Therefore, the report is being printed in readable format. The style of original presentation of report has been changed to accommodate it in book form, certain grammatical mistakes have been corrected, the tables have been re-drawn to accommodate in a A5 format thus there may be some variation in presentation, but content remain the same. The page numbering of various paragraph of report has completely changed and wherever, report is lengthy then same is split-ed into various chapter. However, the efforts have been made to keep the report as original as possible however, there may be some variance as the content of report has been taken from different authentic websites and links, but no authenticity can be claimed as report was not intended to us. Several chapters have been added by undersigned for better understanding of the report. The views expressed in those chapters and content of report are not the views of Central Government and Authors of Report. This Volume is to be used for learning and academic purpose only and not to be taken as an authentic document. While, reading the report, the reader must keep in mind as under:

1. This report is printed as reading material for the purpose of training and learning by trainee officers.
2. The reading material is always prepared after reading several codes, manuals, and other relevant information from authentic Railway sources. It's for training purpose

and nothing to do with actual working of Railways in field.

3. In case, any contradiction in writing, readers are advised to follow the codes, manuals and other extent instructions of Ministry of Railway and Zonal Railway.
4. We have tried to remain to the point, but it is the responsibility of the trainer to prepare the digital content specially PowerPoint presentation, etc. as per latest guideline.
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Hari Shankar Verma, IRTS
Director General, IRITM,
compiler and commentator of High Level Safey Review Committee Reports as reading material at IRITM

FOREWORD

PREFACE

Safety is integral part of railway operation. Since laying of first line of railway track, the Indian Railways is always in total commitment to provide safe, efficient, and economical rail transport in country. If any accident happens on railway system, it put question mark on safe railway working to a common man, but it majorly affects the moral and confidence among railwaymen. The management and staff are always in thought process in improving safety of railway journey.

The training of railway staff and officers is greatly consisting of safety rules. There is no discipline in railways, where safety in rail transportation and maintenance is not taught. At Indian Railways Institute of Transport Management (IRITM), we conduct regular classes to the officers and senior supervisors about the safety and encourage the trainee officers to read and learn the material available in the library about safety.

The primary source of learning in safety are General & Subsidiary Rules (G&SR), several codes and manual, accident reports given by commissioners of railway safety and reports of past Railways Accident Enquiry Committee. Most of the literature is available with the library but Accident Enquiry Reports are not available in physical form and there is no analysis of these reports in condensed form.

It is not possible by everyone to go through these reports in various digital platforms and read them. Some of the reports are also not available digitally also and most of them are not in readable format. Secondly, the Accident Enquiry Reports are also having historical

importance to learn from our past and not to repeat the same mistakes in future.

The recommendations given by Accident Enquiries Committees are not subject to agree by Railway Administration at that time but those carry immense value for further study and improvement in our working. Most of the reports are prepared by best of mind during that time and worth for reading. The railway is dynamic organization which keep changing its technology over the time with progress of technology but the lesson about the safety remains the same therefore it is always needed to learn the things from past also.

In order to prepare reading materials to the probationary officers and in-service officers, I have read most of the reports and strongly feel that all railway officers who are working with the safety and also the officers who are holding the administrative post like Additional Divisional Railway Manager (ADRM), Divisional Railway Managers (DRMs), Principal Head of the Department (PHODs), Additional General Managers (AGMs), General Managers (GMs) and officers in Railway Board, who are in policy making must read these reports.

As a mission mode, IRITM is compiling and printing all Accident Enquiry Reports in book form for easy reading and also put digital format of the same in IRITM website to encourage and facilitate about reading of these reports. The reports would also help the researcher and policy maker to draw the policies for making Indian Railways as one of the best safe Railway systems in the world.

So far Indian Railways had constituted six safety

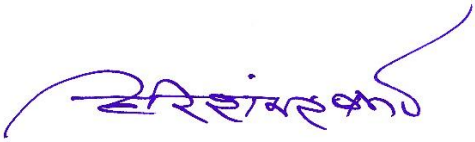
review committees since independence. The purpose of constitution of these safety review committee was to study in deep about the causes leading to railway accident and how to strengthen rail safety. The list of committees which had been formed by Ministry of Railway is as under:

1. The Railway Accidents Enquiry Committee, 1954 (Shahnawaz Committee 1954)
2. The Railway Accidents Committee, 1962 (Kunzru Committee1962)
3. The Railway Accidents Inquiry Committee, 1968 (Wanchoo Committee 1968)
4. The Railway Accidents Enquiry Committee, 1978 (The Sikri Committee 1978)
5. The Railway Safety Review Committee (Khana Committee) (The Khanna Committee 1998)
6. High-Level Safety Review Committee 2012 (Kakodkar Committee)

High-Level Safety Review Committee, 2012 is the latest committee chaired by Dr. Anil Kakodkar. The committee is most important as it was constituted with scientists and technocrats, who were the pioneers in their respective fields while previous committees were headed by retired supreme court judges except Shahnawaz and Kunzru Committee who were headed by parliamentarians and law makers.

I would like to put on record the hard work done by Mr. Rohit Yadav for typing and for formatting, proofreading, and converting it into printable format. I am also grateful to Shri Rajesh Kumar, IRTS, Sr.

Professor Administration and Miss Krishna Tiwari, IRTS, Professor Administration and OSD to Undersigned for getting it published.



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Director General
Indian Railways Institute of Transport Management (IRITM),
Lucknow, UP, India.

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(EDITED IN DETAIL WITH READABLE FORMAT)

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BACKGROUND,
PROFILES OF CHAIRMAN AND MEMBERS,
ANALYSIS OF RAILWAY ACCIDENTS,
AND ANALYSIS OF RECOMMENDATIONS OF

HIGH LEVEL SAFETY REVIEW COMMITTEE 2012:
(KAKODKAR COMMITTEE 2012)

BACKGROUND OF
CONSTITUTION OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: DR. KAKODKAR REPORT, 2012

I

Indian Railways is one of the largest railway systems in the world and is fully owned and operated by Ministry of Railways, Government of India. It plays a significant role in driving economic growth of the country, offering highly affordable, environment-friendly transportation to passengers and freight, especially bulk commodities, across the country. Indian Railways, like any other transportation system, is technology intensive not only for ensuring high productivity of its assets but also safety in train operations.

The Ministry of Railways have earlier constituted the Khanna Committee 1998, the Sikri Committee 1978, Wanchoo Committee 1968, Kunzru Committee1962 and Shahnawaz Committee 1954.

The constitution of High-level Safety Review Committee was announced by the Minister of Railways, Shri Dinesh Trivedi, on 16.09.2011 to examine aspects connected with Signalling Systems, Rolling Stock (of all types), Fixed Structures (Tracks, Bridges and OHE), Human Resource Development with emphasis on Training, Education and Research, Need for a Third Party Audit,

Organizational and structural changes in RDSO and in any other department, and improvements in procedural system and improvement in procedures and systems and any other item/modification which the Committee may desire.

He has further informed that The Committee would lay down the road map on safety related issues which need to be addressed in the short term and the long term and would give invaluable recommendations which would have a significant bearing on further improvement in the systems and protocols. Indian Railways would make all efforts to address the recommendations of the High-Level Committee with a view to achieve further improvement in the safety environment on the Indian Railways.

The backdrop behind constitution of the committee was an accident of Kalka Mail in July 2011 near Kanpur on North Central Railway involving 70 casualties and also the collision near Arakonnam on Southern Railway involving 10 causalities has necessitated a holistic assessment of further additional measures which can be adopted to further enhance the safety environment on the Indian Railways.

It is pertinent to mention that 57 consequential accidents have occurred in the financial year i.e. from 1st April to 15th September 2011 in comparison to 65 accidents in the corresponding period of the previous year, which included 23 incidents at unmanned level crossing gates in each of these two years. As far as Indian Railways is concerned, there can be no tolerance even for a single accident involving loss of human life but the substantial growth in the passenger and freight traffic handled by the system does definitely put considerable strain on the infrastructure which needs to be addressed progressively.

The honorable Minister of Railway had announced that the committee will be headed by Dr. Anil Kakodkar, Former Chairman of Atomic Energy Commission, and assisted by Dr. N. Vedachalam

of Vikram Sarabhai Space Center, Thiruvananthapuram, Prof. Sanjay Dhande, Director IIT Kanpur and Sh. G.P. Srivastava Director E&I Group, Bhabha Atomic Research Centre. Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation has kindly consented to act as the Advisor to the Committee.

Accordingly, the Committee has been constituted as under:

1. Dr. Anil Kakodkar, former Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy (Chairman)
2. Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation (Adviser).
3. Dr. N. Vedachalam, Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, (Member)
4. Prof. Sanjay Dhande, Director, IIT, Kanpur, (Member)
5. Shri G.P. Srivastava, Director E & I Group, Bhabha Atomic Research Centre (BARC), (Member)
6. Shri Amitabh, SAG/IRSME, Chief Rolling Stock Engineer, Northern Railway, (Secretary)

Press Information Bureau
Government of India
Ministry of Railways

16-September-2011 14:44 IST

Railways Constitutes High Level Safety Review Committee
Safety Accorded Highest Priority, Dinesh Trivedi

The Minister of Railways, Shri Dinesh Trivedi, at a press conference here today, announced the constitution of a High-Level Safety Review Committee. The committee comprising of eminent persons/experts in technical and high-end technology related fields with experience and expertise in a managing innovation in technology and change will also provide a valuable independent outsiders' view in respect of the system and protocols. Present on the occasion among others were the Minister of State for Railways Shri Bharatsinh Solanki, Chairman Railway Board, Shri Vinay Mittal, Board Members and three members of the new committee.

The Committee will be headed by Dr. Anil Kakodkar, Former Chairman of Atomic Energy Commission, and assisted by Dr. N. Vedachalam of Vikram Sarabhai Space Center, Thiruvananthapuram, Prof. Sanjay Dhande, Director IIT Kanpur and Sh. G.P. Srivastava Director E&I Group, Bhabha Atomic Research Centre. Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation has kindly consented to act as the Advisor to the Committee.

Based on the accidents and their consequences witnessed in the recent past, the Committee would examine aspects connected with Signalling Systems, Rolling Stock (of all types), Fixed Structures (Tracks, Bridges and OHE), Human Resource Development with emphasis on Training, Education and Research, Need for a Third Party Audit, Organizational and structural changes in RDSO and in any other department, and improvements in procedural system and improvement in procedures and systems and any other item/modification which Committee may desire.

The Committee would lay down the road map on safety related issues which need to be addressed in the short term and the long term and would give invaluable recommendations which would have a significant bearing on further improvement in the systems and protocols. Indian Railways would make all efforts to address the recommendations of the High-Level Committee with a view to achieve further improvement in the safety environment on the Indian Railways.

Safety in train operations is accorded the highest priority by Indian Railways and all measures are being taken on a continual basis to prevent accidents and enhance safety.

Despite the fact that safety record of Indian Railways has shown considerable improvement progressively, with the number of train accidents decreasing from over 2000 in 1960-61 to 473 in 2000-01 and further to 141 in 2010-11, with a corresponding reduction in the accidents per million train kilometers (globally accepted index of safety) from 5.50 in 1960-61 to 0.65 in 2000-01 and further to 0.15 in 2010-11, we in the Railways are seriously concerned with any accident, particularly an accident involving

loss of human lives.

The recent accident of Kalka Mail in July 2011 near Kanpur on North Central Railway involving 70 casualties and also the collision near Arakonnam on Southern Railway involving 10 causalities has necessitated a holistic assessment of further additional measures which can be adopted to further enhance the safety environment on the Indian Railways. It is pertinent to mention that 57 consequential accidents have occurred in the current financial year i.e. from 1st April to 15th September 2011 in comparison to 65 accidents in the corresponding period of the previous year, which included 23 incidents at unmanned level crossing gates in each of these two years.

As far as Indian Railways is concerned, there can be no tolerance even for a single accident involving loss of human life but the substantial growth in the passenger and freight traffic handled by the system does definitely put considerable strain on the infrastructure which needs to be addressed progressively. In the previous decade, the total number of average passenger and freight trains run daily on the Indian Railways' system have increased by 30% from around 14,000 to almost 19,000. These include over 12,000 passenger carrying trains. The number of passengers carried have increased by almost 50% from around 4800 to 7200 million with a growth of almost 90% originating freight traffic from 473 million tonnes to 888 million tonnes. Indian Railways have in fact added over 450 trains including 325 passenger and 125 freight services in the last decade i.e. 2001- 2010, to run on a daily basis as compared to only 30 daily trains added per year in the previous decade i.e. 1990-2000.

It has been Indian Railways' constant endeavour to upgrade its infrastructure for meeting the safety requirement for handling the exponential growth of traffic. Pin pointed safety measures like up gradation of track structure, mechanized maintenance of track, improvement in welding technology, large scale track circuiting, introduction of electrical/electronic signaling systems, advanced monitoring systems such as axle counters, vigilance control devices on locomotives, improvement in rolling stock such as introduction of LHB type coaches and improvement in freight stock with air brake systems, upgraded design of locomotives, improvement of training methodology have received undivided focus and attention.

In view of the extreme demand on the Indian Railways' system, both in respect of infrastructure as also skilled manpower directly connected with safety on the railways arising out of the aspirations of the general public and public representatives and with a view to ensure that safety is given overriding priority and no aspect connected with safety escapes attention, the need was felt for an objective assessment and validation of time tested systems and protocols in vogue on Railway system. In pursuance of these objectives, the above-mentioned High-Level Safety Review Committee has been constituted by the Ministry of Railways.

AKS/HK/LK/T R

PROFILES OF CHAIRMAN
AND MEMEBERS OF HIGH-LEVEL SAFETY RAILWAY COMMITTEE

II

He will head Rail safety committee as per Rail budget speech by Railway Minister in 2012.

The Committee Members are as under:

1. Dr. Anil Kakodkar, former Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy (Chairman)
2. Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation (Adviser).
3. Dr. N. Vedachalam, Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, (Member)
4. Prof. Sanjay Dhande, Director, IIT, Kanpur, (Member)
5. Shri G.P. Srivastava, Director E & I Group, Bhabha Atomic Research Centre (BARC), (Member)
6. Shri Amitabh, SAG/IRSME, Chief Rolling Stock Engineer, Northern Railway, (Secretary)

Dr. Anil Kakodkar, Chairman, High-Level Safety Railway Committee



Dr. Anil Kakodkar is an Indian nuclear physicist and mechanical engineer. He was the chairman of the Atomic Energy Commission of India and the Secretary to the Government of India, he was the Director of the Bhabha Atomic Research Centre, Trombay from 1996 to 2000. He was awarded the Padma Vibhushan, India's second highest civilian honour, on 26 January 2009.

Apart from playing a major role in India's nuclear tests asserting sovereignty, Kakodkar champions India's self-reliance on thorium as a fuel for nuclear energy.

Kakodkar was born on 11 November 1943 in Barwani princely state (present day Madhya Pradesh state) to Kamala Kakodkar and Purushottam Kakodkar, both Gandhian freedom fighters. He had his early education at Barwani and at Khargone, until moving to Mumbai for post-matriculation studies.

Kakodkar graduated from Ruparel College, then from VJTI, University of Mumbai with a degree in Mechanical Engineering in 1963. He joined the Bhabha Atomic Research Centre (BARC) in 1964. He obtained a master's degree in experimental stress analysis from the University of Nottingham in 1969.

He joined the Reactor Engineering Division of the BARC and played a key role in the design and construction of the Dhruva reactor, a completely original but high-tech project. He was a part of the core team of architects of India's Peaceful Nuclear Tests in 1974 and 1998. Further he has led the indigenous development in India's Pressurized Heavy Water Reactor Technology. He worked

in the rehabilitation of the two reactors at Kalpakkam and the first unit at Rawatbhata, which at one stage were on the verge of being written off.

In 1996 he became Director of the BARC and since 2000 he has been leading the Atomic Energy Commission of India and also is the secretary of the Department of Atomic Energy. He has published over 250 scientific papers.

He believes that India should be self-reliant in energy, especially by use of the cheap national thorium resources. He continues to engage in designing the Advanced Heavy Water Reactor, that uses thorium-uranium 233 as the primary energy source with plutonium as the driver fuel. The unique reactor system, with simplified but safe technology, will generate 75 per cent of electricity from thorium.

Other positions

- Kakodkar is a member of many boards, commissions, and other organizations. Some of them are:
- Chairman, Board of Governors of the Indian Institute of Technology, Bombay – 2006–15.
- Chairman, Board of Directors of Maharashtra Knowledge Corporation Limited, Pune (current).
- Member, Atomic Energy Commission
- Member, ONGC Energy Centre Trust
- Chairman, empowered committee on IIT reforms
- Presently updated April-2014 he is serving as a director on the central board of Reserve Bank of India.
- He is a Fellow of the Indian National Academy of Engineering and served as its president during 1999–2000.
- He is a Fellow of the Indian Academy of Sciences, the National Academy of Sciences, India, and the Maharashtra Academy of Sciences.
- He is a member of the—International Nuclear Energy Academy and Honorary member of the World Innovation

Foundation. He was member of the International Nuclear Safety Advisory Group (INSAG) during 1999–2002

- He is on the board of Governors of VJTI, Mumbai
- He will head Rail safety committee as per Rail budget speech by Railway Minister in 2012
- He is chairman Rajiv Gandhi Science and Technology Commission, Government of Maharashtra, Mantralaya, Mumbai.
- He is chairman of steering and monitoring committee of Biomedical Engineering and Technology (incubation) Centre, a network of 11 engineering and medical institutes for medical device innovation.
- He is chairperson of Dr. B R Ambedkar National Institute of Technology, Jalandhar.
- He is Chairman of Maharashtra Knowledge Corporation Limited

Awards

National awards

- Padma Shri in 1998
- Padma Bhushan in 1999
- Padma Vibhushan in 2009

Other awards

- Highest civilian award of the Maharashtra state-Maharashtra Bhushan Award (2011–2012)
- Highest civilian award of the Goa state-Gomant Vibhushan Award (2010)
- Hari Om Ashram Prerit Vikram Sarabhai Award (1988)
- H. K. Firodia Award for Excellence in Science and Technology (1997)
- Rockwell Medal for Excellence in Technology (1997)
- FICCI Award for outstanding contribution to Nuclear Science and Technology (1997–98)
- ANACON – 1998 Lifetime Achievement Award for Nuclear Sciences
- Indian Science Congress Association's H. J. Bhabha Memorial Award (1999–2000)
- Godavari Gaurav Award (2000)

- Dr. Y. Nayudamma Memorial Award (2002)
- Chemtech Foundation's Achiever of the Year Award for Energy (2002)
- Gujar Mal Modi Innovative Science and Technology Award in 2004.
- Homi Bhabha Lifetime Achievement Award 2010.
- Acharya Varahmihir Award (2004) by Varahmihir Institute of Scientific Heritage and Research, Ujjain (M.P.), India

Elattuvalapil Sreedharan
Member, High-Level Safety Review Committee



Elattuvalapil Sreedharan (Popularly E. Sreedharan) is an Indian engineer and politician from the Indian state of Kerala and credited with changing the face of public transport in India with his leadership in building the Konkan Railway and the Delhi Metro while he served as the managing director of Delhi Metro Rail Corporation (DMRC) between 1995 and 2012. Known as the Metro Man, he was awarded the Padma Shri by the Government of India in 2001, the Padma Vibhushan in 2008, the Chevalier de la Legion of Honour in 2005 by the Government of France and was named one of Asia's Heroes by Time magazine in 2003.

Sreedharan was appointed by the former UN Secretary General Ban Ki-moon to serve on the United Nations's High Level Advisory Group on Sustainable Transport (HLAG-ST) for a period of three years in 2015. He is a member of Mata Vaishno Devi Shrine Board. He briefly served as a national executive council member of Bharatiya Janata Party, but later quit active politics in December 2021. he also worked as an advisor of Dhaka metro authority which is called Dhaka mass transit company limited under the railway ministry of people's republic of Bangladesh.

E. Sreedharan was born on 12 June 1932 in present-day

Karukaputhur, Palakkad District, Kerala, India into a Hindu Malayali family to Keezhveettil Neelakandan Moosath and Ammaluamma.

Sreedharan's primary education was from Government Lower Primary School Chathannur near Pattambi in Palakkad district. He completed his education at the Basel Evangelical Mission Higher Secondary School and then went to the Victoria College in Palghat. He later-on completed his Civil Engineering degree from the Government Engineering College, Kakinada, Andhra Pradesh, presently known as Jawaharlal Nehru Technological University.

For a short period, Sreedharan worked as a lecturer in Civil engineering at the Government Polytechnic, Kozhikode, and a year at the Bombay Port Trust as an apprentice. He subsequently joined the Indian Railway Service of Engineers (IRSE), after clearing the Indian Engineering Services Exam in 1953 conducted by the UPSC. His first assignment was in the Southern Railway as a Probationary Assistant Engineer in December 1954.

In December 1964, a cyclone washed away parts of Pamban Bridge that connected Rameswaram to mainland Tamil Nadu. The Railways set a target of six months for the bridge to be repaired while Sreedharan's boss, under whose jurisdiction the bridge came, reduced it to three months. Sreedharan was put in-charge of the execution, and he restored the bridge in just 46 days. The Railway minister's Award was given to him in recognition of this achievement.

Kolkata Metro

In 1970, as the deputy chief engineer, he was put in charge of the implementation, planning, and design of the Calcutta metro, the first ever metro in India. Sreedharan not only completed this much heralded project but also laid down the foundation of modern infrastructure engineering in India. He was taken off this post in

1975.

Cochin Shipyard Limited

When Sreedharan joined the Cochin Shipyard in October 1979, it was undergoing a phase of unproductivity. The production of its first ship MV Rani Padmini had been delayed for a long period. When Sreedharan took over, he turned the fortunes of the shipyard around and made sure its first ship was built while he was its chairman and managing director (CMD). In 1981, under Sreedharan's leadership, the shipyard launched its first ship, the MV Rani Padmini.

Konkan Railway

He was promoted as general manager, Western Railway in July 1987, and in July 1989 elevated to the post of Member Engineering, Railway Board, and ex-officio Secretary to the Government of India.

On his retirement in June 1990, the Government made it clear it still needed his services and he was appointed the CMD of Konkan Railway on contract in 1990 by the then railway minister, George Fernandes. Under his stewardship, the company executed its mandate in seven years. The project was unique in many respects. It was the first major project in India to be undertaken on a BOT (Build-Operate-Transfer) basis; the organization structure was different from that of a typical Indian Railway set-up; the project had 93 tunnels along a length of 82 km and involved tunnelling through soft soil. The total project covered 760 km and had over 150 bridges. That a public sector project could be completed without significant cost and time overruns was considered an achievement by many. Konkan Railway has been covered in the Extreme Railways program by Chris Tarrant as one of the most difficult railway projects to have been constructed in the world.

Delhi Metro

He was made the managing director of Delhi Metro Rail Corporation by then Delhi Chief Minister Sahib Singh Verma and by mid-1997 all the scheduled sections were completed by their target date or before, and within their respective budgets. Sreedharan was given the sobriquet of Metro Man by the media for his grand success in executing the completion of the Delhi Metro. His stint in the Delhi Metro has been considered so successful and crucial to India that in 2005, he was awarded the Chevalier de la Légion d'honneur (Knight of the Legion of Honour) by the government of France, and the Padma Vibhushan by the government of India in 2008. There were also demands by prominent political figures that Sreedharan be awarded the Bharat Ratna, the most prestigious civilian award in India. He was particularly known for isolating his projects from political pressures and influences and winning political commitments for fast execution of projects. He had announced that he would retire by the end of 2005, but his tenure was further extended to oversee the completion of the second phase of Delhi Metro. After 16 years of service with the Delhi Metro, Sreedharan retired from service on 31 December 2011.

Kochi Metro

After his retirement from DMRC, Sreedharan was appointed as Principal Advisor of the Kochi Metro Rail Project. Initially, the project faced hurdles when a controversy broke out with the government announcing a global tender process for Kochi Metro, rather than letting DMRC handle the consultancy and project execution as Sreedharan and DMRC had initially asked for. Vested interests in the government have been alleged in this decision. However, several political parties came out in opposition to the move and backed Sreedharan's decision in enforcing DMRC's role in the Kochi Metro, after which the government reversed its stance.

Kochi metro was finally unveiled on 17 June 2017 amidst many celebrations. The unveiling of the metro was considered a landmark event in India in terms of completion time, control systems used and initiatives such as employing transgender people, vertical gardening, respecting migrant labourers, and use of solar power.

Lucknow Metro

Mr. Sreedharan has also been appointed as Chief Advisor for the Lucknow Metro. As per E. Sreedharan, Kochi metro was built in four years whereas Lucknow Metro will be completed in a period of two years and nine months, and that would be the fastest in India and the world till now.

Other Metros

He has been advising for the Jaipur Metro as well as DMRC has undertaken its implementation. He has also been appointed as advisor for a proposed Metro rail system in Andhra Pradesh in the Visakhapatnam and Vijayawada (VGTM) areas, under the leadership of the Chief Minister Chandrababu Naidu. He has also been advisor for Coimbatore Metro.

Awards and accolades

- Railway Minister's Award (1963)
- Padma Shri by the Government of India (2001)
- Man of the Year by The Times of India (2002)
- Om Prakash Bhasin Award for professional excellence in engineering (2002)
- CII (Confederation of Indian Industry) Juror's Award for leadership in infrastructure development (2002–03)
- One of Asia's Heroes by TIME (2003)
- AIMA (All India Management Association) award for Public Service Excellence (2003)
- Degree of Doctor of Science (Honoris causa) from IIT Delhi.
- Dr. Y. Nayudamma Memorial Award
- Bharat Shiromani award from the Shiromani Institute, Chandigarh (2005)
- Chevalier de la Légion d'Honneur (Knight of the Legion of Honour) by the government of France (2005)
- Qimpro Platinum Standard (Business) National Statesman for Quality in India

(2007)
- CNN-IBN Indian of the Year 2007: Public Service (2008)
- Padma Vibhushan by the Government of India (2008)
- D.Litt by Rajasthan Technical University, Kota, Rajasthan, in 2009
- Degree of Doctor of Philosophy (Honoris causa) from IIT Roorkee, 2009.
- Honorary doctorate by Cochin University of Science and Technology in 2010.
- Newsmaker of the Year by Manorama News in 2012.
- Sree Chithira Thirunal National Award, 2012
- SR Jindal Prize (honorary) awarded by Sitaram Jindal Foundation in 2012.
- TKM 60 Plus award for Lifetime achievement, 2013 by TKM College of Engineering.
- Degree of Doctor of Science (Honoris Causa) by Mahamaya Technical University on its first convocation (2013)
- Rotary International for the sake of Honour Award (2013)
- Lifetime Achievement Governance Award by Grifles, 2013
- Order of the Rising Sun, Gold, and silver star by Government of Japan (2013)
- KPP Nambiar Award by IEEE Kerala Section (2017)
- Lifetime achievement award by Project Management Associates (PMA) India (2019)

Nagarajan Vedachalam
Member, High-Level Safety Review Committee



Nagarajan Vedachalam is an Indian space scientist, K. R. Ramanathan Distinguished Professor of the Department of Space, and distinguished scientist emeritus of Indian Space Research Organization, known for his contributions to Indian space programme. He is a former director of the Liquid Propulsion Systems Centre that developed the cryogenic engine of the Geosynchronous Satellite Launch Vehicle (GSLV) and is reported to have been associated with over 100 space programmes of ISRO. He continues to sit on many committees of the Department of Space though officially retired from ISRO service as the director

of ISRO Inertial Systems Unit (IISU) and holds several patents for his innovations.

Vedachalam, a recipient of the degree of Doctor of Science (Honoris Causa) from the Madurai Kamaraj University, was honoured by the Government of India in 2003 with Padma Shri, the fourth highest Indian civilian award.

Sanjay Govind Dhande
Member, High-Level Safety Review Committee



Sanjay Govind Dhande is an Indian Mechanical engineer and educationist. He is alumnus of college of engineering Pune. He was Director of the Indian Institute of Technology Kanpur and was in temporary charge of the Indian Institute of Information Technology and Management Gwalior. From the year 2016 to 2020, Professor Dhande was the Chairman, Board of Governors of National Institute of Industrial Engineering (NITIE), Mumbai, an Institute established by the Government of India in the year 1963. He was also Chairman, Board of Governors of National Institute of Technology Delhi (NIT Delhi). Professor Dhande was the founder director of Indian Institute of Information Technology, Design and Manufacturing, Jabalpur. He served as a part-time member of Telecom Regulatory Authority of India. Also, he was a member of the Scientific Advisory Council to the Prime Minister of India.

Dhande has worked in the field of Computer Aided Design, Rapid Prototyping, Rapid Tooling and Reverse Engineering. AUTOLAY, an innovative CAD technology, that he developed for the Indian

Aeronautical Development Agency is used by several aircraft manufacturers around the world and for the construction of light combat aircraft in India.

Indian Institute of Information Technology, Design and Manufacturing, Jabalpur is a beneficiary of the protocol signed by the Prime Ministers of India and Japan. Dhande has established another new institute, the Indian Institute of Saddlery Technology and Export Management (IISTEM) at Banther near Kanpur under the aegis of the Indian Ministry of Commerce and Industry, in order to develop the traditional technology available in the region.

He has been assisting the Indian government by preparing the vision documents and charters for the Indian Institutes of Science for Education & Research (IISER) at Pune and Kolkata.

He is honored with Padma Shri in 2013.

In 2014, Professor Dhande founded Mahindra Ecole Centrale, College of Engineering at Hyderabad and left the college in 2015.

Awards and honours

1. (1963) "Best Outgoing Student of the class of '63 at Modern High School", Poona, India.
2. (1967) "Mr. D.P. Joshi and Mrs. J.D. Joshi Scholarship", Poona University.
3. (1968) "Mr. A.V.H. Pearce Scholarship", Poona University.
4. (1968) "Mr. D.P. Joshi and Mrs. J.D. Joshi Scholarship", Poona University.
5. (1968) "Kirloskar Brothers Ltd. Scholarship", Poona University.
6. (1968) "Best Student Award", Rotary Club, Poona.
7. (1969) "Principal G.K. Ogale Memorial Prize", Poona University.
8. (1969) "Gold Medal Award of the Institute of Engineers (India) for the overall performance in the Bachelor of Engineering programme".

9. (1987) "Distinguished Lecturer", Computer Society of India.
10. (1987) "Selected as a member of the TC 5.2 Working Group on CAD and Graphics of the International Federation of Information Processing (IFIP)", Zurich, Switzerland
11. (1990) "Distinguished Instructor (ME 5984, 89-90 / II, Virginia Tech)"
12. (1992) "Procter & Gamble Best Paper Award (jointly with Paul Tidwell", Charles Reinholtz et al.), ASME Conference.
13. (1996) "Distinguished Tutor (TA 101, 95-96 / II, IIT Kanpur)"
14. (1996) "Distinguished Teacher (TA 101, 96-97 / I & 96-97 / II, IIT Kanpur)"
15. (1997) "Distinguished Alumnus Award", College of Engineering, Poona University.
16. (2001) Elected as a Fellow of the Maharashtra Academy of Sciences.
17. (2002) Elected as a Fellow of the Indian National Academy of Engineering, New Delhi
18. (2003) Elected as a Fellow of the IETE, India.
19. (2006) Elected as a Fellow of The Institution of Engineers (India).

ANALYSIS OF RAILWAY ACCIDENTS
BYHIGH-LEVEL SAFETY REVIEW COMMITTEE: DR. KAKODKAR REPORT, 2012

III

Indian Railway is a vast system comprising of nearly 64000 route kilometers with over 7000 block stations and holding nearly 9000 locomotives, 43500 Passenger coaches, The Committee analyzed data of consequential train accidents on IR to have an insight into the weak areas leading to accidents. The Committee is also seized of the fact that the data maintained in the Railway Board office pertains to only those train accidents with apparent consequences and train accidents of minor nature and near misses are not included in the figures. Further, the Committee learnt that casualties due to trespassing of railway track, or for other reasons connected with railway infrastructure and casualties of IRs own staff while on duty, though quite substantial, are not included in the statistics of train accident-related casualties.

The casualties of Railways own staff while on duty were collected from Zonal Railways and the position is markedly high. About 1600 railway staff were killed and 8700 injured while working during the period from 2007-08 to October 2011 which is substantially more than 1019 deaths and 2118 injuries in train accidents for the period

from 2007-08 to 2010-11. It is to be noted that casualties in train accidents include a large chunk of 723 deaths and 690 injuries due to unmanned level crossing accidents attributed to the negligence of road users. Departments that contributed maximum are engineering track with 1100 deaths and 2070 injuries and Mechanical with 110 deaths and 4900 injuries. Mechanization of track and other maintenance is one solution to reduce human presence in high-risk areas of railway working. Overall, Casualties in train accidents and for other reasons due to railway infrastructure remain a serious cause of concern.

Consequential Train Accidents

Total Consequential train accidents have come down from 195 in 2006-07 to 141 in 2010-11 and consequential train accidents per million train Kilometer have also come down from 0.23 to 0.15 during this 5-year period.

Type Wise Accidents

Derailments constitute the largest chunk of 50% of total accidents followed by 36% accidents at unmanned level crossing gates, 5% collisions, 4% accidents at manned level crossing gates, 2% fire accidents and balance 3% accidents are due to misc. reasons.

Variation/decline in types of accident over this 5-year period can be seen in.

Causalities

Deaths have gone up from 208 to 381 and total casualties from 610 to 844 during the same period due to severity of accidents.

The proportion of deaths, injuries, and total casualties (deaths + injuries) due to different types of accidents.

Responsibility of Train Accidents

Cause-wise analysis indicates that 42% of accidents took place due to failure of railway staff, 43% due to failure of other than railway

staff, 7% due to sabotage, 3% each due to failure of equipment and incidental and balance 1% each due to combination of factors and non-establishment of cause.

Thus, a large chunk of 85% of accidents is on account of human failure. The Committee noted that there are prescribed rules to run trains during abnormal conditions with greater human intervention under failure conditions of the assets such as signal failure. The Committee also noted that train accidents due to sabotage have increased from 4.1% on 2006-07 to 11.36% in 2010-11

Collisions

Collisions which are 5% of the total tally but resulted in 24% deaths and 26% injuries (25% total casualties). The number of collisions has varied from 13during 2008-09 to 5 in 2010-11 whereas deaths and total casualties during the same years have been 9 & 62 during 2008-09 and 240 & 536 during 2010-11. This scenario of more deaths/casualties with fewer collisions during 2010-11indicates the severity of collisions.

Analysis of collisions based on their time of occurrence indicates that period of 22:00 to 06:00 hrs is most vulnerable during which about 50% collisions occurred.

Further analysis indicates that out of a total of 43 collisions occurred during this period 21 where on account of driver passing signal at danger (SPAD), 10 on account of driver passing automatic signal in on position at higher speed and balance for other reasons.

Derailments

Derailments, which are half of the consequential train accidents resulted in 4% deaths and 27% injuries (19% total casualties), have gradually come down over this period.

Analysis of derailments based on their time of occurrence indicates that there is no correlation though there is slightly higher possibility

of derailments during 22:00 to 06:00 hrs.

Out of 441 derailments occurred during this period, maximum of 129 were contributed due to Civil Engineering defects, followed by 56 due to sabotage, 54 due to combination of staff, 43 due to carriage & wagon defects, 36 due to failure of other than railway staff, 27 due to failure of operating staff, 24 due to failure of equipment, 28 due to failure of Loco pilot, 26 incidental and balance for other reasons.

Unmanned LC Accidents

Unmanned Level Crossing accidents, which are 36% of the total tally resulted in 59% deaths and 32% injuries (42% total casualties). Their numbers have also come down over this period.

Analysis of Unmanned Level Crossing based on their time of occurrence indicates that day light period of 08:00 to 19:00 hrs is most vulnerable during which about 86% accidents occurred.

Manned LC Accidents

Manned Level Crossing accidents, which are 4% of the total tally resulted in 6% deaths and 6% injuries (6% total casualties). Their numbers have also come down during this period.

Analysis of Manned Level Crossing based on their time of occurrence indicates no correlation between them.

Fire Accidents

Fire accidents, which are 2% of the total tally resulted in 2% deaths and 1%injuries (1% total casualties). Deaths and injuries have not reduced with a reduction in fire accidents in 2008-09.

Analysis of fire accidents based on their time of occurrence indicates that there is a higher possibility of fire between 14:00 to 06:00 hrs. during which 88% of accidents occurred. Eight cases were due to Failure of other than Railway Staff (FORS) out of 16 cases of fire occurred during this period.

It is noted that many a time practices and incidents impinging on safety in train operation and also the cause of accidents are not fairly brought to the notice of management as departmental loyalties often overshadow the quest for getting into the ground realities for improvement. As has been the practice in some of the developed countries, the Committee recommends an IT system based on email / SMS should be put in place to report such matters which should be investigated by the safety officers at Headquarter and Divisional levels followed with appropriate corrective action.

RECOMMENDATION
OF HIGH-LEVEL SAFETY REVIEW
COMMITTEE: DR. KAKODKAR REPORT, 2012

IV

General Safety Matters

1. An IT system based on email / SMS should be introduced to report safety related matters by railway and non-railway persons. (Para 2.4.10).
2. Redundancies should be built in the system such as track circuiting by two diverse means at vulnerable locations so that normal operations are least hampered due to single point failure. (Para 2.5)
3. An IT-based system should be set up within 6 months to collect and collate all train accidents whether consequential or of little significance, near misses, safety related asset failures, etc. (Para 2.5)
4. Projects for augmentation of line capacity on busy routes and maintenance facilities for coaches and wagons in open line and workshops should be funded and executed as top priority in mission mode. (Para 2.7)

5. No new trains should be introduced without adequate capacity for operation and maintenance. (Para 2.7)

Organizational Structure

1. The restructuring of IR should be examined and studied by a Separate Expert Group. (Para 2.8.2)
2. Earlier the system of only Operating and technical officers being considered for general posts of GMs and DRMs should be restored. Only capable officers should be selected as DRMs and posted in divisions with a minimum tenure of 3 years. (Para 2.8.3)

Empowerment at Working Level

1. Powers should be delegated to GMs and DRMs in regard to safety matters as under (Para 2.9.5):
2. The powers of General Managers to be enhanced to 3 times for sanction of works under all Plan Heads except New Lines and M & P items. These should also be applicable on an out-of-turn basis, depending on the urgency. The powers of DRMs also to be accordingly enhanced to 3 times.
3. General Managers must be given full powers for reappropriation of funds from one work to another under the same Plan Head and source of funds under all the Plan Heads, except New Lines.
4. General Managers have full powers to reappropriate funds under Revenue under the same Demand from one PU to another within the overall budget allotment.
5. DRMs to be fully empowered to decide the process/procedure such as Spot Purchase

Committee, Single/Limited Tenders, etc.

