



**SPECIAL STUDY REPORT
TRAIN SAFETY AND ACCIDENTAL
LOSSES IN PAKISTAN RAILWAYS**

Audit Year 2021-22

AUDITOR GENERAL OF PAKISTAN

PREFACE

The Auditor General of Pakistan conducts audit in terms of Articles 169 and 170 of the Constitution of the Islamic Republic of Pakistan 1973, read with sections 8 and 12 of the Auditor General's (Functions, Powers and Terms and Conditions of Service) Ordinance, 2001. The "Special Study on Train Safety and Accidental Losses in Pakistan Railways" was carried out accordingly.

The Directorate General of Audit Railways has conducted special study for the period from 2013-14 to 2020-21 with a view to report significant findings to stakeholders. Audit examined the policies, procedures and data related to train safety and accidental losses. Audit also assessed whether the management complied with applicable laws, rules and regulations and endeavored to identify the issues in train operations with an aim to provide practical solutions and useful input for pragmatic policy formulation. This study also indicates specific actions that, if taken, will help the management to minimize accidents and ensure public safety. The report has been finalised in light of management replies as well as discussions in DAC meetings.

The special study report is submitted to the President of Pakistan in pursuance of Article 171 of the Constitution of the Islamic Republic of Pakistan 1973, for causing it to be laid before both houses of Majlis-e-Shoora (Parliament).

Islamabad
Dated: 03 NOV 2023

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(Muhammad Ajmal Gondal)
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ABBREVIATIONS AND ACRONYMS

AGM	Additional General Manager
ATP	Automatic Train Protection
ATPS	Automatic Train Protection System
AWS	Automatic Warning System
CBI _s	Computer Based Interlocking System
CCM	Chief Commercial Manager
CEN	Chief Engineer/Open line
CME	Chief Mechanical Engineer
COPS	Chief Operating Superintendent
CPEC	China-Pakistan Economic Corridor
CPPO	Chief Project and Planning Officer
CSE	Chief Signal Engineer
CSI	Common Safety Indicators
CTE	Chief Telecom Engineer
CTM	Chief Traffic Manager
DTO	Divisional Transportation Officer
FA&CAO	Financial Advisor & Chief Accounts Officer
FGIR	Federal Government Inspector of Railways
KYC	Karachi
LHR	Lahore
MUL	Multan
OCV	Other Vehicle Coaches (Power, Luggage and Postal Vans)
PCV	Passenger vehicle coaches
POH	Periodic Overhauling
PR	Pakistan Railways
PSC	Peshawar
QTA	Quetta
RWP	Rawalpindi
SERA	Single European Railway Area
SUK	Sukkur

EXECUTIVE SUMMARY

The Directorate General of Audit Railways, Lahore conducted special study on Train Safety and Accidental Losses in Pakistan Railways to detect major causes of accidents, collisions, derailments and to identify flaws in overall system to improve safety measures. The study also focused on evaluating the corrective measures adopted for train safety to minimize accidents.

Transportation networks play a pivotal role in economic development and geographical integration of a country. Pakistan is the fifth most populous country of the world and its rapid population growth has also contributed to an increase in the demand for passengers and goods transportation. An effective Railway system of the country facilitates commerce and trade, reduces transportation cost and promotes economic development as well as national integration.

More than 100 train accidents occur every year over Pakistan Railways network, which resulted in substantial financial and human losses. A total of 1097 accidents occurred during the period from 2013-14 to 2020-21, out of which 360 were major accidents with financial losses of Rs 3517.4 million. PR had not reflected these financial losses in its books of accounts. In these accidents, 631 people lost their lives and 780 were seriously injured.

Audit used internationally recognized ‘Safety Index Model’ to draw comparison of accidents occurred in Pakistan with other countries based on “Train accidents per Million Train Kilometers”. This model is being followed by Indian Railways, European Union Agency for Railways in 28 member countries of SERA and also referred by the Auditor General of Canada for its report on “Rail Safety Transport 2021”. This report highlighted that number of accidents per million kilometers in Pakistan Railways ranged from 117 to 164 per annum during the period 2013 to 2021. The ratio of train accidents in Pakistan was higher than the neighboring country, which indicated major gaps in the overall safety

framework¹. Two DAC meetings were held on 6th and 9th September 2022 to finalize the report.

Key audit findings:

- i. Major cause for train accidents is vulnerable 1565 unmanned level crossings over the Railways network.
- ii. Traffic violations and lack of awareness on the part of road users caused 493 number of train collisions with road users.
- iii. Dilapidated infrastructure and rolling stock constitute another major cause of accidents.
- iv. Non-completion of various safety related projects in projected time period also resulted in untoward incidents.
- v. Absence of decent working conditions and inadequate capacity building programs for operational staff, including training of drivers, remained crucial factors resulting in train accidents.
- vi. The shortage of operational and maintenance staff increased operational risks regarding train safety.
- vii. Loss to property of Pakistan Railways has not been accounted for in the books of accounts.
- viii. Pakistan Railways suffered total losses of Rs 3517.4 million due to accidents during the period from 2013-2021 along with loss of 631 precious human lives.

Recommendations:

- i. Coordinated efforts should be made by the Railways Administration for up-gradation of unmanned level crossings.
- ii. Up-gradation of Railway tracks with gestalt approach to eliminate accident hotspots.
- iii. The scheduled overhauling of rolling stock must be ensured as per standards of operational manuals.
- iv. Train safety related projects should be completed within timelines to reap their planned benefits.

¹ Indian Railways-Safety Performance 2017

- v. Automated systems of CBI, AWS and ATP should be implemented over the entire Railways network on priority basis. Installation of trackers be completed on emergent grounds to ensure real time monitoring.
- vi. Capacity building programs should also be introduced for operational and maintenance staff to sensitize and enhance their knowledge base related to train safety.
- vii. Prompt deployment of operational and maintenance staff at critical safety points.

1. Introduction

Transportation sector plays a vital role in the development of a country. Transportation networks, including rail, road and air network, are the most important factor in the economic growth of a country. The vitality of infrastructure and efficient transport network reflect the level of convenience to travel and transport goods among different industrial zones scattered throughout a country, thus affecting trade, commerce and other aspects of the economy and society.

Rail transport in the Sub-continent began in 1855 during the British Rule. In 1947, after creation of Pakistan, the North Western Railways became Pakistan Western Railways. After 1972, Pakistan Western Railways was renamed as Pakistan Railways and the rail system was re-organized.

Ministry of Railways is responsible for the overall governance and policy formulation of Pakistan Railways while operational control and risk management rests with Chief Executive Officer. Ministry of Railways comprises of four directorates: Administrative, Technical, Planning and Finance Directorate. Railways Board is the decision-making organ and Secretary to the Ministry of Railways serves as its chairman.

Pakistan Railways' trains ran 226.7 million KM and met with 1097 accidents during the study period (2013-2021).

1.1 Purpose of organization:

To provide a competitive, safe, reliable, market oriented, efficient and environment friendly mode of transportation.

1.2 Rules/ Regulations governing the organization:

The legal framework for Pakistan Railways is Railways Act 1890. Subject to the provisions of this act, Ministry of Railways is the executive authority. By virtue of the delegation made under Section 4 of the Railways Board Ordinance 1959, all the functions and powers of the Federal Government, under the Railways Act, 1890, are exercised by the Ministry of Railways (Railway Board).

1.3 Layout of internal control system of organization

Internal controls refer to the policies, rules and regulations made within the organization to ensure that activities are being carried out efficiently and effectively resulting in safeguarding of the organizational assets and compliance with the relevant statutory requirements/standards and established rules and practices.

Strategic level management of Pakistan Railways, which includes Principal Accounting Officer, Chief Executive Officer, Financial Advisor & Chief Accounts Officer and other Principal Officers, is responsible for achievement of the objectives of the organization as stated in the mission statement. In pursuance of these objectives, various internal controls have been developed and their effective implementation provides reasonable assurance for achievement of the stated objectives. However, these controls at times remain ineffective resulting in accidental losses and operational inefficiencies.

Safe and smooth train operations is the responsibility of Additional General Manager (Traffic) whereas Federal Government Inspector of Railways (FGIR) is the operational monitoring unit.

2. Salient Features of the Study

Train accidents include incidents with serious impact in terms of loss of human life or injury, damage to Railways property and interruption in rail traffic. Train accidents may include collisions, derailments, fire in trains, collision with road vehicles at level crossings, and miscellaneous accidents. This study explored the train safety in a time space domain used around the concept that different variables result in different accident probability distributions. The study model is based using data of accidents, travel mileage, financial and human losses as variables. This study will help to identify gaps between policies and actions taken by Railways management to improve train safety and mitigate the chances of train accidents.

2.1 Purpose of the study:

Study was intended to:

- i. Review accidents and their causes during the study period, assessment of volume of financial and human losses and trend analysis of various categories of accidents.
- ii. Examine inquiries conducted at Divisional, Headquarter and FGIR levels to dig out the reasons for accidents and fixation of responsibility /recovery.
- iii. Evaluate repair, maintenance, and fitness of locomotives, coaches, and freight wagons.
- iv. Analyze track fitness including segregation of level crossings.
- v. Gauge the effectiveness of old gear signaling system and Computer Based Interlocking (CBI).
- vi. Review financial and physical progress of projects related to track maintenance, signaling and locomotives etc.
- vii. Assess losses and their compensation with reference to train accidents.
- viii. Review train safety framework (policies/ rules).
- ix. Appraise working conditions and capacity of human resources.

