

# **Research Design and standard organization (RDSO) ,Lucknow**



## **SUMMER INDUSTRIAL TRAINING Department - Computer Division**

**Project Topic- Failure Reporting & Vendor Performance Management  
application on Python technology**

**Under the guidance of :-**

Mr R.K.Yadav, System Analyst Computer,RDSO

From : 04<sup>th</sup> June 2019 To 28<sup>th</sup> June 2019

**Submitted by :-**

KM Sakshi Verma (Roll no. 1705918)

**Kalinga Institute of Industrial Technology  
Bhubaneswar,Odisha**



## ACKNOWLEDGEMENT

The opportunity given to me by Indian Railways to learn and make project under the guidance of very experienced mentors of computer wing(RDSO) .I am sure that it will definitely make a real difference in our engineering aptitude, knowledge and abilities to deal with real time situations and will help us to make projects that can contribute in human welfare in future .

I would like to thank all those who helped me by giving their valuable thoughts and information without which it would have been difficult for me to complete this project I am obliged and honored in expressing the deep sense of gratitude to my training instructor **Mr. R.K. Yadav , System Analyst of research and development standard organization** for his helpful guidance and suggestion at every stage of this report.

# **ABSTRACT**

This report takes a pedagogical stance in demonstrating how results from theoretical computer science may be applied to yield significant insight into the behavior of the devices computer systems engineering practice seeks to put in place, and that this is immediately attainable with the present state of the art.

The focus for this detailed study is provided by the type of failure and vendor management systems currently being deployed throughout Indian Railways. Failure and system reliability concerns dominate in this domain. With such motivation, two issues are to be tackled: the problem of keeping the records of different failures occurring in different departments regularly and also to improve the vendor management and record keeping system. In the former case, the analysis is directed towards proving failure properties of the equipment which are being used by different division of the railway on daily basis. Software also help in keeping the records of different vendors to be used in future for providing better quality equipment to different sheds, depots and workshops of Indian railway.

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# **1. INTRODUCTION TO INDIAN RAILWAY CHAPTER1**

## **1.1 About Indian Railways**

Indian Railways, a historical legacy, are a vital force in our economy. The first railway on Indian sub-continent ran from Bombay to Thane on 16th April 1853. Fourteen railway carriages carried about 400 guests from Bombay to Thane covering a distance of 21 miles (34 Kilometers). Since then there has been no looking back. Today, it covers 6,909 stations over a total route length of more than 63,028 kilometers. The track kilometers in broad gauge (1676 mm) are 86, 526 kms, meter gauge (1000 mm) are 18, 529 kms and narrow gauge (762/610 mm) are 3,651 kms. Of the total route of 63,028 kms, 16,001 kms are electrified. The railways have 8000 locomotives, 50,000 coaching vehicles, 222,147 freight wagons, 6853 stations, 300 yards, 2300 goodsheds, 700 repair shops, and 1.54 million work force. Indian Railways runs around 11,000 trains every day, of which 7,000 are passenger trains. Presently, 9 pairs of Rajdhani and 13 pairs of Shatabdi Express Trains run on the rail tracks of India.

It is interesting to note that though the railways were introduced to facilitate the commercial interest of the British, it played an important role in unifying the country. Railways are ideally suited for long distance travel and movement of bulk commodities. Regarded better than road transport in terms of energy efficiency, land use, environment impact and safety it is always in forefront during national emergency.

Indian railways, the largest rail network in Asia and the world's second largest under one management are also credited with having a multi gauge and multi traction system. The Indian Railways have been a great integrating force for more than 150 years. It has helped the economic life of the country and helped in accelerating the development of industry and agriculture. Indian Railways is known to be the largest railway network in Asia.

The **Indian Railways** network binds the social, cultural and economic fabric of the country and covers the whole of country ranging from north to south and east to west removing the distance barrier for its people. The railway network of India has brought together the whole of country hence creating a feeling of unity among Indian.



### **1.1.1 Organization Overview**

The Ministry of Railways under Government of India controls Indian Railways. The Ministry is headed by Union Minister who is generally supported by a Minister of State. The Railway Board consisting of six members and a chairman reports to this top hierarchy. The railway zones are headed by their respective General Managers who in turn report to the Railway Board. For administrative convenience Indian Railways is primarily divided into 16 zones:

Railway Zone	Headquarters
Central Railway	Mumbai CST
Eastern Railway	Kolkata
Northern Railway	New Delhi
North Eastern Railway	Gorakhpur
North East Frontier Railway	Maligaon, Guwahati
Southern Railway	Chennai
South Central Railway	Secunderabad
Western Railway	Church Gate, Mumbai
South East Central Railway	Bilaspur
East Coast Railway	Bhubaneswar
North Central Railway	Allahabad
North Western Railway	Jaipur
South Western Railway	Hubli
West Central Railway	Jabalpur
East Central Railway	Hajipur

### **List of Zones of Indian Railway**

### **1.1.2 The Ministry of Railways has following nine undertakings:**

- 1.Rail India Technical & Economic Services Limited (RITES)
- 2.Indian Railway Construction (IRCON) International Limited
- 3.3.Indian Railway Finance Corporation Limited (IRFC)
- 4.Container Corporation of India Limited (CONCOR)
- 5.Konkan Railway Corporation Limited (KRCL)
- 6.Indian Railway Catering & Tourism Corporation Ltd (IRCTC)
- 7.Railtel Corporation of India Ltd. (Rail Tel)
- 8.Mumbai Rail Vikas Nigam Ltd. (MRVNL)
- 9.Rail Vikas Nigam Ltd. (RVNL)

Indian Railways have their research and development wing in the form of Research, Designs and Standard Organization (RDSO). RDSO functions as the technical advisor and consultant to the Ministry, Zonal Railways and Production Units.

### **1.1.3 Railway Budget**

Since 1924-25, railway finances have been separated from General Revenue. Indian railways have their own funds in the form of Railway Budget presented to the Parliament annually. This budget is presented to the Parliament by the Union Railway Minister two days prior to the General Budget, usually around 26th February. It has to be passed by a simple majority in the Lok Sabha before it gets final acceptance. Indian Railways are subject to the same audit control as other government revenues and expenditure.

### **1.1.4 Passenger Traffic**

The passenger traffic has risen from leaps and bounds from 1284 million in 1950-51 to 5112 million in 2002-2003.

### **1.1.5 Freight Traffic**

The revenue freight traffic has also grown immensely from 73.2 million tons in 1950-51 to 557.39 million tones. Indian railways carry huge variety of goods such as mineral ores, fertilizers, petrochemicals, agricultural produce and others. It has been made possible with measures such as line capacity augmentation on certain critical sectors and modernization of signaling system and increase in roller bearing equipped wagons. Indian Railways make huge revenue and most of its profits are from the freight sector and uses these profits to augment the loss-making passenger sector.

Here, it is important to note that computerization of freight operations --- Freight Operations Information System (FOIS) has been achieved with the implementation of Rake Management System.

### **1.1.6 Facilities for Passengers**

Computer based unreserved ticketing takes care of the large chunk of unreserved segment of passengers. This facility allows issuance of unreserved tickets from locations other than boarding station.

### **1.1.7 Indian Railway Catering and Tourism Corporation (IRCTC):**

IRCTC has launched on line ticketing facility with the aid of Center for Railway Information System, which can be booked on [www.irctc.co.in](http://www.irctc.co.in). For the convenience of customers queries related to accommodation availability, passenger status, train schedule etc can all be addressed online. Computerized reservation facilities have made the life easy of commuters across India.

National Train Enquiry system is another initiative of Indian Railways which offers train running position on a current basis through various output devices such

as terminals in the station enquiries and Interactive Voice Response Systems (IVRS) at important railway stations.

Indian Railways are committed to provide improved telecommunication system to its passengers.

### **1.1.8 Rolling Stock**

Today, Indian Railways have become self-reliant in production of rolling stock. It supplies rolling stock to other countries and non-railway customers. The production units are at Diesel Locomotive Works, Varanasi, Chittaranjan Locomotive Works, Chittaranjan, Diesel-Loco Modernisation Works, Patiala, Integral Coach Factory, Chennai, Rail Coach Factory, Kapurthala, Wheel & Axle Plant, Bangalore and Rail Spring Karkhana, Gwalior.

## **1.2 GENESIS OF INDIAN RAILWAYS**

The story of the Indian Railways (IR) is not just a saga of mundane statistics and miles of rolling stock. It is the glorious tale of a pioneering institution that has blazed a trail for nearly a century and a half, making inroads into far-flung territory and providing a means of communication.

Indian Railway is one of India's most effective networks that keep together the social, economic, political and cultural fabric of the country intact. Be it cold, mountainous terrain or the long stretches through the Rajasthan desert, Indian Railways cover the vast expanse of the country from north to south, east to west and all in between.