6. DRMs have full powers to accept tenders floated by the division. To enter into repair or Annual Maintenance Contracts (AMC) through OEM or otherwise. To purchase stock items in case of shortages and non-stock items up to Rs. 3 Lakhs per case but without any monthly ceiling.
7. DRMs to be empowered to award works of essential nature related to operation and maintenance assets on quotation basis for 3 months as a stop gap arrangement.
8. DRMs have full powers for hiring resources including utility vehicles.
9. DRMs have full powers to sanction construction of RUBs, limited height subways and ROB under Road Safety works.
10. Powers those vested with DRMs of the Division to be enjoyed by the Chief Workshop Managers (CWM) in respect of their workshops.
11. Powers to sanction cash awards for good performance in safety related matters should be enhanced to three times. (Para 2.9.6)
12. Enhanced delegation of powers to the divisions should be directly mandated by the Railway Board as a onetime measure. (Para 2.9.7)

Safety Related Works and Issues

1. Core Safety Groups should be formed under the convenorship of the Additional General Manager/Safety (a new post carved in Zonal headquarters as part of the new safety architecture) at headquarter level and Sr. Divisional Safety Officer at divisional level.

Principal Heads of Departments at HQ level and branch officers at divisional level of Civil, Mechanical, Electrical, Signalling, Operating and Finance should be the members. (Para 2.10.1)

2. Group of Officers headed by AGMs and ADRMs at the Headquarter and divisional levels respectively should convene meetings once every week to clear all the pending Engineering and Signalling Plans. (Para 2.10.2)

Shortage of Critical Safety Spares

1. Concerned directorates should issue a defined list of safety items to Zonal Railways for uniformity. (Para 2.13.1)
2. RDSO should take full responsibility for all those safety items for which drawing, specification, vendor approval, etc. are issued by RDSO. They should enter into long term rate contract with their approved vendors for 3 to 5years after negotiating rates based on the value of the item which can be best assessed by RDSO. (Para 2.13.3)
3. A simple but effective vendor qualification and approval process should be followed for non-RDSO safety items at Zonal railway level. (Para 2.13.7)
4. A thorough review of the quality system for material procurement processes by an external professional agency and revamping of the system should be done as necessary. (Para 2.13.8)
5. The conventional method of technical inspection should be replaced with a modern Quality Management System for which necessary check

sheets should be developed by the respective departments directly associated with safety. These check sheets should be based on present rules, regulations, manuals, instructions, etc. and should form part of the safety manual of the Railway. (Para 2.14)

Signalling, Telecommunication and Train Protection

1. State of the art signalling and protection system at least equivalent to the functionalities of ETCS L-2 should be deployed throughout IR, starting with the busy routes (19000 Kms) immediately. A sub-group of the Committee shall examine some of the critical aspects during the visit to some of the European railway system and submit its report. (Para 3.5)
2. Diverse and redundant means of Satellite based train position sensing (as used in ACD) should be incorporated and merged into ATP functions. (Para 3.5)
3. A dedicated Special Purpose Vehicle (SPV) should be formed having full powers and the mandate to formulate and execute the sanctioned projects of ATP in a time bound manner (5 Years). (Para 3.6)
4. A high power standing technical review committee should be set up to guide the SPV on technical issues. This Committee should continue till the implementation of the project of ATP and should have experts from Railways as well as from outside. (Para 3.6)
5. Communication Based Train Control (CBTC) system should be used in Metros and dedicated

corridor sections like Mumbai suburban, to meet the requirements of head way less than 1.5 minutes after study of design margins. (Para 3.6)

6. A "Task Force" should be set up to study the feasibility of communication backbone for IR, utilizing diverse and redundant technology to ensure the highest level of availability of the networks for safety and operational requirements. (Para3.6)
7. RDSO signalling directorate should be augmented with comprehensive research framework in order to include work on forecasting/newer signalling and telecom technologies. (Para 3.6)

Level Crossings

1. All Level Crossings whether manned (with or without signals) or unmanned should be eliminated in the next 5 years. This is gigantic task for which dedicated SPVs should be formed in each of the Zonal railway fully empowered and mandated to complete the project in a time frame of 5 years. (Para 5.6)
2. Level Crossings having little road traffic should be closed. Merger of nearby LCs by constructing connecting roads at railways cost even on non-railway and should be taken up. (Para 5.6)
3. Construction of limited height subways, Road under Bridge (RUB) and Road over Bridge (ROB) should be taken up in mission mode and traffic blocks should be generously granted. (Para 5.6)
4. No LC should be newly introduced under any

circumstances on the existing system as well as during gauge conversion, doubling and construction of new railway lines. (Para 5.6)

5. No LC gate should henceforth be manned or interlocked. (Para 5.6)
6. The present policy of sharing the cost of RUB or ROB with the State Governments should be dispensed with and the full responsibility and entire cost of construction should be taken over by the Railways. For this purpose, the present Railway policy needs to be changed and section 19 of the Railway Act needs to be amended. Further, to augment the Road Safety Fund a large share of diesel cess should come to the Railways for which Government of India should be approached. (Para 5.6)
7. To expedite the construction of limited height subways, RUBs and ROBs the CRSs role should be taken away and relevant plans and documents should be approved and signed at the level of the concerned PHOD instead of sending them to the CRS for sanction unless there is some change in the track/yard layout. (Para 5.6)

Human Resource Development

1. A large number of projects of importance to Railways should be regularly awarded to some select engineering academic institutions in which students can participate. Courses, minor stream and major specializations in the area of railway engineering should be introduced in the Indian engineering academic programs. (Para 6.1)
2. All officers should be periodically imparted

training in safety engineering for building a safety culture. (Para 6.2)

3. One training institute at the divisional level should be nominated and upgraded for training for staff on safety environment in the Railways. This institute should have animation films; general equipment, tools and gadgets used on Indian Railways, etc. (Para 6.2)
4. Departmental staff should be encouraged and extended resources to upgrade their professional qualifications and skills to be fit for promotion to a higher level. (Para 6.3)
5. All the newly recruited Assistant Loco Pilots should be Diploma holders instead of present Matriculate/ ITI holders. All the Maintenance Technicians in all Technical Departments should at least be ITI holders and supervisors should be at least Diploma holders, preferably, Engineering Graduates. (Para 6.3)
6. The cadre of electric and diesel running staff should be separated in the present operating environment having a large number of loco variants of both types. (Para 6.4)
7. Such running staff who fails in any of the mandatory refresher course should be given only one extra chance to repeat the course and test should be taken at the concerned Branch Officer Level. In case the running staff fails again, he should be debarred from running duty and posted on other non-safety related assignments or given voluntary retirement following the prescribed rules and process. (Para 6.5)

8. Some portable cheaper versions of loco simulators should be procured and located in drivers' running rooms where running staff can brush up their driving skills at their convenience. (Para 6.7)
9. Customized signalling Panels should be introduced at the earliest in Zonal Railway Training Institutes (ZRTIs) for the training of station operating staff. (Para 6.8)
10. Separate handbooks should be prepared for the operating staff, such as loco pilots, station masters, etc. which should contain all the necessary instructions to be followed by them while performing their duty. (Para 6.9).
11. Each Division should have Grievance Redressal Machinery which should deal with staff grievances in a time-bound manner. (Para 6.10)
12. Special allowance equivalent to 25% of the salary and grade pay should be given to the staff who work as regular Gatemen as a special incentive during the intervening period till LC gates are closed. (Para 6.11)

Training Institutes on IR

1. All sanctioned capacity enhancement works of CTIs, ZRTIs and STSs should be fully funded and executed within the next two years. (Para 6.2)
2. Posting as a trainer in Centralized Training Institutions (CTIs) should be based on the recommendation of a committee of which the Head of the institute concerned must be a member. The tenure of deserving officers may be extended on the recommendation of the Head of

the CTI even if it involves transfer of elements of posts if such a trainer is due promotion so that he/ she can be promoted in the training institute itself. (Para 6.2)

3. Heads of CTIs should be given full powers to invite academicians, industry leaders, technocrats, etc. as visiting faculty within the allocated budget grant. In case of Railway Staff College, where Management training is imparted to officers of all railway disciplines, arrangements should be made to have one or two professional academicians on loan from management institutes of repute for a few years fixed tenure. (Para 6.2)
4. Funds for CTIs, Zonal Railway Training Institutes (ZRTIs) and Supervisors Training Schools (STSs) should be allocated separately both under Works as well as Revenue. Incurrence of expenditure under these fund-allocations should be fully under the control of Heads of the institute. Considering the importance and size of CTIs, they should have their own maintenance infrastructure. (Para 6.2)
5. The Terms of Principals of ZRTIs and STSs should be fixed for at least 3years. (Para 6.2)
6. The teaching allowance of trainers of ZRTIs and STSs should be increased from 15% to 30% to bring it at par with trainers in CTIs. (Para 6.2)

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Ministry of Railways

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High Level Safety Review Committee Presents its Report to Minister of Railways
Safety Accorded Highest Priority, Dinesh Trivedi

High Level Safety Review Committee, constituted by the Ministry of Railways under the Chairmanship of Dr. Anil Kakodkar, presented its report to the Minister of Railways, Shri Dinesh Trivedi, at a function, here today. Addressing a gathering on the occasion, Shri Trivedi complemented all members of the Committee, especially Dr. Kakodkar, for giving their time and expertise in preparing the report. Shri Trivedi said passengers' safety is given highest priority by the Indian Railways. The committee comprising of eminent persons/experts in technical and high-end technology related fields with experience and expertise in a managing innovation in technology and change was constituted in September 2011 to provide a valuable independent outsiders' view in respect of the system and protocols. Present on the occasion among others were Chairman, Railway Board, Shri Vinay Mittal, Board Members and three members of the new committee.

The Committee, headed by Dr. Anil Kakodkar, Former Chairman of Atomic Energy Commission, was assisted by Dr. N. Vedachalam of Vikram Sarabhai Space Center, Thiruvananthapuram, Prof. Sanjay Dhande, Director IIT Kanpur and Sh. G.P. Srivastava Director E&I Group, Bhabha Atomic Research Centre. Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation acted as the Advisor to the Committee.

Speaking on the occasion, Dr. Kakodkar said that though data of consequential train accident over the years on has been showing declining trend despite phenomenal growth of traffic, safety on Indian Railways remains to be a matter of serious concern. He said that while preparing this Report, the Committee held interactions and meetings with Divisions, Zones, Railway Board, RDSO, Commissioner of Railway Safety, some retired railway officials, and representatives of recognized staff federations. He said that the Committee members also visited some of the Zonal Railways to have a first-hand experience of the field conditions and also invited suggestions for general public through Railways' official website. He said that a total of 53 suggestions were received from Railway personnel and general public which have been appropriately considered by the Committee. Dr. Kakodkar said that in the process, the Committee noted that Railway officials at all levels are dedicated, committed, and have deep passion to work.

A presentation was made on the occasion by the Committee. Some of the major recommendations of this Report are as follow:

- Implementation of Advance Signalling System through Special Purpose Vehicle and an expert group for technical issue with an

estimated cost of Rs. 20,000 crores for 19000 route kilometers on trunk route.

- Elimination of All Level Crossings (manned and unmanned both) with an estimated cost of Rs. 50,000 crores over five years.
- All new coaches to be only of LHB design which are much safer for present speeds and train lengths, with a total cost of Rs. 10,000 crores over five years.
- Maintenance of safety related infrastructural and other items with total cost of Rs. 20000 crores.
- The total financial implication over the five-year period would be Rs 100,000 crore.
- The committee also suggested a mode of funding, which includes safety cess on passengers, deferred dividend, road cess, and a matching grant from the Centre.

The Report of the High-Level Safety Committee is available on Indian Railways' official website i.e. www.indianrailways.gov.in

HK/

ANALYSIS OF RECOMMENDATIONS
OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: DR. KAKODKAR REPORT, 2012

V

The Committee has given several recommendations in the report. Some of the recommendations have financial implications while many of the recommendations do not require funds for their implementation.

1. Recommendations which do not require funds may be implemented.
2. The requirement of funds to implement such funds specific recommendations indicating funds required against individual items.

With the present tight financial condition of IR, it is not possible to implement recommendations with funds available.

Methodology proposed for raising funds for this purpose.

A non-fungible non-lapsable safety fund generated with safety cess shall be required. It is possible to find the required resources for the critically needed safety expenditure through an innovative non-fungible and non-lapsable Dedicated Safety Fund for which the

annual inflow comes from the captive passenger traffic.

However, the increase in fares is a political decision, which may not be agreed seeing forthcoming elections.

Deferment of dividend to the tune of Rs. 5,000 Crores per year is proposed. This is justified as social service obligation being borne by Indian Railways is about Rs. 15,000 crores every year due to low ordinary class fare, sub-urban and non-sub-urban season fare, a variety of concessions granted on passenger tickets, transportation of certain commodities below cost and working of un-economic branch lines.

With Railway raising about Rs. 5,000 Crores per annum through safety cess, a matching grant from Central Government for safety related works is fully justified and demanded.
Three most important recommendations are-

1. Advanced Signalling system to prevent collision with increased line capacity.
2. Elimination of all level crossings (manned and unmanned) by grade separation (RUB/Limited High Subway/ROB.)
3. Switching over to production of all new coaches to LHB design.

Other recommendations may be implemented in the order given in Table in Fig 22 depending on availability of funds.

Indian Railways severely suffers from implementation bug. This has caused non-implementation of some of the important accepted recommendations given by the past Safety Review Committees.

It is unfortunate if recommendations of this Committee as accepted by the Ministry of Railways also meet with the same fate.

The Committee recommends an empowered group of officers (including an officer from finance) in Railway Board to pilot the implementation of safety enhancement recommendations and

projects as accepted by the Ministry of Railways in a time bound manner with full funding. Other projects shall be appropriately pended or slowed down for the time being to accommodate funding of these key projects.

The Committee also recommends that newly constituted Railway Safety Authority under the Govt. of India. Instead of this the existing Safety organization of railways may be strengthened.

In the present set-up, the Central Board for Railway Research (CBRR) contains 13 non-Railway members from different academia and industries and 11 Railway Members. This body is chaired by DG/RDSO and focuses on issues that are relevant, urgent and are a priority of IR. RRDC if created would duplicate this work.

DG/RDSO should be made Adviser to MOR on R&D matters. Thus, strengthening/reorganizing CBRR by taking members from proposed RRCs and giving status of Advisor to MOR to DG/RDSO would meet the objective more effectively. Hence establishing RRDC does not appear to be helpful in this regard.

It has been recommended by the Safety Committee that RDSO should take "ful" responsibility of all those safety items, for which drawing, specification, vendor approval etc. are issued by RDSO. The statement gives the impression that in case of any failure of such an item, in the field, RDSO shall be held responsible. RDSO should be responsible only in cases where there is a deficiency in the drawing or specification, or the vendor approval carried out by it. In all fairness, RDSO should not be held responsible for items failing due to other reasons like failure due to poor maintenance or isolated manufacturing defects.

It has been further recommended by the Safety Committee that RDSO should enter into a long-term Rate Contract with their approved vendors after negotiating the rate based on the value of the item as assessed by RDSO. At present, there are 385 safety

items, for which vendor approval is done by RDSO. Finalizing rate contract tenders for all these items will fritter away RDSOs energy and resources in stores procurement, which is not connected with the basic function of R&D, for which RDSO has been created. Moreover, RDSO currently does not have the resources for entering into Rate Contracts for purchasing such a large number of items or carrying out detailed costing of items and hence, is ill-equipped for handling this work. Also, if RDSO were the sole authority to draw specifications, approve vendors, inspect materials, and also finalize rate contracts/procurement, it would give rise to more complaints from the point of view of inherent conflict of interest.

The recommendation seems to have stemmed from the fact that Zonal Railways & PUs are unable to arrange adequate supply of RDSO approved safety items at reasonable rates which is due to the perceived problem that Production Units/Zonal Railways are not able to many a times discipline the

RDSO-approved vendors. Tender committees of the field units always have the option of passing over the offer of those vendors, who exhibit indiscipline in supply or rates or make substandard supplies, which they can always report to RDSO. Moreover, if they send substantiated complaints to RDSO, penal action can be initiated by RDSO against the erring vendors.

However, if it is felt that only a Central Organization should procure such safety items, a separate Central Purchase Organization may be created, to which RDSO should provide the necessary technical support. RDSO is not capable of handling procurement.

Recommendation regarding augmentation of signal directorate of RDSO is welcome. The present set-up of Signalling and Telecom Directorates has limited resources and mainly deals with development of specifications for current and foreseeable future railway requirements, development of vendors either through

indigenous development or through cross approval etc. Most of the advanced signalling systems are now software based and software as well as hardware needs to be evaluated to meet the SIL-4 (Safety Integrity Level-4) requirements. Also signalling systems are now more and more communication based. Presently very little knowledge is available on design of software embedded system in RDSO. It is, therefore, necessary to have expertise in the following areas:

1. Development of software for safety systems.
2. Development of software embedded hardware for signalling systems.
3. Train control systems involving communication.

For this, a separate cell for each of the above areas may be created. Initially a few consultants who have expertise in above areas are hired for a period of at least three years who will be fully associated with the team at RDSO and start development of work in the areas suggested by safety committee. It is expected that in three years, sufficient expertise will be developed in-house to take up these tasks independently. Subsequently, it is also proposed to develop an advanced signalling laboratory with hardware and software simulators which will help in developing and evaluating designs of modern and advanced signalling systems. The core purpose and objective of RDSO is to conduct high-end research to meet the technical requirements in various railway specific areas. Therefore, high end facilities of ARRI can be located at RDSO itself. Creating a separate Advanced Railway Research Institute would only be a duplicating effort as of setting up a parallel institute with the same objective. The logical need is to rationally address the constraint and challenges which today RDSO is facing in meeting its core objective of advanced research. Instead of a parallel institute for the same task it would be appropriate if the relevant issues pertaining to autonomy, logistics, personnel selection/recruitment, and

enhanced powers were tackled at apex level. The recommendation of Railway Research Centers is acceptable, as it would be a good collaboration between academia and railways. It would also help in upgrading expertise of institutions in Railways related area also as the institutes would be able to plan and develop their facilities for Railway Research with long term objective. In turn IR will benefit from their expertise in carrying out research & development activities in relevant fields. At present, CRR (Centre for Railway Research) at IIT, Kharagpur is functional, but it is multidisciplinary, not meant to deal with specific areas of discipline only, as recommended by the Committee.

Conclusion

1. With Implementation recommended by the safety of train operation is likely to be improved to a next level.
2. However, there is a need to generate funds. Based on the availability of funds recommendations may be implemented priority wise.
3. There must be political and bureaucratic will for implementation in a time bound manner.
4. Instead of creating a newly constituted Railway Safety Authority, the existing Safety organization of railways may be strengthened.
5. Instead of opening a new research unit, RDSO may be strengthened.

Press Information Bureau
Government of India
Ministry of Railways

06-June-2014 12:46 IST

Railways Actively Examining the Recommendations of High-Level Safety Review Committee

The Railway Board is currently actively examining the recommendations of the High-Level Safety Review Committee (Kakodkar Committee) in regard to their feasibility and implementation. Full Railway Board meetings with the Safety Directorate were held on 4th and 5th of this week and are now scheduled to be held on Monday i.e. 9th June 2014. It is expected that the detailed examination of these recommendations will be completed within this month.

The Ministry of Railways had set up a High-Level Safety Review Committee consisting of experts in technical and high-end technology related fields with Dr. Anil Kakodkar, former Chairman of Atomic Energy Commission as Chairman and Dr. E. Sreedharan as Advisor to the Committee. The Committee submitted its report in 2012 and made various recommendations for improving Railway safety which needed an outlay of Rs. one lakh crore over a period of five years.

The Committee made a total of 106 recommendations and the same are under examination in detail by the Railway Board. The recommendations pertain to general safety matters, organizational structure, empowerment at working level, vacancies in critical safety category, shortage of critical safety spares, human resource development with emphasis on education and training research eco-system on the Indian Railways, safety architecture on the Indian Railways etc.

AKS/HK

REPORT OF
HIGH LEVEL SAFETY REVIEW COMMITTEE, 2012

(KAKODKAR COMMITTEE REPORT, 2012)

Government of India
Ministry of Railways

Report of High Level Safety Review Committee



February 2012



GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

REPORT
OF
HIGH LEVEL SAFETY REVIEW COMMITTEE
(KAKODKAR COMMITTEE, 2012)

February 2012

सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
HIGH LEVEL SAFETY REVIEW COMMITTEE

Shri Dinesh Trivedi
Hon'ble Minister of Railways
Government of India

Dear Sir,

Submission of Report

We are happy to submit the report of the High-Level Safety Review Committee appointed by the Railway Ministry to review the safety of our railway system and recommend measures to make improvements. Indian Railways is one of the largest railway systems which has served people of India well over a period of time. The demands on the system are rapidly growing without commensurate investments for upgradation of technology and modernization consistent with modern times.

2. Within the limited time available, we have examined various aspects relevant to safety on the Indian Railway system. While detailed recommendations are given in the report, an important recommendation is the creation of a Railway Safety Authority as a statutory safety regulator duly backed up by professional input from within and outside at multiple levels.

3. We estimate that implementation of the recommendations made by the Committee would need an outlay of around Rs. 100,000 crores in the next 5 years. We strongly suggest that the

recommendations should be implemented in a time-bound manner with required resources mobilized and dedicated towards implementation of individual recommendations.

We thank you for the opportunity given to us in undertaking this important assignment.

ANIL KAKODKAR
CHAIRMAN, HLSRC

E. SREEDHARAN
ADVISOR TO HLSRC

N. VEDACHALAM
MEMBER, HLSRC

SANJAY G. DHANDE
MEMBER, HLSRC

G.P. SRIVASTAVA
MEMBER, HLSRC

AMITABH
SECRETARY, HLSRC

New Delhi
17th February 2012

EXECUTIVE SUMMARY

1. Indian Railways is one of the largest railway systems in the world and is fully owned and operated by Ministry of Railways, Government of India. It plays a significant role in driving economic growth of the country, offering highly affordable, environment- friendly transportation to passengers and freight, especially bulk commodities, across the country. Indian Railways, like any other transportation system, is technology intensive not only for ensuring high productivity of its assets but also safety in train operations.
2. Though the data of consequential train accidents over the years has been showing declining trend despite phenomenal growth of traffic, safety on IR remains to be a matter of serious concern. Recent accidents such as derailment of Kalka Mail near Fatehpur on 10.07.2011 resulting in death of 71 passengers and injuries to 264 passengers raise an alarm over the safety standards and practices adopted on Indian Railways. Taking note of the unsatisfactory safety record of IR, the Hon'ble Minister of Railway set up a High-Level Safety Review Committee vide MOR's Notification No. ERB- I/2011/23/37 dated 16-09-2011.
3. During its 5 months of existence the Committee carried out a critical overview of Indian Railway functioning. **Present environment on Indian Railways reveals a grim picture of inadequate performance largely due to poor infrastructure and resources and lack of empowerment at the functional level. The present form of railway organization is more centralized, top- heavy and hierarchical along departmental lines much to the detrimentof a functional and objective oriented organization. The commitment and passion of its strong workforce of 13.62 lakhs though commendablehas done little to translate into productive action due to the present environment. The Committee has given several recommendations having no financial implications to**

empower the functional levels and to simplify processes and procedures to deal with this negative feature. IR must be energized with a new type of work culture.

4. **The financial state of Indian Railways is at the brink of collapse unless some concrete measures are taken.** Passenger fares have not been increased in the last decade during which many passenger carrying trains were introduced on the existing overloaded infrastructure. This has strained the infrastructure way beyond its limit and all the safety margins have been eaten up pushing Indian Railways to a regime of adhocism in infrastructure maintenance. **The Committee has strongly recommended stopping such practice of introduction of new trains without commensurate inputs to the infrastructure.**
5. **There is no practice of independent safety regulation by an independent agency separate from operations.** The Railway Board has the unique distinction of being the rule maker, operator, and regulator, all wrappedinto one. Commissioners of Railway Safety, though considered to be thesafety watchdogs, have a negligible role at the operational level. Compliance with safety standards set by Railways for themselves is often flouted for operational exigencies. **The Committee has recommended a statutory Railway Safety Authority (RSA) and a safety architecture which is powerful enough to have a safety oversight on the operational mode of Indian Railways without detaching safety with the railway operations. The Committee has also recommended measures to strengthen the present Railway Safety Commission to undertake meaningful regulatory inspections.**
6. **Research Design and Standards Organization (RDSO) which is the present apex technical wing of Indian Railways is highly constraineddue to several reasons.** This has hampered the ability of the system to internalize new emerging technologies and indigenous development has not progressed consistent with today's needs. The Committee has examined the

present state of affairs and also the countrywide practices in promoting research and development in technology specific industries similar to Indian Railways. **The Committee has recommended a Railway Research and Development Council (RRDC) to be set up at the apex level directly under the Government. This Council will have Advance Railway Research Institute (ARRI) and 5 Railway Research Centers, for key safety related railway disciplines such as rolling stock, signaling and telecommunications, motive power, tracks and bridges and operations management. The present form of RDSO is recommended for restructuring on the lines of other similar research institutions with appropriate empowerment. The entire research eco-system will have representatives from eminent technologists / scientists from outsideappropriately to make research and technology development vibrant which is essential for Indian Railways in the long run.**

7. Line capacity has been severely constrained due to the introduction of more and more trains over the years. No technical aid is yet available on IndianRailways to run trains during foggy weather which adversely affect train operations during winter season of 2 to 3 months in northern India. Disturbance to running track due to rail / weld breakages and sabotages which have gained prominence during recent times present unsafe conditions. Necessary time for infrastructure maintenance is getting compromised and the casualties of Railways' own workmen while on duty is on increase because of constrained working during scarce maintenance period. **The Committee deliberated on all these issues which have become very prominent on Indian Railways in the present context and attempted to come out with a single solution which could address all the above concerns. The Committee has strongly recommended to adopt an advanced signaling system based on continuous track circuiting and cab signaling similar to**

European train control system Level-II on the entire trunk routes ofabout 19000 route kilometers at an estimated cost of 20,000 croreswithin 5 years. This will be a quantum jump in modernizing the signaling system which is badly needed. **The Committee has further recommended completing this work within 5 years by forming an independent Special Purpose Vehicle (SPV) for execution and an expert group for addressing technical issues if any coming up during implementation.**

8. Casualties in accidents at level crossings is a matter of concern. Levelcrossings not only contribute to a large chunk of accidents and casualties of road users but are also a drag on train operation limiting line capacity. These also cost dearly to Indian Railways for their operation and maintenance. Advance Warning safety equipment earlier tried at level crossings havefailed due to thefts. **The Committee, therefore, has recommended total elimination of all level crossings (manned and unmanned) within 5 yearsat an estimated cost of Rs. 50,000 crores which will get recovered over 7-8 years due to saving in operation and maintenance costs and improved train operation. The gigantic project will also need the setting upof a dedicated and empowered SPV for each Railway zone to accomplish this task within a 5-year period.**
9. ICF design of coaches have seen Indian Railways through in the past yearstill operating speeds were low and formations were short. With the Introduction of long formation of trains running at moderately high speed of 110 to 120 Kmph, use of ICF design coaches is not desirable from safety point of view. The latest design of LHB coaches is far safer and secure to bear the impact loads arising out of accident scenarios. **The Committee has therefore recommended stopping production of ICF design coaches and completely switch over to manufacture of LHB design coaches immediately. Commensurate facilities in production units, workshops and open line coaching depots**

have also been recommended.

10. The Committee has given several recommendations for improvement in maintenance diagnostic, measurement, and maintenance practices for safety related infrastructure such as track, rolling stock, signaling, etc. and commensurate financial implications have also been included in the report.
11. The Committee is seized of the very tight financial conditions of Indian Railways. **Some of the recommendations of the Committee need investment totaling to the tune of Rs. 1 lakh crore over 5 years period. The Committee has also recommended the funding mechanism by which Rs. 20,000 crores per annum should be raised for implementing the recommendations. Funding methodology includes the creation of a non- fungible non-lapsable safety fund generated through safety cess on passengers of different classes in a graded manner.**
12. **IR suffers from** '**Implementation Bug'**. Implementation of accepted recommendations of the previous safety committees has been a major issue. **The Committee has recommended an empowered group of officers from the Railway Board to pilot the implementation of the recommendations in a time-bound manner with full funding. The Committee has also recommended the review of implementation of recommendations by the new statutory outfit of Railway Safety Authority under Government of India.**

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INTRODUCTION

(CHAPTER: I / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

1

1.1 Ministry of Railways, Government of India set up a High-Level Safety Review Committee vide Notification No ERB-I/2011/23/37 dated 16.09.2011 reproduced below:

ORDER

Ministry of Railways (Railway Board) have decided to constitute a High-Level Safety Review Committee to go into all technical and technology related aspects in connection with safe running of train services in the country under the Chairmanship of Dr. Anil Kakodkar, former Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy. Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation will be the Adviser to the Committee. The other Members of the Committee will be as under: -

i) Dr. N. Vedachalam, Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram
ii) Prof. Sanjay Dhande, Director, IIT, Kanpur
iii) Shri G.P. Srivastava, Director E & I Group, Bhabha Atomic Research Centre (BARC).

(Shri Amitabh, SAG/IRSME, Chief Rolling Stock Engineer,

Northern Railway will act as Secretary of the Committee in addition to his own duties and will be assisted by a director level officer and 3 other staff.)

2. The Terms of reference of the Committee will be as under: -
   Whereas Safety is an ongoing multi-disciplinary exercise well entrenched into Railway working that is subject to independent verification, the Committee shall suggest ways and means for reinforcing the mechanism for improvements that are timely, enduring, cost effective and aimed at further enhancement of safety margins, where warranted.
   Based upon trends of accident and their consequences witnessed in the recent past theCommittee may lay down a roadmap for improving safety in respect of the following: -
   a) Signalling Systems
   b) Rolling Stock (of all types)
   c) Fixed Structures (Tracks & Bridges and OHE)
   d) Human resource development with emphasis on Training, Education, and research.
   e) Need for a Third-Party Audit, organizational & structural changes in RDSO and in any other department, improvements in procedural system and improvement inprocedures and systems.
   f) Any other item/modification which the Committee may desire.
3. The Committee will be required to submit its report within 3 months.
4. The headquarters of the Committee will be at New Delhi.
5. The terms and conditions regulating engagement of Chairman, Adviser and Members of the Committee will follow.

--Sd--
(**Shiv Dan Singh)**
Joint Secretary (Gaz)
Railway Board

1.2 Further, vide Ministry of Railways order of even no. dated 16.1.12, the term of the Committee was extended by two months up to 15.2.12 and further extended up to 02.3.12.

1.3 The Ministry of Railways have earlier constituted the Khanna Committee 1998, the Sikri Committee 1978, Wanchoo Commit1968,1968 and Kunzru Committee 1962. The present Committee, which is comprised of scientists and technocrats is more strongly mandated to go into all technical and technology related aspects in connection with safe running of train services in the country.

1.4 Approach and Methodology

The Committee is fully conscious of the fact that railway safety is deeply ingrained into the functioning of Indian Railways (IR in short) at all the levels. Different levels of management and staff directly or even indirectly associated with the railway functioning well understand that safety is one thing which is of paramount importance to the organization and cannot be compromised at all. The Committee is also aware of the sustained and continuous reduction in the number of consequential train accidents per year despite the phenomenal increase in volumes of traffic, both passenger and freight. As a prelude to the formation of the Committee, a detailed presentation was given to us by the Adviser (Safety), Railway Board in the presence of Hon'ble Minister of Railways and Railway Board Members. The presentation covered not only theever-improving safety performance of Indian Railways but also initiatives and steps being taken by different departments for improving safety.

1.5 Safety being a product of the functioning of railway management at differentlevels of hierarchy, our committee decided to interact with all the levels i.e. Divisional, Zonal and Railway Board. Considering that technical and technology

related aspects on IR and functioning of Research Design and Standards Organization (RDSO) have been specifically mandated in our terms of reference, the Committee not only frequented RDSO but also invited RDSO officials in several interactions of technical nature. The Committee also visited some of the zonal railways to have firsthand experience of the field conditions. Representatives of recognized staff Federations were also invited by the Committee to seek their views. During the course of functioning, the Committee had 18 meetings/visits/interactions with various levels of functionaries. At this juncture, the Committee records its appreciation of the dedication, commitment, and deep passion of all those railway officials at various levels and the representatives of Federations with whom the Committee interacted. Free and frank suggestions were invited from Railway Officers working at different levels through letters and e-mails. General public was also invited for their suggestion through IR official website <www.indianrailways.gov.in>. The Committee also interacted with Commissioners of Railway safety and some ofthe retired officials of IR for their valuable suggestions. A total of 53 suggestions were received from Railway personnel and general public which have been appropriately considered by the Committee.

1.6 The Committee noted that Indian Railways not only operate passenger trains but also freight trains on the same network. IR system is the transport backbone of the country for safe transport of suburban, medium to longdistance passengers and freight. It is very affordable to the common man and is equally used by all sections of society. The Committee also noted that present financial condition of Indian Railways is not very encouraging. Thesize of Indian Railways also made us realize that any technological upgradation should be fully absorbed,

and IR should be in full possession of technology to ensure its customization to suit Indian Railway operating environment which may not be similar to other countries.

1.7 However, in all our deliberations and conclusions the prime consideration of the Committee has been that safety on Railways is a non-negotiable subject and paucity of funds or shortage of manpower or for that matter the normal constraints faced by the Railways should not in any manner jeopardize safety.

******

ENVIRONMENT ON INDIAN RAILWAYS AFFECTING SAFETY (CHAPTER: II / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

2

2.1 Indian Railway is a vast system comprising of nearly 64000 route kilometers with over 7000 block stations and holding nearly 9000 locomotives, 43500 Passenger coaches, 7500 Electrical and Diesel Multiple Units and 220 thousand wagons. Further the IR system has 13.62 Lakh strong work force, handles 20 million Passengers and 2.45 million Tonnes of freight, and earns Rs.245 Crores on a daily basis.

2.2 The Committee analyzed data of consequential train accidents on IR to have an insight into the weak areas leading to accidents.

The Committee is also seized of the fact that the data maintained in the Railway Board office pertains to only those train accidents with apparent consequences and train accidents of minor nature and near misses are not included in the figures. Further, the Committee learnt that casualties due to trespassing of railway track, or for other reasons connected with railway

infrastructure and casualties of IR's ownstaff while on duty, though quite substantial, are not included in the statisticsof train accident-related casualties.

2.3 Casualties of Railway's own staff while on duty were collected from zonal railways and the position is markedly high. As can be seen from Annexure 1, about 1600 railway staff were killed and 8700 injured while working during the period from 2007 - 08 to October 2011 which is substantially more than 1019 deaths and 2118 injuries in train accidents for the periodfrom 2007-08 to 2010-11. It is to be noted that casualties in train accidents include a large chunk of 723 deaths and 690 injuries due to unmanned level crossing accidents attributed to the negligence of road users. Departments that contributed maximum are engineering track with 1100 deaths and 2070 injuries and Mechanical with 110 deaths and 4900 injuries. Mechanization of track and other maintenance is one solution to reduce human presence in high-risk areas of railway working. On the whole, Casualties in train accidents and for other reasons due to railwayinfrastructure remain a serious cause of concern**.**

2.4 Appraisal of Statistics of Consequential Train Accidents

Analysis of 5-year data of Consequential train accidents for the period from2006-07 to 2010-11 reveals the following.

2.4.1 Total Consequential train accidents have come down from 195 in 2006- 07 to 141 in 2010-11 (Fig.1) and consequential train accidents per million train Kilometer have also come down from 0.23 to 0.15 during this 5-yearperiod (Fig.2)

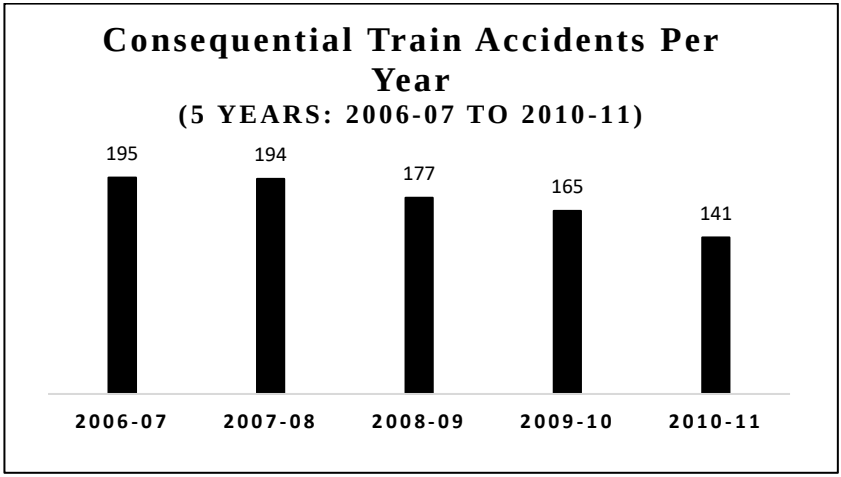


Fig. 1

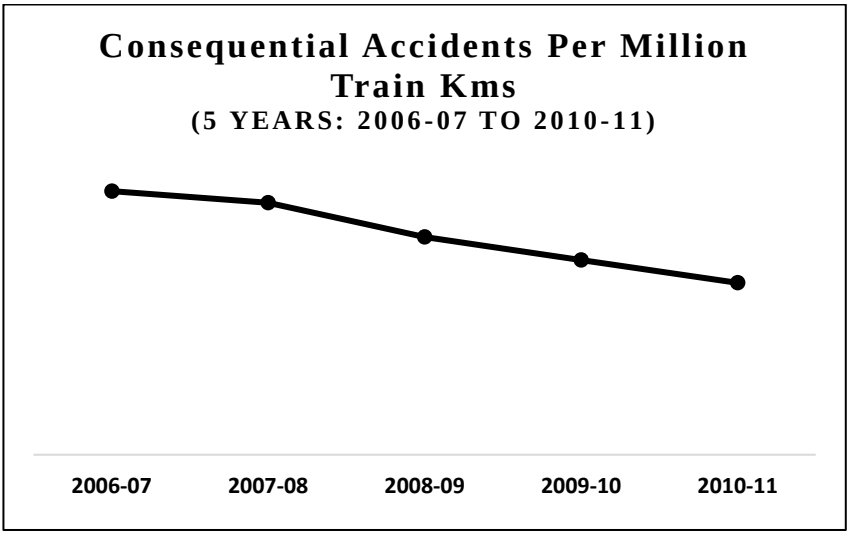


Fig. 2

2.4.2 Derailments constitute largest chunk of 50% of total accidents followed by 36% accidents at unmanned level

crossing gates, 5% collisions, 4% accidents at manned level crossing gates, 2% fire accidents and balance 3% accidents are due to misc. reasons (Fig.3). Variation/decline in types of accident over this 5-year period can be seen in Fig.4.