2.2 Scope of study

The special study on Train safety and Accidental Losses in Pakistan Railways was conducted during the year 2017-18 for the period from financial year 2013-14 to 2017-18. Later on, the study was updated by covering the period from financial year 2013-14 to 2020-21. Different locations were visited for the purpose of audit i.e., COPS safety, FGIR and FA&CAO offices at Headquarters Office, Lahore and all Railway Divisions.

Scope of the study was limited by available record. Audit team could not fully assess losses and damages to PR assets and human lives because of non-availability of consolidated accidental and designed system of

assessment of losses. There is colossal social cost of these accidents in the form of loss of human lives and serious injuries.

2.3 Beneficiary of study

Stakeholders include Railways administration, passengers, freight business entrepreneurs, foreign investors, policy makers and general public.

3. Study Design

3.1 Time period

This special study covered seven (07) divisions of Pakistan Railways for the period 2013-14 to 2020-21.

3.2 Data

Primary data regarding occurrence of train accidents, loss sustained by Pakistan Railways due to accidents, loss and injuries to human life was taken from different PR divisions and offices of COPS safety, FGIR and FA&CAO at Headquarter offices. Published Year Books of Pakistan Railways and financial review of PR were also consulted. However, secondary data has been accessed through different studies on train safety.

3.3 Methodology

In order to collect and analyze the data, Safety Index Model of transport safety was used². Audit examined relevant files and documents and reviewed literature on train safety of India, Canada and 26 countries of European union (SERA).

i) Safety Index

Model for Safety Index was developed to gauge the relationship between accidents and kilometers traveled. This model was evolved by Jovanis, P.P, & Chang, H. L. in 1986. It defined total number of accidents occurred during a specific time per million train kilometers. This model was used by India, European Union Agency for Railways and Auditor General of Canada in their audit reports. The “Indian Railways safety

² Jovanis, P.P, & Chang, H. L. in 1986

performance” in February 2017, European Union Agency for Railways published a “Safety Overview 2021” in March 2021, and “Audit of Rail Safety Transport” by Auditor General of Canada in 2021 respectively.

4. Data Analysis

Causes of train accident have been identified through inspection of record and by using analytical procedures. Data was analyzed and impact has been estimated with respect to different variables that included infrastructure, unmanned level crossings, rolling stock management, human resource management, monitoring system and signaling system. Safety Index Model has been applied for accidents per million KM of train run with reference to human and financial losses (injuries / casualties) for the period from 2013-14 to 2020-21.

4.1 Trend analysis of accidents

When an accident occurs in any division, their respective control offices report the accident to the Control Office, Lahore. The Control Office reports the information regarding accident to the Safety and Accident Branch that is under the administrative control of Chief Operating Superintendent (safety). Finally, the COPS/Safety issues a report on accidents to Railway administration.

Total one thousand ninety-seven (1097) accidents occurred during the period from 2013-14 to 2020-21. Five hundred four (504) accidents were related to derailments and 493 collisions with road users, which is approximately 91 per cent of total accidents. These two major factors encompassing spatial as well as periodical trends have been analyzed in the audit report.

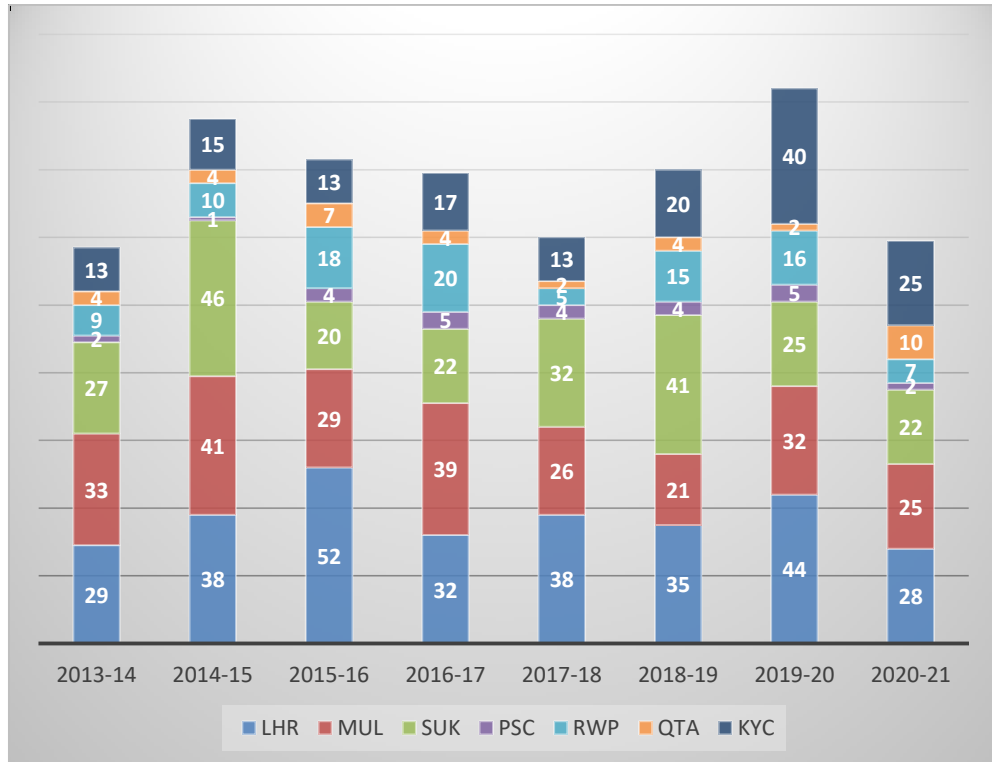
Summary of Accidents in Divisions (2013-2021)

YEAR	LHR	MUL	SUK	PSC	RWP	QTA	KYC	TOTAL
2013-14	29	33	27	2	9	4	13	117
2014-15	38	41	46	1	10	4	15	155
2015-16	52	29	20	4	18	7	13	143
2016-17	32	39	22	5	20	4	17	139
2017-18	38	26	32	4	5	2	13	120
2018-19	35	21	41	4	15	4	20	140
2019-20	44	32	25	5	16	2	40	164
2020-21	28	25	22	2	7	10	25	119
TOTAL	296	246	235	27	100	37	156	1097

Source: COPS office, Pakistan Railways Headquarters Office Lahore

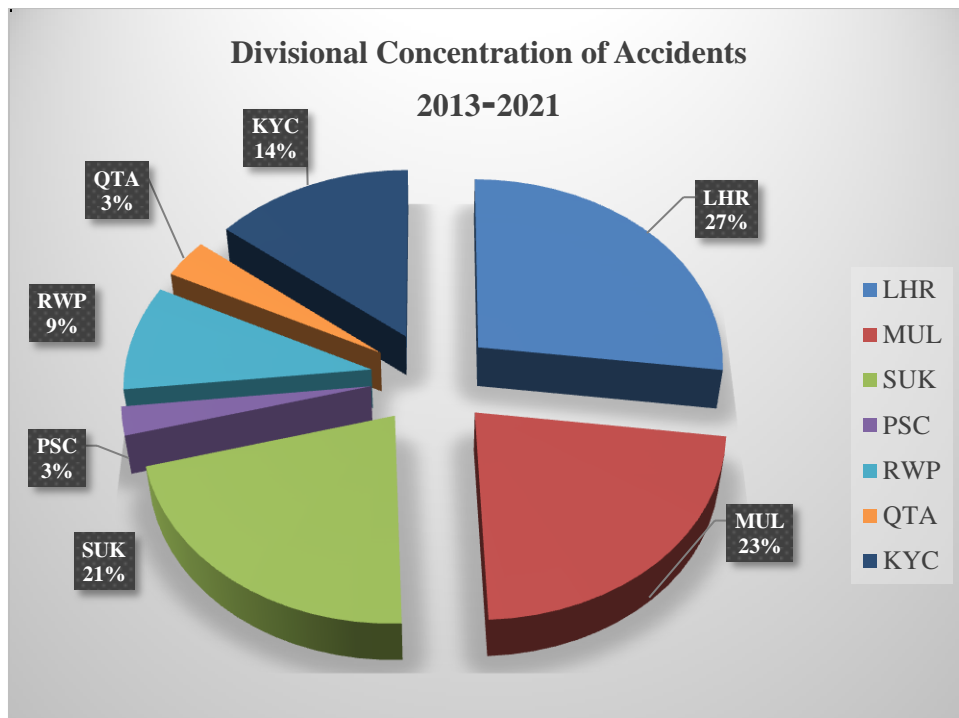
The above data depicted that Lahore, Multan and Sukkur Divisions are more vulnerable to accidents and contribute 71% of total number of accidents. The spatial distribution of nature when juxtaposed against incidence of accidents reveals that specific types of accidents are concentrated in particular divisions calling for targeted interventions at policy and operational levels. The major cause of these accidents was attributed to deteriorating rolling stock, ageing infrastructure, poor and deferred maintenance of track and gradual eruption of vulnerable level crossings.