More than a hundred years ago, on the 16 April 1853, a red-letter day appeared in the glorious history of the Indian Railways. On the day, the very first railway train in India ran over a stretch of 21 miles from Bombay to Thane. This pioneer railway train consisting of 14 railway carriages carrying about 400 guests, steamed off at 3:30 pm amidst the loud applause of a vast multitude and to the salute of 21

guns. It reached Thane at about 4.45 pm. The guests returned to Bombay at 7 pm on the next day, that is, April 17. On April 18, 1853, Sir Jamsetjee Jeejeebhoy, Second Baronet, reserved the whole train and traveled from Bombay to Thane and back along with some members of his family and friends. This was the humble beginning of the modern Indian Railway system known today for its extraordinary integration of high administrative efficiency, technical skill, commercial enterprise and resourcefulness. Today the Indian Railway (IR) is one of the most specialized industries of the world.

### **1.3 OTHER MILESTONES**

Under the British East India Company's auspices, the Great Indian Peninsula Railway Company (GIPRC) was formed on July 15, 1844. Events moved at a fast pace. On October 31, 1850, the ceremony of turning the first sod for the GIPRC from Bombay to Kalyan was performed. The opening ceremony of the extension to Kalyan took place on May 1, 1854. The railway line from Kalyan to Khopoli was opened on May 12, 1856. It was further extended to Poona on June 14, 1858 when the traffic was opened for public use. In the eastern part of India, the first passenger train steamed out of Howrah station for Hooghly, a distance of 24 miles, on August 15, 1854. This marked the formation of the East Indian Railway.

This was followed by the emergence for the Central Bengal Railway Company. These small beginnings multiplied and by 1880, the IR system had a route mileage of 9,000 miles in India. The Northeastern Railway also developed rapidly. On October 19, 1875, the train between Hathras Road and Mathura Cantonment was started. By the winter of 1880-81, the Kanpur-Farukhabad line became operational and further east, the Dibrugarh-Dinjan line became operational on August 15, 1882. In South India, the Madras Railway Company opened the first railway line between Veyasarpady and the Walajah Road (Arcot) on July 1, 1856. This 63-mile line was the first section, which eventually joined Madras and the west

coast. On March 3, 1859, a length of 119 miles was laid from Allahabad to Kanpur.

In 1862, the railway line between Amritsar and Attari was constructed on the Amritsar-Lahore route. Some of the trains started by the British are still in existence. The Frontier Mail is one such train. It was started on September 1, 1928 as a replacement for the Mumbai-Peshawar mail. It became one of the fastest trains in India at that time and its reputation in London was very high. The Kalka Mail from Howrah to Kalka was introduced with the specific goal of facilitating the annual migration of British officials, their families and their retinue of servants and clerks from the imperial capital at Calcutta to the summer capital in Shimla. From Kalka, there was the remarkable toy train service to Shimla. Plans for this narrow-gauge train had started as early as 1847, but it was at the intervention of the Viceroy, Lord Curzon, that work actually began. Hence this train service was also known as the Viceroy's Toy Train. In order to prevent any head-on collisions on the single-track sections of this railway service, the Neals Token System has been used ever since the train was inaugurated. The train guards exchange pouches containing small brass discs with staff on the stations en route. The train driver then puts these discs into special machines, which alert the signals ahead of their approach. The Darjeeling toy trains, the Matheran toy train from Neral to Matheran, the Nilgiri Blue Mountain Railway are other engineering marvels running on routes designed and built by the British. Trains like the Deccan Queen from Bombay to Secunderabad and the Grand Trunk Express from Delhi to Madras are some other prominent trains initiated by the British. With the advancement in the railway system, electrifying railway lines began side by side, and it was in 1925, that the first electric train ran over a distance of 16 km from Victoria Terminus to Kurala.

### 2.1 The need of failure and vendor management system

failure and vendor management application system is needed to ease the reporting of different failures occurring in railways on daily basis and to present a report along with the image of the failed/damaged part of the machinery to the zonal HQ. The system is based on the relational database of headquarters of different zones and their workshops. We will have database server supporting hundreds of divisions of Indian railways.

This software is a protocol for the failure and vendor management system and is limited with the railway premises. This has been implemented under the guidance of RDSO officials . This project is useful for the railway management team.

### 2.2 Scope of the project

We all know that railway works on a huge platform and occurrence of failure in different sheds or workshops of different divisions is very casual but there management is not so easy for that purpose a separate software is necessary as this will tends to decrease the man power and communication between lower level authority to higher level authority resulting the solution of any failure in less time. Second of all vendor management is also mandatory to keep the quality of equipment use by the workshops ,high so that there will be very very less chances of failure.

Vendor management system is like your virtual staff management team that ensures you see every activity and input of your employees. It enables you to make adjustments where it is required so that you stay on top of everything at all times for your company to move forward. To make it more fruitful, it stores all information from resumes to number of hours each employee has worked. The end result is that you have the best kind transparency and accountability ensuring every activity is done with a reason. Install the vendor management system if you want to eliminate staffing errors and other kind of incompetence in your company.

Supplier performance measures are a tool to determine whether your supplier is doing their work as expected. What is expected of the supplier should be as described in the supply contract or statement of work, specification, service level agreement or KPIs – or a mixture of some of these.

There are many tools to assist in measurement of supplier performance. Some are paper-based checklists, many are digitally enabled. Electronic performance measurement helps to set consistent measures for suppliers in similar categories or projects.

## 2.3 Division Details

Indian Railways divides its operations into zones, which are further sub-divided into divisions, each having a divisional headquarters. There are a total of 17 zones.[1] Each of the divisions is headed by a Divisional Railway Manager (DRM), who reports to the General Manager (GM) of the zone. A DRM can be appointed from any of the eight organized services of Indian Railways, viz. Indian Railway Traffic Service (IRTS), Indian Railway Accounts Service (IRAS), Indian Railway Personnel Service (IRPS), Indian Railway Service of Engineers (IRSE), Indian Railway Service of Mechanical Engineers (IRSME), Indian Railway Service of Electrical Engineers (IRSEE), Indian Railway Service of Signal Engineers (IRSSE) and Indian Railway Stores Service (IRSS) for the tenure of three years, but it can be exceeded on the recommendation of Railway Board.



## 2.4 Departments List

<b>SI. No</b>	<b>Name of Department</b>	<b>Headed by</b>	<b>Abbre.</b>	<b>Role and function</b>
1.	Engineering Department	Senior Divisional Engineer	Sr.DEN	Maintenance of all fixed assets of the Division, i.e. Track, Bridges, Buildings, Roads, Water supply etc.
2.	Mechanical Engineering & Power (Transportation) Department	Senior Divisional Mechanical Engineer	Sr.DME	Maintenance of all rolling stock of the Division (except electric locos and EMU/MEMUs), i.e. locomotives, passenger and freight cars; and technical super etc.
3.	Electrical Engineering Department	Senior Divisional Electrical Engineer	Sr.DEE	Maintenance of all electric locomotives, EMUs/MEMUs and fixed electrical assets of the Division, i.e. Overhead equipment, lighting and power for railway establishments etc.
4.	Signal & Telecommunication Engineering Department	Senior Divisional Signal & Telecommunication Engineer	Sr.DSTE	Management of the Signalling and Telecommunication (S&T) infrastructure of the division for Safe Train operations;
5.	Operating and Traffic (Transportation) Department	Senior Divisional Operations Manager	Sr.DOM	Train operations
6.	Commercial	Senior Divisional	Sr.DCM	Passenger ticketing,

	Department	Commercial Manager		ticket checking, booking of freight rakes and collecting fares
7.	Medical Department	Chief Medical Superintendent	CMS	Providing medical facilities to railway employees and their families
8.	Safety Department	Senior Divisional Safety Officer	Sr.DSO	Ensuring safety of train operations
9.	Stores Department	Senior Divisional Material Manager	Sr.DMM	Ensuring material for maintenance of trains (material for all departments except the Engineering Department)
10.	Accounts Department	Senior Divisional Finance Manager	Sr.DFM	Financial management of the division
11.	Personnel Department	Senior Divisional Personnel Officer	Sr.DPO	HR functions
12.	Security Department	Senior Divisional Security Commissioner	Sr.DSC	Security of railway material, passenger and passenger belongings
13.	Managing Department	Additional Divisional Railway Manager	ADRM	

## 2.5 Sheds and workshops of different zonal railway

North Western Railway			
Shed	Type	Loco / MU's	Comments
Bhagat ki Kothi (for Jodhpur)	BG Diesel (was MG)	WDG-4, WDP-4	Former MG shed converted to BG in the 1990s. Homed WDM2, WDM3A and WDG3A locos. Started receiving EMD locos from 2009. Now (2013) entire ALCO fleet has been transferred leaving the shed with 133+ EMD locos.
Abu Road	Diesel	WDM-2, WDM-3A	Formerly premier shed for YDM-4s (MG); converted to BG in the 1990s. Home to some of the most distinctly liveried locomotives. Holds 85+ locos (9/13)
Phulera	Diesel (MG)	YDM-4/4 A	With the shed now being isolated completely from MG lines, its locos are now mostly serviced at satellite sheds. Current holding 25 locos (9/13).

### NWR Workshops

Ajmer	Opened in 1876 it is one of India's premier workshops. Loco workshop (MG diesel) and a carriage and wagon workshop (BG/MG). BG C&W Workshop maintains the Palace on Wheels rake. Also performs POH of MG locos, DDMUs, Railbuses and other rolling stock.
Bikaner (Lalgarh)	Commissioned in 1926. POH of MG coaches and wagons.
Jodhpur	Established in 1986, it was formerly an MG workshop. Currently performs POH of BG passenger coaches.