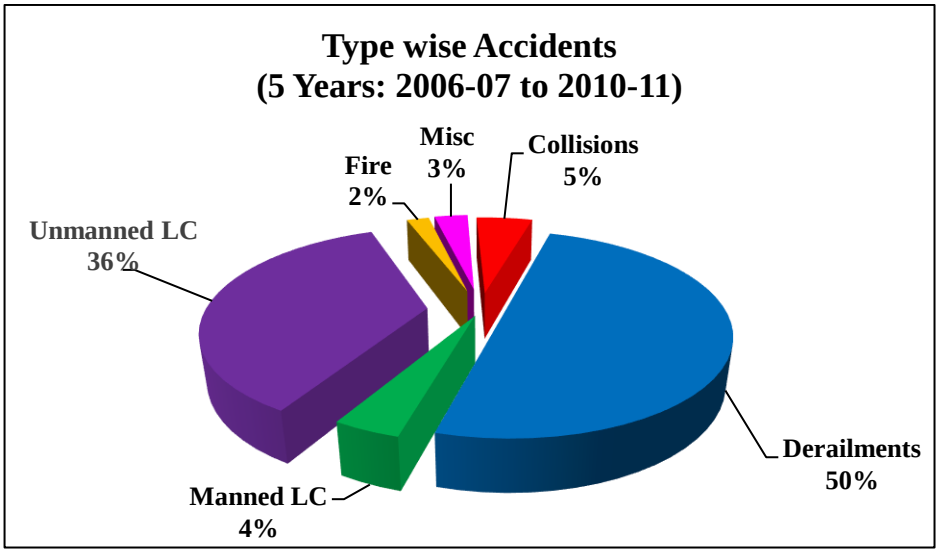


Fig. 3

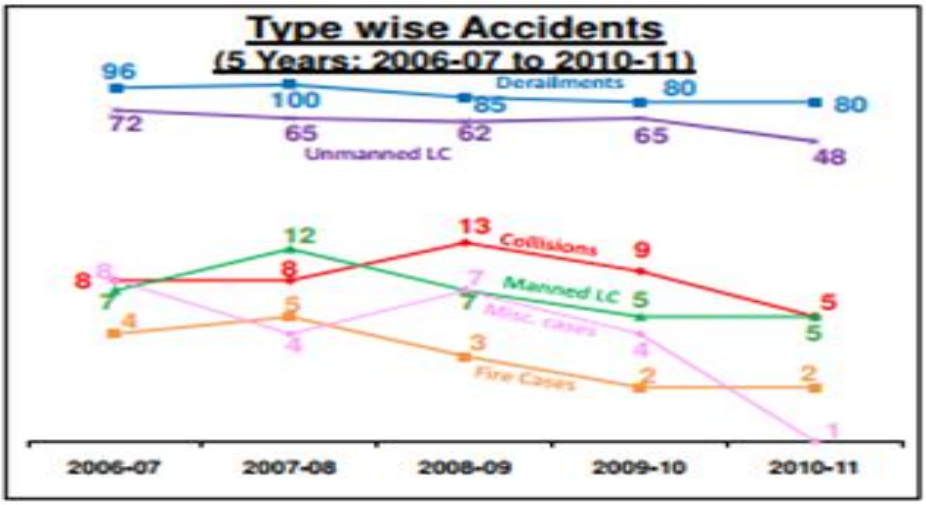


Fig. 4

2.4.3 However, deaths have gone up from 208 to 381 and total casualties from 610 to 844 during the same period due to severity of accidents (Fig.5). The proportion of deaths, injuries, and total casualties (deaths + injuries) due to different types of accidents is shown from Fig.6 to 8.

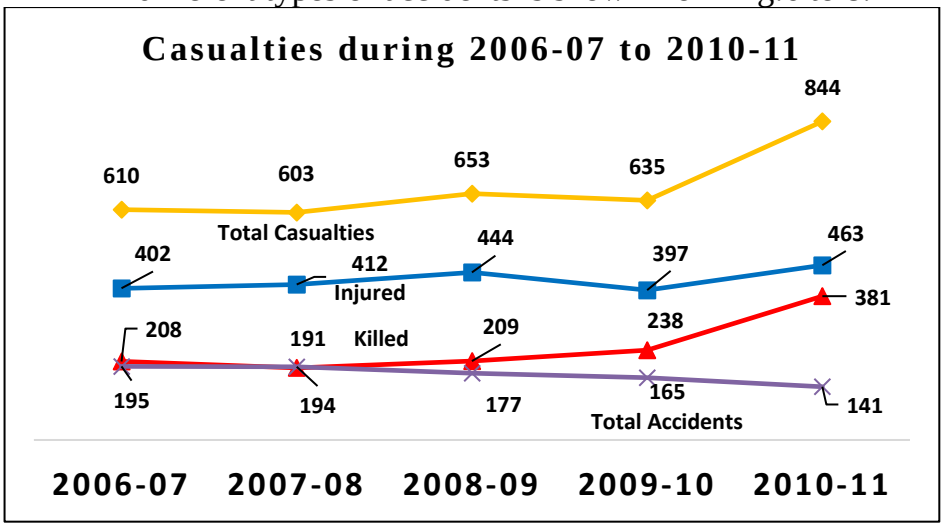


Fig. 5

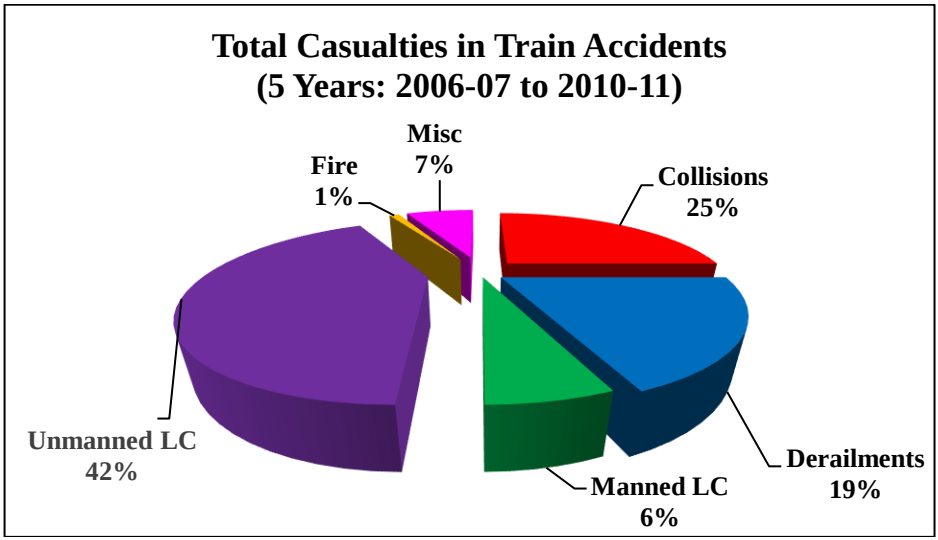

Total Casualties in Train Accidents
(5 Years: 2006-07 to 2010-11)
Misc
7%
Fire
1%
Collisions
25%
Unmanned LC
42%
Derailments
19%
Manned LC
6%

Fig. 6

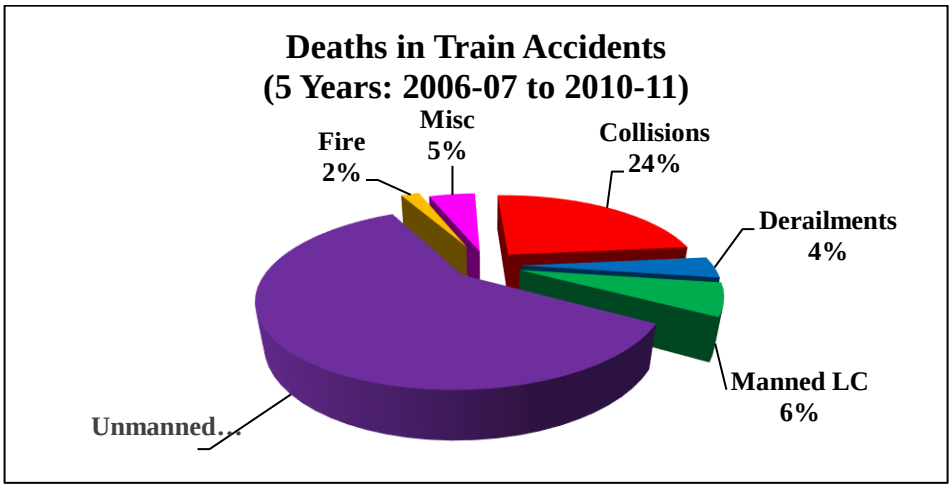

Deaths in Train Accidents
(5 Years: 2006-07 to 2010-11)
Misc
5%
Fire
2%
Collisions
24%
Derailments
4%
Manned LC
6%
Unmanned…

Fig. 7

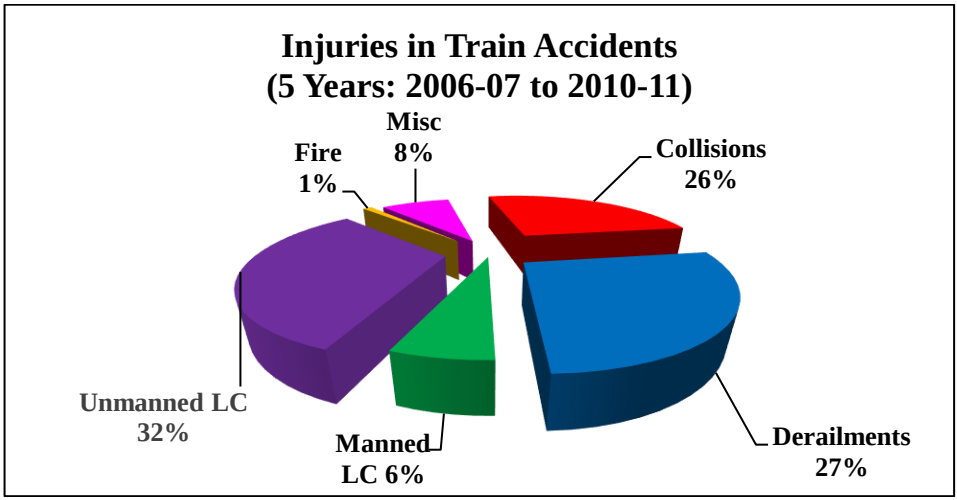


Fig. 8

2.4.4 Cause-wise analysis indicates that 42 % of accidents took place due to failure of railway staff, 43 % due to failure of other than railway staff, 7% due to sabotage, 3 % each due to failure of equipment and incidental and balance 1% each due to combination of factors and non-establishment of cause (Fig.9). Thus, a large chunk of 85 % of accidents is on account of human failure.

The Committee noted that there are prescribed rules to run trains during abnormal conditions with greater human intervention under failure conditions of the assets such as signal failure. The Committee also noted that train accidents due to sabotage have increased from 4.1% on 2006-07 to 11.36% in 2010-11(Fig.10)

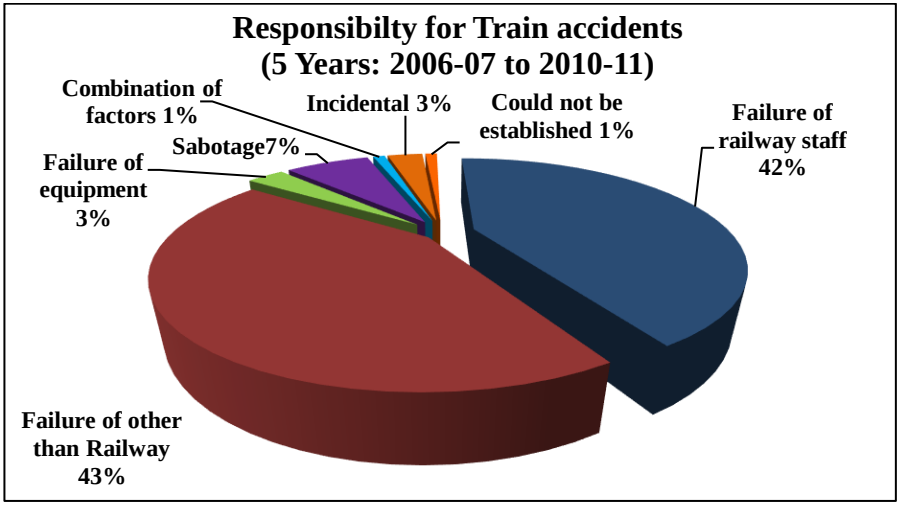


Fig. 9

Responsibility (%age) for Train accidents (5 Years: 2006-07 to 2010-11)					
	2006-07	2007-08	2008-09	2009-10	2010-11
Failure of railway staff	43.59	45.36	42.37	38.18	41.84
Failure of other than Railway	43.08	41.75	42.94	45.45	41.13
Failure of equipment	4.62	4.64	0	3.64	1.42
Sabotage	4.1	3.61	7.34	8.48	11.35
Combination of factors	0.51	0	2.26	0.61	1.42
Incidental	3.59	4.12	2.82	2.42	2.84
Could not be established	0.51	0.52	2.26	1.21	0

Fig. 10

2.4.5 Collisions which are 5% of the total tally but resulted in 24% deaths and 26% injuries (25% total casualties). Numbers of collisions have varied from 13during 2008-09 to 5 in 2010-11 whereas deaths and total casualties during thesame years have been 9 & 62 during 2008-09 and 240 & 536 during 2010-11. This scenario of more deaths/casualties with fewer collisions during 2010-11

indicates the severity of collisions (Fig.11).

Analysis of collisions based on their time of occurrence indicates that period of 22:00 to 06:00 hrs is most vulnerable during which about 50% collisions occurred (fig.12).

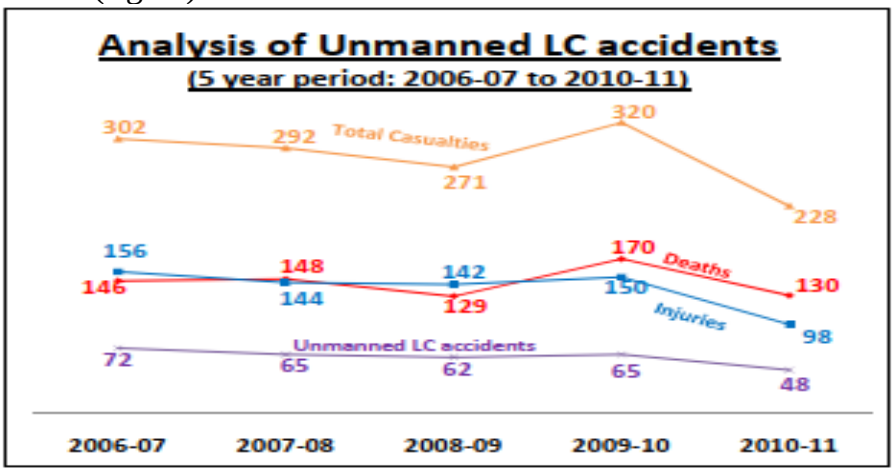


Fig. 11

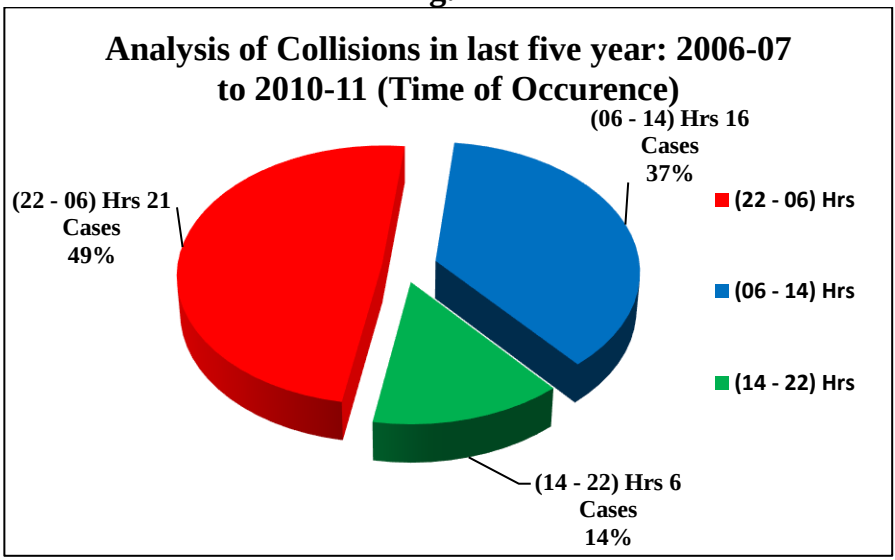


Fig. 12

Further analysis indicates that out of a total of 43 collisions occurred during this period 21 where on account of driver passing signal at danger (SPAD), 10on account of driver passing automatic signal in on position at higher speed and balance for other reasons.

2.4.6 Derailments, which are half of the consequential train accidents resulted in4% deaths and 27% injuries (19% total casualties), have gradually come down over this period (Fig.13). Analysis of derailments based on their time of occurrence indicates that there is no correlation though there is slightly higher possibility of derailments during 22:00 to 06:00 hrs (Fig.14).

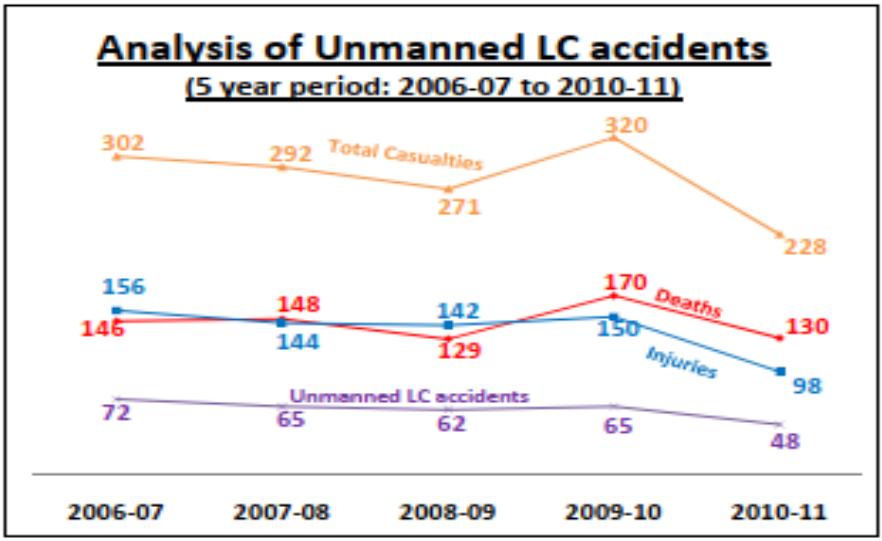


Fig. 13

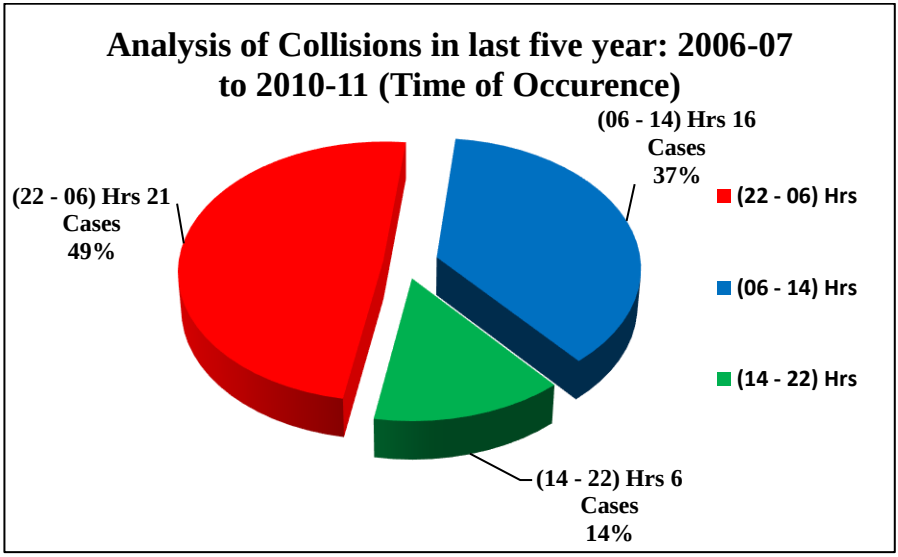


Fig. 14

Out of 441 derailments occurred during this period, maximum of 129 were contributed due to Civil Engineering defects, followed by 56 due to sabotage, 54 due to combination of staff, 43 due to carriage & wagon defects, 36 due to failure of other than railway staff, 27 due to failure of operating staff, 24 dueto failure of equipment, 28 due to failure of Loco pilot, 26 incidental and balance for other reasons.

2.4.7 Unmanned Level Crossing accidents, which are 36% of the total tally resulted in 59% deaths and 32% injuries (42% total casualties). Their numbers have also come down over this period (Fig15). **Analysis of Unmanned Level Crossing based on their time of occurrence indicates that day light period of 08:00 to 19:00 hrs is most vulnerable during which about 86% accidents occurred (Fig.16).**

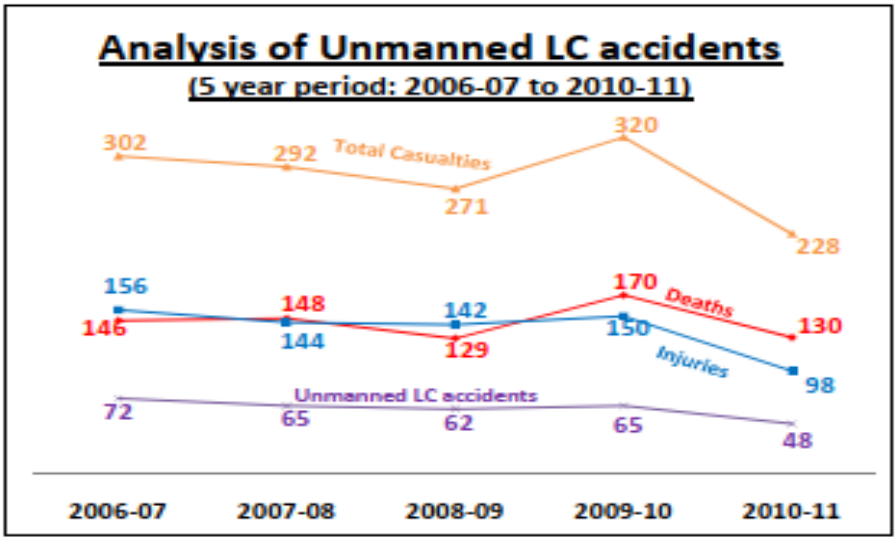


Fig. 15

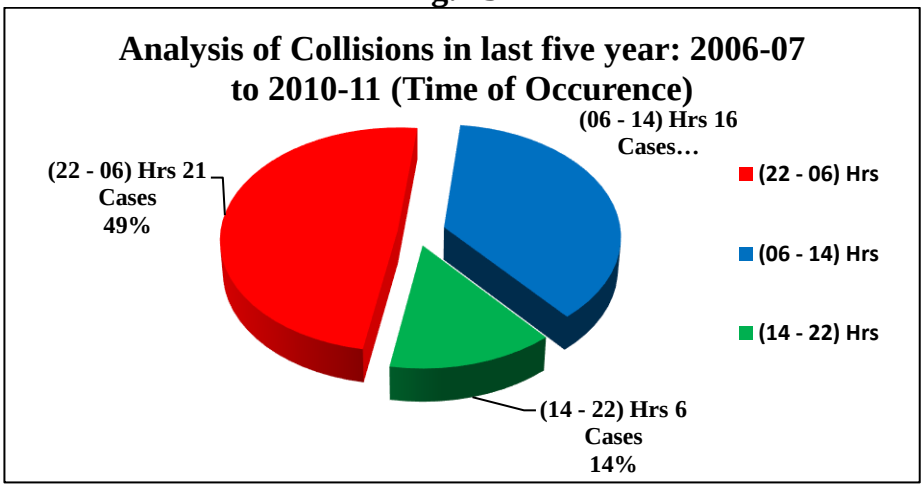


Fig. 16

2.4.8 Manned Level Crossing accidents, which are 4% of the total tally resulted in 6% deaths and 6% injuries (6% total casualties). Their numbers have also come down during this period (Fig.17). Analysis of Manned Level Crossing based on their time of occurrence indicates no correlation

between them (Fig.18).

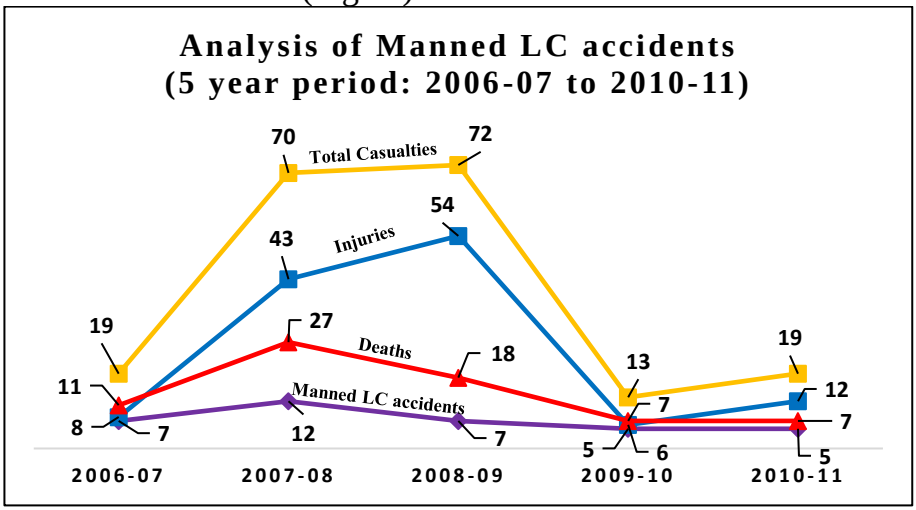


Fig. 17

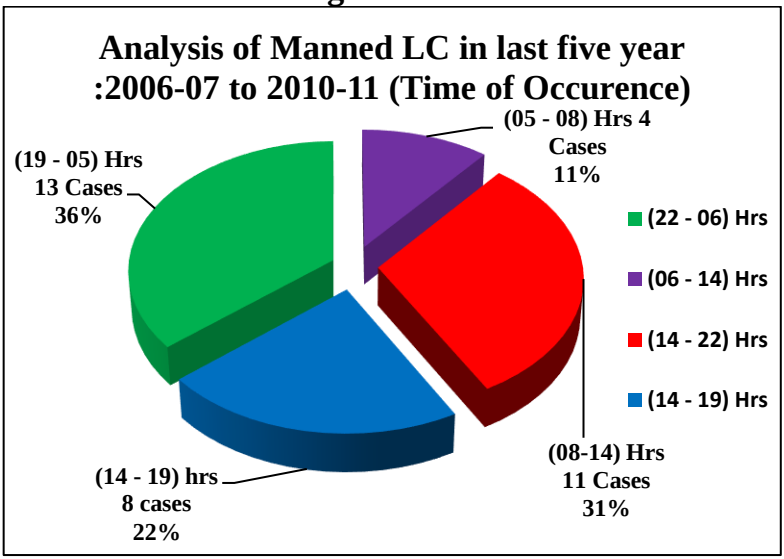


Fig. 18

2.4.9 Fire accidents, which are 2% of the total tally resulted in 2% deaths and 1% injuries (1% total casualties). Deaths and injuries have not reduced with reduction in fire

accidents in 2008-09 (fig.19). Analysis of fire accidents based on their time of occurrence indicates that there is a higher possibility of fire between 14:00 to 06:00 hrs. during which 88% accidents occurred (Fig.20). 8 cases were due to Failure of other than Railway Staff (FORS) out of 16 cases of fire occurred during this period.

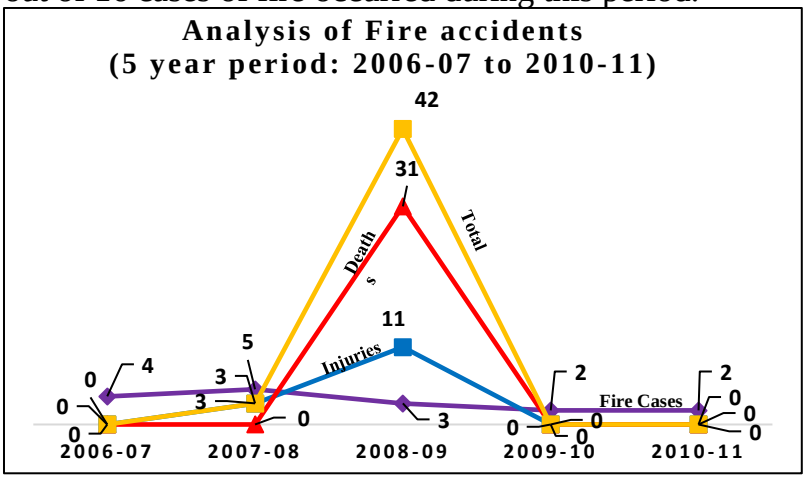


Fig. 19

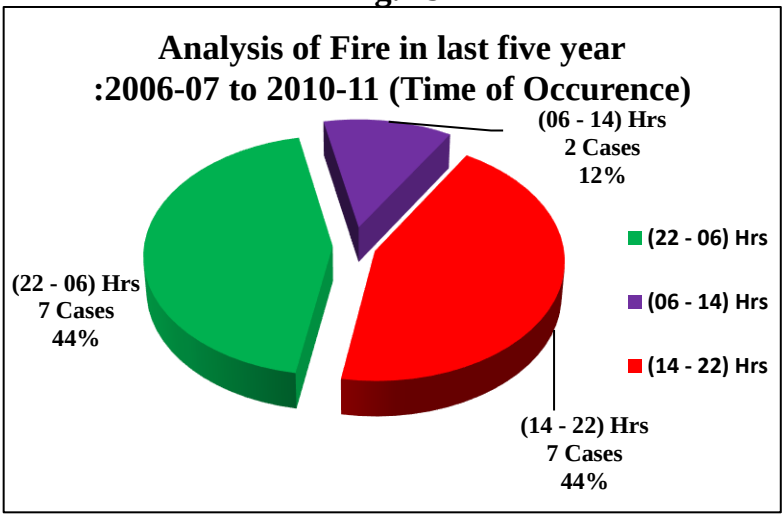


Fig. 20

2.4.10 It is noted that many a time practices and incidents impinging on safety in train operation and also the cause of accidents are not fairly brought to the notice of management as departmental loyalties often over-shadow the quest for getting into the ground realities for improvement. As has been the practice in some of the developed countries, **the Committee recommends an IT system based on email / SMS should be put in place to report such matters which should be investigated by the safety officers at Headquarter and Divisional levels followed with appropriate corrective action.**

2.5 Assets Failures

2.5.1 Since the data of consequential train accidents does not capture the entire picture reflecting vulnerability of the system, details of asset failures whichmay translate into train accidents were also collected from the Board's office as shown in Table 1.

Year	Signal	Rail	Diesel Loco	Electric Loco	Coach	Wagon						OHE
						Detachment	Poor BP	Train Parting	Spring Breakage	Hot Axle	Journal Breakage	
2002-03	106040	10374	4436	2976	149	5796	164	826	2472	1092	5	651
2003-04	117240	8613	4301	2928	156	4586	60	688	1722	776	2	475
2004-05	123752	7162	4410	2639	142	3598	56	668	1188	591	7	541
2005-06	114587	6807	4432	2902	125	2909	30	926	716	527	7	495
2006-07	147966	5953	4181	2653	85	2454	15	996	483	509	2	353
2007-08	167831	5761	3967	2198	72	1936	17	877	300	567	0	332
2008-09	140852	5752	3545	1659	87	1551	6	793	159	599	1	295
2009-10	123502	6734	3505	1668	94	1470	12	778	129	684	0	390
2010-11	118758	6693	3818	1574	66	1350	8	717	104	779	2	379

Table 1

2.5.2 This asset failure data indicates high absolute figures of failures though there is improvement over the past years. It is a different matter that even this data is apparently a fraction of actual position in the field as was understood by the Committee during our interactions.

2.5.3 Asset failures put strain on the capacity of the system which is already scarce.Though very reliable data of the loss of line capacity due to asset failures could not be assembled, it is estimated that down time of system due to failure of assets of all departments (signaling, track, rolling stock, etc.) isabout 3 to 4 hours over 24 hours on busy sections. The Committee further noted that human intervention is at its peak to run trains during this transient period of uncertainly. It was cited during our interactions that more accidents happen during such periods though the same could not be corroborated by statistics of consequential train accidents. It may be that accidents of a minor nature or near misses happen during such a transient period, details of whichare not maintained in the office of the Railway Board. **Thus, there is a strong case to take steps to improve reliability of assets and measures to have redundancies in the systems so that normal operations are least hampered. Some of the redundancies could be track circuiting by two diverse different means at vulnerable locations such as bridges.**

2.5.4 The Committee strongly recommends that IT based system should be set up within 6 months to collect and collate all train accidents whether consequential or of little significance, near misses, safety related asset failures, etc. so that the correct picture is available to the highest level to enable decision making.

2.6 Present Financial Health of IR

2.6.1 The financial health of IR has great bearing on Safety. Without adequate availability of funds, operation and maintenance activities of assets, replacement of old assets, development of new assets based on advanced

technology, etc. cannot be achieved. Unfortunately, the position is not comfortable at this juncture as can be seen from Fig 21 and 22. Gap between gross revenue receipt and working expenses has narrowed down since 2007- 08 largely due to increase in staff costs which doubled in the past 2-3 years with the revision in salaries after VI Pay Commission. Earnings did not pick up commensurately which has lead IR to this situation of funds crunch.

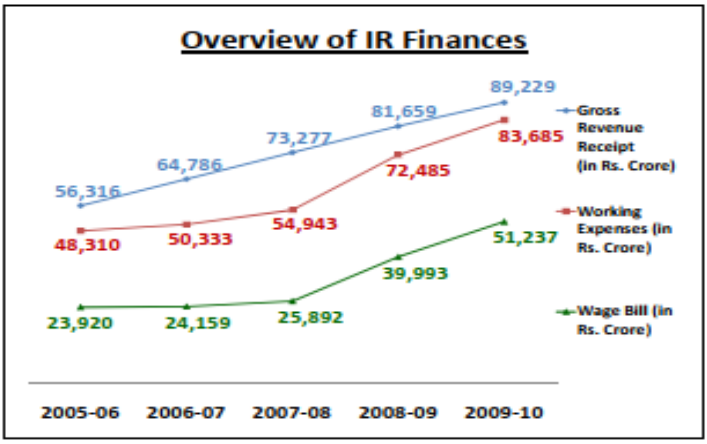


Fig. 21

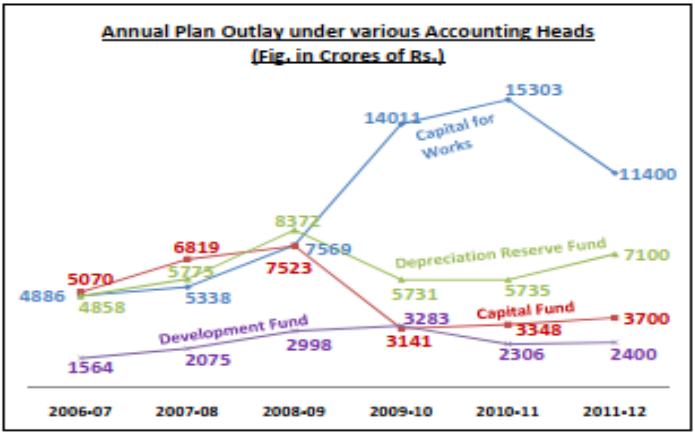


Fig. 22

2.6.2 Most of the functionaries, including the staff Federations, quoted that passenger fares have not been increased in the last 8 to 10 years and their present level is ridiculously low as compared to the bus fare. The Committee noted in one of the presentations that while Wholesale Price Index rose by about 300 % in last 10 years, passenger fares for 2nd class travel on Indian Railways more or less remained the same (Fig. 23 and 24). Such kind of protracted reluctance to increase passenger fares had an ill effect on IR finance and in turn on safety.