Year-wise Accidents in Divisions (2013-2021)



Source: COPS office, Pakistan Railways Headquarters Office Lahore

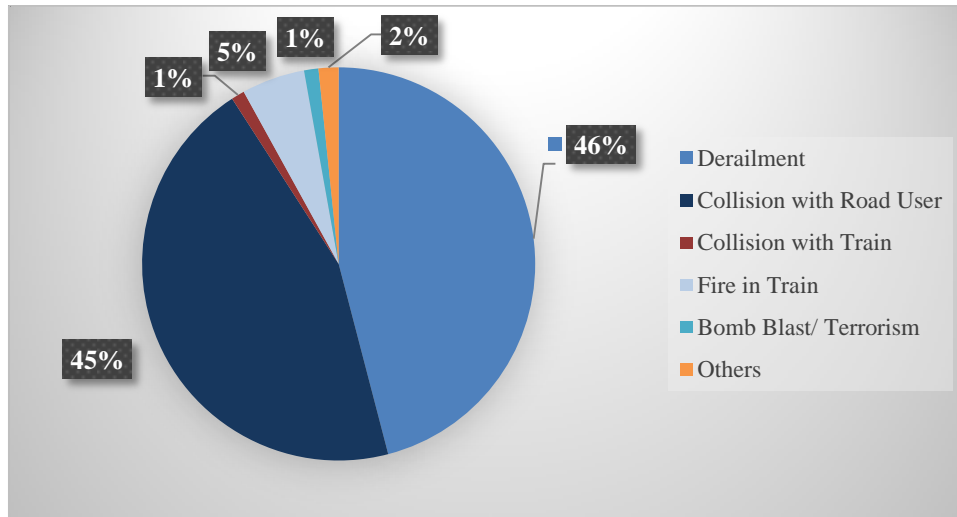
Lahore, Multan and Sukkur divisions had large number of accidents over last nine years continuously. However, Karachi division has random trend of accidents. The existence of lower thresholds in each division indicate that upper thresholds can be brought down with stringent operational level controls to reduce incidence of accidents considerably.



Source: COPS office, Pakistan Railways Headquarters Office Lahore

Concentration of accidents in three divisions (Lahore, Multan and Sukkur) is about 71% of the total accidents. Whereas Quetta, Peshawar and Rawalpindi divisions share only 15% of total accidents. As Lahore and Multan divisions are most densely populated areas of Pakistan with high traffic load, special attention may be given to level crossings segregating the most vulnerable ones from relatively safer ones and directing financial resources to prioritized locations. The critical intervention is elimination of all irregular and unmanned level crossings in densely populated areas.

Nature of Accidents (2013-2021)



Source: COPS office, Pakistan Railways Headquarters Office Lahore

One of the major reasons of train accidents was 1565 unmanned vulnerable level crossings over the entire Railways network (**Annexure-A**). The incidence of collisions with road users is directly proportional to existence of unmanned level crossings which indicates a strong correlation between the two factors. The other important factor contributing to train accidents was the traffic violation and unawareness on the part of road users that contributed 493 No. of train accidents. The above said two factors have been analyzed in detailed in chapter-4 of this study.

Comparative analysis based on Safety Index Model with India for three years depicted that India with the similar geography and demography fares far better than Pakistan in provision of safe and reliable rail transportation system. Moreover, India has eliminated all unmanned level crossings on broad gauge on 31st January, 2019³.

Pakistan Railways surveyed and declared 436 unmanned level crossings as vulnerable in Punjab alone and converted only 124 (28%) into manned level crossings⁴.

³ Press Information Bureau, Govt. of India, Ministry of Railways 26th June 2019.

⁴ Railway Year Book 2019-20.

Passengers' Casualties and Injuries (2013-2021)

YEAR	Casualties	Injuries	Passengers Carried (million)	Index of Casualties to Passengers Carried (million)	Incidence of Injuries to Passengers Carried (million)
2013-14	56	91	47.69	1.17	1.91
2014-15	31	96	52.95	0.59	1.81
2015-16	59	70	52.19	1.13	1.34
2016-17	225	191	52.39	4.29	3.65
2017-18	40	27	54.91	0.73	0.49
2018-19	38	72	60.39	0.63	1.19
2019-20	148	174	44.30	3.34	3.93
2020-21	34	59	28.42	1.20	2.08
TOTAL	631	780			

Source: COPS office, Pakistan Railways Headquarters Office Lahore

One thousand ninety-seven (1097) accidents occurred from 2013-14 to 2020-21. In these accidents, 631 people lost their lives and 780 were seriously injured. The score on safety index of Pakistan Railways was on higher side as compared to the neighboring Indian Railways. The safety index of Pakistan Railways had increased to 1.20 in 2020-21 as compared to 1.17 in 2013-14. Whereas, the safety index of Indian Railways decreased from 0.10 (2013-14) to 0.03 (2020-21)⁵.

⁵ Fifth Worlds Congress on Disaster Management: Volum IV November 2021

Safety Index Ratio (Pakistan vs India)

Country	2013-14			2014-15			2015-16		
	Accidents	Train Run (Million KM)	Safety Index Ratio	Accidents	Train Run (Million KM)	Safety Index Ratio	Accidents	Train Run (Million KM)	Safety Index Ratio
Pakistan	117	22.59	5.18	155	26.66	5.81	143	29.74	4.81
India	117	1096	0.11	135	1166.7	0.12	107	1144.19	0.09

Source: Indian Railways - Safety Performance 2017 and COPS safety Branch HQ office Lahore.

The fact buckles earlier established correlation between unmanned level crossings and road collisions. The goal of bringing down safety index model score to neighboring county's level may be a daunting task but it can be segmented into short and midterm remedial actions by striving to eliminate one cause of accident at a time. The pace of improvement can be enhanced manifold in cases where development has to be financed by sponsoring agencies considering the narrow fiscal space in PR.

The issue was taken up with the management in September 2022 and discussed in DAC meetings dated 06.09.2022 and 09.09.2022. DAC discussed the various aspects of the para and was of the view that there was no denying the fact that Railways management is in dire need to scale up safety measures across the Railways system for improved rail safety. DAC directed that the PO (COPS/Safety) should make a comprehensive reply covering all aspects within one week to audit.

In compliance of DAC directives, management replied that ratio of accidents for the period 2018 to 2021 showed decreasing trend of the accidents over Pakistan Railways network. The ratio of Rail to Road accidents stands at 0.005 and the recommended Rail safety is 50% of the roadside.

Audit is of the view that safety benchmarks should be Railway specific and comparison be made within the Railway sector in the regional context. The reply regarding decreasing trend is contrary to fact that the

number of accidents increased from 140 (2018) to 164 (2020) which was the highest during the study period.

4.2 Analysis of track fitness, bridges and level crossings

4.2.1 Fitness of track

The basic infrastructure of Pakistan Railways revolves around the track. The track is composed of rails, sleepers, ballast, fastenings and fittings. The wear and tear of railway infrastructure is natural, therefore, requires timely renewal/replacement to avoid service failures and accidents.

Pakistan Railways had 8122 km route at the time of independence. Instead of increasing, it has decreased to 7791 km by year 2021. However, track of 8775 km inherited at the time of emergence of Pakistan has now been enhanced to 11881 km.

Province wise Length of the Route and Track (in Km)

Types	Punjab		Sindh		KPK		Baluchistan		Total	
	Route	Track	Route	Track	Route	Track	Route	Track	Route	Track
Broad Guage	4375	6630	1587	2960	315	433	1202	1469	7479	11492
Meter Guage	-	-	312	389	-	-	-	-	312	389
Total									7791	11881

Source: Year Book of Pakistan Railways 2020-21

Pakistan Railways' track can be classified according to speed and gauge. Pakistan Railways had a total of 11,881 track-kilometers (including double line track, yards and sidings) at the end of 2020-2021. This consisted of 11,492 kilometers of broad-gauge and 389 kilometers of meter-gauge. Only 1,409 kilometers of track has been doubled since the project of Doubling of Track began in 1990s.

Classification of the Track Length in Pakistan Railways

Description	Max. Speed (Km/h)	Length (Kms)
Primary-A	105	4771
Primary-B	95	3388
Secondary	75	1336
Tertiary	65	1997
Meter Gauge	55	389
TOTAL		11881

Source: Year Book of Pakistan Railways 2020-21

The fixation of speed limit depends on track fitness which is directly related to travel safety. Derailments, being highest category of accidents, is more often than not caused by over speeding on speed restricted sections of track. The above data depicts that maximum speed limit of 105 km/h is available for 4,771 km out of total track of 11,881 kms, which needs to be enhanced so that maximum speed limit could be attained for the whole track and incidence of derailments due to over speeding can be reduced.

Pakistan Railways executed different track related projects under Public Sector Development Program (PSDP) for improved safety of train operations but failed to achieve the desired level of track safety. At the same time Civil Engineering Department of Pakistan Railways spent Rs 3,939.673 million on account of routine maintenance during the period from 2013-14 to 2020-21 from revenue budget.