Western Railway			
Shed	Type	Loco / MU's	Comments
Ratlam	Diesel	WDS-6, WDM-2, WDM-3A , WDM3-D , WDG-4	Formerly home for the double-headed diesel-hauled Rajdhanis' locos. Started receiving EMD locos from 7/13. Locos mostly serve on routes in Gujarat and down Konkan Railway.
Vatwa (for Ahmedabad)	Diesel	WDM-3A , WDM-3D , WDG-3A , WDS-4, WDS-6	Homes locos for the Swarna Jayanti Rajdhani Express. Locos handle bulk of the freight in Kutch, Saurashtra and Southern Rajasthan regions.
Gandhidham	Diesel	WDS-4, WDS-6	Westernmost shed. Used to have a large fleet of YDM-4's but they have been transferred/ scrapped. This shed used to have MG (YDM-1) locos and later, when YDM-1's were phased out. Now homes locos for shunting duties for Kandla Port traffic.
Sabarmati (for Ahmedabad)	Diesel (MG), now Diesel (BG) (had a steam shed too)	YDM-4, WDG-4	One of the last remaining major MG loco sheds. Nine YDM-4 locos from here have been sold to Togorail SA and shipped to Togo. EMD shed setup alongside in 2009. Holds 125+ WDG4s 9/13
Mhow	Diesel, MG	YDM-4	As many as 40 YDM-4s were transferred from other MG sheds to restart Mhow. Locos now service the isolated MG section from Akola to Indore. Was a steam shed till the early 90s.
Valsad	Electric	WCAM-1 , WAG-5, WAG-7	Shed created in the 1970s specifically to home dual-power locos, but now holds more than 50 WAG-5 class locomotives.

			Post AC conversion of WR, WCAM2 fleet transferred to CR/KYN. WCAM1s being slowly condemned. Started receiving WAG7s in 2013.
Vadodara	Electric	WAM-4, WAP-4, WAG-5, WAP-5	Used to hold WCAM1 locos till the early 1990s and WAP1s for a short while as well. Started receiving WAP5s from 2012.
Vadodara	Electric - MEMU	MEMU units	Close to the main Vadodara electric shed, provides for services towards Ahmedabad and Surat.
Bandra Marshalling Yard (BAMY)	AC/DC trip shed	WCAMx locos	Officially known as Electric Loco Shed, BAMY, Khar Road
Bandra Marshalling Yard (BAMY)	Diesel	WDS-4, WDS-6	First shed in WR to hold ALCO locos which serviced premier trains from Bombay in late 60s. Later converted to shunting duties only, now holds only WDS4s with WDS6s being added 2013 onwards.
Mumbai Central	Trip shed for visiting locos		
Mumbai Central	Car shed for WR EMUs		(Distinct from the Mahalaxmi car shed - this page erroneously claimed they were a single facility earlier.)
Kandivali	Car shed for WR EMUs		WR's dual-power AC-DC EMUs are homed and maintained here.
Virar	Car shed for WR EMUs		The largest EMU car shed in India. Commissioned in 2013.
Pratapnagar	NG Diesel	ZDM-5	Does most of the POH / maintenance on its own locos, however sometimes locos are sent to Motibagh.

Jetalsar	MG Diesel	YDM-4	"Sub-shed" of Sabarmati but handles all primary maintenance of locos that operate in isolated MG pockets of Saurashtra (Veraval, Wansjaliya, Delvada etc;). Locos are marked "Sabarmati".
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### WR Workshops

Lower Parel	Periodic overhaul of BG coaches.
Mahalaxmi	Periodic overhaul of EMU, traction motor rebuilds. More recently, [4/00] EMU conversion to AC/DC. Used to house the air-conditioned EMU coaches? Only one coach with an AC section there now [9/04].
Ajmer	Loco workshop (MG diesel) and a carriage and wagon workshop (BG/MG).
Dahod	BG electric locomotive workshop; POH for WAM-4/WAG-5 locos. Formerly WR mechanical workshop and also a BG steam POH workshop. Carries out rebuilding of WAM4 / WAG5 locos with advanced features like Dynamic Brakes, Microprocessor Control, Static Converters etc. Currently carrying out "TAO-chi" conversion of WAP1 locos.
Pratapnagar	Maintenance of BG and NG wagons/coaches, and BG oil tanker wagons.
Bhavnagar	MG passenger coach maintenance
Junagadh	MG wagon maintenance
Mumbai Central	Coaching depot
Kandivali	AC-DC EMU carshed

## North Western Railway

<b>Shed</b>	<b>Type</b>	<b>Loco / MU's</b>	<b>Comments</b>
Bhagat ki Kothi (for Jodhpur)	BG Diesel (was MG)	WDG-4, WDP-4	Former MG shed converted to BG in the 1990s. Homed WDM2, WDM3A and WDG3A locos. Started receiving EMD locos from 2009. Now (2013) entire ALCO fleet has been transferred leaving the shed with 133+ EMD locos.
Abu Road	Diesel	WDM-2, WDM-3A	Formerly premier shed for YDM-4s (MG); converted to BG in the 1990s. Home to some of the most distinctly liveried locomotives. Holds 85+ locos (9/13)
Phulera	Diesel (MG )	YDM-4/4 A	With the shed now being isolated completely from MG lines, its locos are now mostly serviced at satellite sheds. Current holding 25 locos (9/13).

## NWR Workshops

Ajmer	Opened in 1876 it is one of India's premier workshops. Loco workshop (MG diesel) and a carriage and wagon workshop (BG/MG). BG C&W Workshop maintains the Palace on Wheels rake. Also performs POH of MG locos, DHMUs, Railbuses and other rolling stock.
Bikaner (Lalgarh)	Commissioned in 1926. POH of MG coaches and wagons.
Jodhpur	Established in 1986, it was formerly an MG workshop. Currently performs POH of BG passenger coaches.

Central Railway			
Shed	Type	Loco / MU's	Comments
Kurla (for Mumbai)	Diesel	WDS-4, WDS-6, WDM-2 S	Had WDS-2 shunters earlier. Now holds de-rated WDM2 locos for shunting / departmental duties as well.
Kurla / LTT	DC, AC-DC trip shed		Located near Vidyavihar. Mainly serves trains from LTT.
Kalyan (for Mumbai)	Diesel	WDM-2, WDM-3 A, WDM-3 D, WDG-3 A, WDG-4	Locos usually marked "KYN", or the name Kalyan in Devanagari. Mostly old WDM-2 (180XX), the second WDM-2 imported from ALCo. (18041) is here.
Kalyan (for Mumbai)	Electric (AC, DC and AC-DC)	WCG-2, WCAM-2, WCAM-3, WCAG-1, WAG-5, WAG-7, WAG-9, WCM-6	Kalyan had WCM-1, WCM-2, WCM-5 locos until the mid-1990s which have been decommissioned. WAG-5 and WAG-7 added to handle banking duties on the Kasara-Igatpuri AC section. The two WCM-6s have now been converted to pure AC and transferred back from Bhusaval. Started receiving WAG-9s in 2013.
CSTM (for Mumbai)	DC, AC-DC loco trip shed		
Pune	Diesel	WDM-2, WDM-3 A, WDM-3 D, WDG-3 A,	Locos usually marked with "Pune" in Devanagari script. Shed now homes 175+ locos with 40+ WDG-4s as well (9/13)

		WDG-4	
Pune	Trip Sheds	WCG-2, WCAM-3, WCAG-1	WCM-1, WCM-2, WCM-5 locos until the mid-1990s, now these have been decommissioned. Performs light maintenance for WR WCAM-1/WCAM-2 locos in addition to the CR AC-DC locos. One trip for WDS-4 shunters and another for Pune-Lonavla EMUs.
Bhusawal	Electric	WAM-4, WAP-4, WAG-5	Bhusawal used to be the largest steam shed (after WWII). Had WAP-1 locos, as well as the rare Mitsubishi WAG-2's. The WAP-1 locos were eventually transferred to Ghaziabad. Received WAP-4 locos in 2005 and WAG-7 in 2006. [11/07] Jhansi's entire fleet of WAP-4's were transferred here. 180+ locos (9/13)
Igatpuri	Electric trip shed		Separate sheds for AC locos and AC/DC locos.
Ajni (for Nagpur)	Electric shed, diesel trip shed	WAG-7, WAG-9, WAG-9I , WAP-7	Used be a steam shed. Electric shed also homed WAM-4 locos till early 21st century. Primarily freight shed with large fleet (190 locos). Received WAP7 locos in 2011 for passenger duties as well.
Murtazapur	NG diesel	ZDM-4 (#213), ZDM-5 (#515, #516)	Maintains locos for the famous "Shankuntala" route. About 80km from Badnera on the Bhusawal - Nagpur line.
Neral	NG diesel and Steam	NDM-1 (2), NDM-6 (5), and one ex-DHR B-class steam loco	The DHR B class is being used for steam trials on the Neral-Matheran line [2002]. POH of locos done at Parel.
Kurduwadi	NG diesel	ZDM-4	Locos used to service the famed Barsi Light Railway (Miraj-Latur). Closed down after gauge conversion of the NG section.
Sanpada	EMU carshed for Harbour		