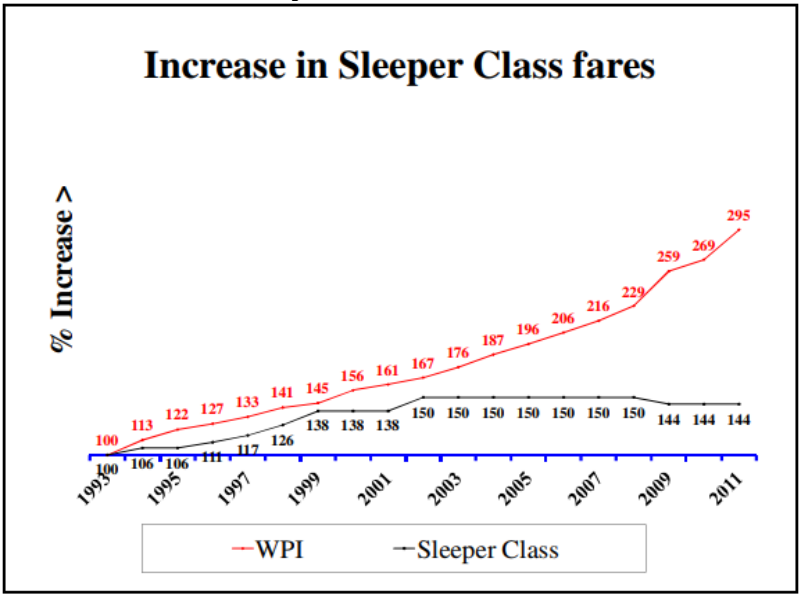


Fig. 23

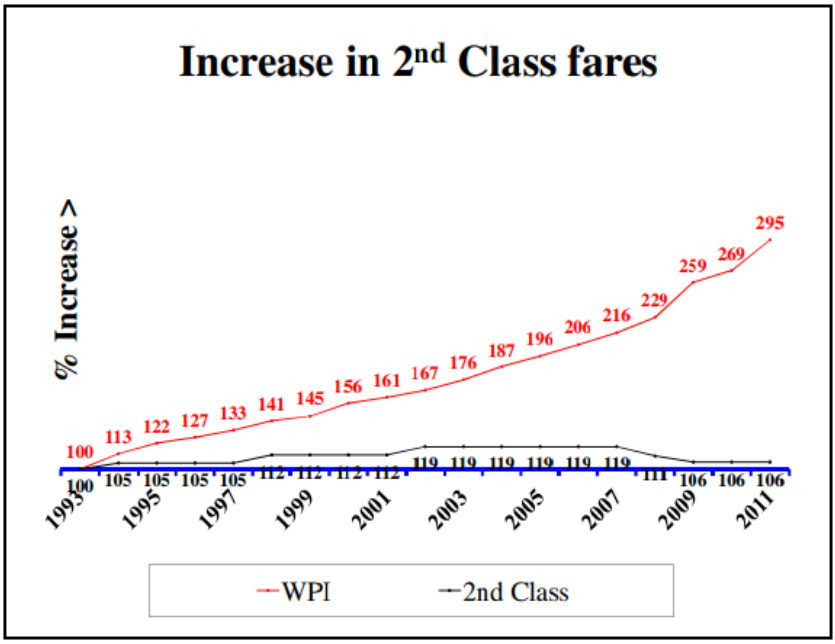


Fig. 24

2.6.3 Allocation of funds under revenue for day-to-day operation and maintenance of assets has not been commensurate with the requirement. During our interaction with zonal railways, it was mentioned time and again that theallocation of funds has been less during the previous and the current years, which gets confirmed by the graphical representation in Fig. 25 to 30. The situation is more pronounced considering the increased productivity (Fig. 26), addition of new assets and inflation affecting cost of material and contractual works. **Such kind of situation is detrimental not only for maintaining high safety standards on Indian Railways which needs appropriate level of investment but also for running railway on business lines.**

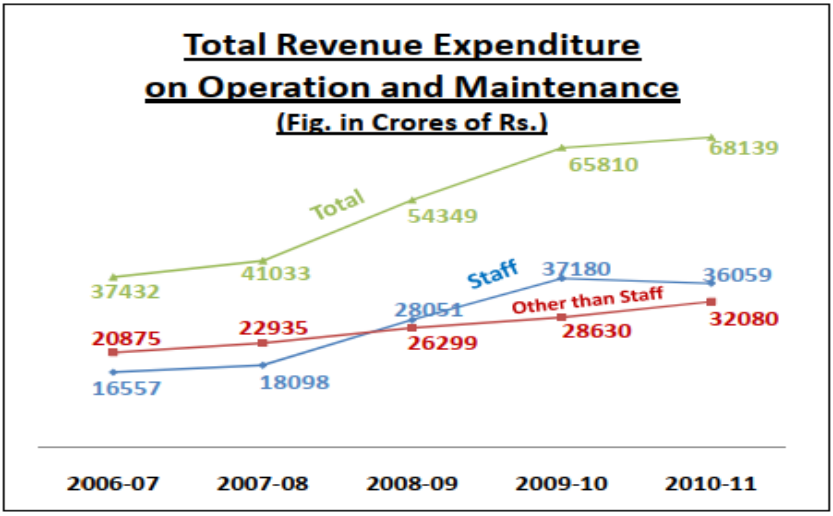

Total Revenue Expenditure
on Operation and Maintenance
(Fig. in Crores of Rs.)
Total
37432
41033
54349
65810
68139
Staff
16557
18098
28051
37180
36059
Other than Staff
20875
22935
26299
28630
32080
2006-07
2007-08
2008-09
2009-10
2010-11

Fig. 25

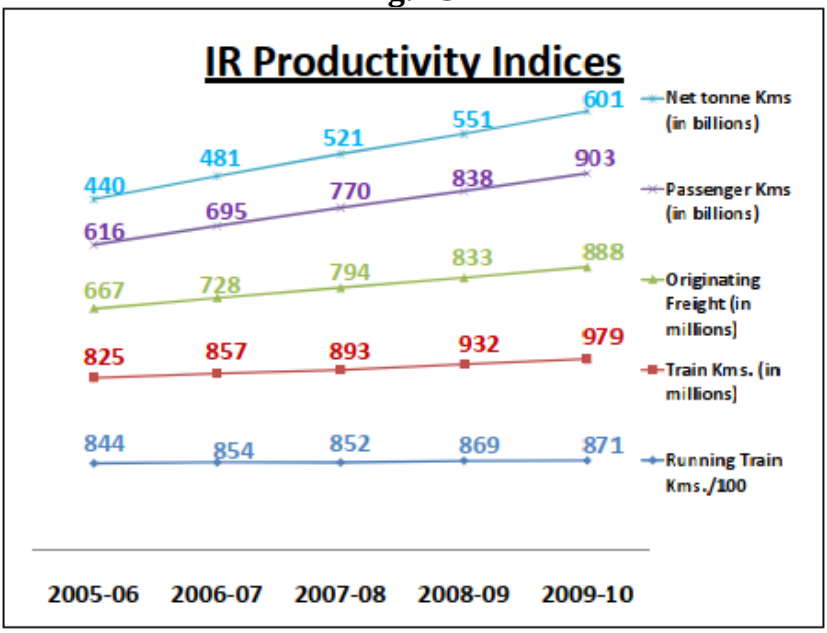

IR Productivity Indices
Net tonne Kms (in billions)
440
481
521
551
601
Passenger Kms (in billions)
616
695
770
838
903
Originating Freight (in millions)
667
728
794
833
888
Train Kms. (in millions)
825
857
893
932
979
Running Train Kms./100
844
854
852
869
871
2005-06
2006-07
2007-08
2008-09
2009-10

Fig. 26

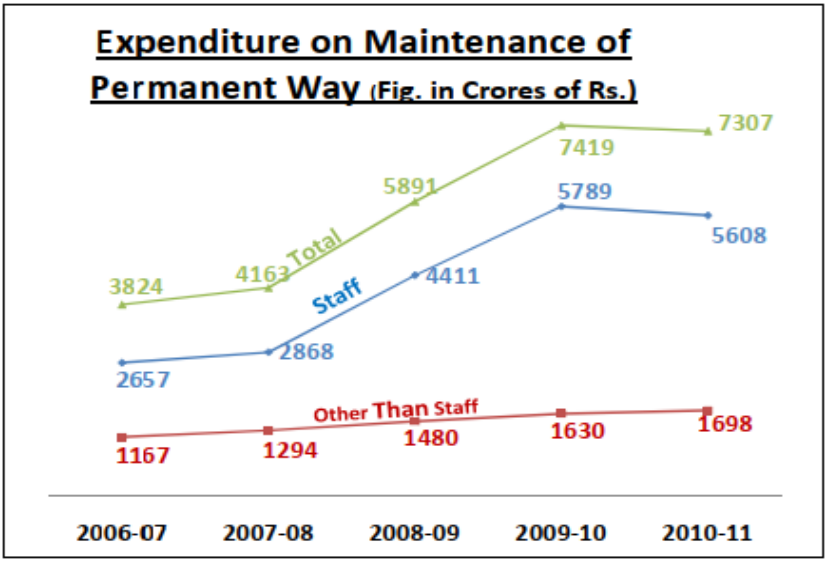

Expenditure on Maintenance of Permanent Way (Fig. in Crores of Rs.)
Total
Staff
Other Than Staff
3824
4163
5891
7419
7307
2657
2868
4411
5789
5608
1167
1294
1480
1630
1698
2006-07
2007-08
2008-09
2009-10
2010-11

Fig. 27

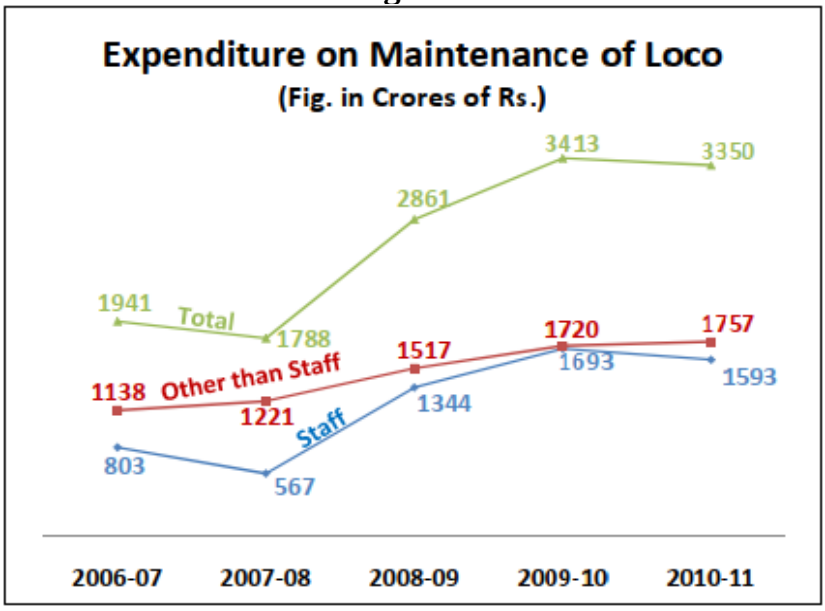

Expenditure on Maintenance of Loco
(Fig. in Crores of Rs.)
Total
Other than Staff
Staff
1941
1788
2861
3413
3350
1138
1221
1517
1720
1757
803
567
1344
1693
1593
2006-07
2007-08
2008-09
2009-10
2010-11

Fig. 28

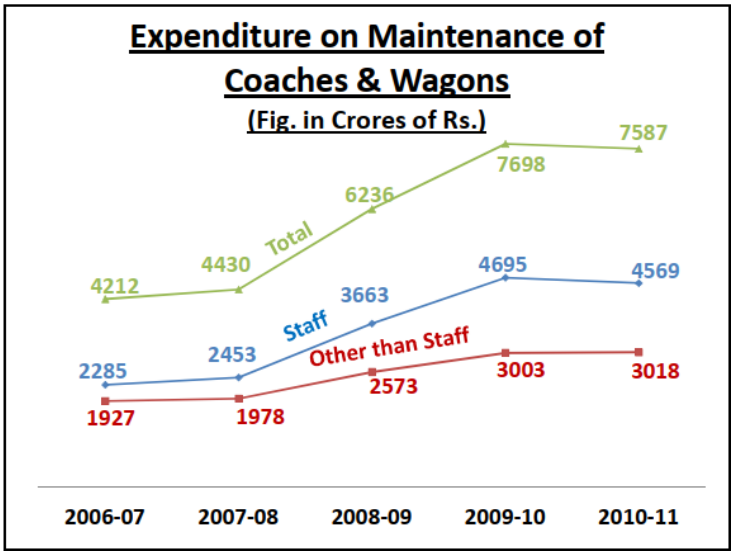


Fig. 29

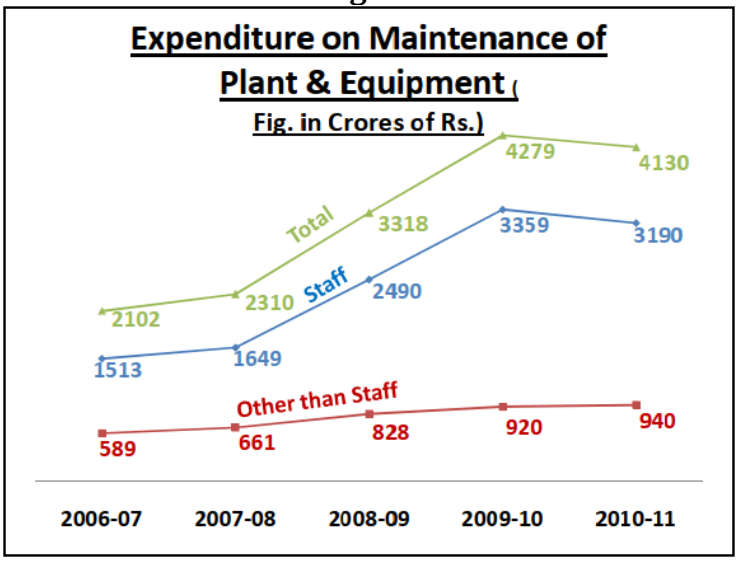


Fig. 30

2.6.4 Renewal of over-aged assets is of paramount importance

for safety of Railway infrastructure. It is also important to have a realistic estimation of the assets requiring replacements for making necessary provision of funds under Depreciation Reserve Fund (DRF). It is, however, seen that there is no system on Indian Railways for any realistic estimation and renewal of assets is programmed on year-to-year basis based on the availability of funds under DRF. Looking at the fund position of DRF it is seen that appropriation to DRF has been constrained specially during 2009-2010 and the closing balance hasbeen more or less 'nil' during 2009-10, 2010-11 and 2011-12 (BE) (Table 2). Position is similar under Development Fund (Table 3).

(Rs. In Crs.)

	Depreciation Reserve Fund				
	Opening Balance	**Appropriation**	**Withdrawal**	**Interest on Fund Balance**	**Closing Balance**
2006-07	4141.11	4298	4957.78	247.73	3729.06
2007-08	3729.11	5550	5774.93	253.17	3757.35
2008-09	4347.71	7100	8371.56	259.84	3335.99
2009-10	3336.19	2287	5731.19	112.99	4.99
2010-11	4.93	5615	5598.91	-16.33	4.69
2011-12 (B.E.)	4.69	7100	7100	0.28	4.97

Table 2

(Rs. In Crs.)

	Depreciation Reserve Fund				
	Opening Balance	**Appropriation**	**Withdrawal**	**Interest on Fund Balance**	**Closing Balance**
2006-07	2546.57	1880	1563.94	248.53	3111.16
2007-08	3111.15	2359	2075.17	270.64	3665.62
2008-09	3665.62	1391	2998.24	240.39	2298.77
2009-10	3023.78	0.75	3141.48	122.38	5.43
2010-11	5.54	1404.9	2576.59	-47.19	-1213.34

2011-12 (B.E.)	-1213.34	2400	2400	-98.64	-1311.98

Table 3

2.6.5 During one of the interactions, the Committee was informed that the net socialservice obligation borne by Indian Railways is quite substantial. Indian Railways incur losses every year by performing a variety of un-remunerative services. These losses are presumably due to low ordinary class fare, sub- urban and non-sub-urban season fare, a variety of concessions granted on passenger tickets, transportation of certain commodities below cost and working of un-economic branch lines imposing burden on Indian Railway finances. A gap is thus created between the revenue income generated through these services and their running cost. **Net social service obligation borne by Indian Railways in 2009-10 is assessed at about 15,000 crores which is more than 17 % of the total revenue earning and 18 % of the total expenditure.**

2.6.6 It is also seen from the position of payment of dividend (Table 4) that since 2006-07 to 2011-12 (BE) the entire amount of due dividend has been paid consistently by Indian Railways. This situation is quite anomalous and unhealthy as the dividend continued to be paid on Capital-at-Charge whereas appropriation to DRF which is for the replacement of assets having direct bearing on safety was compromised.

(Rs. In Crs.)

	Dividend Payment			
	Dividend Payable	**Dividend Deferred**	**Payment of Deferred Dividend**	**Net Dividend Payment**
2006-07	3583.81	0	663	4246.81
2007-08	4238.93	0	664	4902.93
2008-09	4717.67	0	0	4717.67
2009-10	5543.34	0	0	5543.34

2010-11	4941.25	0	0	4941.25
2011-12 (B.E.)	6734.72	0	0	6734.72

Table 4

2.6.7 Such lopsided financial scenario is detrimental to safety as many of theinitiatives for enhancing safety may not see the light of the day due to scarcity of funds. **There is an urgent need to increase ridiculously low passenger fares to at least recover the basic operation and maintenance costs from the users.** Cross subsidization between freight and passenger business is not desirable though in practice on IR. An interesting observation was made by one of a very senior functionary that the effect of high freight charges levied by IR is more pronounced on common man by way of higher inflation than by high passenger fare as rail travel is not often undertaken by common man. Considering this financial scenario, the proposed mechanism to fund those recommendations having financial implication is also detailed by the Committee in the last chapter of the report.

2.7 Populist Addition of Unsustainable Number of Passenger Trains without Commensurate Strengthening of Infrastructure

During the last decade there has been mushroom growth of new passenger trains on an already insufficient rail infrastructure in the country. During last five years, addition of more than five hundred new trains, increasing the frequency of trains and adding more coaches per train has left Indian Railways in a peculiar situation. Today the system is bereft of spare capacity. Such a massive addition of passenger trains every year without serious thought, mainly on political consideration, has severe implications on safety preparedness of railways. Further, neither any system or mechanism exists to evaluate the safety

risk of such uncoordinated measures nor has any effort been undertaken to ameliorate the worsening conditions created by such an act. Such a practice may not exhibit any co-relatable short-term impacts, but safetywill definitely be compromised by running additional trains within the same infrastructure without additional resources and capacity augmentation. As it is,corridor maintenance blocks are not adequately available on several routes creating severe constraints on maintenance/safety upgrades. This situation may further deteriorate if the addition of new trains is continued. **The Committee recommends that technological steps and projects for augmentation of line capacity on busy routes and maintenance facilities for coaches and wagons in open line and workshops should also be funded and executed as top priority. This should be taken in mission mode. Emphasis should be on the creation of world-class infrastructure for this purpose on a futuristic basis commensurate with the projected growth of traffic. No new trains should be introduced without adequate capacity for operation and maintenance.**

Funds to the tune of Rs. 5,000 Crores have been proposed over 5 years for improvement of infrastructure in workshops and open line depots.

2.8 Organizational Structure

2.8.1 The highest level of management is Indian Railway Board which is also the Ministry of Railways under Hon'ble Minister of Railways and two Hon'ble Ministers of State. Indian Railway Board comprises of a chairman and 6 Members representing their specific departmental areas. The Railway Board not only formulates policies but is also actively associated in day-to-day operations and

other affairs of 17 zonal Railways. There are numerous Directorates under the Railway Board, mostly on departmental lines for assisting the Railway Board in policy making and are also closely associated with the routine working of zonal railways. 17 zonal railways are headed by GeneralManagers assisted by Principal Heads drawn on departmental lines. Each zonal railway has divisions under them headed by Divisional Railway Managers who also have departmental branch officers to assist them.

2.8.2 The present organizational set up on departmental lines is very conservative and lacks dynamism needed in a transport organization of the stature of IR. Such a set up also gives rise to inter-departmental rivalry, losing sight of the overall organizational goals including safety. A semblance of this could be seen by the Committee during its interaction. Structure on the functional linesbeginning with Board downwards should be a better proposition. **The Committee recommends the restructuring of the Railways should be examined and studied by a separate expert group considering the complexities involved in this matter.**

2.8.3 GMs and DRMs are the key general management positions on the zonal railways and incumbents are expected to be well versed with operation of trains. The present system of general posts like DRMs, and GMs being thrown open to all departments who have little background or exposure in safety-related train operations has undermined safety in the Railways. **The Committee strongly recommends the earlier system of only Operating and technical officers being considered for such posts need to be restored.**

The present practice of limiting the tenure of DRMs to 2 years is conducive neither to efficiency nor to safety enforcement. Accountability also gets diluted and the tendency somehow to stay on and complete 2 years makes the officer complacent and indifferent. The Committee recommends only capable officers are selected as DRMs and posted in divisions with a minimum tenure of 3 years.

2.8.4 It is the divisional unit which is the actual place of physical activity to derive physical railway transport output. The rest of the other levels i.e. Zonal Railways headquarters and Railway Board basically play roles of policy makers, monitors, and facilitators to the divisions. Some of the operating discipline is though enforced by the higher levels considering pan India working. Duringour close interaction with officials, it was very evident that **the entire management setup has become top heavy not only in terms of number but also in terms of over-centralized executive powers adversely affecting output at the divisional level. The Committee considers this asa major impediment to the smooth working of railways.** There are far lessofficers at the working level than many monitoring, inspecting, and giving suggestions. Such a kind of environment is putting extreme pressure at the working levels which is highly undesirable for safety of Indian Railways.

2.9 Lack of Empowerment at Working Level

2.9.1 Divisions are lacking empowerment on almost all fronts. During deliberationsit was brought out that the powers of DRM to sanction passenger amenity works was Rs. 1.0 crore whereas it was only 30 lakhs in case of safety related works under most of the plan heads including plan heads

for road safety works where there are no constraints of funds**.** Zonal railway headquarters need to be approached even for ratification of some of the processes and procedures to be followed for facilitating operation and maintenance of the assets within the allocated budget. The Committee was informed that enabling powers already delegated by the Railway Board to zonal Railways have not been further delegated to the divisions.

2.9.2 The Committee decided to get to the root of the matter and divisions on different zonal Railways were asked to furnish information on the extent of delegation of financial powers. Feedback was received only from 14 divisions of 9 zonal Railways, and it was found that there is large deviation in the powers delegated to DRMs on different zonal Railways. While delegation is generous on some it is very conservative on others. For example, powers to procure safety related stock and non-stock items vary from Rs.5000 to 3 lakhs; powers to accept tenders of safety related works vary from Rs.4 Cr. to Rs.8 Cr.; powers to sanction works under safety related Plan Heads vary from Rs.5lakhs to Rs.30 lakhs and powers to appoint Spot Purchase Committee varies from "Nil" on most of the divisions to Rs.40 lakhs. This level of exercise may appear to be of little significance on the face of it, but financial empowermentis a great enabler to create favorable safety environment. **The Committee considers this a major adversity which needs to be addressed at the earliest.**

2.9.3 Divisions should be fully empowered to spend the allocated grant for operation and maintenance of assets under their control. Minimal processes and procedures should be laid down by Railway Board and Headquarter

except for areas of significant technical or holistic nature for uniformity purpose. There should be no need for the divisions to send the file or proposal to HQ to process ratification such as single or limited tendering and DRMs should be empowered to take decision.

2.9.4 GMs enjoy a negative list of powers but in practice it was seen many of the powers have been withdrawn by Railway Board by administrative directives. GMs also need to be empowered in a fashion that there is no or very limited need to approach Railway Board till zonal railways are within the allocated grant under revenue as well as works.

2.9.5 The Committee strongly recommends the following enhanced empowerment to zonal railways at HQ and divisional levels in regard to safety matters:

1. **The powers of General Managers should be enhanced to 3 times from the present level for sanction of works and M & P items under all Plan Heads except New Lines. These should also be applicable on an out-of-turn basis, depending on the urgency. The powers of DRMs should also be accordingly enhanced to 3 times from the present levels.**
2. **General Managers should be given full powers for re- appropriation of funds from one work to another under the same Plan Head and source of funds under all the Plan Heads, except New Lines. However, they should keep the Railway Board apprised so that the overall planning if IR is not affected.**
3. **General Managers should have full powers to re-appropriate fundsunder Revenue under the same**

Demand from one PU to another within the overall budget allotment.

4. **DRMs should be fully empowered to decide the process/procedure such as Spot Purchase Committee, Single/Limited Tenders, etc. for execution of work or procurement of stores, for operation and maintenance of assets under them.**
5. **For operation and maintenance of assets and services under the Divisional control within the overall budget allotment, DRMs should have full powers:**
    a. **To accept tenders floated by the division.**
    b. **To enter into repair or Annual Maintenance Contracts (AMC)through OEM or otherwise**
    c. **To purchase stock items in case of shortages and non- stock items through Divisional Stores Manager up to Rs. 3 Lakhs per case but without any monthly ceiling**
6. **DRMs should be empowered to award works of essential nature related to operation and maintenance assets on quotation basis for 3 months as a stop gap arrangement till regular contract is in position.**
7. **Full powers for hiring resources including utility vehicles for the working at the Division level should be with DRMs with associated finance concurrence.**
8. **DRMs on Zonal Railways should be delegated full powers to sanction construction of RUBs, limited height subways and ROB under Road Safety works as closure of level crossing gates is going to one of the mission areas of Indian Railways.**

9. **Powers those vested with DRMs of the Division should also be enjoyed by the Chief Workshop Managers (CWM) in respect of their workshops.**

2.9.6 The Committee was informed of the very limited financial powers vested with GMs, DRMs and Branch Officers to grant On-the-spot awards for meritorious work in safety areas. The Committee recommends increasing this limit to three times at the respective levels to motivate stafffor good performance in safety related matters. It is also recommended that Imprest is created for this purpose so that the cash award is straight away given to the employee for good work without any delay in processing.

2.9.7 The Committee feels these recommendations are crucial to raise the safety level of the railway system. **It is further recommended that delegation of powers to the divisions is directly mandated by the Railway Board as a onetime measure for uniformity over divisions in wake of present conservative delegation of powers.** It must be borne in mind that independence and empowerment of the zonal railways and the division under them for spending allocated budget amount is essential for reliablemaintenance of assets and execution of important safety related works.

2.10 Safety Related Works and Issues

2.10.1 The Committee has a feeling that the issues specific to individual departments are reasonably well taken care of whereas matters pertaining to two or more departments fall flat due to coordination and ownership problems. Safety being multi-disciplinary is also a casualty under such departmentalized regime. It is ultimately up to the GM or the DRM to sit with his safety

officer and dissect the issues to come up with departmental action points which need to be executed for achieving the compliance of thesafety functions. The role of GMs and DRMs thus becomes very important in the context of safety implementation. Though they have safety officers under them to facilitate them in this function, however, coordinated programmed action to address safety issues with the stakeholder departments at the headquarter and divisional level should be in their personal domain on utmost priority. For this purpose, **Core Safety Groups are recommended under the convenorship of the Additional General Manager/Safety (a new post carved in zonal headquarter as part of the new safety architecture) at headquarter level and Sr. Divisional Safety Officer at divisional level. Principal Heads of Departments at HQ level and branch officers at divisional level of Civil, Mechanical, Electrical, Signaling, Operating and Finance will be the members of this core group.** Representation of finance is necessary to ensure expeditious procedural action on the flagged issues. Officers of other departments should be co-opted need based. Core Safety Groups should discuss all aspects of safety in operations/ maintenance/ projects/ quality control- surveillance-assurance/human resource etc. including review of safety related occurrences. The agenda for such meetings should be set by the Safety Organization on the basis of input from all stakeholders**. The meeting of the Core Safety Group should be personally chaired by the General Manager and DRM at headquarters and divisional level respectively** and the action points should be minute

followed with expeditious implementation in a programmed way. Holding such meetings everymonth should be mandatory. Returns on meetings held, their minutes and implementation of decisions should also be submitted to next higher levels both in the functional as well as safety stream.

2.10.2 Execution of replacement/up-gradation of signaling system is very slow and time consuming to the extent that 5 to 8 years are taken due to verycomplex processes of signing of plans at various levels. The Committee was informed that though the replacement of the signaling system is sanctionedfor many locations, the progress has been slow on account of such procedural delays. It was reported that Engineering Site Plans and Signal Inter-locking Plans do rounds in the division and headquarters at lower levelsbefore they are finalized and signed by the authorized officers. Many a times new provisions and facilities are demanded with the change in incumbents needing alteration in the plan which causes further delay. Sinceexpeditious replacement and up-gradation of signaling system is vital from the viewpoint of safety, **the Committee recommends that a group of nominated officers headed by AGM and ADRM at the Headquarter and divisional levels respectively convene meetings once every week to clear all the pending plans. Site should be inspected by the concerned officers well in advance, and the concerned junior officers/senior sub- ordinates as necessary may be called in the meeting. Weekly position of plans pending at Divisional and Headquarter levels should be putup to DRM and GM respectively who should keep an eye on the**

progress.

2.11 High Level of Vacancies in Critical Safety Categories

2.11.1 Severe shortage of manpower in safety categories such as supervisors and technicians under various departments, ASMs, Loco Pilots etc. was universally reported in almost all interactions. The complaint gets substantiated by the position shown in Table 5.

S.N.	Categories	SS	OR	VAC	%age
1	ASMs/SMs/SSs	37475	34138	3337	8.9
2	Controllers	2672	2318	354	13.2
3	Guards	30301	24505	5796	19.1
4	Gateman (Traffic)	11066	7485	3581	32.4
5	Switchmen	3070	2993	77	2.5
6	Cabinmen	10612	9691	921	8.7
7	Levermen	5161	4099	1062	20.6
8	Pointsmen	28149	24886	3263	11.6
9	JE/SE/SSE (P. Way)	6334	5268	1066	19.8
10	Supervisor (P. Way)	4380	3280	1100	25.1
11	Gangmen/Gangmate	204925	148566	55359	27.0
12	Keymen	13331	10968	2363	17.7
13	Gatemen (Engg.)	29707	25373	4334	14.6
14	JE/SE/SSE (Signal)	3408	2841	567	16.6
15	ESM	16014	13792	2222	13.9
16	MSM	0	0	0	0.0
17	Drivers	36772	28940	7832	21.3
18	Motermen	3505	2937	568	16.2
19	Shunters/Engine Turners	7335	5656	1679	22.9
20	Dsl./Elec. Asstts.	3711	28671	7040	19.7
21	JE/SE/SSE	8842	7130	1712	19.4
22	Safety Inspectors/Counsellores of all Deptts.	906	728	178	19.6
23	All Other Safety Categories	175639	153746	21893	12.5
	Total	**675315**	**549011**	**126304**	**18.7**

Table 5

2.11.2 Some kind of helplessness was expressed in filling the existing vacancies due to inordinate delay by Railway Recruitment Boards which have been entrusted with direct recruitment of railway supervisors and staff. Such staff shortage on the existing sanctions is adversely hampering the maintenance of assets affecting safety. that the Committee recommendsthat all the vacancies of supervisors and staff in the safety category are filled up in a time bound manner say within 6 months by leveraging IT based recruitment systems. Since Railway Recruitment Boards function under the administrative control of the Railway Board, the concerned officer in Railway Board should be directly given this responsibility along with commensurate empowerment required for the purpose.

2.11.3 With the introduction of more and more passenger carrying and freight trains, additional posts are required to be created to man and maintain newly created assets. The policy of having a matching surrender for creation of additional posts under safety category may no longer be feasibleconsidering that Railways have been on this venture since last few decades.

It is however possible in the present environment that some of the departments are still holding on to surplus posts and are unwilling to surrender them for the fear that other departments will get the benefit oftheir surrender and will create posts in other departments. This psychosis needs to be addressed at the level of General Manager. It is recommended to form multi-disciplinary teams of 3 officers, one each from Personal, finance and the concerned department, who should go into cadre of the respective departments to identify

surplus posts at the Divisional, Hd. Qrs. and production unit levels. Such identified posts should be surrendered to build up a surplus bank. Multi- disciplinary teams should also carry out the exercise for identifyingthe need for creation of additional posts under safety category and should put up their recommendations. GM should take action based on these recommendations to ensure that creation of additional posts is rightfully done in the deserving safety categories utilizing the surrenders giving first preference to the departments surrendering posts. This exercise should be accomplished with 3 months andposts for which surrender is not available GMs should be empowered to create additional posts with finance concurrence under Safety categories. The Committee strongly mandates that no vacancies are allowed to remain in respect of essential safety categories of supervisors and staff for more than 3 months.

2.11.4 It was brought to the notice of the Committee that individual Directorates in Board's office have issued staff yardsticks with the concurrence of Railway Board finance for operation and maintenance of assets under their control. Considering that there is need of right sizing the organization as staff cost isvery high on Indian Railways and the induction of new technology almost in all areas, the Committee recommends that the existing yardstick should be looked afresh in a dispassionate fashion and the same should be issued to the zonal railways within 3 months.

2.11.5 There are many non-safety and non-core areas wherein outsourcing is not only economical but is also an effective means to improve the quality of work and

services considering the severe constraints in the present railway environment. Some such areas are mechanized cleaning and hygienerelated works in coaches, railway stations and other workplaces, linen management, building maintenance, security of non-core establishments such as offices, etc. These should be outsourced as a policy to save costs and get expert service. The Committee recommends a clear-cut policy guideline in this regard is issued by the Railway Board to Zonal Railways. However, legal implications of outsourcing of works of regular nature may be taken into consideration.

2.12 Role of Finance

2.12.1 Helplessness at all levels of executives was noted by the Committee in dealing with the Finance Department. It was quoted by one officer that his success depended on managing and getting files/proposals cleared through Finance. The Committee was made to understand that the role of Finance has now become all pervasive encompassing almost all processes and procedures and nothing moves without their concurrence. This is not acceptable as the same not only acts as a decelerator to delivery of works but also breeds frustration and kills initiatives of executives which is not good for the organization.

2.12.2 Railways need to trust their executives and the procedure to insist onfinancial vetting or concurrence at every stage needs a thorough review. While 'checks & balances' are essential, the system should not come to a grinding halt. We feel the role of finance needs to be re-defined so that they are also made equally responsible and accountable for delays along with executives. Unless the system is

freed from the vice grip of the finance department, executives cannot deliver in style and in time. While the Committee is greatly concerned with the slow decision-making process on the Railways, we would leave it to the Railways to find the remedy for the same.

2.13 Shortage of Critical Safety Spares

2.13.1 Supply of material for maintenance of assets was universally stated to be unsatisfactory during all our interactions. To get a better appreciation in this matter, zonal railways were advised to give supply compliance of safety items pertaining to different departments. It was noted with concern that even the number of safety items for different departments is not uniform on different Zonal Railways as can be seen from table 6.

No. of Items classified as Safety items on Zonal Railways						
S. NO.	**Zonal Railways**	**Permanent Way (Track)**	**Signaling**	**Mechanical (C&W)**	**Mechanical (DSL)**	**Electrical (Loco + EMU)**
1	CR	16	34	116	172	
2	ER	0	17	209	137	143
3	ECR	155	20	239	140	428
4	ECoR	19	3	143	85	63
5	NR	15	145	301	194	120
6	NCR	11	10	217	137	295
7	NER	15	129	182	186	NA
8	NFR	34	40	196	134	NA
9	NWR	0	30	214	166	NA
10	SR	10	23	140	141	399
11	SCR	NA	NA	NA	NA	NA
12	SER	8	25	216	95	222
13	SECR	10	59	169	119	179
14	SWR	34	14	58	44	6

15	WR	17	15	142	125	424
16	WCR	29	NA	51	NA	312

Table 6

As can be seen from the position, no item is classified as safety items onER and NWR against 155 items in ECR for track; only 3 items in ECoR against 145 items in NR for Signaling; 51 items in WCR against 301 in NR for Carriage & Wagons; 44 in SWR against 194 in NR for Diesel loco and 6 in SWR against 933 in CR in Electric loco and Electrical Multiple Units. It is recommended concerned directorates in the Railway Board issue a well-defined list of safety items to zonal Railways for uniformity.

2.13.2 Supply compliance of safety items is far below satisfaction level on most of the zonal railways for maintenance of safety related infrastructure (Annexure 2). The present procurement policy of tendering based on annual requirements adopted so far has failed resulting in a shortage of essential safety items and it is high time that procurement and supply of material to the maintenance units is completely revamped.

2.13.3 RDSO has an active role in development of design/drawing and specifications of safety items, development and approval of their vendors and inspection before supply to the maintenance units under zonal railways.It is recommended that RDSO should take full responsibility for those safety items which are dealt with by RDSO as above. They should enter into long term rate contract with their approved vendors for 3 to 5 years for all the RDSO items after negotiating rates based on the valueof the item which can be best assessed by the RDSO. Annual requirements of zonal railways

should be kept in view while entering into rate contracts with the firms who should have adequate capacity to meet withthe entire annual requirement of the Railways. While finalizing rate contract for such items coverage of geographical area and economy of scale need to be kept in view to the extent feasible. Once rates contracts are placed for safety items, zonal railways can directly place orders on the vendors based on quantity prescribed for different vendors. The process of approval of vendors should not leave any chance about the capability of vendors to supply items of assured quality which seems to be aquestion mark today. Each vendor approved for a particular safety category item should have a pre-approved quality assurance plan linked to an approved manufacturing process with built in processes for handling audits and non- conformances. The approved quality assurance manual duly linked to overall quality assurance manual of Railways with due safety oversight should spell out all inspection requirements including stage inspections to be carried out / witnessed by external quality surveyor. All inspections of safety items should be recorded in a traceable manner. The inspection records duly signed and approved with designated quality surveyor should move with the supplied items so that accountability for any defective supplies is specific. The quality management process should be subject to periodic audits.

2.13.4 As far as safety items are concerned, while a competitive environment should be ensured through identification of adequate number of qualified and approved vendors, Railways should not endeavor to unnecessarilydevelop more and more vendors as long as the rates offered by

the satisfactory vendors and their manufacturing capacities are reasonable.Some of the low value safety items such as fasteners should be procured only of reputed makes directly from the manufacturers.

2.13.5 RDSO should also deal with the complaints of such safety items regarding poor quality, delayed supply, etc. and appropriately deal with the concerned vendor including penal actions such as black listing for serious quality lapses and non-performance. This centralized control of safety items will ensure reliable and timely supply to the maintenance units improving safety.

2.13.6 For non-RDSO safety items, the Committee recommends this exercise should be done at zonal railway level following a simpler but effective vendor qualification and approval process.

2.13.7 There is reason to believe that the above quality systems although inplace are not effective enough. A thorough review of the quality system by an external professional agency and revamping of the system as necessary is recommended.

2.14 Safety Inspections

2.14.1 Periodic inspection of various functions to ensure compliance is indeed necessary; however, there should be a reasonable proportion between time spent on inspection and time spent on actual performance of the functions. Dealing of inspections by different level of officers has become challenging by the implementing functionaries at the division level. A large number of inspections are followed with voluminous inspection notes issued in narrative mode which not only generate unproductive papers but also wastelots of time of the executive officers who get very little time to actually

plan and make good the deficiencies which may even be known to them.

2.14.2 Practice of cross departmental inspections by officers also leads to unproductive generation of inspection notes for statistical purpose and results in wastage of time. This should be stopped, and officers shouldinspect only their respective area and the areas affecting their work in a meaningful way. Officers from general administration such as GMs, AGMs, DRMs and ADRMs should inspect multiple departments with the viewpoint to the check functioning of the system in a holistic fashion.

2.14.3 Technical inspections by the supervisors and officers have got severely diluted. The inspecting officials must not only be aware of the frequency of carrying out inspections but should also be aware as to what is to be inspected. The follow-up action observed also needs to be ensured by the officer. It is recommended that the conventional method of technical inspection is replaced with a modern Quality Management System for which necessary check sheets should be developed by the respective departments directly associated with safety. The check sheets should be based on present rules, regulations, manuals, instructions, etc. andshould form part of the safety manual of the Railway.

2.15 External Interference to IR system - Encroachment and Sabotage.

2.15.1 Vast expanse of Indian Railway network is prone to outside interference. The Committee had firsthand experience of large-scale encroachment very near the railway track in the Delhi area. OHE masts were seen almost inside the houses at some locations and a large population was seen squatting on the railway track. It is

understood that similar levels of encroachment near the railway track is existing elsewhere near the other metros and populous areas.

2.15.2 Large scale defecation by people living in the nearby areas was also reported. This creates unsafe conditions not only because maintenance of fixed infrastructure badly suffers at such encroachment sites but also there is danger to the population living nearby. The Committee also had firsthand experience of persons crossing the railway track while the train was on approach. It is understood that the removal of encroachment was not possible because of political interference associated with relocation of the affected population. It is strongly recommended to address this issue at the political level to ensure removal of all such encroachments in the vicinity of railway track in the interest of safety. PPEA (Public Premises Eviction Act) should be suitably amended so that eviction of encroachers is easily possible with the help of local police/Railway Protection Force. Suitable amendment in the Railway Act should also be made by which encroachers can be severely penalized.

2.15.3 The deteriorating law and order situation in some parts of the country is having an adverse impact on the railway system. Railways were adversely affected due to sabotage which has also led to some of the serious train accidents, the recent being derailment of train no. 2102 Jnaneswari Express followed byits collision with goods train on the adjoining track during very early morning hours of 28.5.2010 on Southern Eastern Railway in which 150 persons got killed and equal number of persons got injured. This accident occurred due to

tampering on the railway track by outsiders. The Committee is seized of the fact that the prevailing law and order situation in different parts of the country does have a bearing on the functioning of the railway system. However, the Committee recommends having better coordination between Indian Railways and the policing authorities and to strengthen the intelligence network to pre-empt sabotage on the Railways. We also have to handle the situation technologically by having a suitable modern signaling system with track circuits by which any rail discontinuity will automatically stop the trains. The Railway Act should be suitably amended to impose stringent punishment on persons found guilty of sabotage.

2.15.4 The Committee had an interaction with the officials of the Railway Protection Force (RPF). Initiatives taken for better security at railway stations and in trains and bottlenecks were discussed. In our view, the security at busy railway stations where a large number of passengers of all classes are handled should be of different order as compared to the airports. Big railway stations should have 'Intelligent Security' largely based on CCTV cameras with proper monitoring in the control room. As in the case of safety categories of staff, the problem of recruitment in RPF cadre was also stated. The upper limit set for recruitment of Ex-Servicemen as per stipulated standards against vacant posts in RPF cadre should be removed to expedite filling up of vacancies.

2.15.5 The railway system is often disrupted and vandalized due to agitations byoutsider groups including political parties. It was informed that some of the State

Governments (Kerala particularly) have taken political parties and groups to the court for compensation for vandalizing Government properties. Considering the essentiality of service rendered by Indian Railways, it is recommended that Railway should also take up such disruptions and vandalism to their assets to the courts for compensation and remedial measures. Railways should also examine whether suitable provisions can be incorporated in the Railway Act forthis purpose.

2.16 Saving Lives in Railway accidents and Casualties due to Railway Infrastructure

2.16.1 Rescue and relief operations are not included in the scope of the Committeeand therefore the same is not discussed. However, we are aware Railways have an excellent record in restoration at the accident sites and Railwaymen exhibit a rare dedication and earnestness on such occasions. The CRSalso reviews Railway's rescue and relief efforts during their statutory accident inquiries. We have not therefore gone into this subject.