Track Rehabilitation/Maintenance Projects (2013-2020)

Sr. No.	Name of Project	Cost (Rs in million)	Status
1	Rehabilitation and improvement of Track (Karachi to Khanpur TR-I)	11,544.000	Completed
2	Procurement of track material	456.400	50.792 %
3	Doubling of track from Khanewal to Raiwind	12,617.400	Completed
4	Mechanization of Track Maintenance	4,055.403	61%
5	Replacement of Metal Sleepers and Track Renewal on Lodhran-Shahdara Section	2,216.000	Completed
6	Track Rehabilitation on Khanpur-Lodhran Section	8,978.000	67.020 %
7	Rehabilitation of Rolling Stock and Track	2,005.016	Completed
8	Doubling of Track from Shahdara to Lalamusa	13,593.000	5.134 %

Source: Financial Review Pakistan Railways 2013-14 to 2019-20

Track maintenance in Pakistan Railways was predominantly done on manual basis. The track maintenance staff was 39% short of sanctioned strength being the major cause of poor maintenance of track (**Annexure-B**).

The matter was taken up with the management in September 2022. Management informed that some projects were closed due to their inclusion in CPEC and 80% work of remaining projects in different divisions had been completed. Audit is of the view that the number of accidents did not decrease and value for money was not achieved even after incurrence of huge expenditure on projects of infrastructure rehabilitation in addition to routine track maintenance.

4.2.2 Maintenance of bridges

Pakistan Railways had 14021 bridges scattered over the entire network with 3001 bridges on closed sections. According to Railway Codes, the life of masonry substructure of bridges is 100 years, whereas, for superstructure (steel bridges) it is 60 years.

In PR, almost 86% bridges had completed their design life. 281 bridges were identified in acute distress, therefore, different projects for rehabilitation were started. The works on 243 bridges had been completed and remaining were in pipeline till the end of 2020-21. To avoid accidents and to improve safety, serious attention was required for rehabilitation of all these bridges.

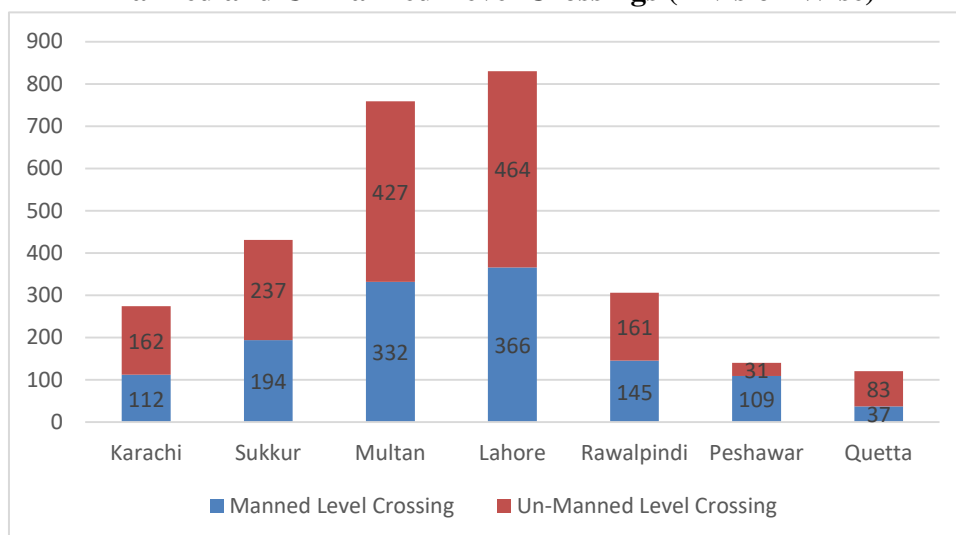
The matter was taken up with the management in September 2022. Management replied that although 86% bridges on Pakistan Railways network were more than 100 years old yet they were structurally safe. The structural health of bridge was regularly checked and maintained through a robust schedule of inspection and repair execution. Audit is of the view that the bridges had completed their life and might cause accidents.

4.2.3 Manned/Unmanned level crossings

To pass vehicular traffic across a Railway track, crossings are provided on the Railway lines. When the road traffic passes at the same level, as that level of the Railway track, the crossing is called as level crossing.

Pakistan Railways had 1565 (55%) unattended and 1265 (45%) attended level crossings at the end of 2020-21 (**Annexure-C**). During the study period, 45% of the total accidents occurred due to collision with road users on unattended level crossings. Total unattended level crossings in Multan and Lahore division are 57% by year 2021, whereas 67% of accidents occurred during the study period.

Manned and Unmanned Level Crossings (Division Wise)



Source: Year Book of Pakistan Railways 2020-21

Level crossings are right of way granted to clients of Pakistan Railways which include public as well as private clients who in turn become sponsoring agencies for financing and maintaining such right of ways while the execution is done by various departments of Pakistan Railways. No right of way can be extended without issuance of no objection certificate (NOC) from the concerned division and deposit of funds by the clients. The existence of so many unmanned level crossings raise serious questions about the Railway crossing execution process. It is pertinent to mention here that India has eliminated all unmanned level crossings on broad gauge by 2019 and this single factor creates the distinction of scores on safety index model.

The matter was taken up with the management in September 2022. Management replied that the up-gradation of un-manned level crossings must be funded by the provincial Government/sponsoring agency. However, to ensure the safety, fencing of level crossing had been included in ML-I (KYC-PSC). In order to avoid accidents at vulnerable unmanned level crossings, Pakistan Railways had persuaded the matter vigorously with the provincial Governments to covert unmanned vulnerable level crossings into manned level crossings.

The matter was discussed in DAC meeting held on 09.09.2022. The DAC directed the principal officer to reconcile the data with respective divisions and give a comprehensive reply to audit.

Audit recommends that inquiries for issuance of NOCs without fulfilling codal formalities. Receipt of funds, claiming amounts of accidental losses from provincial governments and expediting conversion of unmanned level crossings into manned ones at the earliest under intimation to audit.

4.3 Maintenance of rolling stock

Rolling stock include locomotives, railcars, diesel multiple units, track recording, inspection and tamping machines, carriages, wagons, tracks and trollies.

4.3.1 Locomotives (fitness and maintenance)

Locomotive is a power house mounted on a frame that produces motion power for traction on Railways. Pakistan Railways had about 473 locomotives at the end of 2020-21.

Status of Operational Locomotives

Utilization	No of Locomotives	Percentage
Passenger	117	24.7
Freight	76	16.1
Under Repair	74	15.6
Held up	88	18.6
Idle Loco	118	24.6
Total	473	100

Source: Office of the Chief Mechanical Engineer Pakistan Railways

Pakistan Railways has initiated different projects for repair and procurement of locomotives along with maintenance, rehabilitation and up-gradation of track.

Procurement and Repair of Locomotives (2013-2021)

Sr. No.	Name of Project	Expenditure (Rs in million)
1	Rehabilitation of 27 Nos. HGMU-30 D.E Locomotives	6,558.524
2	Special Repair of 100 D.E Locomotives	4,966.751
3	Procurement/Manufacture of 75 Nos D.E. Locomotives	4,549.600
4	Special repair of 150 D.E. locomotives	5,681.679
5	Procurement/manufacture of 58 D.E. locomotives	16,300.000
Total		38,056.554

Source: Financial Review Pakistan Railways 2013-14 to 2019-20

Apart from all these projects for rehabilitation and procurement of locomotives, a huge expenditure of Rs 7,254.471 million was also incurred for the routine maintenance of locomotives (Financial Review 2013-21). The scheduled maintenance of running locomotives was necessary for safe and smooth train operations. Despite incurring huge amount of Rs 45,311.025 million on locomotives, 43% locomotives were non-operational.

The matter was taken up with the management in September 2022. Management replied that schedule of maintenance was based on the availability of material and maintenance and supervisory staff. Audit was of the view that PR had not efficiently managed its repair budget portfolio.

4.3.2 Coaches and wagons (fitness and maintenance)

Non-adherence to safety framework leads to accidents. These rules are described under Para 2204 (b) of the Operating Manual of Pakistan Railways that the Train examiner must pay special attention to all items of running gear and should arrange to have the under gear examined from underneath the vehicles. He should look particularly for broken and damaged springs, hangers (axle and bolster), cracks in bogie trolley frames and bolster arms, insecurely fastened safety brackets, pull rods and bolsters and missing security fastenings. Further, Para 2208 (a) describes that train examiner must prepare damage certificate on form C & W 21 for any vehicle and wagon unfit to run and send it to the Station or Yard Master.

Pakistan Railways had two types of passenger coaches i.e. PCV and OCV. Total number of Passenger Coach Vehicles (PCV) and Other Coach

Vehicles (OCV) coaches were 1378 and 269 respectively during 2019-20. For improvement in rolling stock, different projects were undertaken by Pakistan Railways.

Special Repair Project Coaches and Rolling Stock (2013-2021)

Sr. No.	Name of the projects	Cost (Rs in million)
1	Special Repair to 800 Coaches and 2000 Wagons	1,810.00
2	Rehabilitations of Rolling stock and track	2,000.00

Source: Office of Chief Mechanical Engineer, PR and Year Book of Pakistan Railways 2019-20

Pakistan Railways spent Rs 3,388.639 million on repair and maintenance (Carriage), above said rehabilitation projects during the period from 2013-14 to 2020-21, besides expenditure incurred on above said rehabilitation projects. PR failed to discharge this responsibility because sixty-three (63) coaches were running overdue POH (periodical overhauling) over the entire Railways network. Similarly, 2532 units of freight wagons were running overdue POH till finalization of this report. Safety and reliability of Railways transportation system was largely dependent upon efficient maintenance of rolling stock.