	Line		
Kalwa (near Thane)	EMU carshed		
Kurla	EMU carshed		
Wadi Bunder	Decommisioned, was a DC loco trip shed	formerly WCG-1 locos	
Lonavla	AC loco trip shed	For Bhor Ghat bankers	
Manmad	Electric trip shed		

### CR Workshops

Matunga	Periodic overhaul of BG coaches and EMUs. Also workshop facilities for major repairs to diesel locos; used by other zones too, even WR (many unusual locos can be seen coming to Mumbai for this).
Kurla	Periodic overhaul of tank wagons.
Parel	Periodic overhaul of DC and AC/DC locos (from CR and WR), and Alco diesel locos. They also have facilities to repair emergency equipment such as the 140-ton cranes. Many locos from other zones come here for high-end repairs. Neral-Matheran NDM-6 locos and some CR ZDM locos come here for POH. One of the really old loco workshops; earlier specialized in the 1.5kV DC locos of the Mumbai area. Workshop now assembles WDG-3A locos which have been sent in kit form by DLW.
Nagpur	Coach maintenance workshop
Ajni	Goods wagon repair facility
Bhusawal	Wagon repair workshop, also carries out POH on 3-phase locos and conversions of WAP-1 locos to WAP-4 from all over the northern and central parts of the country. One of the oldest loco workshops, from the steam days when Bhusawal had a large steam shed. It also specializes in rebuilding fire-damaged locomotives.

West Central Railway			
Shed	Type	Loco / MU's	Comments
Tughlakabad (for Delhi)	Electric	WAG-5, WAG-7, WAG-9, WAM-4, WAP-7	This shed is a WCR shed on NR territory! It belongs to the Kota division. This was a WR shed until 2003. The shed was originally built to handle locos for the freight traffic on the busy New Delhi - Bombay route. Has received a few WAG9 starting 02/08. Starting 2010 received WAM-4 locos to be operated in pairs on container trains. WAP-7 locos homed here in 2013. 195+ locos (10/13)
Itarsi	Diesel	WDM-2, WDM-3 A, WDM-3 D, WDS-6, WDP-4	Was in CR until 2003. Shed serves routes all across central India. Started receiving WDP-4 locos in 2011. Holds 145+ locos.
Itarsi	Electric	WAM-4, WAP-4, WAG-5	This shed came up in the 1980s. Was in CR until 2003. Its WAG-5 locos perform banking duties on the Budni - Barkhera ghat section. Shed has the largest surviving WAM-4 holdings. Has received WAP-4s starting June 2008.
Katni	Diesel	WDM-2, WDM-3 A, WDG-3 A, WDG-3C	This is located at New Katni Jn. but the diesel locos always carry the marking that says simply 'Katni' (in Devanagari) or 'KTE'. This is one of IR's biggest diesel sheds. The shed used to be in CR until 2003. Holds the only WDG-3C "Cheetah"
New Katni Jn.	Electric	WAG-5, WAG-7	Located at New Katni Jn. The shed used to be in CR until 2003. Had WAM-4/WAM-4P until the early 1990s or so. Electric locos are marked 'NKJ' (for New Katni Jn.) in contrast to the diesels (above) that say just 'Katni'. It has a large marshalling yard attached. 170+ locos (03/12)

## WCR Workshops

Kota	BG wagon repair workshop
Bhopal	BG coach rehabilitation workshop. Handles rebuilding and overhaul of old passenger stock.

## South East Central Railway

Shed	Type	Loco / MU's	Comments
Bhilai	Electric	WAM-4, WAG-5, WAG-7, WAG-9, WAP-7	Shed used to be in SER until 2003. Some WAM-4's ex-Tatanagar. Bhilai also has an MEMU carshed. Known for its distinct liveries, the shed used to have elaborate suffixes for its WAM-4 locos e.g. WAM-4P-6D-HS+ABC! Now homes WAG9 and WAP-7 locos as well, including some WAG-9H. Has the largest electric loco holding in IR - 205 locos [10/13]
Raipur	Diesel	WDM-2, WDM-3A , WDG-3A , WDG-4, ZDM-4	Shed used to be in SER until 2003. WDS-6 in dark blue / red livery, not standard shunter colours. [2/05] All locos now painted in blue-white livery. Holds WDM-3A and WDG-3A from 2004. Has received a few WDG-4s as well. Also holds 6 ZDM-4 locos for the NG line to Dhamtari.
Motibagh (for Nagpur)	NG Diesel	ZDM-3A, ZDM-3B, ZDM-4A	Has an NG yard. Refuelling facilities for BG diesel locos. A steam shed here was recently [2001] demolished. However it does have [7/02] a working Bagnall steam locomotive used for special heritage runs. Carries out POH/maintenance for its own locos and also for other NG sheds. Was in SER until 2003.

## SECR Workshops

Motibagh	A very important NG/BG workshop. It performs POH on NG coaches and locomotives from all over central and south-eastern India. <a href="#">More in the workshops section.</a>
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Southern Railway			
Shed	Type	Loco / MU's	Comments
Erode	Diesel	WDM-2 , WDM-3 A, WDM-3 D, WDG-3 A, WDG-4	Also had WDM-7 locos, now at Tondiarpet. Many WDM-3A and WDG-3A transferred to Ernakulam and other sheds. Holds one of the largest fleets of WDM-3D locos. Homes the WDM-3D #11121 with a full cab forward design. Received its first WDG-4 in 9/13.
Erode	Electric	WAG-7, WAP-4	Erode Electric shed came up in the late 1990s. WAP-4 locos transferred here in 2001 from Arakkonam. Now home to the largest fleet of WAP-4's on IR, the shed handles some of the longest routes for electric trains in the country.
Ernakulam	Diesel	WDM-2 , WDM-3 A, WDG-3 A, WDS-6	Originally the only shed to have WDM-7 locos (now transferred to Tondiarpet). Has received many WDM-3A locos from Erode. WDG-3A transferred from Erode in 2012
Arakkonam (for Chennai)	Electric	WAP-4, WAM-4 , WAG-5, WAP-1	This electric shed came up in the 1980s, but Arakkonam had a big steam shed earlier. This shed had 5 WAP-1 locos until 2002, were transferred to Ghaziabad. It later got WAP-4 locos -- the entire SR fleet -- which were then moved to Erode/Lallaguda. New WAG-7 locos were acquired but later transferred to Erode. Started receiving new WAP-4's in late 2004. 30+ WAP-1 locos transferred back from Ghaziabad in 2009 out of which all but 5 were sent to Royapuram in 2011. Total holding 135+ (10/13)
Royapuram (for Chennai)	Electric	WAP-1, WAP-4, WAP-7	New Electric shed on site of former steam shed inaugurated in 2010. Received WAP-1 and WAP-4 from Arakkonam and Erode. Started receiving WAP-7s in 2012. Holding 65+ locos (10/13)

Golden Rock (for Thiruchirappalli)	Diesel BG and MG	WDM-2, WDM-3 A, WDP-3 A, WDG-3 A, WDG-4, WDP-4, WDS-6, YDM-4	One of the most distinct liveries on IR comes from Golden Rock in form of its green-cream colored ALCO units. Holds a tiny portion of its once vast MG diesel fleet. Now receiving EMD units as well. Also, one of only two sheds to hold the WDP-3A class.
Tondiarpet (for Chennai)	Diesel	WDM-2, WDM-3 A, WDG-3 A, WDM-7 , WDS-4 B, WDS-4 D	WDM-7 locos were transferred here from Ernakulam and serve now serve inferior duties. Some WDM-2's from Erode have been transferred here. Also refuelling point for WDM-2's and WDP-2's coming to Egmore.
Coonoor	Steam, Diesel	'X' class (steam) and YDM-4	Serves the Nilgiri Mountain Railway
Basin Bridge (for Chennai)	Electric trip shed		
Egmore	Electric/ Diesel trip shed		This was an important MG shed with several YDM-2's stabled here, but now the lines out of it are BG, and the shed stands demolished.
Tondiarpet	Electric trip shed		[2/04] Recently created to lessen load on Basin Bridge. Also serves as crew change point for freights.
Jolarpettai	Electric/ Diesel trip shed		

SR Workshops	
Golden Rock near Thiruchirapalli	IR's premier diesel loco restoration and rebuilding workshop; also undertakes the POH of diesels from all over the south. Currently [3/05] it handles both BG and MG, but the MG repair facilities (which have been here for a century!) will likely soon be shifted to Tiruvarur as gauge conversion leaves Tiruchy entirely on BG. Another facility may also come up at Pollachi.
Carriage and Wagon Workshops, Perambur (Aynavaram), Chennai	BG coaches and wagons
Locomotive Workshops, Perambur (Chennai)	This was the premier BG steam loco repair shop in the south; now it deals with repair and maintenance / POH of electric locos from all over the south. SR, SCR, SER, and other zones' locos are often repaired here and sent for POH; sometimes locos from even farther afield such as from Tughlakabad can be seen being worked on. KR's DMU sets also come here for their POH. Also performs yearly overhaul of the Fairy Queen steam locomotive.
Aynavaram Locomotive Workshops (Chennai)	POH, recabling, dual brake conversion, etc.
Mysore Central Workshops, Ashokapuram	BG coaches, railcars
Tambaram	Former electric shed and home to the YAM-1 locomotives. Now a BG EMU maintenance and car shed.
Avadi	BG EMU maintenance and car shed.
Arakkonam	Engineering workshops
Basin Bridge	Carriage maintenance works