2.16.2 Apart from the casualties due to consequential accidents, the Committee was informed that a large number of casualties take place over the entire railway system due to unlawful trespassing though the exact figures have not been compiled by the railways nor are readily available. The estimationis almost 15000 persons get killed in such a manner on the entire railway system every year of which about 6000 deaths are only on the Mumbai Suburban System. Reluctance of Indian Railways to own these casualties, which do not fall under the purview of train accidentsbut are nevertheless accidents on account of trains can by no means be ignored. No civilized society can accept such a massacre

on their railway system. While publicity, exhibiting warning notices and instilling awareness through media, educational institutions, NGOs etc. are measures necessarily to be taken by railways, we feel the grim situation on the Mumbai Suburban system has to be tackled on a different war footing. Here trespassing takes place mainly on account of lack of barricading, fencing, absence of adequate number of pedestrians over bridges, reluctance to replace pedestrian level crossings with foot over bridges etc. The lack of passenger facilities such as sufficient number of platforms, narrow platforms, escalators and elevators for physically challenged etc. and insufficient train services are the main reasons for such a heavy human toll on the Mumbai Suburban System. This is clearly the responsibility of the railways and railways cannot have the excuse that urban transport is not their responsibility. The Committee, therefore, strongly recommends that a High-Level Task Force involving the State Government, ZRUCC and NGOs is set up to recommend constructive measures which will alleviate or eliminate this problem in the near future.

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SIGNALING, TELECOMMUNICATION AND TRAIN PROTECTION

(CHAPTER: III / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

3

3.1 Background

3.1.1 At present, train operations on IR are based on trackside signaling andmanual control of operations. Most of the routes are covered with track circuiting and "Multi-aspect Colour Light Signal (MACLS)" in an interlocked manner. Widely used and accepted MACLS is the backbone of passing movement authority to the driver. Signaling systems play a key role in safe train operations and IR have taken several steps to upgrade and modernize their signaling systems over the decades. Efficient and reliable signalling also contributes to Safety by enabling availability of corridor maintenance works through the scheduled operation. Further modern signaling technologies can also contribute to greater throughput without compromising Safety.

3.1.2 However, little has been done to provide communication based on–board systems to assist loco pilots in train operation. This has now become quite significant with the

increasing traffic and trailing loads on the existing sections, most of which are saturated. Absence of Train Protection systems coupled with human failure are likely to result in collisions which are the most serious type of train accidents. Around 24 % deaths and 26% injuries occur due to 5% train collisions. Most train collisions occur due to a loco pilot signal passing at danger (SAPD) or running at higher speed than prescribed after crossing a red automatic signal. Deployment of Automatic Warning System (AWS) in Mumbai suburban section is a good example to avoid SPAD. The training of loco pilots and improvement in other related matters such as the condition of running rooms, prescribed rest before duty, etc. have only contained train collisions in a limited way.

3.2 Practices of Automatic Train Protection System on Developed Railways

3.2.1 The Committee reviewed the information on Automated Train Protection Systems prevailing and planned in different countries like Italy, Germany, France, UK, Japan, China, and USA. Although, functionalities are by and large similar at train operation management and control/protection levels, the implementation of technologies vary widely.

3.2.2 European countries, due to their interoperability requirements of track and cab (Loco) signaling have attempted harmonization of their systems through standardization/adoptability of existing and proposed signaling and protection systems. Commonly known as European Train Control System (ETCS), it sets out to create a standardized train control system at European level to address concerns on track–to-train transmission of information. Different levels of ETCS systems are

reported depending upon how the routes are equipped and the way in which the information is transmitted on the train.

3.2.3 In the USA, "Positive train Control (PTC)" for command, control, communication, and information is reported for adoption. Besides a few track side identifiers, the train position and speed are correlated with precision using GPS signals. This reduces the probability of collision between trains and works all along therail route.

3.2.4 In Japan, a combination of Computer and Radio Aided Train (CARAT) Control System and Advanced Train Administration and Communication System (ATACS) is reportedly planned. Currently, the Japan rail mostly uses Radio asthe data bearer along with leaky RF cables and Coded track circuits for track to train information exchange.

3.3 Scenario On IR

3.3.1 The Committee interacted with senior signaling and telecom experts from RDSO, Railway Board, Zonal Railways, Konkan Railways and RailTel on the present and proposed plans on Signaling, Train Protection Systems and Collision Avoidance systems. During 12-13 January 2012, the Committee alsohad the opportunity to interact with manufacturers and experts of signaling systems from abroad. Discussions were held keeping in mind the issues enlisted at Annexure 3.

3.3.2 Recognizing human over dependence in train operations leading to collisions in the present scenario of traffic growth, IR have been experimenting with technical solutions such as Anti-collision Device (ACD) since 2000; and Train Protection Warning System (TPWS) since 2009.

3.3.3 The Committee noted that introduction of Automatic Collision Device (ACD),as one of the main features of the Corporate Safety Plan of Indian Railways (2003-13), was slated to bring down collisions to 'zero'. ACD is an indigenousdevice, designed on the concept of locating the train position and calculating the speed based on GPS signals along with necessary computations. ACD broadcasts its position and identification which are picked up by the nearby passing locos for due protection as required. To this extent it offers diversity inoff-the-track signaling techniques. ACD has been designed and manufactured by Konkan Railway Corporation Limited (KRCL) through outsourcing withfunctional inputs from IR. It is presently deployed on KRCL and NF Railway on about 1800 route kilometers. During the trials, mostly on Diesel loco routes, its functioning has been periodically reviewed by NF Railway, RDSO and Railway Board. Railway officials have reported some uncertainties on its intended operation which are being rectified by KRCL. Version II of ACD for multiple line electrified section has been put on trial on Southern Railway and discrepancies observed are being addressed by KRCL. ACD projects also stand sanctioned for some of the other zonal railways.

3.3.4 Another type of in-cab signaled system known as Train Protection and Warning System (TPWS) has been deployed and put on trial at Chennai sub-urban since 2009 and also planned for about 160 Kms. of Delhi-Agra section. TPWS is based on ETCS Level 1. In this system, the driver gets audiovisual indication of the signal aspect and in case he fails to acknowledge yellow/red signals within a stipulated period, brakes are applied

automatically. In additionto this, on-board controllers can compute the permissible train speed (based on braking distance and distance to the signal) and apply brakes if this speed is exceeded. Even though TPWS provides safety in fixed block mode, its protection integrity rating is very high since the signaling loop is mostly in a hardwired mode. However, this system, based on proven European design, is reportedly not working well under IR conditions. This was observed during the committee members' visit, when the motormen operating on Chennai suburban complained of false braking, system problems, etc.

3.3.5 The above two cases present a bleak picture of implementation strategy of critical safety items. Ten Year period is too long a period for design and development of ACD which was once accepted as a remedy to prevent train collisions. Similarly poor functioning of TPWS which is based on proven European technology also indicates lack of its topicalization and customization to Indian conditions. IR may like to consider a paradigm shift in implementation strategy for deploying modern and effective signaling systems.

3.4 Discussions and Views

The Committee discussed the issues on adoption of Automatic Train Protection measures and other associated modern signaling systems as enumerated below:

1. Automatic train protection (ATP) and control system necessitates the identified track availability, wherein the line-side signal information at fixed locations along with track identifier is communicated through transponders to the driver's cabin. On board computer computes and provides controls on the maximum permissible speed of

operation; and in case of logical violation, automatically limit the speed to permissible level or apply brake to avoid consequence of "Signal Pass at Danger (SPAD)". Therefore In-cab signaling and its interface to the loco speed control system are prerequisites to ATP. TPWS of IR features spot transmission of data from the ground to trackside to the driver's cabin using radio beacons located on the sleepers at fixed points. This offers protection function with high design integrity. However, it does not provide significant enhancement to line capacity.

2. The Committee then deliberated on the ATP configured to provide higher line capacity by using fixed as well as small virtual blocks. This utilizes markers (such as Radio Frequency Becons) all along the track at small distances to enable trains to sense their positions and continuous real-time data communication between all operating trains (Mobile) and fixed (immobile) control stations to send movement authority to the trains. For achieving higher capacity (headway less than 3 minutes) in train movements, track side to in-cab communicationmedia in wireless mode are needed with suitably installed full duplex radio blocks throughout the rail route. The radio blocks are in turn connected to the central traffic control system using optical fibers, preferably laid on both sides of the track (redundancy to enhance availability). Network Management system should be planned to be secure to ensure that outsiders cannot take control of or paralyze the radio network.
3. Various possibilities of communication mediums were debated upon. One of the communication backbones for this purpose is reported as GSM-R, wherein normal

GSM technology has been tailored for railway functions to provide better signal strength throughout the rail-route and using special protocols of data transfers. During the discussions, it is also noted that GSM-R technology is likely to be up-graded soon and replaced by "Long Term Evolution (LTE)". It should also be borne in mind that GSM has limited suppliers as well as foreign dependence on Network Management System and special care has to be taken for its sustained operations. Terrestrial Trunked Radio (TETRA) is another technology which could be considered for this level of ATP related signal transmissions. TETRA has the added attraction of Indigenously developed network management system and also a feature of limited functionality in case of network failure through handheld terminals- working as walkie-talkies.

4. Since the Protection and Control function loops are utilizing wireless modes of data transfers, special care is needed to ascertain theadequacy (like latency, bit error rate etc.) and engineering margins towards the safety requirements. Architecture of control & communication system and the technology to be adopted (GSM-R or TETRA or other alternative) can be decided only after very careful examination of issues such adequacy for the control and protection requirements, reliability, long term serviceability, security (vulnerability to malicious attack), etc.
5. IR has set up limited section with GSM-R based communication sectorsprimarily for 'voice mode' and the same should be evaluated for 'data mode functions' to gain first-hand experience for using GSM-R for critical protection and control function. Safety scenarios

in Indian mixed traffic conditions causing signal fade out due to rain, fog etc. andbandwidth required for peak traffic/ maintenance operations, should be analyzed in most demanding sections to ensure protection system integrity for the specified safety functions.

6. IR utilizes diverse types of locos. The signaling based protection systems as well as driver's MMI panel need be designed for uniform adoption to the chosen technology and their possible up-grades. This interface of signaling system to the speed controls and emergency brakes (braking curve) should be uniformly designed and interfaced.
7. Considering the mixed traffic operations in major part of IR, a highly systematic approach should be followed to achieve the objectives of Zero Train Collisions and High Capacity utilizing the latest and proven technologies. Even though the newer technologies with virtual block or moving block creation do not anticipate using line side signals along the tracks, the practice should be carefully dispensed with. Since the new technology has to be added on to an existing Rail setup, the presence of optical signals would ensure aid to the driver as a fallback option–in the intermediate phase of work, particularly in case of In-cabsystem malfunction.
8. It is also deliberated that the emphasis is needed on setting up adequate standards, analysis, evaluation, and adoption of vital safety systems going up to the sub-system/component levels. These include standardization of radio beacons for track to train information transmission, Driver's MMI panel and other associated digital interlock systems. Quality of service plan and system safety program throughout the life of the system

needs to be worked out and implemented.

9. Signaling directorate of RDSO best suited to be the custodian of the knowledge base related to complete set of signaling solutions including documents such as: system requirements, indigenization, adoption policy and plans on technology transfers; inspection procedures; commissioning procedures; and maintenance plans/ schedules. They should also be responsible for technology forecasting, up-gradation, modernization of these systems/devices, in addition to its current roleof facilitating the creation of vendors on the given specifications. Special emphasis has to be laid on the issues such adequacy for the requirements with hazard scenarios developed through use of Simulators, functional reliability assurance, long term serviceability, security (vulnerability to malicious attack) and adoptability in IR environmental conditions including Electromagnetic Compatibility (EMC). RDSO activities need to be augmented for comprehensive research framework such that it constantly looks at newer technologiesin co-ordination with other expert groups and industry in the country.
10. The communication backbone across IR in the form of "Centralized Traffic Control (CTC)" towards monitoring control and protection ishighly inadequate at present. The committee felt the need to create a Indian Rail Traffic Management System (IRTMS), which would be useful for systemization of train and crew planning, train operation control, maintenance and management of rolling stock, track, signal and telecommunication, etc. These can have hierarchical structure. While the Functional level control centers

could be at the Division and Zonal levels, at Apex level, an IR Traffic Centre could be planned for monitoring purposes. Redundant fibers-based connectivity could be planned for good bandwidth and immunity for electrical interferences. The unique identification of each loco, coach and even bogie should bequickly adopted. This would help with proper train formation, the identificationof rolling stock at various locations as well as time-based information being passed on for the traffic controllers and also to the passengers. Proven transducers and diagnostic tools must be devised for communicating health of track, rolling stock and signal to the central traffic controller for monitoring the health of identified objects to initiate either immediate or planned maintenance work. The data stored throughsuch a feedback mechanism can offer very strong feed back to the designers as well as to the regulators.

11. Committee deliberated on creation of a "Task Force" to study thefeasibility of communication back bone for IR, utilizing diverse and redundant technology to ensure highest level of availability of the network to the IRTMS centers. Representatives and experts from RAILTEL, IR signaling, and telecom wing and a few more communication experts drawn from with-in, and outside country could be engaged for the task. Data/Control centers with fully functional and geographically redundancy would have to be planned to support IRTMS.
12. Anti Collision Device (ACD) based protection system has been extensively put to test and nearly 550 diesel locos are already equipped with ACD. Trials at NF Railway and Konkan railway, which are equipped with

the required RF communication network, have met with limited success. However, ACD in its current form is not a safety system and so is not yet fully engineered for ATP equivalence in stand-alone form. But off –the -track loco position sensing through GPS as used in ACD, is a diverse technique and therefore is a promisingconcept. However, contentious IPR issues need be resolved if this work has to be taken to its logical conclusion.

13. In Metros and dedicated corridor sections like Mumbai suburban, AWS is in use with reasonably good performance for more than a decade. However, it needs technological upgradation now. Further, to meet the demands of heavy traffic necessitating a requirement of head way less than 1.5 minutes, committee was informed on IR plans of deploying the radio frequency Communication Based Train Control (CBTC) system. This is intended to satisfy both "Automatic Train Protection (ATP)" and maximize train throughput with the concept of creation of moving block. This necessitates large number of mini-RBC (transceivers) positioned along and off the track on poles at a suitable height and with very short-range RF transceiver for continuous communication with loco. For a typical location like Mumbai suburban, which suffers from waterlogging on and off track, locating off- the- track signaling systems is considered more appropriate.

3.5 Recommendations on Automatic Train Protection and Optimized Headway

1. **Automated train protection (ATP) systems are necessary to prevent collisions due to drivers passing signal at danger (SPAD).While TPWS is sufficient for this function, it does not provideextra line capacity.**

IR is starving for line capacity on busy routes. Therefore, it is important for IR to adopt a signaling system that improves the utilization of existing track system by reducing the headway. The committee noted that equivalent European Train Control Systems Level-2 functionalities are reportedly designed to achieve both–automatic train protection and high line capacity. Such systems use digital radio-based signal and train protection systems, providing better utilization in situations like fog. Therefore, the Committee recommends that IR should aim for state of the art signaling and protection system - at least equivalent to the functionalities of ETCS L-2 and deployed throughout IR, starting with the busy routes (19000 Kms) immediately. However, the implementation should be carefully planned, and all the issues related to the Indian environment shall be considered upfront in order to achieve the intended results. Special emphasis would be put on the choice of technologies for communication of commands/signals between moving and stationary equipment. A subgroup of the committee shall examine all the above aspects during the visit to some of the European rail sectors and submit its report.

2. **The committee also recommends the incorporation of diverse andredundant means of Satellite based train position sensing (asused in ACD) and merging in ATP functions.**
3. **Implementation of this technology is a technically complex and gigantic effort This would have to be carried out through a dedicated Special Purpose Vehicle (SPV) having full powers and the mandate to formulate and execute the sanctioned projects in a time**

bound manner (5 Years). The SPV for this purpose alone should be created at the earliest. To guide and monitor the SPV, a high power standing technical review committee should be set up which shall continue its work till the implementation of the projectof ATP. The technical committee should have experts from Railways as well as from outside.

4. **In Metros and dedicated corridor sections like Mumbai suburban, to meet the requirements of head way less than 1.5 minutes, the Committee recommends the use of Communication Based Train Control (CBTC)" system after careful study of design margins on signaling systems.**
5. **The committee recommends the creation of a "Task Force" to study the feasibility of communication back bone for IR, utilizing diverseand redundant technology to ensure highest level of availability ofthe networks for Safety and operational requirements.**
6. **RDSO signaling directorate should be augmented with comprehensive research framework in order to include work on forecasting /newer signaling and telecom technologies.**
7. **On the matter of ongoing plans, IR can take suitable measures in light of the above recommendations.**

The Committee has proposed funds to the tune of Rs. 20,000 Crores over 5 years for an advanced signaling system to prevent collision and to increase line capacity.

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ROLLING STOCK

(CHAPTER: IV / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

4

4.1 Introduction

Indian Railways (IR) is one of the World's best in transporting a vast population of people every day at an affordable and low fare. Significant passenger comforts have been gradually being introduced without increasing fares for the past 10 years. The Committee finds that passenger train speed has increased from 80 kilometers per hour to 100-110 kilometers per hour for express trains. The number of passenger coaches in train formation is also increased to cater to heavy demand.

4.2 Safety Features of ICF and LHB Designs

4.2.1 After carefully analyzing the casualties of passengers in train collisions and derailments for the past 10 years, **the Committee is of the view that ICF design of passenger coaches that served IR for many decades are no safer at the present operational speeds of 100-120 Kmph with trailing loads of 20-24 coaches.** Lack of anti-climbing features due to screw coupling with buffers and weak securing arrangement between coach body and

bogies makes them vulnerable in the present operating environment on IR. The anti-climbing features are not only essential to reduce the effect of impact during direct collision of Passenger trains, but also during train derailments when coaches encounter severe deceleration beyond 4 times the gravitational acceleration. It is noted that ICF design coaches running on Mail or Express trains with the formation of 22 to 24 coaches are unsafe in the event of collision or sudden derailment which are not rare on IR. Around 43,000 ICF coaches that were manufactured for the past 50 years are currently running in Indian Railways with various formation lengths at moderate to higher speed. Though ICF shell is designed to be anti-telescopic,however, the screw coupling is a design limitation as this out beats theconcept of anti-telescopic feature of the coach as a whole.

4.2.2 The Wanchoo Committee had recommended which later re- was emphasized by Sikri Committee, that to prevent significant loss of life in collision and derailment, marshalling of first few coaches should be with anti-telescopic feature. However, in that period the need for anti-climbing feature of Passenger coaches was not realized perhaps due to low operating speeds and shorter trailing loads and anti-telescopic ICF coach design was considered satisfactory. Subsequently the speed of Mail & Super-Fast Express trains was increased to 110 Kmph and formations up to 24 coaches were introduced having high kinetic energy of moving train. Accidents occurring on such trains exhibited a lack of anti-climbing features in these ICF design coaches.

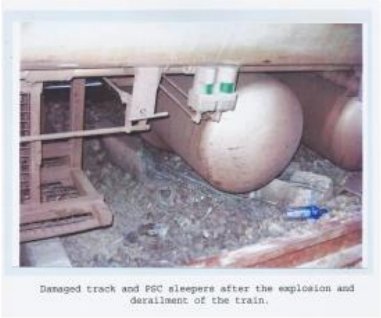
4.2.3 This technological gap was bridged when IR started to manufacture LHB Design Coaches at RCF Kapurthala,

for Shatabdi and Rajadhani Express trains fit to run at high speeds 130-150 Kmph. These Coaches have anti-climbing tight lock couplers with robust securing arrangement between coach body and bogie. These positive design features have been demonstrated in the service during derailment of Bhubneshwar New Delhi Rajdhani Express with LHB coaches on 22.3.2010 on East Central Railway due to explosion of bomb on the track by miscreants. As can be seen from the pictures in Fig 31 and 32, the entire train formation was intact, and no passenger was even hurt in this accident while train was running at 75 Kmph when train engine and 10 LHB coaches were derailed.



Derailed locomotive and coaches of 2443 up Bhubneshwar -New Delhi Rajdhani express .

Fig. 31



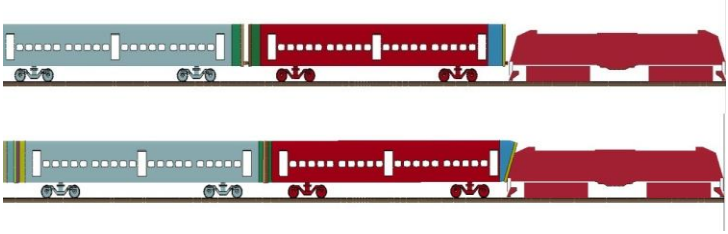
Damaged track and PSC sleepers after the explosion and derailment of the train.

Fig. 32

4.2.4 The committee approached RDSO, Directorate of Carriage, to carry out a mathematical simulation and modeling using ADAMS- Rail software to assess the intensity of the damage potential of ICF coaches in comparison to LHB coaches. The simulation analysis by RDSO indicates that 24 ICF coach-based train running at 80 Kms per hour, when encounters head -on collision against a stationary train leads to severe damages in terms of first two tothree coaches crushing

& climbing one over the other and separation of coach bodies with the bogie. However, when the same software simulation was run with LHB coaches, the formation remained intact by systematicabsorption of the collision energy in various coach body through buckling process. The Bhubaneswar Rajadhani Express derailment photographs are once again clear proof of LHB Coach Simulation, confirming the intact formation of train. In order to ensure safety of passengers in a collision or severe deceleration due to derailment, RDSO was requested to estimate the limiting number of coaches using ICF design for 110- 120 Kilometers per hour speed and also alternatively to evolve the safe operating speed with 24 ICF coach formation. This simulation result confirmed that even at 56 Kmph speedof 24 ICF coach train formations, there will be climbing and some derailment of coaches. Simulation pictures as supplied by RDSO are as under:

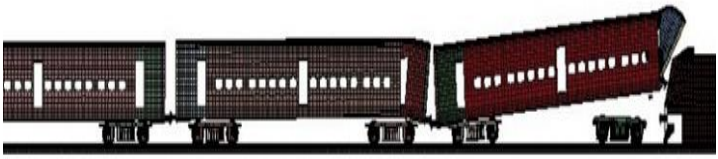
1. **Lumped Mass Crash Simulation Of 24 Coaches of Typical Rajdhani Train, Consisting of LHB/FIAT Composition**



Crash Response of 24 Coaches of Typical Rajdhani Train (LHB/FIAT) impacting against WAP7 locomotive.

2. **Crash Response of Typical 24 ICF Coaches Train of Typical Composition.**

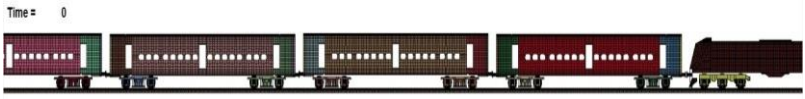
Figure shows initial crash response of 24 coaches of typical ICF train impacting against WAP7 locomotive at a speed of 40 kmph under conditions similar to simulation in previous section. This simulation snapshot is taken only 0.30 second after beginning of impact and it corresponds to only 20% of drop in speed due to impact.



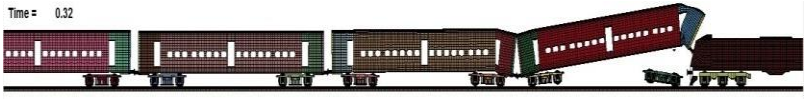
Initial crash response of 24 coaches of typical ICF train

In later stage of the impact, it is observed that front eight coaches derailed out of which front 2 coaches are seriously damaged because of frontal impact combined with climbing and uncontrolled collapse.

Calculated collision response of a rake of 24 ICF coaches



Time – 0.00 Sec



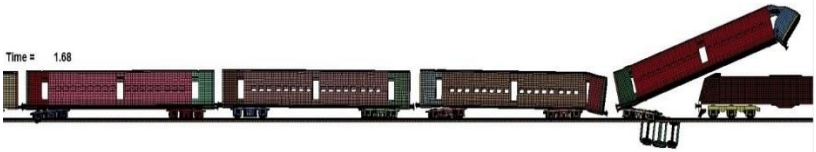
Time – 0.32 Sec



Time – 0.48 Sec



Time – 1.48 Sec



Time – 1.68 Sec



Time – 1.92 Sec



Time – 2.64 Sec

3. Assumption Made in Lumped Mass Crash Simulation

Apart from various assumptions mentioned in above sections including different combinations of coupler connections, followings are the important assumptions made in the simulation.

i. The track and track structure are rigid. Track is straight.

ii. Bogies and their components of LHB coaches are rigid and bogies are rigidly connected with

coach bodies.

4.2.5 Following action should be taken in this regard:

1. **The ICF coach design being a serious safety risk, the Committee strongly recommends complete switching over to the manufacture of LHB design coaches in all the coachmanufacturing units in India and stopping the manufacture of ICF design coaches immediately.**
   The Committee has proposed funds to the tune of Rs. 10,000Crores for complete switching over to LHB production in 5 years with matching additional capacity in Production Units, Railway Workshops, and open line depots.
2. **While the LHB design coach has all the necessary safety features, the existing tight lock coupler design has certain clearances resulting in unacceptable jerks affecting passenger comfort. The Committee was informed that a new design of draft gear hassolved the problem of jerk. If that is so then this new design should be adopted with immediate effect and the existing coaches should be retrofitted with such a design of draft gear. The Committee is also seized of the maintenance related problems such as consequential failure to roller bearings, wheel shelling, etc. which should be addressed at the earliest.**
3. **It is a very difficult task for the Committee to recommend the disposal and usage of the existing large fleet of ICF design coaches. During discussions with representatives of RDSO, the Committee suggested that some adaptation**

should be designed for the existing design of ICF coaches for facilitating energy absorption and anti-climbing during crash or sudden deceleration. It was informed that RDSO was already working on this, which needs to be urgently finalized and provided on all ICF design coaches in Mission mode.

4. **The Committee also recommends with immediate effect that IR must strategize to utilize only LHB design coaches for speeds 110 Kmph and above with 18 and above coach formations on the trunk routes. ICF design coaches should be relegated to lesser speeds and shorter compositions.**

4.3 Roller Bearing Failures on LHB Coaches

4.3.1 Roller bearing failure leading to Hot Axle on passenger carrying trains running athigh speeds of above 110 kmph is a safety hazard. Though enroute railwaystaff at level crossing gates and stations have been able to detect such cases before an accident, it is desirable to have on-board temperature measurement equipment in coaches. Measurement of the axle box temperature in the rangeof 30 to 100 degree Celsius in the coaches on the moving train is a simple engineering problem.

A simple low-cost device such as bimetallic sensor to open or close a circuit at around 60 to 80 degrees Celsius fitted on each axle with a display of red lights and alarm bell is recommended, which can be implemented in coaches that run on services having escorting technicians.

4.3.2 A report by RDSO points out that LHB coaches have more cases of roller bearing failures leading to enroute

detachment of coaches from service. RDSO identified one of the reasons as loosening/breakage of M8 Fastener of the axle speed-sensing device leading to consequential damage to housing and bearing seal. A committee member visited the RCF Kapurthala, where LHB coaches are manufactured. The member requested the shop floor Engineers to open two or three Axle speed sensing device fasteners to study the most probable defect. All the RCF shop floor engineers were very surprised when the mechanic opened brand new fasteners as 2 out of 4 M8 Fasteners came out with all the threads sheared. The M8 fasteners were of sub-standard quality. These critical fasteners are inside the Axle Roller Bearing Box and if these fasteners loosen due to shock and vibration, consequential damage due to disengagement of speed sensing device may lead to damage to bearing seal and axle box housing and eventually roller bearing failure.

4.3.3 The committee records its strong concern towards procurement and supply of Sub-standard parts in IR. Immediate steps to ensure adherence to quality standards with traceable accountability in procurement process on IR are a must. Procurement of sub-standard spares has been covered in detail under chapter 2 of the report.

4.3.4 In view of the above problem specific to LHB coaches, they must be grounded at the Maintenance yards with immediate effect and the sub- standard M8 Fasteners should be replaced with high tensile bolts of the specified quality of reputed make.

4.4 Track-side Diagnostic Equipment

4.4.1 Track side diagnostic equipment is necessary to deal with failures due to maintenance and operational reasons.

While efforts need to be made to improve the maintenance some failures will still happen which should not lead to any major consequential accident. Track side equipment is also necessary for measurement of some data such as flat wheels, bogie condition, etc. as the same cannot be measured when train is stationary. This is also in line with the practices adopted world over.

4.4.2 The Committee recommends the following track side equipment:

i) **Hot box detectors for temperature measurement of axle boxes** of all types of rolling stock. Rolling stock running with temperature higher than prescribed should be communicated to the divisional control center where necessary action should be taken for its detachment.

ii) **Wheel impact load detector (WILD)** to detect the rolling stock with flatplaces on moving trains.

iii) **Track side bogie monitoring system –** to assess the condition of bogie and under gear components in running condition and condition data should be transmitted to the maintenance depot for preventive maintenance.

4.4.3 Way-side equipment should be located near a manned level crossing to prevent their theft.

4.4.4 However, any such trackside equipment will be useful only if individual rolling stock i.e. locomotives, coaches and wagons are provided with radio tags so that their condition data is connected to the control center and maintenance depots. It is strongly recommended to provide radio tags on all types of rolling stock which can also carry commercial data if so desired in addition to ID and maintenance related data. A communication

backbone needs to be provided along the railway network with last mile connectivity for transfer of condition data to the control center as wellas maintenance depots. The Committee has proposed funds to the tune of Rs. 1,000 Crores over 5 years for trackside equipment, ID tags on rolling stock and communication backbone.

4.5 Toilets in Coaches

4.5.1 Indian railways are the pride of our Nation, transporting approximately 2 % of Indian population every day. That means in every 50 days passengers equalto the entire nation's population are transported by IR. Barring the Shatabdi and Rajadhani Express trains which constitutes very small percentage passengers carried per day, the rest of the passengers who travel everyday defecate in toilets in the train, which falls on the rail track. Apart from the issue of hygiene, this has several serious safety implications arising out of corrosionof rails and related hardware as well as poor maintenance of under carriage equipment due to inhuman unhygienic conditions.

4.5.2 During our discussion with the concerned officials, it was informed that IR has been experimenting with different types of technologies for bio-toilets (aerobic and anaerobic both), vacuum toilets, etc. for quite some time. Such experiments should be expedited and the technology suitable to IR environment should be frozen.

4.5.3 The committee recommends that toilets either with no discharge or with harmless discharge are introduced in all the 43000 coaches within next five years, otherwise Indian Railways may continue to face acute problem of the rail track corrosion especially in suburban areas and refusal by the railwaymen in maintenance of track and coaches.

The Committee has proposed funds to the tune of Rs. 3,000 Crores over 5 years for this purpose.

4.6 Fire Accident Prevention

4.6.1 While IR have significantly introduced Fire-Retardant Materials in passenger coaches, there remains 2 % of total loss of life due to fire accidents.

4.6.2 Accidents due to fire in coaches may lead to several casualties. At present, railways only have Dry Chemical Powder (DCP) type portable fire extinguishers which are kept in locomotives, guards' vans, pantry cars and AC coaches. In the event of any smoke or fire in coaches these fire extinguishersare used by railway staff who are trained to use such types of fire extinguishers. However, this type of rudimentary arrangement has generally proved to be insufficient in the event of fire accidents and it is only the fire brigades under the local authorities which played the major role in fire extinguishing.

4.6.3 Experiments with fire alarms in coaches based on smoke detection have not been a success till date under moving conditions of coaches. Ongoing trial of microp rocessor-b a s e d fire alarm in coaches is not yet proven though thetrials are still on. Stopping of trains in the event of break out of fire is an important function which should be integrated into the fire alarms as many a times passengers may not be able to operate Alarm Chain Pulling (ACP) system to inform the loco pilot and guard to stop the train.

4.6.4 Considering that fire alarm systems based on smoke detection are not reliablein running condition of coaches **it is recommended that Indian Railways should go in for flame detection system in coaches which should sound hooter at many places in coaches to warn the passengers. Its interface with ACP equipment may be**

considered based on field trials.

4.6.5 A careful study of the passenger AC and Sleeper coaches indicates provision of four emergency escape windows. According to Aviation Safety Standards, in case of emergency landing & take-off, the evacuation time of all passengers from an Aircraft must be designed and demonstrated within 90 seconds. IR has no such standards. It is however noted that passengers cannot jump out of emergency windows without any aid in the event of some accident to their train.

A simple ladder or equivalent feature with a permanent fitment or foldable and deployable provision is recommended.

4.7 Fire Hazard in Pantry Cars

4.7.1 Indian Railways run around 11000 passenger trains per day including Rajdhani, Shatabdi, Duranto etc. There are about 414 Pantry Cars available on IR -71 Air conditioned and 343 non-Air conditioned. In non-AC pantry cars, cooking is done by the catering contractors/parties using LPG cylinders with open flame gas stores despite being strictly prohibited. Such violations can be dangerous as the temperature of cooking oil rises to more than 150degree Celsius and pantry cars are full of flammable cardboard cartons,sacks, oil canisters and packaging material which can easily catch fire. Further, serious fire accidents may occur if the train derails when the food is being cooked.

4.7.2 Cooking is also dangerous in AC Pantry Cars as was demonstrated in the fire incident on Mumbai Rajdhani Express on 18.04,11. CRS in his report has mentioned that a 'Patila' (container) filled with oil and frying spoon inside itwas left on a hot plate element in the night and

the staff forgot to switch it off causing major fire resulting in gutting of three AC coaches.

4.7.3 The Committee recommends strict enforcement of the existing instructions prohibiting cooking in Pantry Cars. The license of violating contractors should be cancelled and they should be severely penalized if found cooking. Necessary provisions in this regard should be made in the Railway Act.

4.8 Technologically Aided Train Examination

IR train Examiners watch at nominated Railway stations the condition of Under Carriage of Passenger coaches and freight wagons, specifically Brake Shoe Condition, unusual dislocation of under slung fitments, etc. This visual observation by Train Examiners is a vital safety function but the methodology is archaic in nature. With the availability of modern video cameras, the train examination can be efficiently carried out at the Train Examination pointsthrough camera and monitors.

The Committee strongly recommends Introduction of Video Camera based data logging, storage, and display in monitoring room of Train Examiners Cabin so that staff is deployed for identifying repairs.

4.9 Train Air Brake System

4.9.1 The Committee visited the air brake Laboratory in RDSO and assessed the various experimental results documented. In a recent accident, a freight train parked at a station was rolled back after 5 hours and collided with the Brahmaputra Mail entering the station in loop line, which resulted in death and injury to few passengers. When the committee went through the design and specifications of Air Brake System, it was found that the Air Brake system could hold air pressure for 15 hours with the allowable system leak. The detailed report of what

happened at the above-mentioned accident is still awaited.

4.9.2 However, from the RDSO Air Brake laboratory test results, the Committee found the Air pressure leaking completely in short, a time as 30 minutes in some of the wagons. Thus, the Air Brake system specification of allowable leak rate is not even achievable in RDSO lab. This makes the committee wonder as to how Air Brake system shall hold for 5 hours on a goods train!

4.9.3 The manufacturers of critical valves, pipe joints and hose assembly do not meet the overall leak rate stipulation for the train formations. This non- compliance is a safety hazard requiring thorough investigation concerning the specification of Air Brake System Leak rate and its enforcement in open line. Accordingly, the staff responsible for Air Brake Power evaluation and assurance must also ensure System Leak Rate for a stationary train formationis within stipulated limits.

4.9.4 The Committee recommends that every train should be checked for formation Leak rate during maintenance in addition to Brake Power Certification.

4.10 Other Items

4.10.1 Weighbridges should be installed at all major loading depots and at other places in a way that every loaded wagon is weighed within 50 to 100 kilometers after loading to ensure that the gross load is within prescribed limit and the rolling stock, and the track is not subjected to excessive loads / stresses. A uniform operating protocol to deal with over loaded wagon for its detachment should be prescribed by Railway Board for the sake of uniformity.

4.10.2 In one of the interactions, the Committee was informed that the wagons with track friendly bogies will give highly

enhanced life of track due to reduced wear. It is understood that **wagons with track friendly bogie are being developed on Indian Railways which should be expedited on top priority.**

4.10.3 Some studies and trials are being done for **introducing distributed power in freight operations to reduce coupler forces and rail wear.** Such initiatives are welcome to work heavier loads in the overall interest of the Railways and should therefore be expedited.

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FIXED STRUCTURES (TRACK & BRIDGES)

(CHAPTER: IV / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

5

5.1 Introduction

Indian Railways (IR) have a total track length of 11,3611 Kilometers. Of this, 88% of the track is on concrete sleepers and 78% are Continuously Welded Rail (CWR) track. Both 52 Kilogram per meter and 60 kilogram per meter rails sections are used in Indian Railways. Based on the past 5-year accident datait is seen that derailments of trains constitute more than half of total accidents on IR. 29% of derailments are caused due to track defects largely due to rail and weld failures.

5.2 Rail manufacture

5.2.1 After careful investigation of Rail materials used by IR, the Committee finds that the choice of rail steel is primarily based on tensile strength. But as per UIC norms, the choice of rail material selection should not only be based on basic parameter of tensile strength but also on wear properties in curved tracks and Rolling Contact Fatigue (RCF). Thus, when the radius of curvature is beyond 1000 meters, standard rail steel without heat

treatment may be adequate for the required GMT with negligible wear rate. However, RCFbased rail failures require serious attention in terms of GMT, axle loads, rolling stock induced impact loads, and frequent accelerating and de-accelerating of rolling stock. IR has mixed traffic in almost all the routes and hence the choice of rail material must conform to not only tensile strength alone but also be able to cope up with wear and RCF. In addition, corrosion resistance may have to be considered, if warranted in certain sections.

5.2.2 During detailed discussion at RDSO, it was found that a compendium of rail failures has been published by the Metallurgical and Chemical Directorate. RDSO has carried out excellent metallurgical and chemical analysis of the failure of rail in IR which are basically encountered in various accidents. RDSO and M&C Directorate have not taken into account all other rail and weld failures encountered in the open line due to non-reporting and other reasons.

Thus, the compendium is limited only to accident-related rail failures. After going through all the relevant documents and live samples of fractured rails furnished by M&C Directorate, the committee has come to conclusion that all types of metallurgical, manufacturing and welding defects reported in textbooks and literature are happening in IR (Fig. 33 to 38). No attempt has been made to trace back the root cause of failures in terms of steel melting, steel billeting and rolling defects and cold rolling while straightening, field abuse, improper handling and last but not least over stressing the rail. In the absence of systematic failure analysis, RDSO is unable to find scientific and technological solutions for preventing rail

failure.



Fig. 33



Fig.34



Fig. 35



Fig. 36



Fig 37



Fig. 38

5.2.3 RDSO has initiated Nickel, Chromium, and Copper (NCC) alloy steel rails for Indian Railways. A sample quantity of 10,000 tonnes is under evaluation in 5 zones. The evaluation is expected to be concluded by June 2015, but IR cannot wait till 2015 for the results. There are many ways of accelerated life testing in laboratories and simulated field conditions. There is no focused material research and specific recommendations by RDSO, for IR's long term rail manufacture and supply for mixed traffic.