The matter was taken up with the management in September 2022. Management replied that all efforts were made to remain on schedule but schedules were disturbed due to congestion in workshops. Further, the operating divisions were not in position to dispatch the coaches or wagons at due time owing to operational reasons. The issue was discussed in DAC held on 06.09.2022. DAC discussed various aspects of the para and directed that the Principal Officer (COPS/Safety) should submit a comprehensive analysis of the factors causing accidents as reported in the audit report in terms of divisions, traffic intensity, types of accidents etc. within one month. The report should clearly identify the actual causes over specific divisions, sections and type of accidents. In addition, course corrective measures should also be part of the report which the management should implement on priority. The report should be shared

with audit and management latest by 10th of October 2022. Compliance of DAC directives was awaited.

Audit was of the view that contention of management was not based on facts as large number of coaches and wagons were running over due which was a serious threat to smooth and safe train operations.

4.4 Analysis of signal and interlocking system

The basic purpose of Railway signals is to enhance safety by guiding acceleration, deceleration of trains. The comparative advantage of Railway over its counterparts is low friction of steel wheel on rail which contributes to greater fuel efficiency. This in turn makes it hard for the train to stop; a modern express train may require more than 2 km to stop on a leveled track and 3 km to stop on a downhill slope.

4.4.1 Old gear signaling system

Existing signaling and block system cannot cater for the requirements for double track. Signaling systems plays an important role in smooth, safe and efficient train operation. These systems are used to protect train from accidents, enhance transportation efficiency, increase speed and line capacity.

Although, Railway signaling originated from the basic needs of safety, but its further development has allowed for utilization of other avenues of economy and efficiency along with the attainment of higher speeds and improved controls. It is supported by telecommunication facilities, both in ancillary functions and in establishing efficient Railway communication services, using both land and radio transmission media.

Summary of Projects Underway for Improvement of Signaling System

Sr. No.	Name of Projects	Cost (Rs in million)	Status
1	Rehabilitation of damaged Railway assets during riots on 27 th & 28 th December 2007	4,657.080	96% completed
2	Replacement of old Signal on Lodhran-Khanewal- Shahdara Bagh	17,464.176	64% completed
3	Replacement of old Signal with CBI on Lodhran-Kotri and Shahdara Bagh-Lalamusa and Shahdara Bagh-Faisalabad section	PC-I approved but the work is yet to be undertaken	

Source: Financial Review, Pakistan Railways 2013-14 to 2020-21

Despite considerable budget allocation for these projects to enhance train safety and reduce accidents, an amount of Rs. 2,634.072 million was also spent by the Signal Department of Pakistan Railways for the period 2013-14 to 2020-21 for routine maintenance. The Old gear signal project was required to be completed by June 2012, Whereas, it could not be completed and was unduly extended up to June 2022 but the same was yet to be completed.

Other safety systems being used by PR are described below:

i. Automatic warning system

Automatic Warning System was developed in 1950's to provide the driver with a warning of signal which was not green. It consists of a pair of magnets (1 permanent and 1 electro) mounted between the rails about 200m before each signal. If the signal is green, the electro magnet is energized, and the driver receives a bell sound in the cabin. In all other cases, the permanent magnet causes a horn to sound in the cabin, and the brakes will be applied automatically if the driver does not acknowledge it within a certain time.

ii. Automatic train protection systems

Automatic Train Protection Systems (ATPS) are used in Railway control to supervise train speed against an allowed speed profile which is automatically elaborated vs on-board equipment, on the basis of the

information received by the signaling subsystem. The on-board control system, which is installed in train cockpit, has the aim of guaranteeing the respect of the speed profiles, elaborating the so called “braking curves” in order to allow the train to slow down and brake before any stop signal or emergency condition. In case of an erroneous or late intervention by the train driver, which interacts with the system by a Man Machine Interface (MMI), the on-board control system automatically commands the braking procedure, directly acting on train-borne apparatuses via a specific interface, namely Train Interface Unit (TIU).

Pakistan Railway initiated the Replacement of Old and Obsolete Signal Gear (LON-SDR) which included the installation of ATP on at 31 Railway stations (07 Stations for Signal-I & 24 Stations for Signal-II) which was still under process.

iii. Tracker

Tracker is necessary to be used for the protection of train. A Tracker would help the control office to get live location of each train and protect train against collision. Pakistan Railways got trackers for trains from the Ministry of IT but after spending millions of rupees, those trackers were not installed. Railway Control offices were still relying on an old telephone system for obtaining the location of trains. Reportedly, the trackers provided by Ministry of IT were obsolete now and Pakistan Railways would have to procure new trackers. This is a very serious concern and needs a quick decision by the management so that train protection can be ensured.

4.4.2 Non-operational IT intervention (CBI system)

Different signal and interlocking systems are in operation around the world, but the most widely used is known as SSI (Solid State Interlocking) and was developed by British Railways in the 1980's. It is based on 8-bit microprocessor and achieves its safety integrity by operating 3 processors in parallel, of which at least 2 have to agree on a change of output before it is put into effect. The interlocking communicates with individual points and signals by means of a duplicated serial data link, with complex data coding, which interfaces with a TFM (Trackside Functional Module) to

provide parallel input and outputs at an appropriate power level for individual signal and points. The required functionality at a particular location is entered as configuration data and is produced in a bespoke language and then compiled. Other computer-based interlocking systems include:

- Interlocking developed in mainland Europe and customized for UK application.
- Successor interlocking to SSI operates in a very similar manner but on a more modern hardware platform.

Pakistan Railway initiated the Replacement of Old and Obsolete Signal Gear (LON-SDR) for the design, manufacture, supply, installation and commissioning of Computer Based Interlocking system at 31 Railway stations out of 458 operative Railway stations (07 Stations for Signal-I & 24 Stations for Signal-II) which was still under process. Despite lapse of one decade of CBI initiation in 2012, not a single Railway station could be equipped with CBI system.

This unnecessary delay in completion of projects resulted in multiple accidents, causing human casualties, serious injuries and grave financial losses. The ATP system that was procured by the Pakistan Railways was incompatible with the CBI system, resultantly, Pakistan Railways had suffered financial loss of Rs 1,551.20 million⁶.

The issue was taken up with the management in September 2022 and discussed in DAC meeting dated 09.09.2022. DAC discussed the various aspects of the para and constituted a high-level committee comprising of Member Finance, AGM/Traffic and AGM/Infrastructure, to review and analyze the role of FGIR in terms of its performance covering its role as inspector with inspections targets/achievements, actionable recommendations, inquiries, safety approvals relating to Railways infrastructure, rolling stock, governance etc. The Committee should submit its report within one month. The report should give course corrective measures which the management should implement on priority.

⁶ Audit Para No. 2.4.38 and 2.4.40 of Audit Report on the Accounts of Pakistan Railways Audit Year 2016-17

The report should be shared with audit and management latest by 10th of October 2022. Compliance of DAC directives was awaited.

Audit suggested that the issues raised by audit regarding manned / unmanned level crossings, shortage of loco drivers, track maintenance and non-completion of CBI system be taken seriously and strenuous efforts are required to be made to avoid loss of human lives and financial assets.

4.5 Review of accidental inquiries and role of Federal Government Inspector of Railways

The Federal Government Inspector of Railways (FGIR) as generally recognized has technical advisory and quasi-judicial functions and has no executive authority. He is supposed to be the Eyes & Ears of the Federal Government to keep a watch over the general working and efficiency of the Railways especially with regard to the safety standards. The FGIR has the prime responsibility by pointing out defects and short comings in the Railways working and by making useful and pertinent suggestions conducive to safe travel. The duties and functions of the FGIR, focus mainly on the safety aspect of Railways constructions, maintenance and operation⁷.

4.5.1 FGIR: Safety control authority

The Federal Government Inspectorate for Railways has been established under section 4 of the Railways Act 1890. This inspectorate is considered to be the safety controlling authority. He is responsible to oversee the public safety related issues. He is required to inspect the Railways track and other infrastructures to be used for public carriage and issue an annual safety certificate. Any section of Railways cannot be opened for public traffic without prior inspection and approval of the FGIR. He has to conduct statutory enquiries in case of major accidents under the provisions of Railways Act 1890.

⁷ Year book of PR 2015-16

i. Periodical inspections

From 2000 to 2021, FGIR conducted periodical inspections of all divisions and pointed out 28355 actionable items out of which actions on 14226 inspection items were still awaited. It was pertinent to mention that inspection of Quetta Division had not been carried out since 2006. Thirty (30) major accidents occurred in Quetta division during last five years. These accidents could have been reduced if the periodical inspections of FGIR had been conducted regularly (**Annexure-D**). Frequency of the detailed inspection on a certain section takes place annually and vulnerable points added up during the gap period remain unidentified.

ii Inquiries of accidents conducted by FGIR

FGIR is required to hold an inquiry into an accident where there is loss or injury to a human life or there is damage to property of a certain value. Therefore, FGIR may decide to hold an inquiry by himself or may order an inquiry in certain cases by Railways officers at appropriate level on his behalf. From 2000 to December 2021, FGIR conducted 53 inquiries determined the loss amounting to Rs 977.036 million. Only 19 (36%) inquiry reports had been concluded which are 36% of total quantum of major accidents.