South Central Railway			
Shed	Type	Loco / MU's	Comments
Gooty	Diesel	WDG-3A, WDM-3A, WDM-3D, WDG-4, WDP-4	One of the largest sheds (175+ locos). Many locos fitted with Auto Emergency brakes for service on Braganza Ghats in Goa. Also handles routine maintenance on WDG-4 locos. Gooty used to be a BG steam shed.
Guntakal	Diesel, BG and a few MG	WDM-2, WDM-3A, WDM-3D, WDG-3A	Serves passenger traffic on SCR / SWR routes sector. Many old WDM-2 units rebuilt to WDM-3A specs. Large batch of WDM-3A's transferred here from Gooty in 2005. Former MG shed; BG shed was inaugurated in 1995 after gauge conversion of the Guntakal and Hubli divisions.
Lallaguda (for Secunderabad/H yderabad)	Electric	WAP-4, WAP-7, WAG-7, WAG-9	Built on the site of the former steam shed and inaugurated in Sep 05. Used to hold WAM-4 and WAG-7 locos then moved to BZA and KZJ. Received new WAG-9 locos starting 2007. WAP-7 locos are also being homed here starting Jan. 2009. 180+ locos (10/13)
Sanatnagar (for Hyderabad)	Diesel and Electric trip sheds		A diesel refuelling point (with Indian Oil bulk terminal near it).
Kazipet	Diesel	WDM-2, WDM-3A, WDG-3A, WDG-4	Had 27 WDM-2C locos (the 'original' models of this class); [4/02] moved to Gooty and Vishakhapatnam. [6/07] Many WDM-3A transferred here from Guntakal. Ex-Gooty WDG-3A locos moved to service the Sanathnagar-Raichur sector. Had WDP-1 locos, transferred to Vijayawada. Received WDG-4 locos in 2013.

Kazipet	Electric	WAG-7	Inaugurated in 2006, it got a large chunk of WAG-7s based at Lallaguda. Has received new units as well. 135+ locos (10/13)
Vijayawada	Diesel	WDM-2, WDP-1, DEMUs (30+) and 2 Railbus	WDM-2 locos used mostly for shunting. WDP-1 locos transferred from Kazipet. Home also to 2 BEML railbuses that run on the Kakinada - Kotipalli line. Also had WDS-4 until 2001.
Vijayawada	Electric	WAG-5, WAM-4, WAG-7	Many WAG-5 locos are re-fitted and used for passenger operations only including the modified #23989 'Krishnaveni'. The electric shed here was inaugurated in April 1980 with a capacity to maintain 100 locos. Electric shed is among the largest holding 195+ locos (03/12).
Renigunta	Diesel shed, Electric trip shed		
Maula Ali (for Secunderabad)	Diesel and EMU car shed	WDM-2, WDM-3A, WDG-3A, DHMUs (3-car and 6-car) (9) and EMU's	Former MG shed; converted to BG in the late 1990s, completely converted to BG in 2003 with 10 old units (182xx series from GY/GTL/KZJ) were assigned in for shunting duties. Later, more WDM-2 and WDG-3A locos were transferred from other sheds for mainline duties on the northern Hyderabad and Nanded division routes. Electric car shed caters for suburban MMTS service.
Hyderabad	Electric trip shed		
Rajahmundry	Electric car shed (MEMU )		Has SCR entire fleet of MEMU cars. Handles primary maintenance and rebuilding of damaged units. Setup on the site of the erstwhile steam shed.

SCR Workshops	
South Lallaguda	Coaches and wagons
Rayanapadu	Wagons
Tirupati	Coaches
ROH depots for wagon maintenance at Gooty, Vijayawada, Ramagundam, Sanatnagar, Raichur and Bellampally	
Coaching maintenance depots at Secunderabad, Hyderabad, Kacheguda, Nanded, Vijayawada, Tirupati, Guntur, Kakinada, Narsapur, Purna, Kazipet, Guntakal and Machilipatnam.	

South Western Railway			
Shed	Type	Loco / MU's	Comments
Hubli	Diesel	WDG-4, WDP-4	The first EMD shed to be setup (1999). Some units were transferred to KJM and SGUJ. Still has the largest holding of EMD locos at 180+ (10/13)
Krishnarajapuram (for Bangalore)	Diesel	WDS-6, WDM-2, WDM-3A WDP-4, WDG-3A, WDG-4	Shed opened in 1983, initial holding capacity was 60 locos. Capacity was raised to 125 locos in 2003; with additional facilities later added for EMD locos since 2005. First 5 WDM-3D units were homed here; these were later transferred to Erode. Now has WDG-4 units as well (10/13)
Bangalore City	Diesel, electric trip shed		Electric Trip shed. Was in SR until 2003.
Bangalore Cantonment	Diesel	WDS-4	Locos actually belong to Tondiarpet (SR).
Mysore	Decommissioned MG	YDM-4	Locos had a distinctive dark green livery.

	diesel shed		
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SWR Workshops	
Hubli	Coaches, ROH depot for wagon maintenance, coaching maintenance depot.

East Coast Railway			
Shed	Type	Loco / MU's	Comments
Vishakha patnam (Waltair)	Diesel	WDM-2 WDM-3A , WDG-3A , WDS-6, WDG-4	IR's largest diesel shed with 195+ locos. It used to be on SER until 2003. There was a shed at Simhagiri which shut down and the new diesel shed at Waltair took over. Rarely, diesel locos can (could) be seen with Simhagiri markings [2001]. Has received WDG-4s starting 2013.
Vishakha patnam (Waltair)	Electric	WAG-5, WAG-6A /6B/6C, WAM-4, WAG-7, WAP-4	This shed used to be on SER until 2003. Most electrics from here work on the Kirandul-Kottavalasa heavy mineral freight line and are rarely seen elsewhere. The WAG-5 locos are quite old, converted from the original 211XX series of WAM-4B locos. [1/04] Also homes the entire holding of the WAG-6 classes. WAM-4 locos were intended for Angul but retained here. Some WAP-4s homed here as well with WAG-9s planned.
Angul	Electric	WAG-7	Started life on paper as a diesel shed but soon converted to an electric shed. Received locos even when the shed building was not complete. The WAM-4 and WAG-5 locos were brought from other sheds. After a short while, all WAM-4 and WAG-5 were transferred to VSKP. Currently (10/13) holds more than 110 WAG-7s.

## ECoR Workshops

Manches hwar	Carriage repair workshop. Commissioned in Nov. 1981. Performs POH maintenance on about 100 coaches a month ([5/10] to be expanded to 150/month).
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## Northern Railway

Shed	Type	Loco / MU's	Comments
Ghaziaba d (for Delhi)	Electric	WAM-4, WAP-1, WAP-4, WAP-5, WAP-7	Built to cater to passenger traffic in the Delhi area. Received the first WAP-1s. Some WAP-1 and WAP-4s were transferred to Arrakonam shed. Retains 31 WAP-1 locos. Also the home for the WAP-3 locos which have been converted back to a WAP-1. Also homes WAP-4, WAP-5 and WAP-7 and one WAM-4 for departmental duties. Has largest fleet of 3 phase passenger locos.
Tughlaka bad (for Delhi)	BG Diesel	WDM-2, WDM-3A, WDP-1, WDP-3A, WDP-4	Large shed housing more than 150 locos. One of the only sheds on IR to home the WDP-1 and WDP-3A locos. WDM-3D and WDP4s were added to the roster the former were transferred out. The first two twin cab WDP4-D locos came here as well.
Shakurba sti (for Delhi)	Diesel	WDS-4A/4B /4D, WDM-2, DEMUs	Also a BG trip shed for WDM-2, WDG-3A. WDS-4 shunting locos are based all over NR and sent here for annual / semi-annual maintenance. Homes DMUs for Delhi region including the country's first CNG run DMU which was converted in-house from diesel. This shed has 55+ WDM-2 locos for local duties with occasional main line link.
Ludhiana	Diesel	WDM-2, WDM-3A, WDG-3A	A large shed: 170+ locos [10/13]. Locos serve a large swathe of Northern and North-western India.
Ludhiana	Electric	WAM-4, WAG-5, WAG-7	Commissioned in 2001 when most GZB WAG-5's transferred here. These locos were later moved elsewhere. Newer WAG-7s since 2003 including BHEL built units. Retains only 1 WAM-4 for internal use. Holds 9 WAP-4 locos as well.