5.2.4 Rail corrosion is to be specifically addressed in terms of toilet droppings. The toilet droppings are one of the primary causes for the rail corrosion and resulting in Rail

failure. Significant improvement in rail corrosion can be achieved if Mild Steel liners used in non-track circuited areas are substituted with liners made of appropriate grade of steel with required strength and corrosion resistance and Elastic Rail Clips (ERC) are cadmium plated and greased. With a ban on toilet droppings forthwith to prevent corrosion of rail and its fittings, the need for corrosion resistant rail steel is not considered essential.

5.2.5 Following action should be taken in this regard:

a. It is strongly recommended to establish the root cause of rail fracture/failure by bringing in all concerned expertise from steel melting to open line end user based on systematic assessment to arrive at specific recommendations. A national level expert committee should be constituted to establish the root cause of railfailures and identify the metallurgical and chemical solutions including enhanced quality assurance and control protocols from steel melting to laying of rail on the track on a war footing within the next three months. This expert team may also study the proposed rail manufacturing process, its quality assurance conforming to international UIC standards.

b. The Committee also recommends a Senior Administrative Grade officer of high integrity and strong background in Material Science & Chemistry should be posted full time to monitor and control the Rail production process at Bhilai Steel Plant.

c. The Committee was informed that with the increase in axle load even 60 kg/m rails are fully stressed with no margin left. Under these

circumstances it is not prudent to use 52 kg/m rails in Indian Railways. The Committee therefore recommends the productionof 52 kg rail should be stopped and no further 52 kg PSC sleepers are produced. The Committee also recommends use of only 60 kg/m head hardened rails on curves sharper than 400-meter radius of curvature.

d. The present procedure of manual inspection by trolley by PWI and rail testing manually ultrasonic equipment are outdated. Whilethis manual method is time consuming, labour intensive intervenes leading to many losses of railway staff life, the Committeecommends the use of modern technologically driven vehicle borne ultrasonic testing machine for faster and reliable detection rail and weld flaws.

e. To increase the life of rails and wheels of rolling stock the Committee recommends Rail grinding at required intervals to be mandatory.

Necessary funds to the extent of Rs. 1000 crores for Vehicle BorneUltrasonic Testing Machine and Rs. 5000 crores for Track Maintenance Machines including Rail Grinding Machine are proposed.

5.2.6 An impression was given to the Committee that rail and weld fractures have increased with the increase in loading allowance of wagons. It was further presented that fractures were more after funds for track replacement under Special Railway Safety Fund (SRSF) were exhausted (Fig.39).

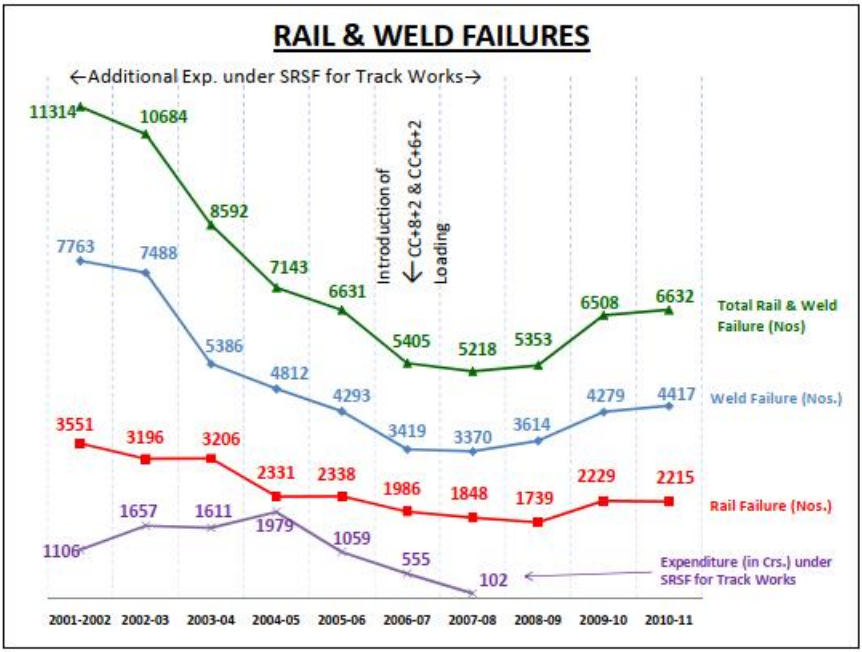


Fig. 39

While this aspect should be analyzed more systematically, the measures to improve quality of rails and welds and maintenance practices need to be pursued as a priority.

5.3 Rail Welding

Rail weld failures are also encountered in a large scale in IR which is mostly using Alumino Thermit Welding (ATW). The Committee notes that IR have not adopted in all respect the European/UIC norms for AT welding, European Standard ENI 14730-1 adopted in August 2006. AT welding is still extensivelyused in high-speed European railways. It appears IR had adopted the AT Weldingprocess which existed few decades before and continue to use the old procedure without any current update conforming to UIC/European specification. The AT welding process and standardization conforming to ENI

14730-1 are essential along with quality control of raw materials used. Evaluations of welding efficiency based on impact and fatigue loads are not performed. **The Committee recommends a systematic AT welding improvement programme conforming to the European standards, procurement of the latest and proven raw materials and quality welding procedures must be introduced in IR to eliminate AT welding failure.**

Flash But welding is being carried out by IR in Zonal FBW Plants for Long/Continuous Welded Rails (LWR/CWR). Impact and fatigue load testing are not carried out on any statistical basis for establishment of the life of FBW on a periodical basis. The quality control procedure for FBW carried out at the Zonal plants and in the open lines by mobile units are to be established and followed rigorously. **The Rail Welding improvement programme also be referred to by the above-mentioned National Expert Committee.**

5.4 Track Maintenance

During our discussions with all concerned in Indian Railways, need for corridor maintenance block was strongly felt for a minimum of few hours everyday. This is a very valuable and essential input towards accident prevention. Today, IR operates most of the corridors beyond 100% utilization every day and hence little maintenance time is provided. This shows very clearly that there are no policy guidelines laid down by IR in terms of maintenance protocol or if it exists then IR clearly violating the prescribed norms eventually leading to unsafe working.

Preventive maintenance norms, in addition to emergency and breakdown maintenance, also are to be taken into account. Systematic co-ordination of maintenance activities of fixed infrastructure in terms of track, overhead electrical equipment

and signaling systems are essential for periodicmaintenance within corridor block. Corridor planning should be such that adequate time in a day is reserved for planned periodic maintenance. It is a simple management problem to plan and execute preventive maintenance. There should be no compromise on this aspect. In the absence of systematic preventive maintenance plans, inadequate machines and manpower, the safety is the primary victim, and no administration can tolerate this. During the interaction the Committee was informed that it was very difficult to carry out planned and systematic maintenance on trunk routes as little time was available due to excess traffic. Under such a scenario, maintenance in a hurry shall not yield quality compromising safety and may also lead to loss of life of Railway men on duty as mentioned in chapter 2 of the report due to hurried action. IR needs to fix this at the earliest by taking measures to improve line capacity.

5.5 Bridges

5.5.1 Safety of train travel on the bridges is of paramount importance because the casualty or loss of human lives may be large in the event of an accidenton the bridge. IR have classified around 3000 bridges as 100 years age and above and also identified 32 distressed bridges. During our discussion with RDSO, it was informed that IR periodically assess and take appropriate safeguards in terms of limiting axle loads and speed on distressed bridges. Such distressed bridges are inspected visually by lower-level engineers who are trained little and may be freshly recruited. No photographic evidence is taken, instead they keep their report in the bridge registers. **Instead, photographs should be taken using modern handheld electronic cameras and should be posted on**

MIS/ sent through Internet to all concerned senior engineers having vast experience to visualize the impending bridge failure.

5.5.2 Vulnerable bridges should also be fitted with water level gauges and turbine flow meters to measure flow which should be interlocked in a way to warn the driver of the approaching train.

5.5.3 The Accident occurred on Southern Railway near Kadalundi is a classic example in which one Assistant Engineer examined the bridge and found visually no indication of damage on this bridge whose cast iron pile were morethan 140 years old but not declared by IR as one of the distressed bridges. The assistant engineers apparently used divers to go under turbid water level for visual inspection and found no specific observation. However, within a few days, the bridge collapsed, and a serious accident took place with loss of life.

Based on inquiry, the Assistant Engineer, Divisional Engineer and Chief Engineer of Southern Railway were held blameworthy for this accident. Scientific inspection of the underwater foundation is needed even in turbid conditions. In Indian context waterways are full of sewage drainage /turbid and no human will be able to go inside and check the condition of thefoundation or the footing of the bridge. Solution lies not in punishing people but evolving scientific and innovative means to assess the condition of submerged footing of such bridges. **It is strongly recommended to instrument all the bridges in terms of deflections/displacements, water level and flow velocity on a continuous basis and data should be communicated to the office of the concerned Chief Bridge Engineer for monitoring. Advanced scientific**

measurement and inspection for the condition assessment of the under-side of the bridges using mobile and articulating platform are essential.

5.6 Level Crossings

5.6.1 Of the total 32,735 level crossings on Indian Railways, a large number of 14,896 are unmanned. Such unmanned level crossings have persistently stayed as death traps though due to the negligence of road users with accidents at unmanned level crossings remaining at unacceptable high level both with regard to number of accidents and severity of causalities.

5.6.2 During deliberations with different functionaries, the Committee was made to understand the nuances of having Level Crossings (LC), both manned (with or without signals), and unmanned on railway networks. Casualties in Level crossings accidents contribute to 65% deaths and 38% injuries out of the total tally of casualties due to consequential train accidents of all types. Moreover, LC gates are resource intensive for their operation and maintenance. It was brought to the notice of the Committee that infrastructure such as liftingbarrier, gate lodge, etc. was ready at many of the unmanned level crossings but CRS was not agreeing to permit operation either due to delay in sanction of posts of gatemen or no incumbents being available to man. Accidents at such level crossing gates have also been reported to have happened in recent times. Many a time, non-clearance of road traffic causes detention to trains and it is estimated that about 5% mail/express trains lose punctuality on account of non-closure of manned level crossing gates in time.

5.6.3 Though it is the road users who are the casualty in most of the cases, there is significant risk to trains also in accidents at level crossings if the road vehicleis heavy. The Committee noted with regret the accident that occurred on 3.2.12 in Northeast Frontier Railway when 9 coaches of a passenger train were derailed out of which 5 were capsized after hitting of the train against JCB which was negligently crossing the railway track at an unmanned level crossing gate resulting in death of both the road users and injuries to 16 passengers. Pictures of this accident are shown in Fig.40 and 41.



Fig.40



Fig.41

5.6.4 The Committee is also seized of the technical measures having been taken earlier by the Railways such as Train Actuated Warning Device (TAWD), Gate Warning System as part of ACD System, etc. These met with limited success due to theft of equipment. The instances of manhandling of gatemenand forcing opening of LC gates have also been reported.

5.6.5 The Committee recommends as under:

a. **Eliminating all Level Crossings whether manned (with or without signals) or unmanned in next 5**

years. This will not only eliminate theaccidents at level crossings which account for 65% of total deaths due to train accidents but will also improve the line capacity as trains get held up at busy LC gates. It will also save operation and maintenance costs incurred at gates.

Funds to the tune of Rs. 50,000 Crore has been proposed for this purpose.

Apart from saving lives, it is estimated that monetary saving on account of elimination of all level crossings will be to the tune of about 7000 crores per annum and thus the entire investment will be recovered in about 7 to 8 years' time.

b. This is gigantic task for which the Committee recommends dedicated SPVs in each of the zonal railway fully empowered and mandated to complete the project in a time frame of 5 years.

c. No LC should be newly introduced under any circumstances on the existing system as well as during gauge conversion, doubling and construction of new railway lines.

d. **Level Crossings having little road traffic should be closed. Merger of nearby LCs by constructing connecting roads at railway's cost even on non-railway land should be taken up.** The Committee was informed of the good work being done by IR, which should be speeded up.

e. Construction of limited height sub-ways, Road under Bridge (RUB), Road over Bridge (ROB) should be taken up in mission mode and traffic blocks should be generously granted for the construction, so that all the LCs are eliminated in

the next 5 years'time.

f. In keeping with this spirit, no LC gate should henceforth be manned or interlocked. A large number of unmanned level crossings have been sanctioned for manning and many manned have been sanctioned for interlocking. However, LCs where infrastructure has been constructed should be manned only on temporary basis till these are closed.

g. The present policy of sharing the cost of RUB or ROB with the State Governments should be dispensed with and the full responsibility and entire cost of construction should be takenover by the Railways. For this purpose, the present Railway policy needs to be changed and Section 19 of the Railways Act needs to be amended. Further, to augment the safety fund a largeshare of diesel cess should come to the Railways for which Government of India should be approached.

h. To expedite the construction of limited height sub-ways, RUBs and ROBs the CRS's role should be taken away and relevant plans and documents should be approved and signed at the level of the concerned Principal Head of the Departments (PHODs) instead of sending them to the Commissioner of Railway Safety (CRS) for sanction unless there is some change in the track/yard layout.

i. Regular meetings and coordination between Railway and civil administration at the highest to the local levels should be held to expedite the execution as above.

5.7 Strengthening of Track

Bad and yielding formations are a cause for track geometry being vitiated creating a safety risk as well as enormously adding to the permanent way maintenance cost. There is a dedicated Directorate in RDSO to assist zonal Railways to improve such formations, but much headway has not been made. The Committee recommends that the Directorate in RDSO is strengthened, stretches of weak formation identified and an action plan formulated to treat such weak formations in a scientific manner with a view to eliminate such weak spots permanently including improvement to drainage positively within the next 5 years. The Committee has assessed a requirement of Rs. 2,000 crore for this purpose. Traffic blocks for carrying out formation treatment works should be given on high priority.

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HUMAN RESOURCE DEVELOPMENT WITH EMPHASIS ON EDUCATION AND TRAINING (CHAPTER: VI / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

6

6.1 Introduction

6.1.1 All successful organizations are learning organizations. A learning organization ensures that its employees are growing in terms of their skills, knowledge, and perception. One way to achieve this goal is by developing an infrastructure and making provisions for all officers and staff members to continue to develop a habit of life-long learning. Indian Railways has many establishments of training. The organization also deputes its staff members for training and also commissions academic institutions to conduct somerefresher courses for its staff and officers.

6.1.2 However, it has been found that opportunities for enhancing or improving qualifications are not adequate for the officers. Most of the officers are selected for service after their graduation. Their career progression is based on their field experience. They provide opportunities for study leave for acquiring higher degrees.

However, there is no scheme of Indian Railways by which officers are deputed to national or international academic institutions of higher learning. Indian organizations like DRDO, defense forces, department of atomic energy have schemes under which officers are deputed for acquiring master's degrees at IITs and IISc. A scheme similar to this isdesirable for officers of Indian Railways. In fact, for fostering the spirit of research and technology development, it is desirable to sponsor some officersunder a scheme for doctoral programs as well.

6.1.3 Young men and women look for bright career after their graduation. Their choices are based on their exposure to different areas during their college years. Their choices are also based on the issues like assured career option, reasonable security of job, professional challenges, and social respectability of profession. Indian Railways is not as much on their radar for lack of exposure. **It is, therefore, recommended that a large number of projects of importance to Railways are regularly awarded to some select engineering academic institutions in which students can participate. It isalso recommended that courses, minor stream, and major specializations in the area of railway engineering be introduced in the Indian engineering academic programs. The issues of safety should be an integral part of such academic programs.**

6.1.4 Continuing education of railway staff is very crucial for increasing the awareness of new technology and safety considerations. Modern techniques of Information and Communication Technology can be used for training a large size cadre of railway staff members. These courses can be developed specifically tailored for Indian Railway

requirements. The technology of simulation can be used very effectively for such training. The certification of competence can be done by the existing training establishment of Indian Railways.

6.1.5 In summary, the Committee recommends the following.

- Developing Indian Railways as a learning organization with special emphasis on safety
- Launching a scheme of higher education for officers of Indian Railways examples of DAE and DRDO
- Establishment of some Railway Laboratories/ projects in Indian engineering institutions.
- Introducing academic programs in terms of electives, minor and major specialization in railway engineering.
- Development of continuing education programs for staff members of Indian Railways using ICT and simulation tools
- Introducing a summer training scheme for students at engineering colleges to provide them with experience of working on the railway network.

6.2 Existing Training Institutes on IR

6.2.1 Indian Railways have 7 Central Training Institutes (CTIs), 9 Zonal Railway Training Institutes (ZRTIs) and 9 Supervisors Training Centers (STCs). While the officers are trained at CTIs, supervisors and staff were trained at ZRTIs and STSs. In addition to these training institutes, there are numerous other training institutions for different departments such as signaling, engineering, mechanical, electrical, etc. for training of supervisors and staff of respective departments.

6.2.2 The Committee interacted with the Heads of all the CTIs

and Heads of select ZRTIs and STSs etc. It is the assessment of the Committee that training of officers, supervisors and staff requires all round systemic improvements. There is a lack of adequate capacity in training infrastructure, the quality of trainers is often suspect and Heads of training institutes lack empowerment which have implications on the quality of training being imparted.

6.2.3 The Committee recommends the following to give a fillip to the training of railway officials: -

1. **All sanctioned capacity enhancement works of CTIs, ZRTIs and STSs should be fully funded and executed within the next two years.** The execution of these works should be in close coordination with the Headof the training institute concerned.
2. Poor quality of trainers contributes to poor quality of training. It is understood that posting as trainers even in CTIs is done without consideration to the candidate's assessment by the head of the institute concerned and that such postings are often made for accommodating the incumbent's personal requirements without consideration of his abilities as a trainer. Although rules have been laid down by the Board for selection of trainers for training of non-gazetted staff through a committee, the Board itself does not follow the same process while posting trainers in CTIs. **It is recommended that posting as a trainer, even in CTIs, should be based on the recommendation of a committee of which the Head of the institute concerned must be a member. Tenures of deserving officers may be extended on the recommendation of the Head of the CTI even**

ifit involves transfer of elements of posts if such a trainer is due promotion so that he/ she can be promoted in the training instituteitself.

3. **Heads of CTIs should be given full powers to invite academicians, industry leaders, technocrats, etc. as visiting faculty within the allocated budget grant. In case of Railway Staff College, where Management training is imparted to officers of all railwaydisciplines, arrangements should be made to have one or two professional academicians on loan from management institutes ofrepute for a few years fixed tenure.**
4. Financial powers vested with most training institutions are limited. No funds are allocated either under Revenue or under Works separately for training institutes. Even in the case of CTIs who have separate revenue budget, there is complete dependence on adjoining zonal railway for sanction and execution of petty works that are important for maintaining the ambience of the institute and its facilities. **It is recommended that funds for CTIs, ZRTIs and STSs are allocated separately both under Works as well as Revenue. Incurrence of expenditure under these fund-allocations should be fully under the control of Heads of the institute. Considering the importance and size of CTIs, it is recommended that they should have their own maintenance infrastructure for both engineering and electrical. This infrastructure together with empowerment of Heads of CTIs to sanction works and allot funds for works of minor nature within the allocated Budget is absolutely necessary for**

enhancing training effectiveness.

5. Though the training in respective descriptions is imparted to the officers, supervisors and staff, there is hardly any training on the safety engineering /environment. It was reported that though Railway Staff College, Vadodara and IRITM, Lucknow are running some courses on safety management, the attendance was poor. For building a safety culture it is necessary that all officers are periodically imparted training in safety engineering.
6. Improving the training content in the field of safety is also important. Like any other training, the training in safety management requires a significant amount of study, analysis, preparation of cases etc. This activity in CTIs seems to be lacking. Necessary inputs required by the trainers of CTIs should be provided to enable them to engage in meaningful development of training contents. It may be a good idea to provide training/ research assistants to trainers to develop this area ina big way. **It is recommended that training on safety environment on Indian Railways should be placed on a sound footing and the training material as well as trainers should be developed appropriately for this purpose.**
7. **The terms of Principals of ZRTIs and STSs should be fixed for at least 3 years.**
8. It was reported that newly recruited staff including erstwhile Group D under different departments are not imparted any appreciation training before their entry into the railway environment. It was also brought to our notice that though different departments are having somearrangements for training of their staff in

their respective disciplines at the divisional level, there is no center for them to be trained on the overall safety environment present on the Indian Railways. Lack of thisis causing poor appreciation of the overall safety environment on IndianRailways in lower-level functionaries. **It is recommended that one training institute at the divisional level is nominated and upgraded for such training under safety organization. This institute should have animation films; general equipment, tools and gadgets used on Indian Railways, etc.**

9. **The teaching allowance of trainers of ZRTIs and STSs should be increased from 15% to 30% to bring it at par with trainers in CTIs.**

6.3 During our interaction with various railway functionaries, it was brought out that the existing technical and professional qualifications of newly recruited staff were inadequate to operate and maintain the existing assets. It was alsobrought to the notice of the Committee that the educational and technical qualification of staff recruited through Departmental system is lower thanthose recruited directly from the market. With the advent of introduction ofnew technology on IR, there is a need to have elevation in minimum technical and professional qualification of supervisors and staff operating and maintaining railway infrastructure. Qualification for safety category posts should be the same for direct recruits and departmental staff. **The Committee recommends that the departmental staff should be encouraged and extended resources to upgrade their professional qualifications and skills to be fit for promotion to the higher level than bringing down their proficiency in standards as is the present practice. All the newly recruited Assistant Loco Pilots should be Diploma**

holders instead of present Matriculate/ ITI holders. All the Maintenance Technicians in all Technical Departments should at least be ITI holders and supervisors should be at least Diploma holders, preferably, Engineering Graduates.

6.4 There are about 19 variants of diesel and electric locomotives on Indian Railways. It was brought to the notice of the Committee that the location of throttleand brakes is different on electric and diesel locomotives. Loco Pilots are expected to master driving skills of all these variants which is insurmountable and unsafe from the safety point of view. During one of our interactions with a very senior railway officer, it was brought out that some accident took place because of late reaction by the Loco Pilots attributed to different locations on brakes and throttle. However, the committee could not get the report. **The Committee is convinced and therefore recommends that the cadre of electric and diesel running staff should be separated in the presentoperating environment having a large number of loco variants of both types.** Commissioners of Railway Safety (CRS) have also recommended separate cadres for electric and diesel tractions. This may perhaps result in some additional requirements which may be counter-balanced by savings due to less time required for their training for dual traction. Henceforth Indian Railways should ensure that the basic loco controls in the cab are similarly configured ergonomically.

6.5 The issue of disposal of running staff who failed repeatedly during refresher courses was also brought to the notice of the Committee. In the absence of no clear-cut implementable guidelines, running staff with inferior knowledge are put on line compromising on safety. **It is recommended that such running staff who fail in any of the mandatory refresher courses shouldbe given only one extra chance to repeat the**

course followed with their test taken at the concerned Branch Officer level. In case the running staff fails again, he should be debarred from running duty and posted on other non-safety related assignments or given voluntary retirement following the prescribed rules and process.

6.6 Certain issues related to the management of running staff were brought to the notice of the Committee. It was reported that running staff are called for driving the train at midnight after completion of their leave period on the previous day which puts undue pressure on them if their personalengagement lasted till late in the evening. **It is suggested that the running staff are called at 08:00 hours on the subsequent date after availing leave till the previous date.**

6.7 Indian Railways already have Loco Simulators both for electric and diesel locomotives. It was informed that more Loco simulators are under procurement. These full-scale simulators are located in training schools and can be used by the running staff during their assignment for such training**. It is recommended that some portable cheaper version of loco simulators is procured and located in drivers' running rooms whererunning staff can brush up their driving skills at their convenience.**

6.8 Simulators for Station operating staff for training on operation of all types of signaling panels sanctioned many years back have not yet seen the light ofthe day and Station Masters are largely trained on-job which is not correct. **The Committee recommends such training panels should be introduced at the earliest in Zonal Railway Training Institutes (ZRTIs).**

6.9 Trains run on Indian Railways as per the provisions of several rule books, manuals, instructions, etc. Operating staff are expected to know provisions contained in all such books and to impeccably follow them, failing which they are punished in

case of failures. This appears to be impractical. Instead, **the Committee recommends that separate handbooks are prepared for the operating staff, such as loco pilots, station masters, etc., which should contain all the necessary instructions to be followed by them while performing their duty.** There should be no need for them to refer to several voluminous books, which is impossible.

6.10 Interaction with the staff Federations led us to feel that the staff working at the cutting edge were not well looked after. Their dues were not given to them in time and the machinery in the offices does all kinds of things to harass them. **The Committee recommends that each Division should have Grievance Redressal Machinery which should deal with staff grievances in a time-bound manner. DRM should personally oversee the working of the system.**

6.11 Unwillingness of staff to work as Gateman at engineering Level Crossing gates was brought to the notice of the Committee. It is also reported that the grade of the Gateman who performs more responsible duties than the Trackman is the same. While the issues related to LC gates have been deliberated in chapter 5, **it is recommended that a special allowance equivalent to 25% of the salary and grade pay is given to the staff who work as regular Gatemen as a special incentive during the intervening period till LC gates are closed.**

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RESEARCH ECO-SYSTEM ON INDIAN RAILWAYS

(CHAPTER: VII / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

7

7.1 Introduction

Safety is the most important consideration of any transportation network. In such a network, the operational commitments are attended to on a priority basis.However, the considerations of research, technology development and absorption of new technology get less attention even though these aspects ultimately affect the efficiency and safety of the network. Besides the operational commitments, the network also has to have a large establishment for development and maintenance of design standards, testing of equipment, development of inspection procedures etc.

7.2 Present Research Eco-system on IR

7.2.1 RDSO, in its present form, is largely discharging its role as a support organization for operational network of Indian Railways in terms of inspection and testing, coordination between vendors / suppliers and operational units, marginal improvement of systems / sub-systems etc. RDSO also carries out the work of development of

design and specifications of systems and sub- systems, audit of vendors and their approval and inspection of critical items related to operation and safety. There is, however, no semblance of any original research or technology development initiative and the general style of functioning is around customization of designs of vendors to suit the requirements of Indian Railways.

7.2.2 Poor empowerment of RDSO in forwarding the sanctioned area of work within the budgeted amount was also brought to the notice of the committee. It was informed that RDSO was dependent on zonal railways in awarding the contracts for trial projects of RDSO which cause delay.

There is hardly any permanent cadre of scientists or officers at RDSO to carryout the R&D work. The officers at the senior positions such as EDs, Sr EDs and Directors are drawn from the zonal railways on deputation basis. These officers go back to the zonal railways after completion of their term of 3 to 5 years or on promotion. RDSO-specific recruitment is done only at the subordinate level on a permanent basis. After converting the status of RDSO as a zonal railway, even this recruitment has come to a halt. These subordinate employees are not able to go beyond JAG level.

7.2.3 The committee had detailed presentations and interactions on Technology Mission on Indian Railways (TMRS). It is observed that though this was agood effort on the part of RDSO and IIT Kanpur, the role of industry was very limited. This was perhaps due to the fact that there was no incentive to the industry. Their efforts in association with IIT Kanpur and RDSO were not going to be rewarded in any way as the procurement of the product was through

open tender. IPR policy of Indian Railways was not conducive for promotion of this academia-industry-railway partnership. This led to the unwillingness of industry partners to participate actively. World over, the associating industry is having some advantage during the initial business by way of some royalty or preferential treatment while awarding the contract for the supply of the product. **Thus, despite the best intentions and reasonable success on the development front up to trial demonstration stage, the process of technology transfer could not be carried out successfully.**

7.2.4 In order to improve the technology of rolling stock, motive power equipment, track system and other assets, it is essential to invest continuously in applied research and technology development. This perspective is singularly absent in the present scenario. The response to the deficiencies cannot be removed unless the problems are studied in depth and solutions are developed indigenously. In the case of nuclear and space agencies, the backbone of research and development is as strong as the operational wings of these agencies. It is because of this that the country is able to achieve a level of independence and excellence in these areas. It is also important to observe that issues of safety in these agencies are also taken as a part of the research agenda from the initial phase onwards.

It must be mentioned that a certain element of ownership and independence in railway engineering is necessary in India. If there is a tendency of over- independence on suppliers and vendors and if the equipment procured is in the form of a black box, then certainly the organization is at the mercy of vendors time and again. This is certainly

not a safe scenario. The specifications of the equipment as well as the technological know-how should be owned as well as controlled firmly by Indian Railways. Development of technology as well as indigenous vendors is necessary. As such, the R&D establishment should establish the standards for Indian Railway system. This needs to be fostered. When some technology is to be procured, it should confirm to well-known international standards and should be sufficiently transparent for the Indian Railways.

7.3 Proposed Research Eco-system on IR

7.3.1 In order to promote the overall level of operational as well as engineering efficiency, the Committee proposes the establishment of a new architecture for research and development. An apex body called Railway Research & Development Council (RRDC) is recommended to be established. This body will be chaired by an eminent technologist / scientist. It will have three members from the Railway Board and three members, one each from academia, research establishments, and industry associations (CII, FICCI etc.) respectively. One of the three members from the Railway Board shall be Member (Safety & Research). It may be mentioned that this position has been proposed by the committee. The other two members may be selected from the Mechanical, Electrical or Engineering members of the Railway Board.

7.3.2 The committee strongly feels that up to 2 % of the revenue of Indian Railways should be available for supporting the activities of the entire research eco-system of Indian Railways. This will include the support for ARRI, RDSO and RRCs.

7.3.3 There shall be two more members of RRDC. The Director

General of RDSO and the Director General of the proposed Advanced Railway Research Institute (ARRI) shall also be members of RRDC. The council will have a full- time secretariat headed by a full-time Member-Secretary of RRDC. The Member-Secretary will be an official of the RRDC as well as coordinator of the railway research eco-system. This official will be drawn from within railwayresearch and engineering stream.

7.3.4 The RRDC will provide the overall guidance as well as resources for the railway research eco-system in India. The Council will also provide a perspective plan of research and development in view of the safety considerations on one hand and the technological solutions on the otherhand. **The research eco-system is conceived of the following three wings.**

1. **Research, Design & Standardization Organization (RDSO)**
2. **Advanced Railway Research Institute (ARRI)**
3. **A set of Railway Research Centers (RRCs)**

In short, the committee strongly feels that an apex body such as RRDC will guide the RDSO, ARRI and RRCs. Organizational structure is shown in Figs.42 to 44.

The details on each of these are as follows.

7.3.5 The committee wishes to record that the role of RDSO shall continue to be a design, testing and certification agency for Indian Railways. ARRI is conceived to be a high-end research organization for Indian Railways. It may be recalled that BARC plays a similar role for the atomic energy programmeof the country and VSSC plays a similar role for the space programme of the country. So, ARRI will be an agency which can focus on areas of research which will cover engineering, operational,

material development, and several other futuristic and long-term options. There are operational wings in both Nuclear and Space agencies. However, the efficiency of operational agencies continues to remain high with the inputs from high-end research wings. Besides, the activities of design standardization, testing and inspection continue to be important supportive functions for production units and operational units of the Indian Railways.

7.3.6 The committee strongly recommends the establishment of about five or more Railway Research Centers (RRCs). Each of these research centers will focus on areas like Rolling Stock, Fixed Engineering Assets, Motive Power, Signaling & Telecommunication, Operations Management, Economics & Social Planning etc. These RRCs are to be co-located with the leading technological or management institutions of the country. These centers will be – in some sense – draw upon the intellectual strengths of the academic community and will have core full time staff of the center. The Head of the parent Institution will chair the governing body of the center. The executive director of the center will be the officer-in-charge of the center. The concept of RRCs has been strongly propounded by the Kakodkar Committee for the IITs. This committee was established to review and propose a roadmap of growthof IITs.

7.3.7 RDSO will continue to function as an organization more oriented towards assisting in the functioning of zonal railways. It will have linkages with ARRIs and RRCs. It will continue to play its present role and strive to achieve higher standards in the research and technology development domain.

The Committee recommends the present system of only having railway officers on deputation at senior positions should be done away with and professionals and scientists from reputed technical institutions should also be inducted at higher levels on the permanent cadre. Candidates who have worked on railway specific projects for their doctoral degree should also be a good choice. Their career progression should be on thesimilar lines as followed in other research institutions of Government of India.

The Committee further recommends enhancing the powers of DG/RDSO to improve its functioning:

1. Full autonomy with financial powers to function within the sanctioned budget.
2. To award consultancy contracts of enhanced value up to Rs. 1 Cr. In each case against the present delegation of Rs. 30 lakhs in each case. Powers for awarding MOU/Consultancy Contract should also be extended to benchmarked organizations in India and abroad like AAR, TTCI, UIC etc.
3. Full powers to award Consultancy Contract once sanctioned by the Board for values more than Rs. 1 Cr. each and there should not be anyfurther need to send the proposal to the Board.
4. Full powers for placement of developmental order within lump sum

Budget Grant of RDSO irrespective of cost. This will expedite prototype and field validation for which RDSO is presently dependingon PUs and Railway Board.

In short, RDSO, ARRI and RRCs will constitute the eco-system of researchfor Indian Railways. This eco-system will be under the overall guidance of RRDC. The Chairman of RRDC will report to the Railway Minister, Government of India.

7.3.8 In summary, the following recommendations are made by the Committee.

1. **Indian Railways should establish an apex council on research and development. This Railway Research and Development Council (RRDC) will be chaired by an eminent technologist / scientist ofthe country reporting to the railway minister.**
2. **Indian Railway should establish a high-end research and development organization – Advanced Railway Research Institute (ARRI). This organization should be a high-end research organization focusing on engineering challenges in railway specific areas.**
3. **Indian Railways should establish a string of five or so railway research centers. These centers should be co-located on the campuses of Indian technological academic institutions of**

national importance. Each center should specialize in specificareas like signaling, rolling stock, motive power, track and bridges, operations management, etc.

4. **Indian Railways should strengthen RDSO and make it more efficient organization with respect to the work of design standards, inspection, testing and technical support to zonal railways. It should be restructured and empowered to perform the assigned task.**
5. **Financial support up to 2 % of yearly revenue of Indian Railways should be available to support the entire research eco-system of railways in India.**

The Committee has proposed funds to the tune of Rs. 2,500 Crores over 5years for the above.

Railway Research & Development Council (RRDC)

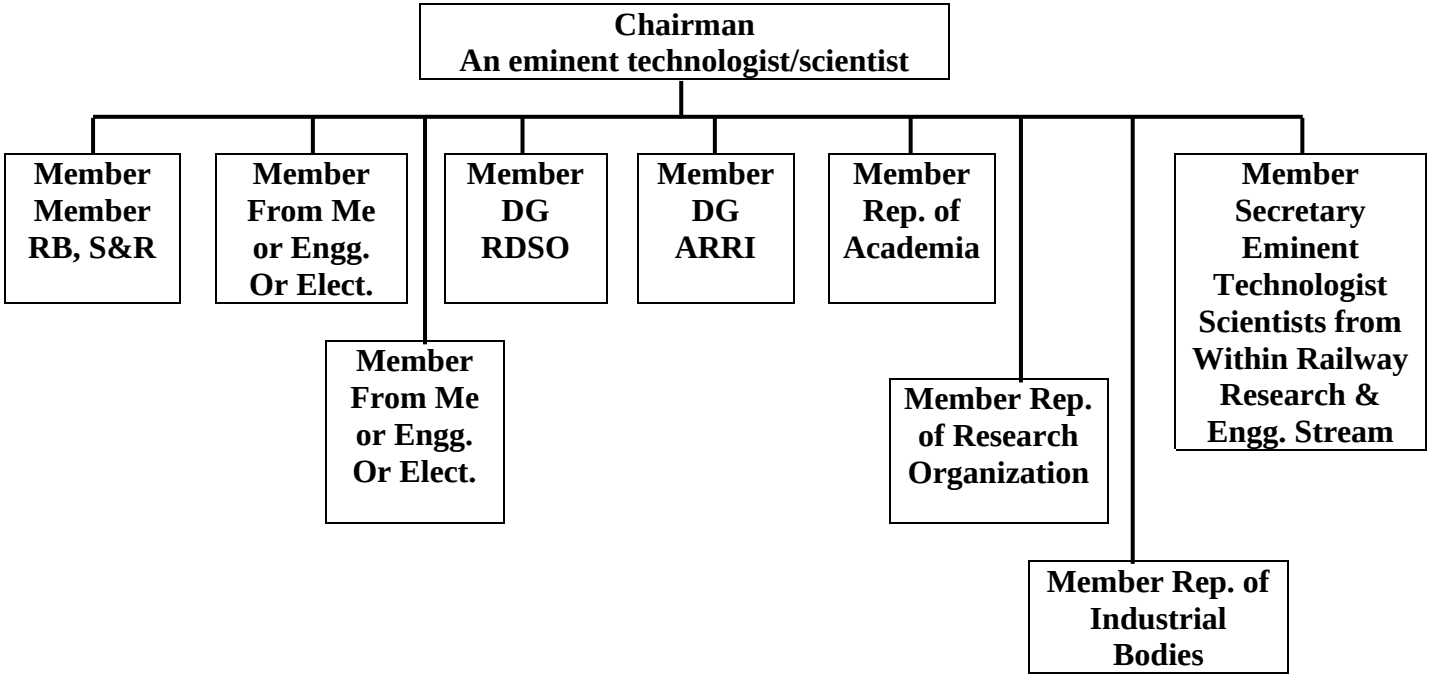


Fig. 42

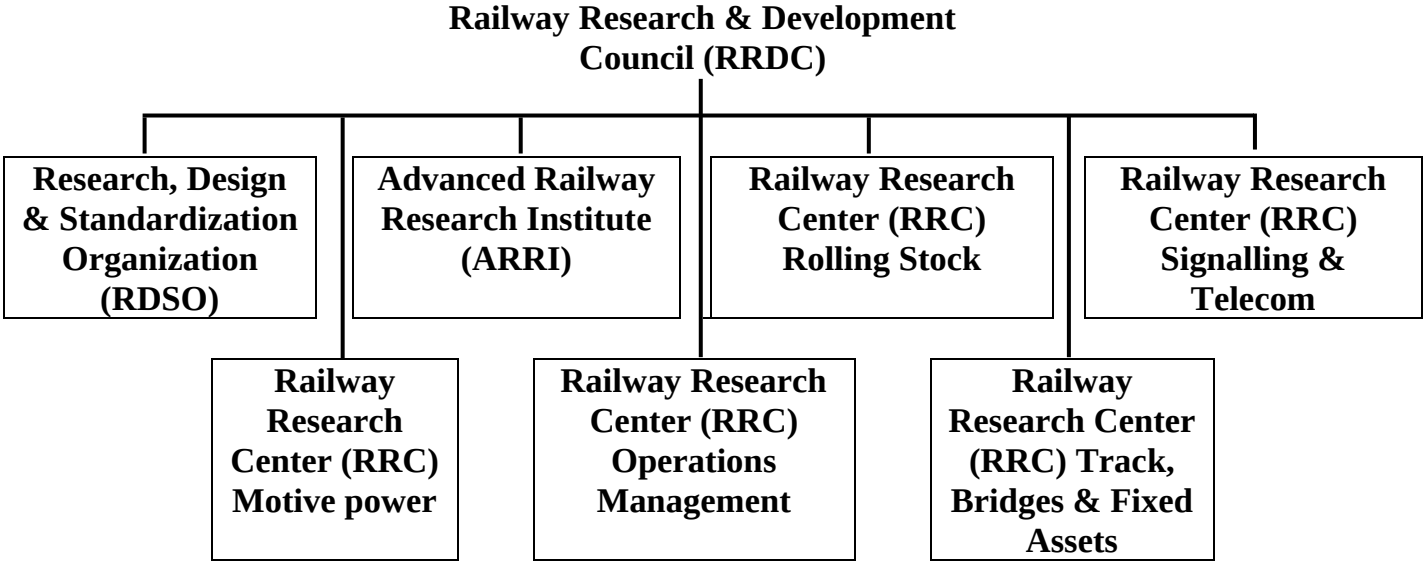

Railway Research & Development Council (RRDC)
Research, Design & Standardization Organization (RDSO)
Advanced Railway Research Institute (ARRI)
Railway Research Center (RRC) Rolling Stock
Railway Research Center (RRC) Signalling & Telecom
Railway Research Center (RRC) Motive power
Railway Research Center (RRC) Operations Management
Railway Research Center (RRC) Track, Bridges & Fixed Assets

Fig.43

Railway Research Center

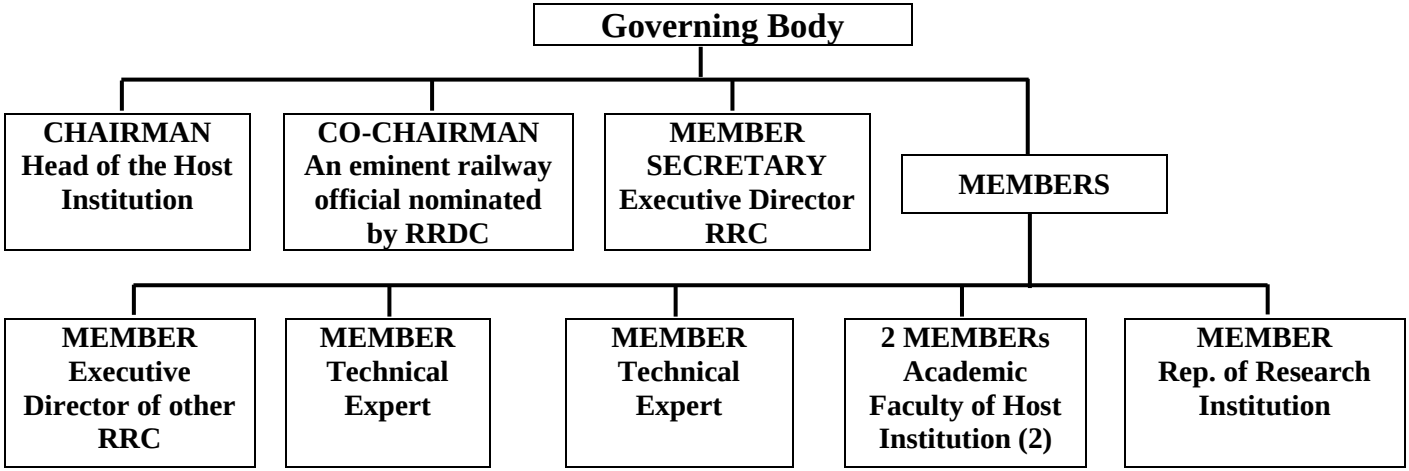


Fig. 44

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SAFETY ARCHITECTURE ON IR

(CHAPTER: VIII / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

8

8.1 Introduction

8.1.1 An effective Safety framework requires a holistic approach that ensures adequate safety culture all across the organization beginning with the topmost layer. The system should have the ability to spot and more importantly correct potential unsafe situations. There should be a keen watch on precursor events and corrections brought in at the root cause level. Safety should evolve as a discipline that can ensure adequate safety margins and avoid cliff edge situations. Most importantly, there is a need for an independent and effective oversight of safety that should be free from day to day operational and business pressures.