The matter was discussed in DAC meeting held on 06-09-2022. DAC discussed the various aspects of the para and constituted a high-level committee comprising of Member Finance, AGM/Traffic and AGM/Infrastructure, to review and analyze the role of FGIR in terms of its performance covering its role as inspector with inspections targets/achievements, actionable recommendations, inquiries, safety approvals relating to Railways infrastructure, rolling stock, governance etc. The Committee should submit its report within one month. The report should give course corrective measures which the management should implement on priority. The report should be shared with audit and management latest by 10th of October 2022. Compliance of DAC directives was awaited.

4.5.2 Chief Operating Superintendent Safety

The inquiries of the accidents had been conducted through different inquiry committees which were nominated either by COPS/safety or by divisional authorities.

The examination of data for minor accidents for the period from 2013 to 2021 depicted that either the responsibilities for accidents were not fixed or the enquiries had not been finalized. The loss involved in these accidents couldn't be ascertained due to non-finalization of inquiries.

The issue was discussed in DAC meeting dated 06.09.2022. DAC directed that the Principal Officer (COPS/Safety) should give a comprehensive reply to audit within two weeks. Compliance of DAC directives was awaited.

Audit is of the views that delay in the finalization of inquiries and non-fixation of responsibility resulted in compromise on safety of train operations.

4.6 Human Resources of PR

Skilled and efficient manpower is the key to success in any organization. However, shortage of operational and maintenance staff increases the risk of accidents in Pakistan Railways. Category wise position of staff is discussed below:

4.6.1 Shortage of staff on level crossings

To avoid accidents both on manned and un-manned level crossings, the availability of concerned staff was necessary. However, there was shortage of the staff deployed at level crossings in Pakistan Railways. The on-roll position of Gatekeepers and Gatemen in all divisions of Pakistan Railways showed shortage of 421 (19.4%) against the strength of 2,170 (**Annexure-E**).

4.6.2 Shortage of locomotives drivers

Skilled and alert fleet of locomotive drivers was pivotal for safety of train operations. Locomotive drivers had three categories i.e. drivers, deputy drivers and assistant drivers. There was shortage of 786 (28.6%)

locomotive drivers in all the divisions of Pakistan Railways against the sanctioned strength of 2749 (**Annexure-F**).

Locomotive drivers had to perform duty beyond their normal working hours due to shortage. It caused unrest and mental stress among drivers and may result in train accidents.

The matter was taken up with the management in September 2022 and discussed in DAC held on 06.09.2022. DAC discussed various aspects of the para and directed that the Principal Officer (COPS/Safety) should submit a comprehensive analysis of the factors causing accidents as reported in the audit report in terms of divisions, traffic intensity, types of accidents etc. within one month. The report should clearly identify the actual causes over specific divisions, sections and type of accidents. In addition, course corrective measures should also be part of the report which the management should implement on priority. The report should be shared with audit and management latest by 10th of October 2022. Compliance of DAC directives was awaited.

Audit observed that responsibility for majority of the derailments during the period had been fixed on the drivers and assistant drivers by the inquiry committees. Audit was of the view that either the loco operating staff lacks capacity or had over worked. Hiring and training of skilled staff needs to be prioritized to save precious human lives and Railway property from losses.

4.7 Accidental losses

Consequences of an accident include loss of life and injuries, loss of goods consignment, cancellation or detention of trains, compensation payable on account of casualties and injuries, refund of tickets, damages to locomotive, rolling stock and other infrastructure. In this study, each type of loss had been quantified in financial terms.

4.7.1 Loss of life and injuries

Compensation to the passengers and consigners on destruction or damage to consignment is governed under Para 31.6 (iv) of Commercial Manual of Pakistan Railways, which is reproduced here. "Payment shall

be made by either Railway for a compensation claim arising out of loss, damage or deterioration to booked consignments or loss of life or injury to passengers and staff in accordance with the provision of law of the country concerned”. The amount of compensation to dead and injured varied from case to case and was announced by the competent authority.

An amount of Rs 314.26 million was paid to diseased and injured passengers during the period from 2013 to 2021.

Compensation paid to Deceased/Injured Passengers (2013-2021)

(Rs in million)

Year	Compensation to deceased	Compensation to injured	Total
2013	1.00	1.90	2.90
2014	9.00	5.36	14.36
2015	30.40	9.33	39.73
2016	29.10	6.58	35.68
2017	3.00	0.40	3.40
2018	1.50	1.80	3.30
2019	154.50	5.20	159.70
2020	--	--	--
2021	54.00	1.20	55.20
Total	282.5	31.76	314.26

Source: Financial Review of Pakistan Railways 2013-14 to 2020-21

4.7.2 Cancellation of trains

When an accident occurs, it also affects prospective revenue due to cancellation of trains. During the last nine (09) years from 2013 to 2021, Twenty-six (26) trains were cancelled due to accidents.

Cancellation of Trains

	LHR	MUL	SUK	KYC	RWP	QTA	PSC	TOTAL
Trains Cancelled during last 9 years (2013-21)	10	0	5	5	0	6	0	26

Source: Chief Controller, Headquarters office PR, Lahore

The matter was taken up with the management in September 2022. Management replied that trains were cancelled mainly due to accidents, these trains were cancelled to make right time departures from originating stations in the following days, the passengers of these long lead trains were accommodated into other trains and as such there had never been loss to prospective revenue.

Audit did not agree with the view point of Railway management and was of the view that if such accidents had not occurred, Pakistan Railways could have earned revenue from cancelled trains.

4.7.3 Loss on account of detention of trains

Pakistan Railways launches a campaign every year from 1st April to 30th April as Fuel Economy Month in order to create awareness among operational staff. This campaign also creates an environment of competition on divisional level and hence results in the saving of fuel. As per Chief Operating Superintendent letter No. 39-FA/0/2 dated 26.03.2018 addressed to all the Divisional Superintendents, a locomotive consumes 22 liters of fuel in case of one-minute stoppage out of schedule running.

Loss Assessment Due to Detention of Trains (2013-2017)

(Fuel cost @ Rs 98.20 per/liter)

(Rs in million)

Division	Total Detention in Minutes	Rs 98.20 per litre x 22 litre*	Cost of Detention
LHR	16946	2160	36.60
MUL	14020	2160	30.28
SUK	112798	2160	243.64
KYC	57720	2160	124.68
RWP	12635	2160	27.29
QTA	22804	2160	49.26
PSC	2144	2160	4.63
Total	239067	2160	516.38

Source: DTO Branch of Divisional Offices, Pakistan Railways and COPS letter No. 39-FA/0/2 dated 26.03.2018.

Loss Assessment Due to Detention of Trains (2018-2021)

(Fuel cost @112.71 and 117.20 per/liter)

(Rs in million)

Division	Total Detention in Minutes (2018)	Total Detention in Minutes (2019-21)	Rs 112.71 per litre x 22 litre*	Rs 117.20 per litre x 22 litre*	Cost of Detention 2018	Cost of Detention 2019-21
LHR	7483	16182	2480	2578	18.55	41.72
MUL	10237	34539	2480	2578	25.39	89.04
SUK	47436	109150	2480	2578	117.64	281.39
KYC	2437	29221	2480	2578	6.04	75.33
RWP	1501	10602	2480	2578	3.72	27.33
QTA	1293	18986	2480	2578	3.21	48.95
PSC	1013	401	2480	2578	2.51	1.03
TOTAL	63917	202899			177.06	564.79

Source: *COPS letter No. 39-FA/0/2 dated 22.01.2018 and **letter No. 39-FA/0/2 dated 29.04.2019.

The total loss on account of fuel cost due to detention of trains amounts to Rs 1,081.17 million during the study period.

4.7.4 Loss on account of fare refund

Accident anywhere disturbs the overall traffic flow of trains. Some trains become late or even cancelled/diverted, resulting in cancellation of reservation by the passengers. Refunds of fare/tickets due to train accidents could not be estimated precisely because cancellation of a train in one division may affect reservation in another division too. This study gathered the data from divisions and director of IT regarding refund of tickets on account of train accidents.