Lucknow	Diesel	WDM-2, WDM-3A, WDM-3D, WDG-3A, WDG-4	Locally called "Alambag Diesel Shed". 160+ locos including the first 3300hp fuel injected WDM-3A rebuilt by DMW Patiala. Locos seen in blue-grey livery with the words 'Prabal' written in Devnagari script on the side.
Mughals arai	Diesel	Decommissioned. Had WDM-4 locos (was at the time the only shed to have these).	This shed was an NR shed on ER territory! This was just adjacent to the (still existing) ECR (formerly ER) diesel shed. It lost the role it had earlier as the WDM-4's were phased out, and more recently [2001] was decommissioned.
Ambala	Diesel	WDS-4	Outstation shed for Shakurbasti WDS-4s.
Pathankot	NG Diesel, also BG trip shed. WDS-4 A/4B shunters are kept here for long periods.	ZDM-3, ZDM-4/A	Northernmost shed. WDS-4A belong to Shakurbasti, but kept here for long periods. Received some ZDM-4 locos in 2007, possibly from CR/WR.
Chakki Bank (for Pathankot)	Steam shed now decommissioned.		
Kalka	NG diesel	ZDM-3, ZDM-5, KC (steam)	Carries out POH of these NG NR locos. Also has Parel workshop built dual cab ZDM-3
Rewari	Steam	WP, YP, YG, AWD	The Rewari steam shed has been restored and houses BG and MG steam locos.
New Delhi	Trip shed		Caters to visiting electric and diesel locomotives with maintenance for both.
H. Nizamud	Trip shed		Caters to visiting electric locos

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Jalandhar	Diesel (DMU and Railbus)		IR's first and biggest DMU shed. Holds 90 units that service much of rural Punjab and Haryana. Also holds two BEML built railbuses which operate on the Beas-Goindwal Sahib line.
Jammu Tawi	Diesel trip shed		Trip shed for visiting locos. WDS-4 homed at Shakurbasti are retained here for long periods.
Electric (EMU and MEMU)	EMU and MEMU	Shed located near Ghaziabad. [9/08] Holds 216 EMU cars and 221 MEMU cars.	

NR Workshops	
Charbagh	Locomotive workshops. Performs POH and other maintenance on many locos from NR, WCR, etc.
Jagadhari	Carriage and Wagon workshop, Bridge workshop
Amritsar	POH of WDS-4 and breakdown cranes, bogie manufacture

North Central Railway			
Shed	Type	Loco / MU's	Comments
Kanpur Central	Electric	WAP-4, WAG-7	Shed used to be in NR until 2003. Homed the last WAG-2 and WAG-4 locos. Holds only WAP-4 and WAG-7 locos now, but 3 WAM-4 retained for departmental duties. Holding 195+ locos (10/13)
Jhansi	Diesel	WDM-2, WDM-3 A, WDM-3 D, WDG-3A , WDS-6,	Shed used to be in CR until 2003. Received the WDM-3B class mid 2006 which were later converted to WDM-3D. Shed holding 125+ locos including some new WDG-4 units (10/13)

		WDG-4	
Jhansi	Electric	WAG-5H A / WAG5H B, WAG-7	180+ locos [3/12]. Shed used to be in CR until 2003. Home to IR's entire WAG-5HB fleet, since these were manufactured by BHEL Jahnsi. First shed to receive WAP-4 locos before some were transferred to Lallaguda & Arrakonam. In late 2007, all remaining WAP-4 transferred to Bhusaval shed. Has received WAG-7 locos manufactured by BHEL.
Gwalior	NG diesel	NDM-5	Locos marked "GWL". Carries out POH of these locos.
Dhaulpur	NG diesel	ZDM-3	Locos for Dhaulpur - Tantpur / Sirmuttra section
Agra	Diesel	WDS-4, WDM-2S	Diesel shed here homes 32 WDS4. The shed caters to the loco requirement for shunting at major NCR stations and the Jhansi Workshop. Has a batch of derated WDM2 for heavy shunting duties.

NCR Workshops	
Allahabad	Engineering workshops
Gwalior	Coaching workshop for NG stock
Jhansi	Largest POH workshop for freight wagons on IR. Reputed to handle more than 20% of wagon POH on IR.

North Eastern Railway			
Shed	Type	Loco / MU's	Comments
Gonda	Diesel	WDM-2, WDM-3A, WDM-3D, WDG-3A, WDS-6, YDM-4	The last WDM-2 made by DLW (#16887) is homed here. Received WDM-3B class in late 2006 and WDM-3D in early 2007. Has a small holding of WDG-3A and YDM-4 locos as well.

Izzatnagar (for Bareilly)	MG Diesel 1	YDM-4, WDM-3D, WDP-4	For NER trains on the MG network, BG shed started with 30 WDM-3Ds in 2010. Started receiving WDG-4s and WDP-4s in 2013.
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### NER Workshops

Izzatnagar	Workshops for both MG coaches and diesel (YDM-4) loco overhaul
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### Northeast Frontier Railway

Shed	Type	Loco / MU's	Comments
Malda Town	Diesel	WDM-2, WDM-3 A, WDG-3 A, WDM-3 D	This shed is an NFR shed on ER territory!! The diesel shed was established on the grounds of a former steam shed in 1984. Serves mainly NFR passenger links. Holds 80 locos (10/13)
New Guwahati (NGC)	Diesel	WDS-6, WDG-3 A, WDM-2, WDM-3 A	BG holdings started with a few WDS-6 shunters in the early 1990s. Used to be an MG shed for YDM-4 locos; those were transferred to Lumding. The shed is located within the Guwahati Goods Yard, about 5km east of Guwahati (GHY) station towards Lumding. Locos fitted Anti-Collision Device(ACD).
Lumding	MG Diesel	YDM-4	When the MG line from Guwahati to Lumding / Tinsukia / Dibrugarh was converted to BG, the Lumding - Badarpur (and beyond) section became isolated and at the same time the MG diesel shed at NGC was closed, with the locos from there transferred here. Easternmost shed of IR and has the highest remaining holding of YDM-4s. (10/13)
Badarpur	MG Diesel trip shed	YDM-4	Trip shed only. Locos home at Lumding.
Siliguri	Diesel	WDP-4, WDG-4,	BG shed inaugurated in 3/07 with WDP-4 and WDG-4 locos transferred from Hubli. Also

homes the famous WDP-4 #20012, "Baaz".  
Current (10/13) holding 160+ locos.

Eastern Railway			
Shed	Type	Loco / MU's	Comments
Howrah + Bamanganchi	Diesel	WDM-2, WDM-3 A, WDS-6, WDM-3 D, WDS-4	Was set up in 1983 to home WDS-4 shunting locos for Howrah region at Bamangachi. Later a twin unit was setup to home mainline locos alongside for trains north and west of Howrah. One WDS-4 unit fitted with vacuum equipment for station apron cleaning, named "Swachhata".
Howrah	Electric	WAP-4, WAP-7	Commissioned at the end of 2001. Had 18 or so WAP-1 locos that were sent to Ghaziabad later. One of the largest WAP-4 sheds in IR with 90+ locos of the class stabled here. All WAP6 locos from Asansol shed converted to WAP4 and transferred here. Homed WAM-4s for a short while before receiving WAP-7s starting 2011.
Belaghata (for Sealdah)	Diesel		Diesel loco trip shed
Andal	Diesel	WDS-6, WDM-2, WDM-3 A, WDG-3 A	Set up in 1981 and home the now defunct WDS-5 shunters. Also homed the first WDM-2 manufactured by DLW, No. 18233. Present holding (10/13) 110 locos.
Burdwan	Diesel	WDM-2, WDM-3 A	The only two WDM-6 units ever built were homed here. Locos haul the trans-border 'Moitree Express' between Kolkata and Dhaka.
Jamalpur	Diesel	WDM-2, WDM-3 A, WDG-4, WDS-6	Has a large workshop, one of the oldest; BG diesels from many parts are sent here for POH. Started receiving WDG-4s in 2013.
Asansol	Electric	WAG-5, WAM-4,	This shed used to have the WAM-1/2/3/4, WAG-3/4, and WAP-4 locos. It also had the

		WAG-7	only (?) 4 WAP-2 locos, and the only WAM-3 locos: #20333, #20337. [1/08] Asansol also had 16 WAP-6 locos which were converted and transferred Howrah. [6/08] Some old WAM-4's from Mughalsarai have been transferred here recently. This is the oldest electric shed of IR.
Narkeldanga ("NKG", for Sealdah)	Electric trip shed		Used to have some WAM-1, WAM-2 locos. This is not a separate loco shed but an EMU carshed now used to stable some locos and for loco maintenance.
Gholsapur (Majerhat)	EMU car shed		
Barasat	EMU car shed		
Bandel	EMU car shed		
Howrah	EMU car shed		
Sealdah	EMU car shed		This is the EMU car shed at Narkeldanga Canal, which also houses some locomotives.
Sonarpur	EMU car shed		
Tindharia	B class tanks, etc.	Steam	Darjeeling Himalayan Railway. All POH and maintenance for the DHR B class locos happens here.