8.1.2 A close look at Indian Railways systemic approach to safety reveals that within the railways system everybody is supposed to look after safety, but in reality, it gets translated to safety of railway system as a whole being no body's baby. Theoretically speaking, safety is

supposed to be the common factor embedded in all the activities of railway production, maintenance and operations and is supposed to be a running theme in all modernization and technological up-gradation. Apart from a safety set-up at Railway Board, both at Zonal and Divisional level railways are armed with safety organization, butin reality, the safety organization at the Zonal and Divisional Railways is at best a co-coordinating service department mainly involved with safety audit functions.

8.1.3 It is also not clear that officers and staff with the right orientation and attitude are placed or deputed to discharge the safety related functions. Thus, realistically speaking, the respective operating departments are responsiblefor ensuring safety as well as its regulation in their area of work.

8.1.4 Thus while safety in Indian railways should have been the end productof a cohesive fusion of concerted working of track, rolling stock, signaling, electrical equipment departments along with operationaland maintenance excellence, adherence to standards and other protocols, discipline, rules and procedures and coordinated functioningof various wings of the staff and officials, in real sense it turns out to bedisjointed effort which is not in the best interest of safety of railway users.

8.2 Commissioner of Railway Safety

8.2.1 The institution of Commissioner Railway Safety is instituted to be independentof Indian Railways as it works under the overarching umbrella of Ministry of Civil Aviation. The responsibilities, duties, functions, and powers of Commissioner of Railway Safety are laid down

under Sections 5-10 andSections 114-118 of the Railways Act, 1989. A careful perusal of these sections of Railways Act indicates that, the role of Commissioner of Railway Safety is very narrow and is limited to specifically three areas- inspection and certification of new works if the new lines are to be opened for public carriage of passengers, certification of new rolling stock and enquiry into railway accidents.

8.2.2 In a railway line already opened and functional, the role of Commissioner of Railway Safety if any is very marginal. Even the power of CRS to make periodical inspections of any railway or of any rolling stock used therein must be directed by the central government. Therefore, its autonomy from Indian Railway administration is rather elusive. The Railway Board can still over-ride and do over-ride the Commissioner of Railway Safety, and such a prevalent scenario makes the functioning of Commissioner Railway Safety for all practical purposes, as one that is subordinated to the Railway Board. AnArchitecture of Safety organization is detailed later in this chapter to overcome these weaknesses.

8.3 Railway Board Remains Three in One- Policy Framer,Operator and Regulator

8.3.1 Ever since Railway Board was first constituted in 1905, its size, functions and responsibilities have gone on widening. Today the Railway Board presents itself as an all-encompassing monolithic structure where it has become an all-in-one-policy framer, operator of train services and regulator. Numerous past committees on the working of Indian Railways have considered this as an untenable proposition in the long run. Such a situation

where the Railway Board has all-in-one authority often results in operational compulsions superseding safety. Further, the silo-based approach of departmental working results in working at cross purposes. It is ironical that Railway Board has both the executive responsibility as well as the regulatory authority to enforce and control safety in the Indian Railway system. There is critical need for an agency separate from Railway Board, whose overarching responsibility is all aspects of safety, prevention of accidents, enquiring into the breaches and enforcing remedial measures if safety must become the prime concern of railway operations.

8.3.2 The above scenario presents a strong case for immediate steps to bolster safety orientation of Indian Railways along with inculcating a culture of zero tolerance of accidents. If the avowed goal must be achieved there is urgent need for setting up of a statutory Railway Safety Authority which acts asan independent Authority under the Government and is responsible for all aspects pertaining to safety regulation and enforcement while the prime responsibility for safety continues to be that of the Railway Board.

8.4 Safety of Railways is Becoming Over-Arching Concern Globally

8.4.1 In recent years, safety of railways is becoming overarching concern in major countries like U.S.A., England, Australia, and those governed by the European Commission. In the working of railways system in these countries, the trend is to statutorily ensure that safety is accorded highest priority. Some of the more important legislations/guidelines in this arena, which have been enacted/issued during last one decade, are enumerated

here under:

- United States of America, Rail Safety Improvement Act of 2008
- Queensland Australia, Transport (Rail) Safety Act of 2010 and Transport Rail Safety Regulation (2010)
- United Kingdom (UK), Railways and Transport Safety Act, 2003
- European Commission Rail Safety Directive No 2004/49/EC for member countries dated 29th April 2004
- Ireland Rail Safety Act, 2005 in pursuance of European Commission Rail Safety Directives
- Australia, Transport Safety Investigation Act (2003) to provide for investigation of transport accidents and other matters affectingtransport safety and related purposes.

8.4.2 The Committee studied the basic features of the Railway Safety Acts of the different countries which are worth emulating. Central to the recent efforts in these countries has been the system-based approach of having safety plans geared towards zero tolerance of incidence and proactive and positive safety measures. Setting up of dedicated safety watchdog and regulator as an entity separate from rail operator and those whose responsibility is to manage rail infrastructure has been the common running theme in recent developments. It is noted that **the approach adopted by the above Railways was of a very proactive accident reduction strategy, duly including a risk mitigation strategy, technology plan and fatigue management plan is something which is critically needed in the context for Indian railways plan for a positive safety orientation.**

8.4.3 An important component of US Act is mandating the Government to establish a grant program for the deployment of train control technologies, train control component technologies, processor-based technologies, electronically controlled pneumatic brakes, rail integrity inspection systems, rail integrity warning systems, switch position indicators and monitors, remote control power switch technologies, track integrity circuit technologies, and other new or novel railroad safety technology.

8.4.4 It is important to note here once again that even in Indian context, the Indian Railways with its present financial status, is ill equipped to undertake such measures for safety unless a clear dedicated line of funding including with the support of government exchequer is created upfront. Such a programme must be sustained over a period of time, at least for next ten years, to make a real difference to the Indian Railway system.

8.4.5 The Indian situation is different from American situation in one important aspect – while the American Railroad is a summation of several Class I, Class II and other railroads, the Indian Railways is the single agency so far in the country and this situation is likely to prevail in near future. But the principle of government establishing the safety Infrastructure Improvement Grant for Indian Railways is as sound as in the case of American Railroad. **In fact, given the present financial health of Indian Railways, without such a grant, the overall safety programme of Indian Railways will be a non-starter.** This aspect is further covered in the last chapter of the report.

8.5 Urgent Need for setting up Railway Safety Authority for Railways in India

The elaborate discussion of reasons for present lack of safety orientation in foregoing paragraphs presents a strong case for the urgent need for setting up of Railway Safety Authority under the Government. It is worth mentioning that the Railway Safety Authority to be set up in the country must be such that it meets the needs of the present structure of Railways in the country as well as remains relevant for emerging structure for the future. The modalities of setting up of the Authority, its Functions, and its Structure, its roles, duties, and responsibilities are the subject matter of this section:

8.5.1 Railway Safety Authority should be set up as a Statutory Institution

It has been seen that various countries in recent times have taken proactive steps for giving pre-eminent importance to railway safety and have moved in the direction of zero tolerance of accidents. In this connection the developments of setting up dedicated statutory and independent institutions for rail safety in USA, UK, Ireland, Australia, and South Korea have become the precursor of more such actions by other countries.

It is about time that India moves to the paradigm of proactive prevention, positive safety measures, highest priority to safety and zero tolerance for accidents. Such a paradigm change is also consistent with the Vision 2020 of Indian Railways. As such the Safety Committee recommends setting up of a Railway Safety Authority as a statutory body independent of Indian Railway Board under the Government. Such an institution should be set up by making robust changes through amendments in the Railways Act, 1989.

8.5.2 Railway Safety Authority should be independent of Indian Railways

It has to be clearly understood that for the Railway Safety Authority to be an effective watchdog and regulator, it has to be set up not only at arm's length from Indian Railways, but it should be an independent authority having comprehensive powers to direct railways on all matters pertaining to safety and ideally such an authority should be accountable to Railway Minister and through him to the parliament.

The Railway Safety Authority to be set up should have the powers to issue directives to Railways and its directives must necessarily be implemented by the Railways within a fixed time frame. In case railways are not implementing the directives of the Authority, the Act should provide the Authority with statutory powers to penalize the Railways. If there is a serious difference of view between the Railway Board and Railway Safety Authority which does not get resolved at their level the issue will go to the Central Government (Railway Minister) for arbitration and a decision.

As discussed above It should be possible to set up Railway Safety Authorityby making robust amendments to Railways Act, 1989. Alternatively, a cue can be taken from the latest Rail Safety Improvement Acts in USA (2008), Australia (2010) and UK (2003) and such separate Acts should form the basis of setting up, functioning and regulation by the Rail Safety Authority. Elaborate Rail Safety Regulations will need to be issued like the Safety Regulations issued by the European Union. Railway Safety Authority should have powers for enforcement of

its safety directives and in case of infringement in implementation of the directives it should have punitive powers.

8.5.3 The Institution of Commissioner of Railway Safety should be merged with the Authority.

The responsibility of the Railway Safety Authority should be all encompassing and the present institution of Commissioner of Rail Safety should also be made a part of the Authority. This will be consistent with the changes made in the British Act. Further, the same will be needed for seamless working of the Authority having powers and authority in the entire range of safety related issues from directing railways to make positive short term and perspective safety plan to enforcement of the plan, to arrive at those critical risks to safetyand issuing directives to reduce risks, to promote research in the areas of rail safety as well as to avoid incidents and accidents, to inspect and carry enquiry in case of the accidents and to suggest immediate and long term remedial measures for ensuring safety, avoiding accidents and ensuring non repetition of the incidents. The Chief Commissioner of Railway Safety atpresent works under the Ministry of Civil Aviation. There is hardly any benefit that has accrued from this arrangement. The institution should therefore be delinked from the Ministry of Civil Aviation and brought in as a part of the Railway Safety Authority. **The role of Commissioner of Railway safety should be withdrawn from the routine clearance of proposals from the railways such as changes in plans, working rules, etc., which consume lots of his time. These should be dealt and finalized by the concerned Principal Head of the department who should full**

responsibility of the changes. Under this safety dispensation, the institution of Commissioner of Railway Safety must be strengthened and empowered. There should be CRS for each zonal railway and each CRS will have a regulatory inspection team consisting of HODs of the concerned technical departments. The CRS will continue to discharge its functions as per the Railways Act and will devote more time to regulatory inspections and safety superintendence.

8.5.4 Key Objectives and Functions of Railway Safety Authority

Setting up of Railway Safety Authority should mark a complete shift and paradigm change from the present safety orientation of Indian Railways. It should result in giving safety the highest priority on railways. Instead of merely looking at the incidents, accidents, failures, and safety infringements its objects among other things should include:

a. Substantial improvement in safe railways operations and managing all aspects of railway working.
b. To identify and minimize risks with the railway's operations.
c. To ensure special provisioning for the control and mitigation of specific risks to safety arising out of railways operations. Minimization or elimination of risks to safety to the best level practicable should be the hall mark of working of Railway Safety Authority
d. To inculcate the discipline of zero tolerance of all types of incidents of safety significance including substantial reduction of failures which can be causative factor of such incidents and
e. To enhance the confidence of the public by promoting

greater safety of passenger or freight by rail.

Working of the Office of Rail Regulator in United Kingdom and provisions of the Rail Safety (Improvement) Act, 2008 of United States of America provide excellent template for the vision, strategy, functions, responsibilities, and enforcement powers of the proposed Railway Safety Authority in the Indian context. Such an authority among other things should have powers to ask the Indian Railways and other railway operators in India to develop a short term (1year), medium term (3-5 years) and perspective (10 years) Safety Management Plan with the clear intent of substantial improvement in safety and drastically reducing the number of accidents, incidents, injuries and fatalities involving railroad working including but not limited to collisions, derailments and human factors, substantially improving the consistency and effectiveness of enforcement and compliance programs pertaining to safety, having a programmed completion target of safety related/ safety enhancement works including enhancement of line capacity, renewal of assets, infusion of technology and fostering a culture of improving research efforts to promote and substantially improve the safety and performance of railways. The Authority should provide general requirements and areas to be included in the safety management plan. A key function of the Authority shall be monitoring of the safety management plan and imposing penalties for non-adherence to the plan. As it will not be possible to implement all safety related measures with railways finances, General or Special Safety Grants to begiven out of the general exchequer shall be monitored by the Railway Safety Authority both

for their utilization and results. A periodical review of the safety management plan and consultation shall also be part of the functions of the Authority. The Authority shall cause the railway administrations to publish their annual safety performance reports and should be responsible for ensuring that the railway administration starts remedial measures on the deficiencies orirregularities so brought out by the Authority. The Railway Safety Authority shall have overriding powers of inspecting and enquiring in the case of railwayaccidents and such powers shall include the powers to impose penalty on the rail administration. The powers of Authority to give directions in the matters of rail safety shall be comprehensive and such a direction shall state the time frame within which the safety matter direction must be complied with and in case the same is not done by the railway administration the punitive powers ofthe Authority shall be invoked.

8.5.5 The Organization of the Railway Safety Authority

1. The Rail Safety Authority should have commensurate organization having representation at the highest level of all the key functions of railway functioning. It shall also have special officers having expertisein the matters of rail and transportation safety, persons having distinguished track record in safety related research as well as it shall have the incident/accident investigation department. In contrast with the silo-based working of Indian Railways, the Rail Safety Authority should be organized on the basis of functions and functionality.

2. **The Authority shall have a separate budget fully funded by the Ministry of Railways.**
3. **RSA shall comprise of a part time 'Chairman'; three 'Members' from outside IR (Part time) who shall be eminent technologists and having good knowledge of IR; two members from Railway Board, --Member (Safety and Research), a new post to be created in Railway Board and Member (Traffic); and Chief Commissioner of Railway Safety (CCRS) as its Member Secretary. The Members and officials of Rail Safety Authority shall have statutory powers through amendment of Railways Act, 1989.**
4. **RSA shall have a full-fledged secretariat consisting of experts and professionals from railways and outside with necessary wherewithal.**
5. RSA shall function through 2 major routes to achieve broad functions of Safety Regulation, accident investigation and safety management as explained under:

    A. Chief Commissioner Railway Safety (CCRS) as Member Secretary of the RSA shall, in addition to its current functions, be in-charge of collating all the safety related occurrences from all the CRSs working at corresponding zones. Zonal Safety Committees (ZSC) shall be formed and chaired by CRS with Principal Officers of the safety related departments of the zone as members. ZSC shall review unusual incident reports, reports of designated regulatory

inspection teams, safety issues bugging the railway, etc. Regulatory Inspection Terms (RIT) shall be formed under the zonal CRSs consisting of SAG railway officers of safety related departments having experience in the field of safety. This team may have permanent members under CRS or drawn from the existing railway officers. Agencies and experts from outside may also be requisitioned based on needs. RIT will carry out regulator safety audits at Zonal (Field) level and shall submit its report to CRS and AGM/Safety. Action taken on such a regulatory inspection report will be submitted by AGM/Safety to the CRS who will forward the same to CCRS, Member (Safety and Research), Railway Board and GM. RIT shall also assist CRS in conducting statutory inquiry into accidents. This shall create a chain of Regulatory functions. RIT shall have the defined charter of regulatory inspection work to carry out periodic as well as on demand inspections. The SAG officers of RIT should be on5 years deputation and should be from the existing cadre strength ofthe railways.

B. Newly created post of Member (Safety and Research) in Railway Board will formulate and execute the Safety functions of IR. M (SR) shall also

suggest the "research" works to be undertaken by Railway Research & Development Council on matters related to "Safety". M (SR) shall arrange the execution of Safety functions through Additional General Manager (Safety) at zonal level and Sr. Divisional Safety Officers at Divisional level. The adequate staff for their functions shall be drawn from respective zones and divisions. AGMs and Sr. DSOs shall report to Member (SR) in the chain of "Safety" discipline. This implies creation of a Safety cadre to foster the safety culture. However, functionally AGM (Safety) which will be the upgraded post of CSO shallreport to the concerned GM.

6. With the limited time available from the Committee the finer detailscould not be drawn which should be done in Railway Ministry based on the given framework.

7. An organizational chart of Railway Safety Authority is shown in fig.45.

8. Functional linkage between Railway Board, Railway Safety Authority and Railway Research and Development Council is depicted in the chart at fig 46.

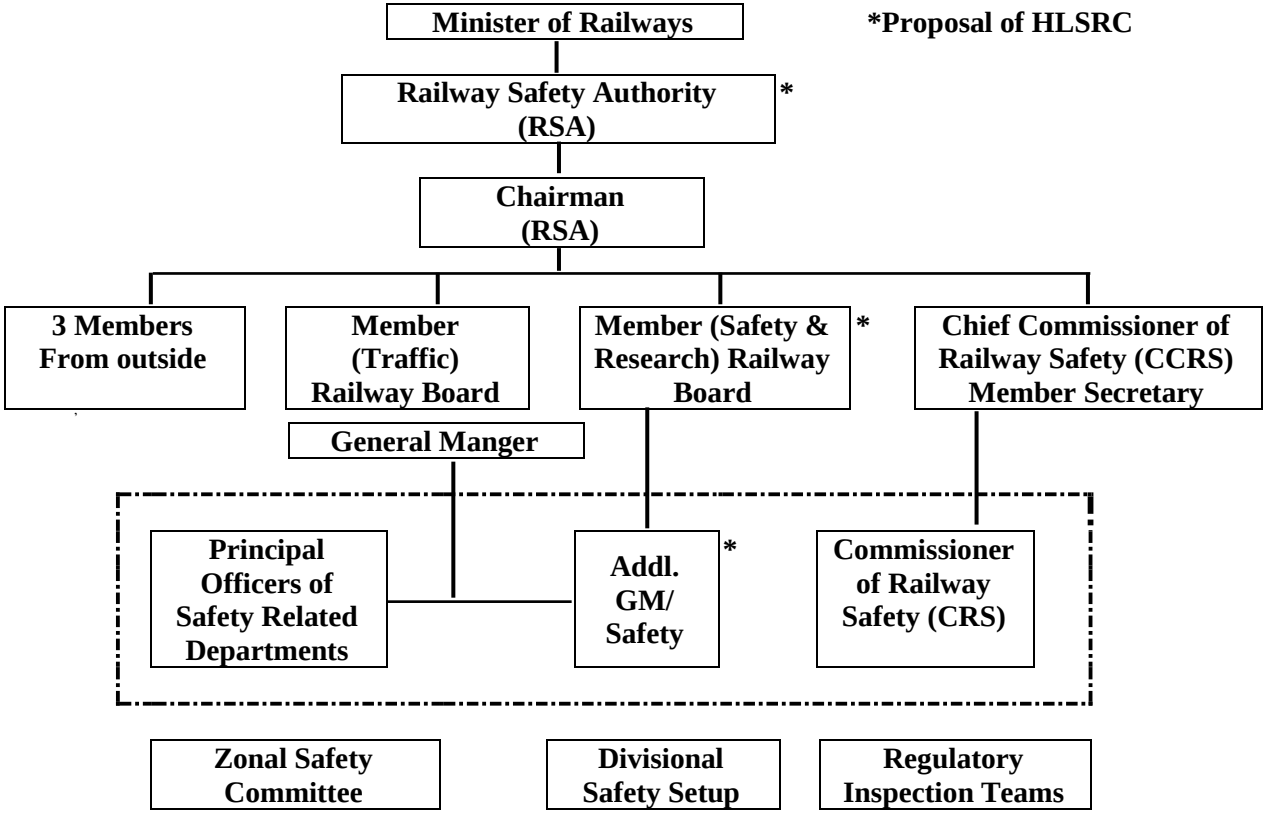

Minister of Railways
*Proposal of HLSRC
Railway Safety Authority (RSA) *
Chairman (RSA)
3 Members From outside
Member (Traffic) Railway Board
Member (Safety & Research) Railway Board *
Chief Commissioner of Railway Safety (CCRS) Member Secretary
General Manger
Principal Officers of Safety Related Departments
Addl. GM/ Safety *
Commissioner of Railway Safety (CRS)
Zonal Safety Committee
Divisional Safety Setup
Regulatory Inspection Teams

Fig. 45

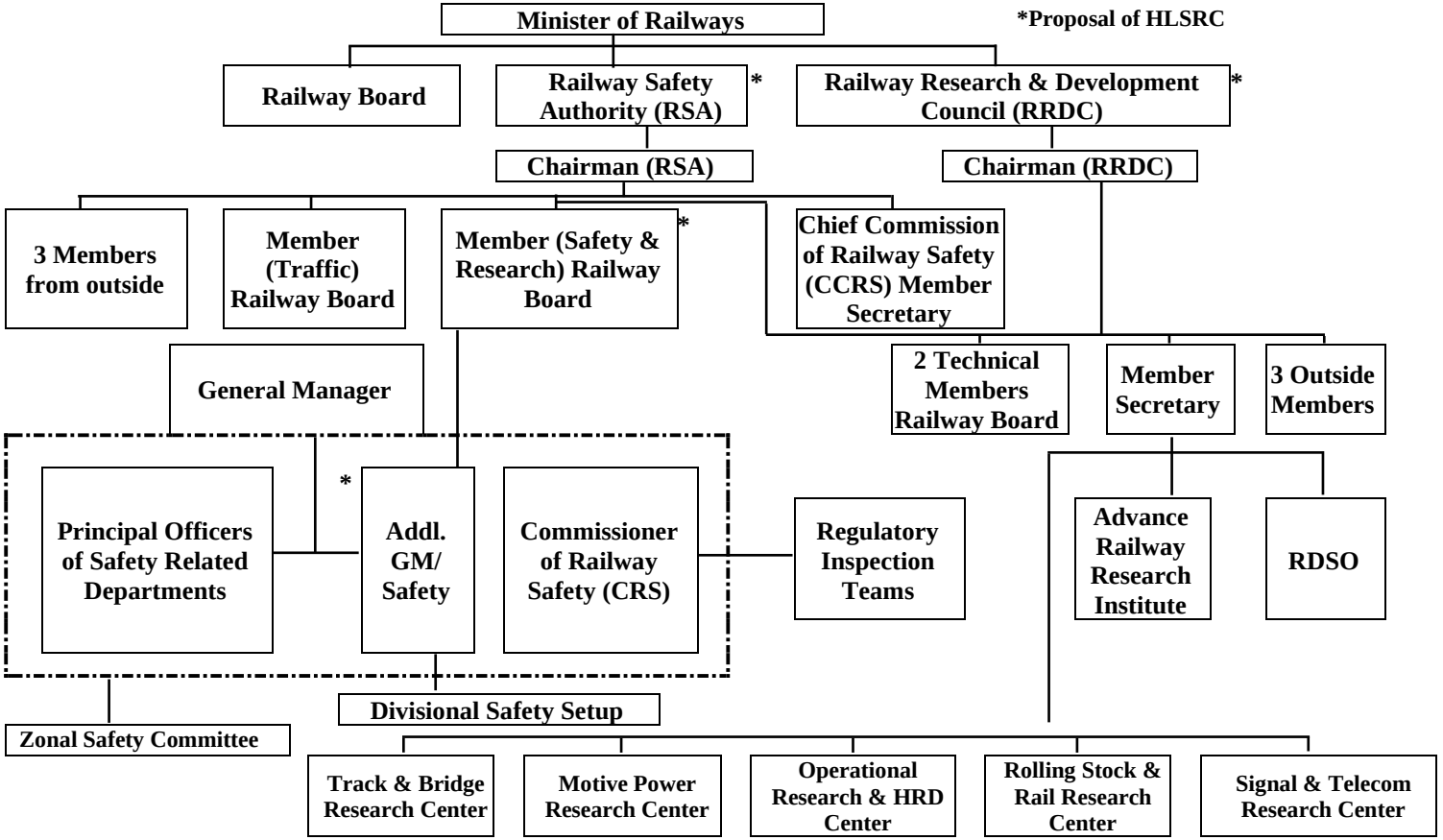

Minister of Railways
*Proposal of HLSRC
Railway Board
Railway Safety Authority (RSA) *
Railway Research & Development Council (RRDC) *
Chairman (RSA)
Chairman (RRDC)
3 Members from outside
Member (Traffic) Railway Board
Member (Safety & Research) Railway Board *
Chief Commission of Railway Safety (CCRS) Member Secretary
General Manager
2 Technical Members Railway Board
Member Secretary
3 Outside Members
Principal Officers of Safety Related Departments
*
Addl. GM/ Safety
Commissioner of Railway Safety (CRS)
Regulatory Inspection Teams
Advance Railway Research Institute
RDSO
Zonal Safety Committee
Divisional Safety Setup
Track & Bridge Research Center
Motive Power Research Center
Operational Research & HRD Center
Rolling Stock & Rail Research Center
Signal & Telecom Research Center

Fig. 46

CONCLUSION

(CHAPTER: IX / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

9

9.1 The Committee had a very satisfying time in interacting with various stakeholders and visiting workplaces on Indian Railways. Our impression that Indian Railway is committed to the nation got strengthened during our working with Indian Railways for the past about5 months. The commitment and passion with which railway men of all stature and class work is truly commendable and can take Indian Railways to great heights.

9.2 The Committee also brings it on record that the contents of this report are largely based on the shortcomings observed on Indian Railway system and good points, though many, have not been detailed or discussed for the sake of brevity.

9.3 The Committee has given several recommendations in the previous chapters of this report. Some of the recommendations have financial implications whilemany of the recommendations do not require funds for their implementation. The requirement of funds to implement such funds specific recommendations indicating funds required against individual items is shown in

table 7.

Proposed Investment on Safety over 5 years as per HIGH LEVEL SAFETY REVIEW COMMITTEE		
S.N.	**Items**	**Total Estimate Cost**
1	Advanced Signalling system to prevent collision with increased line capacity.	20000
2	Elimination of all level crossings (manned and unmanned) by Grade separation (RUB/limited High Subway/ROB.)	50000
3	Switching over to production of all new coaches to LHB design. Following is the breakup: (a) Cost differential of LHB and ICF coaches (@ Rs. 1 Cr.) (b) Additional Capacity in production units. (c) Maintenance infrastructure in workshops and coaching depots.	10000 7500 1500 1000
4	No discharge toilets in coaches (bio toilets/vacuum toilets).	3000
5	Weigh bridges.	10
6	Improvement in infrastructure in workshops and open line depots.	5000
7	Track friendly bogies for wagons.	2000
8	Identification tag on all types of rolling stock, communication backbone on the entire system, IT enabled applications such as Wheel Impact Load Detectors (WILD), hot box detectors, On-sight High Speed Camera at examination points, Acoustic bearing, and bogie monitoring system.	1000
9	Self-propelled USFD and track measurement machines.	1000
10	Track Maintenance Machines including rail grinding M/C	5000
11	Mobile Flash Butt welding Plants (@15 Cr. Per Machine). 1 each for the divisions.	1000
12	Formation improvement works	2000

13	Capacity enhancement in training CTIs, ZRTIs, STSs. Divisional Training Schools.	500
14	Proliferation of portable simulators for loco pilots and ASMs.	100
15	Railway Research & Development Council, Advanced Research Centers, RDSO upgradation, etc.	2500
16	Capacity Enhancement works to decongest existing network to facilitate corridor maintenance blocks	Included in Modernization Report
	Total	**103110**

Table 7

9.4 The Committee is aware of the tight financial condition of IR. **Methodology proposed for raising of funds for this purpose is shown in table 8.**

S.N.	Mode of funding	Annual Amount in Crores of Rs.
1	Safety Cess on Passengers	5000
2	Matching grant from Central Govt.	5000
3	Deferred dividend (against social burden)	5000
4	Road Cess	1000
5	RLDA earnings	4000
	Total	**20,000**

Table 8

9.5 A non-fungible non-lapsable safety fund generated with safety cess as above is proposed. It is possible to find the required resources for the critically needed safety expenditure through an innovative non-fungible and non-lapsable Dedicated Safety Fund for which the annual inflow comes from the captive passenger traffic. Following concept is proposed for this purpose:

As per latest statistics emerging out of Indian Railways (numbers available till 20th December),

total number of passenger traffic during first nine months of the current financial year has increased to approximately 6000 million and it is expected that total number of passengers during the financial year 2011-12 will approximate to 8000 million for the year i.e. nearly 22 million per day. It is also worth noting that the number of non-suburban passengers is growing at a rate, faster than that of the suburban passengers. During the first half of the financial year non-suburban passengers have grown at the rate of 6.7% while the suburban traffic has grown at the rate of 4.22 % over last year's numbers. The split between suburban and non-suburban traffic is reaching the welcome 50:50 mark and soon non-suburban traffic is likely to cross the fifty percent mark. Another feature of railways passenger movement is that the number of reserved journey passengers has increased to 6-7 million perday.

For nearly a decade passenger fares on Indian Railways have not been increased despite substantial increase of the input cost during the period. It is important to note that in the passenger segment, other than possibly AC Chair-car and AC Three-tier; all other segments have been making losses and are heavily subsidized by the freight traffic. Present financial position of Indian railways is precarious, and the most critical investment needed for the safetyand line capacity augmentation of the railways systems has been badly neglected.

It is suggested that because freight rates already are carrying heavy subsidy burdenof subsidizing passenger services, freight traffic should be left alone, and no safety surcharge shall be levied on the same. It is recommended that the safety fund should be dedicated non- fungible and non-lapsable so that this money is not mixed up with the general exchequer is specifically spent for the purpose of which the same is created and accrual of one year can beused in the subsequent years. The principal instrument for annual inflow in the Safety Fund will be a Safety Surcharge to be levied on every passenger ticket. It is clarified that safety surcharge will have a differential rate and all classes of passengers including the free riderson Indian Railway System will have to pay the safety surcharge. Such a surcharge should be given a statutory status by making a small amendment in the Railway Act if found necessary. The surcharge will be stepped up in nature i.e. those travelling reserved class will be paying more than those travelling non-reserved and in the reserved category higher the class of journey higher will be the rate of surcharge.

A calculation of total daily safety surcharge accrual is as below. For the purpose of calculation certain assumptions have been made. It has been assumed that there is a 50:50 split between suburban and non-suburban traffic, that total number of reserved passengers per day is 7 million and 92.5% of the total reserved passengers travel by Sleeper Class. It has also

been assumed that out of total passengers travelling in AC Reserved Coaches, 65% belong to AC III tier / AC Chair Car Category, 25% in AC Sleeper and 10% in AC First. For suburban passengers' safety cess has been assumed at Rs. 3 per ticket, for non-suburban unreserved tickets it has been assumed at Rs. 6 per passenger, for reserved sleeper class it has been taken as Rs. 10 per ticket, for AC Sleeper /AC Chair car it is assumed as Rs. 20 perticket, for AC Sleeper Rs. 30 per ticket and for AC First Rs. 50 per ticket:

Class of Journey	Daily number of passengers	Safety Surcharge per ticket (Rs.)	Daily Safety Surcharge accrual (Rs. Crore)	Annual Safety Surcharge Accrual (Rs. Crore)
Suburban	11 million	3	3.3	1204.5
Non-suburban	11 million			
(a) Non-suburban	4 million	6	2.4	876.00
(b) Reserved Sleeper Class (assum	6.475 million	10	6.475	2363.4
(c) Reserved AC III, AC Chair	.341	20	.682	249.00
(d) Reserved AC II Tier	.131	30	.393	143.45
(e) Reserved AC I	.054	50	.27	98.55
(f) Total			13.52	4935

Table 9

It can be seen from above that the Safety Special Cess will be netting a minimum of Rs. 14 Crore per day and the annual collection can safety cross Rs. 5000 Crore. Such a collection from Safety Cess shall be exclusively usedfor the purpose of

the Safety Related Expenditure being recommended by the Safety Committee.

9.6 Deferment of dividend to the tune of Rs. 5,000 Crores per year is proposed. This is justified as social service obligation being borne by Indian Railways is about Rs. 15,000 crores every year due to low ordinary class fare, sub-urban and non-sub-urban season fare, a variety of concessions granted on passenger tickets, transportation of certain commodities below cost and working of un-economic branch lines.

9.7 With Railway raising about 5000 Crores per annum through safety cess, a matching grant from Central Government for safety related works is fully justified and demanded.

9.8 Implementation of Accepted Recommendations

9.8.1 Indian Railways severely suffers from implementation bug. This has caused non-implementation of some of the important accepted Recommendations given by the past Safety Review Committees. In this regard, this Committee would like to quote Para 2.2.1 of Chapter 1 (Page No.12) of the previous Report of Railway Safety Review Committee 1998 (Part 1):

> ***"If this Committee were to make only one recommendation it would be for IR to rigorously monitor implementation of safety items already known and languishing at various stages of consideration/ execution. The most serious deficiency in safety matters is that these are inordinately delayed or insufficiently funded."***

9.8.2 It will be unfortunate if recommendations of this Committee as accepted by the Ministry of Railways also

meet with the same fate. The Committee recommends an empowered group of officers (including an officer from finance) in Railway Board to pilot the implementation of safety enhancement recommendations and projects as accepted by the Ministry of Railways in a time bound manner with full funding. Other projects should be appropriately pended or slowed down for the time being to accommodate funding of these key projects.

9.8.3 The Committee also recommends that newly constituted Railway Safety Authority under the Govt. of India also reviews the implementation of accepted Recommendations at a prescribed periodicity, say, once every 3 months for the next 2 to 3 years.

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SUMMARY OF RECOMMENDATIONS

(CHAPTER / REPORT OF HIGH-LEVEL SAFETY REVIEW COMMITTEE: KAKODKAR COMMITTEE, 2012)

10

1.0 General Safety Matters

1.1 An IT system based on email / SMS should be introduced to report safety related matters by railway and non-railway persons. (Para 2.4.10)

1.2 Redundancies should be built in the system such as track circuiting by two diverse means at vulnerable locations so that normal operations are least hampered due to single point failure. (Para 2.5)

1.3 An IT-based system should be set up within 6 months to collect and collate all train accidents whether consequential or of little significance, near misses, safety related asset failures, etc. (Para 2.5)

1.4 Projects for augmentation of line capacity on busy routes and maintenance facilities for coaches and wagons in open line and workshops should befunded and executed as top priority in mission mode. (Para 2.7)

1.5 No new trains should be introduced without adequate capacity for operation and maintenance. (Para 2.7)

2.0 Organizational Structure

2.1 The restructuring of IR should be examined and studied by a Separate Expert Group. (Para 2.8.2)

2.2 Earlier the system of only Operating and technical officers being considered for general posts of GMs and DRMs should be restored. Only capable officers should be selected as DRMs and posted in divisions with a minimum tenure of 3 years. (Para 2.8.3)

3.0 Empowerment at Working Level

3.1 Enhanced powers should be delegated to GMs and DRMs in regard to safetymatters as under (Para 2.9.5):

1. The powers of General Managers to be enhanced to 3 times for sanction of works under all Plan Heads except New Lines and M & P items. These should also be applicable on an out-of-turn basis, depending on the urgency. The powers of DRMs also to be accordingly enhanced to 3 times.
2. General Managers are to be given full powers for re-appropriation of funds from one work to another under the same Plan Head and source of funds under all the Plan Heads, except New Lines.
3. General Managers have full power to re-appropriate funds under Revenue under the same Demand from one PU to another within the overall budget allotment.
4. DRMs to be fully empowered to decide the process/procedure such as Spot Purchase Committee, Single/Limited Tenders, etc.
5. DRMs to have full powers:
   i) To accept tenders floated by the division.
   ii) To enter into repair or Annual Maintenance Contracts (AMC) through OEM or otherwise
   iii) To purchase stock items in case of shortages

and non-stockitems up to Rs. 3 Lakhs per case but without any monthly ceiling

6. DRMs to be empowered to award works of essential nature related to operation and maintenance assets on quotation basis for 3 months as astop gap arrangement.
7. DRMs to have full powers for hiring of resources including utility vehicles.
8. DRMs to have full powers to sanction construction of RUBs, limitedheight subways and ROB under Road Safety works.
9. Powers those vested with DRMs of the Division to be enjoyed by theChief Workshop Managers (CWM) in respect of their workshops.