Refund of Fare due to Train Accidents (2013-2021)

(Rs in million)

Year	LHR	MUL	SUK	KYC	RWP	QTA	PSC	IT	TOTAL
TOTAL	-	1.150	5.738	2.444	0.065	0.167	0.00	9.500	19.065

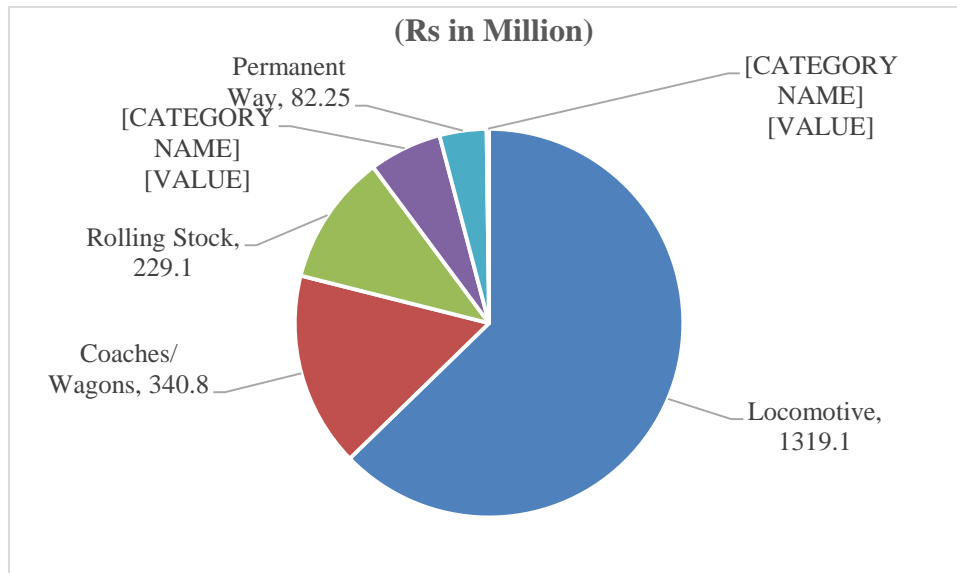
Source: DCO Branch of Divisional offices, Pakistan Railways

4.7.5 Loss to Railways' property

According to para 1802 of Pakistan Railways General Code Vol-I and Para 373 of Pakistan Railways Code for the Accounts Department Part-I, any defalcation or loss of cash, stores or property belonging to Government should be reported immediately after its discovery, to the head of accounting unit, division or department, as the case may be, and serious cases to the General Manager also; copies of the report being sent simultaneously to the Financial Advisor and Chief Accounts Officer.

Losses and damages to the property amounting to Rs 2,102.90 million due to train accidents were not found reflected in the appropriation accounts of Pakistan Railways during the period 2013-2021 as required under Para 376 of Pakistan Railways Code for the Accounts Department Part-1. The losses of Rs 2,102.960 million to property of Pakistan Railways were calculated during the period of this study (**Annexure-G**).

Damages to Pakistan Railways' Property (2013-2021)



Source: COPS Safety Branch, Pakistan Railways

Locos are driving engines and most costly machines on the track, head to head collisions and derailments wreck havoc to these machines as the rehabilitation entailed international tendering and import of costly

spares alongwith operational halts for extended periods of time. Observance of speed limits alone can considerably reduce number of derailments and collisions.

Division-wise Damages to PR Property (2013-2021)

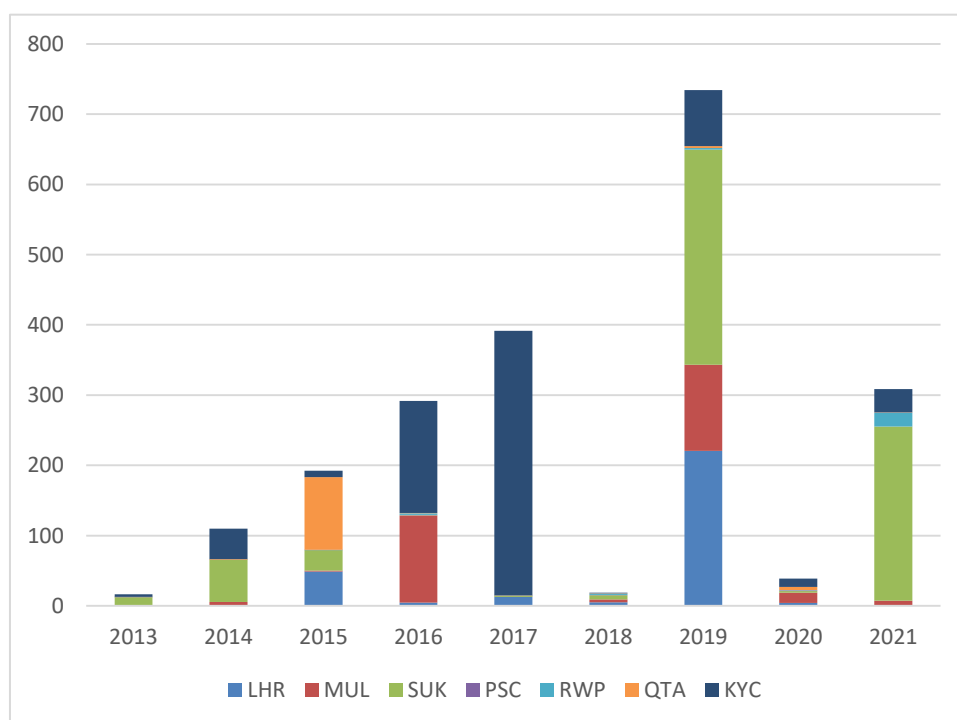
Year	LHR	MUL	SUK	PSC	RWP	QTA	KYC	TOTAL (Rs Million)
2013	0.328	0.216	11.762	0.050	0.027	0.626	3.596	16.605
2014	1.182	4.516	60.129	0.021	0.026	0.929	43.336	110.139
2015	48.752	1.426	29.450	0.024	0.079	103.612	8.956	192.299
2016	4.703	123.787	0.681	0.239	2.525	0.148	159.855	291.938
2017	12.929	0.106	1.560	0.095	0.345	0.310	376.311	391.656
2018	5.300	3.858	6.042	0.310	1.857	0.686	0.681	18.733
2019	220.654	122.505	306.487	0.000	2.144	2.690	79.618	734.099
2020	4.169	14.662	2.247	0.960	0.267	4.675	12.060	39.040
2021	0.072	7.429	247.647	0.000	19.967	0.303	33.033	308.451
TOTAL	298.089	278.505	666.005	1.699	27.236	113.979	717.447	2102.960

Source: COPS Safety Branch, Pakistan Railways

Audit observed that derailments, concentrated in Karachi and Sukkur divisions, were more costly in terms of mechanical/financial losses than loss to human lives except for head to head collisions. On the other hand, accidents related to collisions with road users were more common in Multan and Lahore divisions due to existence of unmanned level crossings, and were more costly in terms of loss of human lives as relatively lesser damage was done to locomotives in collisions with light travelling vehicles.

Damages to Pakistan Railways' Property

(Rs in million)



Source: COPS Safety Branch, Pakistan Railways

Above data depicts that major loss due to train accidents was from Locomotives which was 63% of total loss during the last nine years and highest loss is in Karachi Division. The year wise loss indicates that accidental losses were on increasing trend. These losses to PR property were not reflected in the books of accounts.

Accidental Losses to Pakistan Railways (2013-2021)

(Rs in million)

S.No	Description	Amount
1	Loss on Account of Property	2,102.90
2	Loss on account of detention of Trains (cost of fuel)	1,081.17
3	Compensation paid to Deceased / Injured Passengers	314.26
4	Loss on account of refund of tickets	19.07
	Total	3,517.4

Source: COPS Safety Branch, Pakistan Railways

In the study period, total 1097 accidents occurred in which 631 people lost their lives and 780 were seriously injured. Accidental losses were calculated to tune of Rs 3.51 billion. Audit could not fully assess losses and damages to PR assets because of non-availability of designed system of assessment in PR. Loss of human lives entailed colossal social cost and mistrust of general public on the Railway system as a safe mode of transportation.

The issue was discussed in DAC meeting held on 09.09.2022. DAC directed that Principal Officers (COPS/Safety, FA&CAO/PR and CFO) should make a comprehensive analysis on calculation of damages costs, accountal of damages cost, international benchmark of damages cost both of developed Railway systems and comparative Railways within one month. The report should give course corrective measures which the management should implement on priority. The report should be shared with audit and management latest by 10th of October 2022. Compliance of DAC directives was awaited.

5. Results

From the above discussion, the results and findings of the study can be summarized as follows.

5.1 With reference to purpose of study

- a) Due to obsolete infrastructure and its poor maintenance in Sukkur and Karachi Divisions, the incidence of derailments remained concentrated in these two divisions.
- b) Major cause for train accidents is 1565 unmanned vulnerable level crossings over the Railways network. Lahore and Multan Divisions remained hotspots of collisions with road users by virtue of having highest number of unmanned level crossings.
- c) Various projects were introduced by the Railway management to enhance train safety during last two decades but, owing to multiple factors mentioned in this report, these projects could not be completed within the prescribed period. Resultantly the envisaged benefits could not be derived.
- d) Number of accidents per million kilometers travelled fluctuated slightly over and under a stable mean but severity of accidents increased in terms of financial loss due to associated cost of damages.
- e) Examination of inquiry reports revealed that assessment of losses, fixation of responsibility and conclusion of inquiries was not done within reasonable period of time and were delayed to the point of losing impact. The punitive measures adopted were disproportionately tilted towards lower rungs of operating staff and punitive severity was not commensurate with the gravity of negligence.
- f) Absence of proper capacity building program for operational staff including training of drivers, remained a factor resulting in train accidents.
- g) Trackers were not installed in locomotives due to poor change management by the department.

- h) There are 468 Railway Stations in PR however the project for installation of CBI was executed for only 31 Railway stations (07 Stations for Signal-I & 24 Stations for Signal-II) without fully operationalizing the automated safety apparatus thus robbing the project of its intended benefits.
- i) Losses and damages to the Railway assets caused by train accidents, political riots, arson and other incidents during last nine years were not reflected in the appropriation accounts of Pakistan Railways as required under Para 376 of Pakistan Railways Code for the Accounts Department Part-1. The inquiry reports grossly under-assessed the cost of damages as evident from the difference in value of assessment between inquiry committees and Rehabilitation projects.