### ER Workshops

Jamalpur Locomotive Workshops	Established in 1862, Jamalpur was assembling locos very early, and began manufacturing locos from scratch by 1899. Established in 1862, Jamalpur was assembling locos very early, and began manufacturing locos from scratch by 1899. Also manufactures 140 tonne cranes , BOXN/H wagons and other equipment.
Liluah Carriage & Wagon	Maintenance & POH of passenger coaches, freight wagons and PW vehicles

Workshops	
Kanchrapara	POH on BG AC locos from all over the east (Howrah, Santragachhi, Mughalsarai, Asansol, Gomoh), including the WAG-7 locos. One of the oldest loco workshops setup in 1863; originally was the site for 3kV DC electric locos of the Calcutta area.
Bamangachi	Coach maintenance
Tikiapara	Coach maintenance

### East Central Railway

Shed	Type	Loco / MU's	Comments
Mughalsarai	Diesel	WDM-2, WDM-3 A, WDG-3A	There was also an NR diesel shed at Mughalsarai just adjacent to this one which was decommissioned. One of the only two sheds to home the rare WDS-5 shunter class.
Mughalsarai	Electric	WAM-4, WAP-4, WAG-7	First shed to get the WAG-7. WAP-1 locos from here were transferred to GZB. Holds 175+ locos (10/13)
Gomoh	Electric	WAG-7, WAG-9	Was the first shed in IR to home WAG-9 and WAP-7 locos. Some WAG9 units transferred to Ajni. WAP-7 locos served the prestigious Howrah Rajdhani link but were transferred out. Shed holding 185+ (10/13)
Patratu	Diesel	WDM-2, WDM-3 A, WDG-3A, WDG-4	On the Katni - Chopan line, Central Indian Coalfields (CIC) section, Dhanbad division, Jharkhand (near Barkakana and Gomoh). Was in ER until 2003. Loco are very rarely seen further afield. Started receiving WDG-4s in 2013.
Samastipur	Diesel	WDM-2, WDM-3 A, WDM-3 D, WDG-3A	Former MG shed converted to BG in the 1990s. Locos rarely seen far afield; observed sometimes at Allahabad, very rarely at Delhi. Used to be in NER until 2003.

ECR Workshops	
Harnaut (near Patna)	A new railway coach maintenance workshop is under construction here [6/03], which will have the capacity to repair and refurbish 500 coaches or more every year.
Mughal sarai	IR's largest wagon repair workshop.

South Eastern Railway			
Shed	Type	Loco / MU's	Comments
Kharagpur	Diesel	WDM-2, WDM-3A WDG-3A	With the electrification of the SER tracks up to VSKP, locos mainly serve routes south west and north west of KGP and freight.
Bondamunda	Diesel	WDM-2, WDM-3A ,	Had a few of the WDM-1 class. Also home to the rare WDS-5 class of shunters. WDM-3D's inducted in early 2007 and WDG-4 in 2013.
Bondamunda	Electric	WAG-5, WAG-7	One of the largest sheds with a holding of 200+ locos. Has the largest holding of WAG-7 locos. Only 2 WAG-5 units remain here as of 10/13.
Tatanagar (for Jamshedpur)	Electric	WAM-4, WAP-4, WAG-5, WAG-7, WAG-9	Holds SER's entire fleet of WAM-4 locos. Received WAG-7 locos in 2002 and WAG-9 in 2011. Has a small holding of WAP-4s as well.
Santragacchi	Electric	WAP-4	Came up in 1999. Used to have WAM-4s. Also outstation / trip shed for SER electrics near Howrah, and for Kharagpur locos. Shed holding 70 locos.
Bokaro Steel City	Diesel	WDM-2, WDM-3A ,	Also large yard for Bokaro Steel Plant. Loco spotted in a distinctive green/red livery. Has a small holding of 45+ locos

			(10/13)
Bokaro Steel City	Electric	WAG-5, WAG-7	New shed commissioned in 2011 with WAG5s transferred from other sheds. Holds a few WAG-7s as well.
Nimpura (for Kharagpur)	Electric	Trip Shed	
Dongargarh (for Nagpur)	BG diesel, now decommissioned		Was in use until a few years ago (late '90s). All SER diesels for Nagpur are now from Raipur shed. Would have been in SECR territory.
Tikiapara (for Howrah)	EMU carshed		
Panskura	EMU carshed		
Kharagpur	EMU carshed		

SER Workshops	
Kharagpur Loco and C&W Workshop	Locomotive, carriage, and wagon overhaul. More in the workshops section.
Santragachhi	Rake maintenance

Konkan Railway			
Shed	Type	Loco / MU's	Comments
Panvel	Diesel [decommissioned]		Was in use for Panvel, Roha, Pen, Uran, JNPT traffic earlier
Verna	Diesel [planned but later cancelled; construction was never completed]		

KR Workshops	
Verna C&W Workshop	Workshop for carriage maintenance at a site close to the still-born loco shed site.
Madgaon	Rake maintenance

## 2.6 Classification of Locomotives in India by Type

Locomotives can be broadly classified into what fuel they use. But they can also be classified according to the gauge they run on. Then again, they can still be classified according to what work they are used for and according to their power. So which parameter do we use to classify locomotive types? Easy. We use all of them! To avoid confusion and to uniquely identify locomotives according to what they do and how they work, Indian Railways have developed a stunningly simple system which classifies locomotives into different classes taking into account all their parameters like Gauge, Traction, Usage, Version, Power etc. Locomotives are divided into the broadest classes at first and then sub-classified into narrower parameters and are given a notation or name which is basically a string of alphabets and numbers, which each letter or number representing a unique parameter of the loco or engine. These derived classes are called “Class Names” or “Class Types”. There may be hundreds or thousands of units of one class type or there might be none or below 10 units of another type.

Each locomotive Class Name will consist of three or four alphabets followed by a number and then an optional alphabet or two. Each of these letters can be said to be a “slot”, which can be filled by a predefined set of alphabets or numbers to denote some characteristic of the loco such as the gauge on which it runs, the traction it uses, the work it is supposed to do, the power rating/model/variant of the locomotive etc. The Class Name can be found painted on the front, back and sides of the loco. The most common classes of locomotives in India are the YDM4, WDM2, WDM3A, WDG3A, WDS4B WDP4, WDG4, WAM4, WAG5, WCAM2, WAP1, WAP4, WAP5, WAP7, WAG9 etc. It is important to note that the class name is assigned by the Railways for ease of classification and NOT by the manufacturer.

**Mixed locomotives are:**

- **WDM 1:** India's first mainline diesel electric locomotives, imported in 1957 from **ALCO** as part of **ALCO FA** 'world Locomotive'. It was rated at 1,950-horsepower (1,450 kW) with a top speed of 110 km/h (68 mph). The very first WDM1 #17000 is on display in the National Rail Museum, New Delhi. Rest are scrapped
- **WDM-2:** The country's most widely-used and first homemade mainline diesel-electric locomotives

- WDM-2A, WDM-2B: WDM-2 variants; the WDM-2A has dual brakes, and the 2B usually has air brakes.
- WDM-2G: [Indian Railways](#)' first locomotive, manufactured by DLMW [Patiala](#) in 2013. In February 2014, two locos were in service: #80000 and #80001.[\[4\]](#) They have been approved for a maximum speed of 105 km/h (65 mph).[\[5\]](#)
- WDM-3: Eight were imported in 1970 from [Henschel & Son](#). With a [hydraulic transmission](#), the 2,500 hp (1,900 kW) engines have a maximum speed of 120 km/h (75 mph). Scrapped in late 1990s
- [WDM-3A](#): Formerly known as the WDM-2C, it is a WDM-2 variant unrelated to the WDM-3. With a maximum speed of 120 km/h (75 mph), it has 30,450 kgf of [tractive effort](#). Manufactured since 1994, it is one of India's most heavily-used diesel locomotives.
- WDM-3A R: Formerly the WDM-2, it is rebuilt with DBR on a short hood and is unrelated to the WDM-3.
- WDM-3B: [Co-Co bogies](#) with a top speed of 120 km/h (75 mph), they operate out of the [Uttar Pradesh](#) sheds. Twenty-three were built by [DLW](#). Similar to the WDM-3D, they are rated at 3,100 hp (2,300 kW).[\[6\]](#)
- WDM-3C, WDM-3D: Higher-powered versions of the WDM-3A, rated at 3,300 hp (2,500 kW). The WDM-3C is rebuilt from the WDM-2. The WDM-3C and WDM-3D have maximum speeds of 120 km/h (75 mph) and 160 km/h (99 mph), respectively.
- WDM-3E: Reclassified as WDM-3D, it is restricted to freight at 105 km/h (65 mph). Eight 3,500 hp (2,600 kW) units were known to have been manufactured by DLW.
- WDM-3F: Manufactured by DLW, the 3,600 hp (2,700 kW) HAHS bogies have conventional DBR and air brakes.
- [WDM-4](#): Entering service with the WDM-2, its 2,600 hp (1,900 kW) prototypes were designed by [General Motors](#). Although it was considered superior to the WDM-2, General Motors did not agree to a [technology transfer](#) agreement.
- WDM-6: Two were made, and exported to Sri Lanka. Rated at 1,350 hp (1,010 kW), their maximum speed was 75 km/h (47 mph) and they had 19,200 kgf of tractive effort and [Bo-Bo](#) bogies.
- WDM-7: Fifteen 2,000 hp (1,500 kW) locos were built from June 1987 through 1989. Designed for branch-line duty, they are used primarily for shunting. They can be spotted performing shunting duties at Chennai Central or Chennai Egmore.
- Passenger locomotives are:
- [WDP-1](#): With [Bo-Bo](#) bogies and weighing 80 tons, their top speed is 120 km/h (75 mph). The 12-cylinder, 2,300 hp (1,700 kW) engines were built by [DLW](#) in 1970 and operate out of the [Vijayawada](#) and Tughlakabad sheds.
- WDP-2 (new class name WDP-3A): Entering service in 1998, the DLW loco has a maximum speed of 140 km/h (87 mph), 29.25 tons of tractive effort and is rated at 3,100 hp (2,300 kW).