3.2 Powers to sanction cash awards for good performance in safety related matters should be enhanced to three times. (Para 2.9.6)

3.3 Enhanced delegation of powers to the divisions should be directly mandated by the Railway Board as a onetime measure. (Para 2.9.7)

4.0 Safety Related Works and Issues

4.1 Core Safety Groups should be formed under the convenorship of the Additional General Manager/Safety (a new post carved into zonal headquarter as part of the new safety architecture) at headquarter level and Sr. Divisional Safety Officer at divisional level. Principal Heads of Departments at HQ level and branch officers at divisional level of Civil, Mechanical, Electrical, Signaling, Operating and Finance should be the members. (Para 2.10.1)

4.2 Group of Officers headed by AGMs and ADRMs at the Headquarter and divisional levels respectively should convene meetings once every week to clear all the pending Engineering and Signaling Plans. (Para 2.10.2)

5.0 Vacancies in Critical Safety Categories and Manpower Planning Issues

5.1 All the vacancies for supervisors and staff in the safety category should be filled up in a time-bound manner say within 6 months by leveraging IT based recruitment systems. Concerned officer in Railway Board should be given this responsibility along with commensurate empowerment.

5.2 Multi-disciplinary teams of 3 officers, one each from Personal, finance and the concerned department should identify surplus posts at the Divisional, Hd. Qrs. and production unit levels for surrendering to build up a surplus bank. These teams should identify the need for additional posts under safety categories. GMs should ensure that creation of additional posts is rightfully done in the deserving safety categories within 3 months. (Para 2.11.3)

5.3 GMs should be empowered to create additional posts with finance concurrence under Safety categories if no matching surrenders are available. (Para 2.11.3)

5.4 The existing staff yardstick to be looked afresh in a dispassionate fashion and the same should be issued to the zonal railways within 3 months. (Para2.11.4)

5.5 The Railway Board should issue an outsourcing policy to get expert service and save costs. (Para 2.11.5)

6.0 Shortage of Critical Safety Spares

6.1 Concerned directorates should issue a defined list of safety items to Zonal Railways for uniformity. (Para 2.13.1)

6.2 RDSO should take full responsibility for all those safety items for which drawing, specification, vendor approval, etc. are issued by RDSO. They should enter into long term rate contract with their approved vendors for 3 to 5 years after negotiating rates based on the value of the item which

can be best assessed by RDSO. (Para 2.13.3)

6.3 A simple but effective vendor qualification and approval process should be followed for non-RDSO safety items at zonal railway level. (Para 2.13.7)

6.4 A thorough review of the quality system for material procurement processes by an external professional agency and revamping of the system should be done as necessary. (Para 2.13.8)

6.5 The conventional method of technical inspection should be replaced with a modern Quality Management System for which necessary check sheets should be developed by the respective departments directly associated with safety. These check sheets should be based on present rules, regulations, manuals, instructions, etc. and should form part of the safety manual of the Railway. (Para 2.14)

7.0 External Interference – Encroachment and Sabotage

7.1 Removal of all encroachments in the vicinity of railway track should be addressed at the political level in the interest of safety. (Para 2.15.2)

7.2 PPEA (Public Premises Eviction Act) should be suitably amended so that eviction of encroachers is easily possible with the help of local police/Railway Protection Force. Suitable amendment to the Railway Act should also be made by which encroachers can be severely penalized. (Para 2.15.2)

7.3 Better coordination between Indian Railways and the policing authorities should be established to strengthen the intelligence network to pre-empt sabotage on the Railways. (Para 2.15.3)

7.4 The Railway Act should be suitably amended to impose stringent punishment on persons found guilty of sabotage. (Para 2.15.3)

7.5 Big railway stations should have 'Intelligent Security' largely based on CCTV cameras with proper monitoring in the control room. (Para 2.15.4)

7.6 The upper limit set for recruitment of Ex-Servicemen as per stipulated standards against vacant posts in RPF cadre should be removed to expedite filling up of vacancies. (Para 2.15.4)

7.7 Railways should also take up disruptions and vandalism to their assets to the courts for compensation and remedial measures. It should be examined whether suitable provisions can be incorporated in the Railway Act for this purpose. (Para 2.15.5)

7.8 A High-Level Task Force involving the State Government, ZRUCC and NGOs should be set up to recommend constructive measures which will alleviate or eliminate casualties due to railway infrastructure in the near future. (Para 2.16.2)

8.0 Signaling, Telecommunication and Train Protection

8.1 State of the art signaling and protection system – at least equivalent to the functionalities of ETCS L-2 should be deployed throughout IR, starting with the busy routes (19000 Kms) immediately. A sub-group of the Committee shall examine some of the critical aspects during the visit to some of the European railway system and submit its report. (Para 3.5)

8.2 Diverse and redundant means of Satellite based train position sensing (as used in ACD) should be incorporated and merged into ATP functions. (Para 3.5)

8.3 A dedicated Special Purpose Vehicle (SPV) should be formed having full powers and the mandate to formulate and execute the sanctioned projects of ATP in a time bound manner (5 Years). (Para 3.6)

8.4 A high power standing technical review committee should be set up to guide the SPV on technical issues. This Committee should continue till the implementation of the project of ATP and should have experts from Railways as well as from outside. (Para 3.6)

8.5 Communication Based Train Control (CBTC)" system should be used in Metros and dedicated corridor sections like Mumbai suburban, to meet the requirements of head way less than 1.5 minutes after study of design margins. (Para 3.6)

8.6 A "Task Force" should be set up to study the feasibility of communication back bone for IR, utilizing diverse and redundant technology to ensure the highest level of availability of the networks for safety and operational requirements. (Para 3.6)

8.7 RDSO signaling directorate should be augmented with comprehensive research framework in order to include work on forecasting /newer signaling and telecom technologies. (Para 3.6)

9.0 Rolling Stock

9.1 IR should switch over to the manufacture of LHB design coaches in all the coach manufacturing units and manufacture of ICF design coaches should be stopped immediately. (Para 4.2)

9.2 The problem of jerks on LHB design coach should be resolved by adopting a new design of draft gear subject to its satisfactory performance. The existing LHB coaches should also be retrofitted. (Para 4.2)

9.3 Other maintenance-related problems faced on LHB coaches such as consequential failure to roller bearings, wheel shelling, etc. should be addressed at the earliest. (Para 4.2)

9.4 Some adaptation should be designed and provided on all the existing ICF design coaches in a Mission mode for facilitating energy absorption and anti-climbing during crash or sudden deceleration. (Para 4.3)

9.5 IR must strategize to utilize only LHB coaches at 110 Kmph and above speeds with 18 and above coach formations on the trunk routes. ICF design coaches should be relegated to lesser speeds with shorter compositions. (Para 4.2)

9.6 A simple low-cost device such as bimetallic sensor to open or close a circuit ataround 60 to 80 degrees Celsius on each axle with a display of red lights and alarm bell should be fitted in coaches that run on services having escorting technicians. (Para 4.3)

9.7 LHB coaches must be grounded at the Maintenance yards and sub-standard M8 Fasteners of speed sensor should be replaced with high tensile bolts ofthe specified quality of reputed make. (Para 4.3)

9.8 Toilets either with no discharge or with harmless discharge should be introduced in all the 43000 coaches within the next five years. (Para 4.5)

9.9 Flame detection system should be provided in coaches which should sound hooter at many places in the coach to warn the passengers. Its interface with ACP system should be considered based on field trials. (Para 4.6)

9.10 A simple ladder or equivalent feature with a permanent fitment or foldable and deployable provision should be available for assisting passengers to get downfrom coaches in the event of accident. (Para 4.6)

9.11 Existing instructions prohibiting cooking in Pantry Cars should be strictly enforced. The license of violating contractors should be cancelled and they should be

severely penalized if found cooking. Necessary provisions in this regard should be made in the Railway Act. (Para 4.7)

9.12 Video Camera based data logging, storage, and display in monitoring room of Train Examiners Cabin should be introduced. (Para 4.8)

9.13 Hot box detectors, Wheel impact load detector (WILD) and Track side bogie monitoring system should be extensively deployed. (Para 4.4)

9.14 Radio tags on all types of rolling and a communication backbone should be provided along the railway network with last mile connectivity for transfer of condition data from track side to the control center as well as maintenance depots. (Para 4.4)

9.15 Every train should be checked for formation Leak rate during maintenance in addition to Brake Power Certification. (Para 4.9)

9.16 Weigh- bridges should be installed at all major loading depots and at other places in a way that every loaded wagon is weighed within 50 to 100 kilometers. A uniform operating protocol to deal with overloaded wagons should be prescribed by the Railway Board. (Para 4.10.1)

9.17 Wagons with track friendly bogie should be deployed on Indian Railways on priority. (Para 4.10.2)

9.18 The concept of distributed power in freight operations to reduce coupler forces and rail wear should be developed. (4.10.3)

10.0 Track

10.1 A national level expert committee should be constituted to establish the root cause of rail failures and identify the metallurgical and chemical solutions including enhanced quality assurance and control protocols from steel melting to laying of rail on a war footing within the next three

months. This expert team should also review Rail Welding technology. (Para 5.2)

10.2 A Senior Administrative Grade officer of high integrity and strong background in Material Science & Chemistry should be posted full time to monitor and control Rail production process at Bhilai Steel Plant. (Para 5.2)

10.3 Production of 52 kg rail should be stopped, and 52 kg PSC sleepers should no longer be produced. Only 60 kg/M head hardened rails should be used on curves sharper than 400-meter radius of curvature. (Para 5.2)

10.4 Modern technologically driven vehicle borne ultrasonic testing machine should be introduced for faster and reliable detection of rail and weld flaws. (Para 5.2)

10.5 Rail grinding at required intervals should be mandatory to increase the life of rails and wheels of rolling stock. (Para 5.2)

10.6 A systematic AT welding improvement programme should be introduced conforming to European standards. Procurement of the latest and proven raw materials and quality welding procedures must be introduced to eliminate AT welding failure. (Para 5.3)

10.7 Directorate dealing with track formation in RDSO should be strengthened, stretches of weak formation identified and an action plan formulated to treat weak formations in a scientific manner with a view to eliminate such weak spots permanently including improvement to drainage within the next 5 years. (Para 5.7)

11.0 Bridges

11.1 For recording and monitoring the condition of distressed bridges, photographs should be taken using modern handheld electronic cameras and should be posted on MIS/ sent through Internet to all concerned expert

engineers havingvast experience. (Para 5.5)

11.2 Vulnerable bridges should be fitted with water level gauges and turbine flow meters to measure flow which should be interlocked in a way to warn thedriver of the approaching train. (Para 5.5)

11.3 Distressed and vulnerable bridges should be instrumented in terms of deflections/displacements, water level and flow velocity on a continuous basis and data should be communicated to the office of the concerned Chief Bridge Engineer for monitoring. Advanced scientific measurement and inspection for the condition assessment of the under-side of the bridges using mobile and articulating platform is essential. (Para 5.6)

12.0 Level Crossings

12.1 All Level Crossings whether manned (with or without signals) or unmanned should be eliminated in the next 5 years. This is gigantic task for which dedicated SPVs should be formed in each of the zonal railway fully empowered and mandated to complete the project in a time frame of 5 years. (Para 5.6)

12.2 Level Crossings having little road traffic should be closed. Merger of nearby LCs by constructing connecting roads at railway's cost even on non-railway land should be taken up. (Para 5.6)

12.3 Construction of limited height subways, Road under Bridge (RUB) and Road over Bridge (ROB) should be taken up in mission mode and traffic blocks should be generously granted. (Para 5.6)

12.4 No LC should be newly introduced under any circumstances on the existing system as well as during gauge conversion, doubling and construction of new railway lines. (Para 5.6)

12.5 No LC gate should henceforth be manned or interlocked. (Para 5.6)

12.6 The present policy of sharing the cost of RUB or ROB with the State Governments should be dispensed with and the full responsibility and entire cost of construction should be taken over by the Railways. For this purpose, the present Railway policy needs to be changed and section 19 of the Railway Act needs to be amended. Further, to augment the Road Safety Fund a large share of diesel cess should come to the Railways for which Government of India should be approached. (Para 5.6)

12.7 To expedite the construction of limited height sub-ways, RUBs and ROBs the CRS's role should be taken away and relevant plans and documents shouldbe approved and signed at the level of the concerned Principal Head of the Departments (PHODs) instead of sending them to the Commissioner of Railway Safety (CRS) for sanction unless there is some change in the track/yard layout. (Para 5.6)

12.8 Regular meetings and coordination between Railway and civil administrationat the highest to the local levels should be held to expedite the execution.

13.0 Human Resource Development with Emphasis on Education and Training

13.1 A large number of projects of importance to Railways should be regularly awarded to some select engineering academic institutions in which students can participate. Courses, minor stream, and major specializations in the areaof railway engineering should be introduced in the Indian engineering academic programs. (Para 6.1)

13.2 All officers should be periodically imparted training in safety engineering for building a safety culture. (Para 6.2)

13.3 One training institute at the divisional level should be nominated and upgraded for training to staff on safety environment in the Railways. This institute should have animation films; general equipment, tools and gadgets used on Indian Railways, etc. (Para 6.2)

13.4 Departmental staff should be encouraged and extended resources to upgrade their professional qualifications and skills to be fit for promotion to a higher level. (Para 6.3)

13.5 All the newly recruited Assistant Loco Pilots should be Diploma holders instead of present Matriculate/ ITI holders. All the Maintenance Technicians inall Technical Departments should at least be ITI holders and supervisors should be at least Diploma holders, preferably, Engineering Graduates. (Para 6.3)

13.6 The cadre of electric and diesel running staff should be separated in the present operating environment having a large number of loco variants of both types. (Para 6.4)

13.7 Running staff who fail any of the mandatory refresher courses should begiven only one extra chance to repeat the course and the test should be taken at the concerned Branch Officer level. In case the running staff fails again, he should be debarred from running duty and posted on other non-safety related assignments or given voluntary retirement following the prescribed rules and process. (Para 6.5)

13.8 Some portable cheaper versions of loco simulators should be procured and located in drivers' running rooms where running staff can brush up their driving skills at their convenience. (Para 6.7)

13.9 Customized signaling Panels should be introduced at the earliest in Zonal Railway Training Institutes (ZRTIs) for the training of station operating staff. (Para 6.8)

13.10 Separate handbooks should be prepared for the operating staff, such as loco pilots, station masters, etc. which should contain all the necessary instructionsto be followed by them while performing their duty. (Para 6.9)

13.11 Each Division should have Grievance Redressal Machinery which should deal with staff grievances in a time-bound manner. (Para 6.10)

13.12 Special allowance equivalent to 25% of the salary and grade pay should be given to the staff who work as regular Gatemen as a special incentive during the intervening period till LC gates are closed. (Para 6.11)

14.0 Training Institutes on IR

14.1 All sanctioned capacity enhancement works of CTIs, ZRTIs and STSs should be fully funded and executed within the next two years. (Para 6.2)

14.2 Posting as a trainer in Centralized Training Institutions (CTIs) should be based on the recommendation of a committee of which the Head of the institute concerned must be a member. Tenure of deserving officers may be extended on the recommendation of the Head of the CTI even if it involves transfer of elements of posts if such a trainer is due promotion so that he/ she can be promoted in the training institute itself. (Para 6.2)

14.3 Heads of CTIs should be given full powers to invite academicians, industry leaders, technocrats, etc. as visiting faculty within the allocated budget grant. In case of Railway Staff College, where Management training is imparted to officers of all railway disciplines, arrangements should be made to have one or two professional academicians on loan from management institutes of repute for a few years fixed tenure. (Para 6.2)

14.4 Funds for CTIs, Zonal Railway Training Institutes

(ZRTIs) and Supervisors Training Schools (STSs) should be allocated separately both under Works as well as Revenue. Incurrence of expenditure under these fund-allocations should be fully under the control of Heads of the institute. Considering the importance and size of CTIs, they should have their own maintenance infrastructure. (Para 6.2)

14.5 The terms of Principals of ZRTIs and STSs should be fixed for at least 3 years. (Para 6.2)

14.6 The teaching allowance of trainers of ZRTIs and STSs should be increased from 15% to 30% to bring it at par with trainers in CTIs. (Para 6.2)

15.0 Research Eco-System on Indian Railways

15.1 An apex body called Railway Research & Development Council (RRDC) should be established. It should be chaired by an eminent technologist / scientist of the country reporting to the railway minister. (Para 7.3.1)

15.2 Financial support up to 2 % of yearly revenue of Indian Railways should be available to support the entire research eco-system of railways in India. (Para 7.3)

15.3 The Advanced Railway Research Institute (ARRI) should be established which should be a high-end, research organization focusing on engineering challenges in railway specific areas. (Para 7.3)

15.4 A string of five or so Railway Research Centers should be established which should be co-located on the campuses of Indian technological academic institutions of national importance. Each center should specialize in specific areas like signaling, rolling stock, motive power, track and bridges, operations management, etc. (Para 7.3)

15.5 The present system of only having railway officers on deputation at senior positions in RDSO should be done

away with and professionals and scientists from reputed technical institutions should also be inducted at higher levels on the permanent cadre. Their career progression should be on the similar lines as followed in other research institutions of Government of India. (Para 7.3.4)

15.6 Power of DG/RDSO should be enhanced as under:

1. Full autonomy with financial powers to function within the sanctioned budget.
2. To award consultancy contracts of enhanced value up to Rs. 1 Cr. In each case against the present delegation of Rs. 30 lakhs in each case. Powers for awarding MOU/Consultancy Contract should also be extended to benchmarked organizations in India and abroad like AAR, TTCI, UIC etc.
3. Full powers to award Consultancy Contract once sanctioned by the Board for values more than Rs. 1 Cr. each and there should not be any further need to send the proposal to the Board. (Para 7.3.4)
4. Full powers for placement of developmental order within lump sum Budget Grant of RDSO irrespective of cost. This will expedite prototype and field validation for which RDSO is presently depending on PUs and Railway Board.

16.0 Safety Architecture on IR

16.1 A Railway Safety Authority (RSA) should be set up as a statutory body independent of Indian Railway Board under the Government. The Authority shall have a separate budget fully funded by the Ministry of Railways and shallbe backed by a full-fledged Secretariat. (Para 8.5).

16.2 A new post of Member (Safety and Research) in the Railway Board should be created who will be the link

between Railway Board, Railway Safety Authority (RSA) and Railway Research and Development Council (RRDC) at the apex level. (Para 8.5).

16.3 The existing posts of Chief Safety Officers on zonal railways should be upgraded to Additional General Manager (Safety) as part of the new Safety Architecture. (Para 8.5)

16.4 The Institution of Commissioner of Railway Safety should be merged with Railway Safety Authority and should be strengthened and empowered. There should be CRS for each zonal railway and each CRS should have a Regulatory Inspection Team consisting of HODs of the concerned technical departments. (Para 8.5.3)

16.5 The role of Commissioner of Railway safety should be withdrawn from the routine clearance of proposals from the railways such as changes in Plans, Working Rules, etc. which consume lots of his time. These should be dealt and finalized by the concerned Principal Head of the department who should full responsibility of the changes. (Para 8.5.3)

17.0 Implementation of Recommendations

17.1 A non-fungible non-lapsable safety fund generated through safety cess on passengers of different classes in a graded manner should be created to raise funds to the tune of Rs. 5,000 Crores per annum. (Para 9.5)

17.2 Payment of dividend to the tune of Rs. 5,000 Crore per annum should be deferred in view of the social service obligation being borne by Railways which is assessed as Rs. 15,000 Crores every year. (Para 9.5)

17.3 An empowered group of officers (including an officer from finance) in Railway Board should pilot the implementation of safety enhancement recommendations

and projects as accepted by the Ministry of Railways in a time bound manner with full funding. Other projects should be appropriately pended or slowed down for the time being to accommodate funding of these key projects. (Para 9.8.2).

17.4 Newly constituted Railway Safety Authority under the Govt. of India should also review the implementation of accepted Recommendations at a prescribed periodicity, say, once every 3 months for the next 2 to 3 years (Para 9.8.3).

******

Annexure – 1

Death/Injury to Railway Staff during working (period 2007-08 to Oct. 2011) (only open line cases).

Rly	Departments															Total		
	Engg.			Mech.			Elect.			S&T			Optg.					
	K	I	T	K	I	T	K	I	T	K	I	T	K	I	T	K	I	T
CR	141	504	645	12	1397	1409	35	265	300	20	140	160	15	87	102	223	2393	2616
ER	104	4	108	9	114	123	22	206	228	7	8	15	11	42	53	153	374	527
ECR	119	5	124	8	115	123	6	2	8	13	1	14	9	23	32	155	146	301
ECoR	41	283	324	6	72	78	15	58	73	0	26	26	12	55	67	74	494	568
NR	73	2	75	2	0	2	4	0	4	4	0	4	8	0	8	91	2	93
NCR	135	96	231	11	727	738	9	2	11	9	46	55	7	28	35	171	899	1070
NER	53	13	66	7	150	157	1	0	1	5	11	16	9	1	10	75	175	250
NFR	42	2	44	5	181	186	7	4	11	3	2	5	12	1	13	69	190	259
NWR	43	13	56	1	14	15	2	1	3	0	2	2	5	1	6	51	31	82
SR	56	33	89	13	551	564	11	15	26	5	41	46	10	91	101	95	731	826
SCR	8	2	10	11	1065	1076	5	3	8			0	2	0	2	26	1070	1096
SER	37	9	46	6	8	14	9	6	15	3	0	3	9	2	11	64	25	89
SECR	26	4	30	2	114	116	15	6	21	1	2	3	8	1	9	52	127	179
SWR	19	132	151	1	76	77	2	11	13	2	10	12	2	50	52	26	279	305
WR	102	739	841	12	242	254	22	110	132	34	59	93	9	131	140	179	1281	1460
WCR	106	230	336	4	75	79	1	95	96	5	54	59	4	38	42	120	492	612
Total	1105	2071	3176	110	4901	5011	161	781	950	111	402	513	132	551	683	1624	8709	10333

Annexure – 2/1

Supply of safety items for the maintenance of fixed and rolling assets of Railways (P. Way Department)												
S.N.	**Rly.**	**No. of defined safety items**	**% age supply of safety items (2010-11)**					**% age supply of safety items for 2011-12 (up to Oct'-11)**				
			100% - 90%	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**	**100% - 90%**	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**
1	**CR**	16	14	1	0	1	0	6	0	0	1	6
2	**ER**	0	0	0	0	0	0	0	0	0	0	0
3	**ECR**	155	17	25	6	101	6	25	20	11	87	12
4	**ECoR**	19	14	0	0	0	5	7	4	3	3	8
5	**NR**	15	2	0	3	4	6	2	0	2	3	8
6	**NCR**	11	7	0	0	2	2	9	1	0	0	1
7	**NER**	15	10	3	0	0	2	10	3	0	0	2
8	**NFR**	34	21	2	2	4	5	18	2	2	0	12
9	**NWR**	0	0	0	0	0	0	0	0	0	0	0
10	**SR**	10	8	0	0	0	2	9	0	0	0	1
11	**SCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
12	**SER**	8	5	2	1	0	0	6	2	0	0	0
13	**SECR**	10	7	1	0	2	0	10	0	0	0	0
14	**SWR**	34	27	2	1	0	4	23	3	1	3	4

15	**WR**	17	16	0	0	1	0	16	0	0	0	1
16	**WCR**	29	8	2	0	1	18	0	0	0	0	29
Total		**373**	**156**	**38**	**13**	**116**	**50**	**141**	**35**	**19**	**97**	**84**
%age			**41.8%**	**10.2%**	**3.5%**	**31.1%**	**13.4%**	**37.8%**	**9.4%**	**5.1%**	**26.0%**	**22.5%**

Annexure -2/2

Supply of safety items for the maintenance of fixed and rolling assets of Railways (Signalling Department)

S.N.	Rly.	No. defined safety items	% age supply of safety items (2010-11)					% age supply of safety items for 2011-12 (up to Oct'-11)				
			100% - 90%	90% - 80%	80% - 70%	70% - 60%	<60%	100% - 90%	90% - 80%	80% - 70%	70% - 60%	<60%
1	**CR**	34	13	2	1	2	16	7	0	0	1	26
2	**ER**	17	16	0	0	0	1	16	0	0	0	1
3	**ECR**	20	18	0	0	0	2	0	0	0	0	20
4	**ECoR**	3	3	0	0	0	0	1	0	0	0	0
5	**NR**	145	36	5	4	10	122	36	9	6	17	138
6	**NCR**	10	10	0	0	0	0	10	0	0	0	0
7	**NER**	129	0	90	30	0	9	0	95	0	0	34
8	**NFR**	40	36	2	2	0	0	36	4	0	0	0
9	**NWR**	30	26	4	0	0	0	27	3	0	0	0
10	**SR**	23	17	2	1	3	0	16	3	1	3	0
11	**SCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

12	**SER**	25	25	0	0	0	0	25	0	0	0	0
13	**SECR**	59	0	0	0	0	26	0	0	0	0	59
14	**SWR**	14	14	0	0	0	0	14	0	0	0	0
15	**WR**	15	8	1	1	1	4	1	1	0	0	13
16	**WCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total		**564**	**222**	**106**	**39**	**16**	**213**	**189**	**115**	**7**	**21**	**291**
%age			**39.4%**	**18.8%**	**6.9%**	**2.8%**	**37.8%**	**33.5%**	**20.4%**	**1.2%**	**3.7%**	**51.6%**

Annexure – 2/3

Supply of safety items for the maintenance of fixed and rolling assets of Railways (Mechanical (C&W) Department)												
S.N.	**Rly.**	**No. defined safety items**	**% age supply of safety items (2010-11)**					**% age supply of safety items for 2011-12 (up to Oct'-11)**				
			100% - 90%	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**	**100% - 90%**	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**
1	**CR**	116	94	3	2	3	14	80	3	3	2	28
2	**ER**	209	146	28	13	21	1	107	27	15	58	2
3	**ECR**	239	56	7	8	19	149	18	3	4	5	209
4	**ECoR**	143	143	0	0	0	0	116	18	0	0	0
5	**NR**	301	89	28	30	27	127	70	25	32	35	139
6	**NCR**	217	216	0	0	0	1	216	0	0	0	1
7	**NER**	182	69	14	17	17	65	44	9	16	16	97
8	**NFR**	194	177	10	4	2	3	185	5	2	1	3

9	**NWR**	214	214	0	0	0	0	214	0	0	0	0
10	**SR**	140	113	5	5	4	13	108	1	4	12	15
11	**SCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
12	**SER**	216	206	2	4	2	2	201	2	2	2	9
13	**SECR**	169	133	1	6	7	22	117	8	6	3	35
14	**SWR**	58	28	11	7	4	8	50	5	1	0	2
15	**WR**	142	79	15	13	16	19	70	13	16	13	30
16	**WCR**	51	47	0	0	0	4	46	0	0	0	5
Total		**2893**	**1810**	**124**	**109**	**122**	**427**	**1642**	**119**	**101**	**147**	**575**
%age			**69.8%**	**4.8%**	**4.2%**	**4.7%**	**16.5%**	**63.3%**	**4.6%**	**3.9%**	**5.7%**	**22.2%**

Annexure – 2/4

Supply of safety items for the maintenance of fixed and rolling assets of Railways (Mechanical (DSL) Department)												
S.N.	**Rly.**	**No. defined safety items**	**% age supply of safety items (2010-11)**					**% age supply of safety items for 2011-12 (up to Oct'-11)**				
			100% - 90%	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**	**100% - 90%**	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**
1	**CR**	172	119	8	9	2	34	117	7	4	7	35
2	**ER**	137	105	9	8	13	2	108	8	4	12	3
3	**ECR**	140	139	0	0	0	1	139	0	0	0	1
4	**ECoR**	85	85	0	0	0	0	84	0	0	0	0
5	**NR**	194	88	19	15	16	54	95	22	9	18	50

6	**NCR**	137	137	0	0	0	0	136	0	0	0	1
7	**NER**	186	127	10	9	7	33	138	8	7	3	30
8	**NFR**	134	127	4	2	1	0	131	2	0	0	1
9	**NWR**	166	166	0	0	0	0	166	0	0	0	0
10	**SR**	141	121	8	1	3	8	59	12	8	12	50
11	**SCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
12	**SER**	95	93	0	1	0	1	95	0	0	0	0
13	**SECR**	119	119	0	0	0	0	119	0	0	0	0
14	**SWR**	44	44	0	0	0	0	44	0	0	0	0
15	**WR**	125	105	5	3	5	4	108	4	2	5	6
16	**WCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total		**1875**	**1575**	**63**	**48**	**47**	**142**	**1539**	**63**	**38**	**57**	**177**
%age			**84.0%**	**3.4%**	**2.6%**	**2.5%**	**7.6%**	**82.1%**	**3.4%**	**2.0%**	**3.0%**	**9.4%**

Annexure – 2/5

Supply of safety items for the maintenance of fixed and rolling assets of Railways (Mechanical (DSL) Department)												
S.N.	**Rly.**	**No. defined safety items**	**% age supply of safety items (2010-11)**					**% age supply of safety items for 2011-12 (up to Oct'-11)**				
			100% - 90%	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**	**100% - 90%**	**90% - 80%**	**80% - 70%**	**70% - 60%**	**<60%**
1	**CR**	933	691	17	21	9	195	737	13	13	17	163
2	**ER**	143	143	0	0	0	0	143	0	0	0	0
3	**ECR**	428	405	2	2	2	17	406	1	2	2	17

4	**ECoR**	63	63	0	0	0	0	64	0	0	0	0
5	**NR**	120	120	0	0	0	0	114	0	0	0	6
6	**NCR**	295	292	0	0	0	3	291	0	0	0	4
7	**NER**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
8	**NFR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
9	**NWR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
10	**SR**	399	277	16	33	16	57	300	8	8	15	68
11	**SCR**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
12	**SER**	222	212	2	4	2	2	216	2	2	0	2
13	**SECR**	179	179	0	0	0	0	179	0	0	0	0
14	**SWR**	6	6	0	0	0	0	6	0	0	0	0
15	**WR**	424	375	25	7	6	11	380	22	6	5	11
16	**WCR**	312	301	0	0	0	11	302	0	0	0	10
Total		**3524**	**3064**	**62**	**67**	**35**	**296**	**3138**	**46**	**31**	**39**	**281**
%age			**86.9%**	**1.8%**	**1.9%**	**1.0%**	**8.4%**	**89.0%**	**1.3%**	**0.9%**	**1.1%**	**8.0%**

Annexure 3

Signaling, Protection and Telecommunication

A. Objectives

1. Eliminate/minimize direct manual operations in rail safety and protection chain.
2. Contain manual operations to policy making for safety mechanisms and traffic flow.
3. Identify various aspects of rail safety that can be effectively and efficiently served through technological means primarily.
4. Deployment of systems with high speed, high traffic, fully safe andeasily maintainable subsystems.
5. Realization of very high reliability and availability automation andindigenous technology solutions for rail safety and protections.
6. Arrangements of thorough documentation and documentation control.
7. Innovate modern training and diagnostics tools – on line; as well as - offline thru' simulators (scenario games)
8. Tame and utilize robust novel technologies in safety systems to realize apparently challenging problems.
9. Encourage liberal use of communication and information technology to increase scope of safety systems and seamless integration of specialized, distributed, and hierarchical systems.
10. Clear safety regulatory guidelines and polices and frequent audit regulatory compliance.
11. In-depth review of the Safety Management system.
12. Evaluate the alternatives in augmenting the current safety systems withnew train protection systems with potentials and features which are/or will in the future, become mandated due to safety needs and policies ina phased but

progressive/upgradable manner.

B. Design guidelines

While designing or procuring equipment of "Safety Critical" (Protection) and "Safety Related" (Control and Monitoring) nature, following points need due considerations,

1. Clear documentation of desired features and functionalities with identifiable, quantifiable, and verifiable performance levels, Figures of merits to be achieved.
2. Maintain mutual independence of one safety system with other safety/non-safety system.
3. Utilize/ deploy high repeatability and sustainable underline physical phenomenon for detection, identification, measurement, and transmission of parameters.
4. Build and maintain high Reliability systems, "Fail Safe" and "Fault Tolerant" systems.
5. Ensure high system availability by extensive On-line/In-system testing, Fault Diagnostics, and preventive maintenance schedules.
6. Deploy Sentinel system to monitor correct functionality of a target system through diverse means.
7. Effective mechanisms to lower Mean Time to Repair (MTTR).
8. Robust designs incorporating liberal tolerances and engineering margins, realized using quality component, adoption of good, standardized manufacturing practices, rigorous and extensive qualification testing at manufacturing and deployment stages, comprehensive software verification/validation etc. are required for high reliability equipment design and realization.
9. In the event of an equipment failure, the failed state of the equipment should not compromise the safety aspect of the application. To improve availability of an application

function, redundant equipment must take over and the desired functionality be still achieved.

C. Areas for technology applications

1. Precise location acquisition of the train "mobile assets" through Belies transponders, RFIDs, GPS geodetics and switching to radio communication assisted block marking.
2. Use of low cost, bogie mounted track condition monitoring system(solid state MEMS accelerometers and gyroscopes to record abrupt high accelerations and rotation rates of the bogies).
3. Bogie, Axel and Bearing fatigue monitoring system. Train wide short range digital wireless communication network for train integritymonitoring, equipment health monitoring and reporting.
4. Robust, secure, fault tolerant, 'real time' RF packet radio for wireless data communication between fixed and mobile systems.
5. GPS based sentinel for detection and reporting of missed/lost Track ID markers in Automated Collision warning/avoidance system.
6. Large distributed Real time communication networked systems to realize integrated centralized train monitoring and operation.

D. Design motivations:

1. Substantial achievements in enabling technologies to fairly good maturity levels have paved the path for their effective and risk-free use in safety equipment.
2. Easy and large-scale availability of field-tested quality technology and products at affordable cost.
3. Good availability of manpower with exposure to advanced technologies for design, manufacture, deployment, and maintenance.

4. Emergence of (lesser ground equipment which is directly exposed tothe environment; prone to theft and sabotage; wired to wireless communication among distributed sub-systems etc.).
5. Utilizing redundant and diverse sensors, systems, and technologies in safety systems, collectively augmenting each other to achieve high availability, high reliability, all-weather performance, un-ambiguous and convenient signalling, and protection.
6. Many proven commercial products are available and are being used in railways all over the world. It is needed to concentrate, to isolate and generate requirements peculiar to IR needs and identify IR specific technology solutions.
7. Long-term rail system usage leading to generation of precise know-how for standardization of rail safety system requirements and solutions.

E. Search of proven, Indian adoptable and sustainable technology?

F. Radio technologies—GSM-R, Tetra, Satellite based, Wi max etc.?

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List of Abbreviations Used

AAR	Association of American Rail Roads
AC	Air Conditioned
ACD	Anti Collision Device
ACP	Alarm Chain Pulling
ADAMS	A software for modeling
ADRM	Additional Divisional Railway Manager
AGM	Additional General Manager
AMC	Annual Maintenance Contract
ARRI	Advance Railway Research Institute
ASM	Assistant Station Manager
Asstts.	Assistants
ATACS	Advanced Train Administration & Communication System
ATP	Automatic Train Protection
ATW	Alumino Thermit Welding
BE	Budget Estimate
C&W	Carriage & Wagon
CARAT	Computer And Radio Aided Train
CBTC	Communication Based Train Control
CCRS	Chief Commissioner of Railway Safety
CCTV	Close Circuit Television
CII	Confederation of Indian Industry
CR	Central Railway
Cr.	Crores
CRS	Commissioner of Railway Safety
CTC	Centralized Traffic Control
CTIs	Central Training Institutions
CWM	Chief Workshop Manager
CWR	Continuously Welded Rail
DCP	Dry Chemical Powder

Deptts.	Departments
DF	Development Fund
DG	Director General
DRDO	Defence, Research and Development Organization
DRF	Depreciation Reserve Fund
DRM	Divisional Railway Manager
DSL	Diesel
DSO	Divisional Safety Officer
ECoR	East Cost Railway
ECR	East Central Railway
ED	Executive Director
Elec.	Electrical
EMC	Electro Magnetic Compatibility
Engg.	Engineering
ER	Eastern Railway
ERC	Elastic Rail Clips
ESM	Electric Signal Maintainer
ETCS	European Train Control System
FBW	Flash Butt Welding
FIAT	An Italian design of bogie used in LHB coaches.
FICCI	Federation of Indian Chambers of Commerce and Industry
Fig.	Figure
FORS	Failure of Other than Railway Staff
GM	General Manager
GMT	Gross Million Tonne
GPS	Global Positioning System
GSM	Global System for Mobile communication
GSM-R	Global System for Mobile Communication-Railway
HLSRC	High Level Safety Review Committee
HQ	Headquarter
Hrs.	Hours

ICF	Integral Coach Factory
IR	Indian Railway
IT	Information Technology
JCB	Jig Crane with Bucket
JE	Junior Engineer
Kg.	Kilogram
KRCL	Konkan Railway Corporation Limited.
LCs	Level Crossings
LHB	Linke-Hoffmann-Busch (Modern Indian Railway Coach)
LTE	Long Term Evolution
LWR	Long Welded Rails
M	Meter
M&C	Metallurgical and Chemical
MACLS	Multi Aspect Colour Light Signal
MMI	Man Machine Interface
MR	Minister of Railway
MTTR	Mean Time to Repair
NCC alloy	Nickel, Chromium & Copper alloy
NCR	North Central Railway
NER	North-Eastern Railway
NFR	North-East Frontier Railway
NGO	Non-Government Organization
NR	Northern Railway
NWR	North-Western Railway
OEM	Original Equipment Manufacturer
OHE	Over Head Equipment
P. Way	Permanent Way
PHODs	Principal Head of the Departments
PPEA	Public Premises Eviction Act.
PTC	Positive Train Control
PU	Production unit

RBC	Radio Block Centers
RCF	Rail Coach Factory
RDSO	Research, Design and Standards Organization
RF	Radio Frequency
RIT	Regulatory Inspection Team
RLDA	Railway Land Development Authority
ROB	Road Over Bridge
RRCs	Railway Research Centers
RRDC	Railway Research & Development Council
Rs.	Rupees (Indian)
RSA	Railway Safety Authority
RUB	Road Under Bridge
SCR	South Central Railway
SE	Section Engineer
SECR	South-East Central Railway
SER	South-Eastern Railway
SMS	Short Message Service
SPAD	Signal Passing At Danger
SPV	Special Purpose Vehicle
SR	Southern Railway
Sr.	Senior
SSE	Senior Section Engineer
STCs	Supervisors Training Centers
SWR	South-Western Railway, Station Working Rules
TETRA	Terrestrial Trunked Radio
TMRS	Technology Mission on Indian Railways
TPWS	Train Protection Warning System
TTCI	Transportation Technology Center Inc.,
UIC	International Union of Railways
UK	United Kingdom
USA	United State of America

WAP7	Modern Electric Locomotive on IR
WCR	West Central Railway
WILD	Wheel Impact Load Detector
WR	Western Railway
ZSC	Zonal Safety Committee
ZRTIs	Zonal Railway Training Institutes
ZRUCC	Zonal Railway Users Consultative Committee



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