5.2 General findings

- a) Lack of effort to realize receivables against right of way from provincial governments for up-gradation of remaining unmanned level crossings which resulted in serious train accidents causing loss to Railway assets as well as to human lives.
- b) Lack of proper coordination among different operational departments of Pakistan Railways was observed.
- c) The shortage of operational and maintenance staff was not made good which created operational risks that may lead to untoward incidents.

6. Recommendations

- i. The track in Sukkur and Karachi Divisions should be upgraded using gestalt rather than piece meal approach which has failed to reduce the chances of accidents in past.
- ii. Coordinated efforts in collaboration with provincial governments should be made by the Railway Administration for up-gradation of remaining unmanned level crossings.
- iii. Train safety related projects should be planned keeping train safety as top priority and completed within timelines to reap their planned benefits.
- iv. Wide publicity campaigns should be launched through different means of media for public awareness to observe signals at level crossings and to avoid trespassing of Railway track.
- v. Ensure proper signs and signals at level crossings strictly.
- vi. Fencing of level crossing should be installed with wire on both sides up to 50 feet.
- vii. The scheduled overhauling of rolling stock may be ensured as per prescribed operational manuals.
- viii. Special capacity building program should be introduced for the operational and maintenance staff.
- ix. In order to eliminate human error in train operation, it is recommended that appropriate Automatic Train Protection be provided so that brakes are applied in case the driver does not observe red aspect of signal. This would help in avoiding accidents if adopted in Pakistan Railways.
- x. Role of FGIR should be strengthened to improve public safety and objectivity. The 12759 pending actionable points as communicated by FGIR should be complied with in letter and spirit.
- xi. Railway Management should take prompt action for installation of trackers in the locomotives for better public safety through effective change management policy.

- xii. The role of telecom department should be revitalized regarding provision of speedy communication devices to operational staff and control offices for ensuring prompt reporting of undesired events that lead to train accidents.
- xiii. System may be devised to report losses and damages to the office of the FA&CAO concerned promptly enabling him to reflect the same in the books of accounts as required under Para 373 and 376 of Pakistan Railway Code for the Accounts Department Part-1.

7. Conclusion

On the basis of detailed analysis of train accidents, it is concluded that Pakistan Railways has obsolete infrastructure, technology equipment, shortage of operational staff, huge number of unmanned level crossings, absence of capacity development programs and lack of coordination among different operational departments which led to several minor and major train accidents. Dilapidated tracks in Sukkur and Karachi divisions along with unmanned level crossings in Lahore and Multan divisions account for more than three quarters of total accidents. Other major areas to be addressed include less funding by the sponsoring agencies for conversion of unmanned level crossings into manned ones and development of pragmatic policies after thorough surveys and analysis of ground realities. Pakistan Railways started various projects related to the train safety in last decade but most of the projects could not be completed in time. In spite of executing different track upgradation and loco rehabilitation projects, safety controls could not be improved largely. The policy makers and the Railway management should take pragmatic steps to minimize existence of potential avenues for accidents and strengthen operational controls for safe travelling of general public.

Acknowledgement

Audit acknowledges the support of the CCM, COPS, CPPO and all Divisional Superintendents, for their cooperation and assistance in providing the necessary information and record.

Analysis of Nature Wise Accidents for the Period 2013-14 to 2020-21

Nature	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Total
Collision with Road User	63	81	75	65	50	48	59	52	493
Collision with Train	1	0	0	1	1	2	5	2	12
Derailment	30	58	59	65	67	79	87	59	504
Fire in Train	16	12	5	4	1	8	7	4	57
Bomb Blast/ Terrorism	4	3	2	1	1	2	0	0	13
Oil Leakage	0	0	0	0	0	0	0	0	0
Others	3	1	2	3	0	1	6	2	18
Total	117	155	143	139	120	140	164	119	1097

Source: COPS office, Pakistan Railways Headquarters Office Lahore

**Division wise Sanctioned Strength of Mate, Keyman and Gangman in
Pakistan Railways**

Division	Category	Sanctioned Strength	On Roll	Vacancy
Karachi	Mate	191	125	66
	Keyman	271	194	77
	Gangman	2040	1785	255
Sukkur	Mate	-	-	-
	Keyman	320	295	25
	Gangman	2191	1449	742
Quetta	Mate	160	146	14
	Keyman	162	157	5
	Gangman	1275	960	315
Multan	Mate	278	226	52
	Keyman	286	250	36
	Gangman	2450	1990	460
Lahore	Mate	243	237	6
	Keyman	250	233	17
	Gangman	2211	1336	875
Rawalpindi	Mate	124	110	14
	Keyman	146	126	20
	Gangman	1290	678	612
Peshawar	Mate	89	87	2
	Keyman	102	92	10
	Gangman	899	549	350

Source: Chief Personnel Office and all divisional offices, Pakistan Railways
Headquarters Office Lahore

Manned and Unmanned Level Crossings

Sr. No.	Division	Manned Level Crossings	Un-Manned Level Crossings	Total
1	Karachi	112	162	274
2	Sukkur	194	237	431
3	Multan	332	427	759
4	Lahore	366	464	830
5	Rawalpindi	145	161	306
6	Peshawar	109	31	140
7	Quetta	37	83	120
Total		1295	1565	2860

Source: Year Book of Pakistan Railways 2020-21

Annexure–D

**Position of Implementation of F.G.I.R’s Recommendations Made through
Annual Inspection Reports from the Year 2000 to 2021**

S.No.	Year	Total actionable items	Items Accepted	Total Outstanding items
1	2021	1487	230	1257
2	2020	1845	395	1450
3	2019	1537	556	981
4	2018	1297	896	401
5	2017	1769	1349	420
6	2016	2265	167	2040
7	2015	1630	801	829
8	2014	1011	568	443
9	2013	1776	889	887
10	2012	1372	895	525
11	2011	-	-	-
12	2010	902	1004	497
13	2009	963	226	138
14	2008	744	795	609
15	2007	845	500	345
16	2006	197	184	13
17	2005	979	551	428
18	2004	1776	1294	482
19	2003	1004	820	184
20	2002	952	624	328
21	2001	1036	755	281
22	2000	948	727	221
TOTAL		26335	14226	12759

Source: FGIR office, Pakistan Railways Headquarters Office Lahore

**Division wise Sanctioned Strength of Gateman and Gate Keeper in
Pakistan Railways**

Division	Category	Sanctioned Strength	On Roll	Vacancy
Karachi	Gateman	186	173	13
	Gate Keeper	202	132	70
Sukkur	Gateman	191	156	35
	Gate Keeper	167	121	46
Quetta	Gateman	19	18	1
	Gate Keeper	40	28	12
Multan	Gateman	179	153	26
	Gate Keeper	98	71	27
Lahore	Gateman	330	270	60
	Gate Keeper	286	239	47
Rawalpindi	Gateman	130	108	22
	Gate Keeper	163	136	27
Peshawar	Gateman	68	36	32
	Gate Keeper	111	108	3

Source: Chief Personnel Office and all divisional offices, Pakistan Railways
Headquarters Office Lahore

Division wise Sanctioned Strength of Drivers, Dy. Drivers and Assistant Drivers in Pakistan Railways

Division	Category	Sanctioned Strength	On Roll	Vacancy
Karachi	Drivers	150	117	33
	Dy. Drivers	107	99	8
	Assistant Drivers	270	172	98
Sukkur	Drivers	150	150	0
	Dy. Drivers	43	43	0
	Assistant Drivers	225	145	80
Quetta	Drivers	72	37	35
	Dy. Drivers	25	20	5
	Assistant Drivers	97	61	36
Multan	Drivers	185	135	50
	Dy. Drivers	40	40	0
	Assistant Drivers	245	142	103
Lahore	Drivers	225	128	97
	Dy. Drivers	75	57	18
	Assistant Drivers	330	246	84
Rawalpindi	Drivers	99	77	22
	Dy. Drivers	24	20	4
	Assistant Drivers	165	124	41
Peshawar	Drivers	84	49	35
	Dy. Drivers	16	16	0
	Assistant Drivers	122	85	37

Source: Chief Personnel Office and all divisional offices, Pakistan Railways
Headquarters Office Lahore

Annexure- G

Category Wise Damages to Pakistan Railways' Property

	LHR	MUL	SUK	QTA	PSC	RWP	KYC	Total (Rs Million)
Locomotive	257.7	129.2	371.9	27.6	0.88	1.086	530.5	1319.1
Coaches/ Wagons	16.2	6.29	129.0	71.7	0.00	0.416	117.0	340.8
Rolling Stock	1.256	136.1	37.06	1.633	0.00	23.17	29.78	229.10
Commercial/ Electrical	4.499	6.041	86.51	11.40	0.00	0.00	18.94	127.40
Permanent Way	18.00	0.72	40.97	1.52	0.78	2.51	17.73	82.25
Signal	0.309	0.015	0.399	0.000	0.01	0.043	3.375	4.151
Fuel Wasted	0.00	0.00	0.00	0.00	0.02	0.00	0.000	0.021
Medical	0.03	0.00	0.00	0.00	0.00	0.000	0.000	0.037
Total	298.1	278.5	666.0	113.9	1.70	27.23	717.4	2102.9

Source: COPS/Safety Branch, Pakistan Railways