- WDP-3: WDP-1 prototypes, they were designed in 1996 by DLW. The 2,300 hp (1,700 kW) locos have Co-Co bogies.
- **WDP-4:** A 4,000 hp (3,000 kW) EMD (former GM-EMD) GT46PAC passenger version of the WDG-4 (**GT46MAC**)
- WDP-4B: Improved WDP-4 with 4,500 hp (3,400 kW), six traction motors (like the WDG-4), a wider cabin to aid visibility and minor exterior design changes. Production of the single-cab locomotives has ended.
- WDP 4D: A WDP-4 with twin cabs, the 4,500 hp (3,400 kW) locomotive with an LCD instrument display and driver toilet has entered serial production and regular service.

## Goods locomotives are:

- WDG-2 (new class name WDG-3A): Upgraded **WDM-2** built by DLW, with a maximum speed of 100 km/h (62 mph)
- WDG-3B, -3C and -3D: Upgraded WDG-2 or -3As. The WDG-3B and WDG-3C are rebuilt WDG-3As, and the WDG-3C is rated at 3,330 hp (2,480 kW).<sup>[9]</sup>
- **WDG-4:** General Motors 4,000–4,500 hp (3,000–3,400 kW) **GT46MAC** models, first imported in 1999 and numbered from #12000 to #12999 and upward from #70000.<sup>[10]</sup> Local production began in 2002.
- WDG-4D: A WDG-4 with dual air-conditioned cabs and a maximum speed of 100 km/h (62 mph), India's first dual-cab diesel freight engine<sup>[11]</sup>
- **WDG-4G:** Evolution Series GE ES43ACmi 4500HP (3,350kW) diesel locomotives which GE Transportation is building for Indian Railways<sup>[citation needed]</sup>

## Shunting locomotives are:

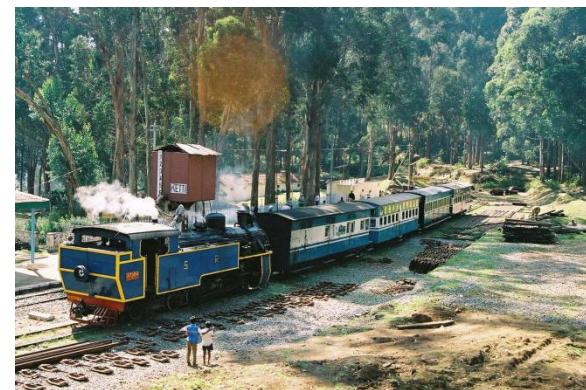
- WDS-1: India's first widely-deployed diesel locomotive (imported in 1944–45), the 386 hp (288 kW) engine is out of service.
- WDS-2: With bogies and an eight-cylinder engine, it is based at Central Railway. Built by Kraus Maffei in 1954–55, the 440 hp (330 kW) engine has 15,420 kgf of tractive effort and a maximum speed of 54 km/h (34 mph).
- WDS-3: The 618 hp (461 kW) locomotives of this class were rebuilt and reclassified as WDS-4C from 1976 to 1978. With 17,100 kgf of tractive effort, they were built in 1961.
- WDS-4, -4A, -4B and -4D: Designed by **Chittaranjan Locomotive Works** (CLW), the 600–700 hp (450–520 kW) locos have C bogies and were built from 1968 to 1997.
- WDS-4C: Rebuilt by CLW and reclassified from WDS-3, the 700 hp (520 kW) locomotive has 18,000 kgf of tractive effort and C bogies. Out of service, its maximum speed is 65 km/h (40 mph).
- WDS-5: Some are used for industrial shunting, and a few are used on Indian Railways. It is rated at 1,065 hp (794 kW).

- WDS-6: Heavy-haul shunters made in large numbers for industry and Indian Railways, it is rated at 1,200–1,350 hp (890–1,010 kW).
- WDS-6R, -6SL and -6AD: Variants of the WDS-6, the -6SL is exported to Sri Lanka. The -6AD has a maximum speed of 50 km/h (31 mph) and a six-cylinder engine.
- WDS-8: Five 800 hp (600 kW) locos, with a maximum speed of 35 km/h (22 mph) and 22,000 kgf of tractive effort, were made by CLW and transferred to steelworks.

Several 250 hp (190 kW) hydraulic diesel shunters were in use at **Integral Coach Factory**, **Diesel Locomotive Works** and **Chittaranjan Locomotive Works**. The WDS-1 to WDS-4D classes have a hydraulic transmission, and the WDS-4, -4B, -4C and -4D are the only extant broad-gauge **diesel-hydraulic locomotives**.

The WCDS6, a YDM4 locomotive, was converted to broad gauge by the **Golden Rock Railway Workshop** for large industrial companies; the first one was delivered to **RITES**. New water and air lines were added, the **control stand** was modified, and it has a dual brake system.

A few routes have **DMU** service. Depending on their transmission system, they are classified as **DEMU (diesel-electric transmission)** or **DHMU (diesel-hydraulic transmission)**. There is diesel **railcar** service (known as railbus) in several areas.



**Indian Railways locomotives: (clockwise from upper left) Preserved HPS, NRM WP 7200, B-26 and preserved YP-class**

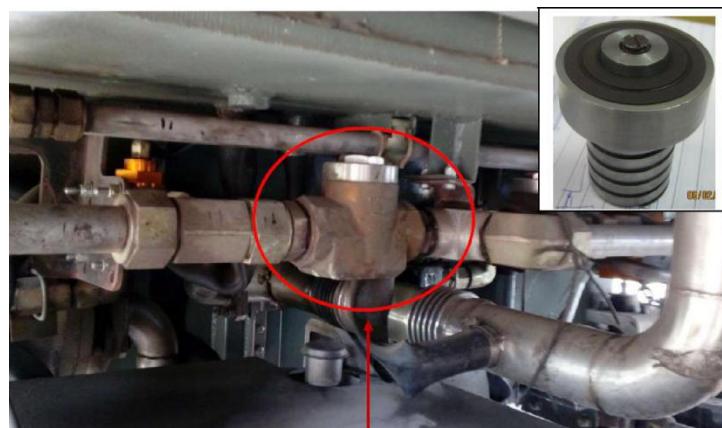
## 2.7 Failure Mode

Some of the failure modes including their cause and action that needs to be taken.

### 2.5.1 Failure of metal seated Non Return Valve (NRV):

#### (a) Problem

Railways were reporting the problem of metal seated NRV's (Disk Valve type) getting stuck up in E70 brake system leading to air leakage.



Non Return Valve (NRV)

#### (b) Investigation

The reason for stuck up of NRV had been attributed to breakage of studs/spring seats and ingress of foreign particles. Carbon deposits were also causing NRV's to stuck-up.

#### (c) Action Taken:

Metal seated type NRV was replaced by rubber seated type (Polyurethane seated). The Polyurethane rubber has excellent tear and abrasion resistant with high hardness and a low resilience. After the provision of the Polyurethane seated NRV, the problem of NRV getting stuck-up reduced substantially.

### 2.5.2 Failure of Pressure Reducing Valve (PRV):

#### (a) Problem

Railways reported the crack/shearing of Pressure Reducing Valve body (made of Polycarbonate) provided in parking brake circuit and aux. equipment manifold of E-70 brake system.

**(b) Investigation:**

Modified high flow Pressure Reducing Valve (PRV) was tested at firm's premises with air leakage by providing choke of 1.2 mm to simulate the actual working condition. There was no loss of air pressure in the modified PRV. Therefore, high flow modified Pressure Reducing Valve with metallic body was adopted.

**(c) Action Taken:**

Consequent upon satisfactory field performance of 12 numbers of indigenous high flow modified Pressure Reducing Valve of metallic body at pressure setting of 6 kg/cm<sup>2</sup> and 8 kg/cm<sup>2</sup> in parking brake and auxiliary equipment circuit respectively, the clearance for fitment of the same in E-70 brake panel was accorded in place of existing SMC make. The letter had been issued to all Railways vide letter No. EL/3.2.19/3-Phase dated 14.06.2013.

### **2.5.3 Failure of Driver Brake Control (DBC):**

**(a) Problem:**

When DBC Handle, is moved to Neutral position, potentiometer output was dropping to zero volts. The failure of DBC was attributed due to the play in the handle of indigenous potentiometer. However, Railways reported few cases of failures of DBC fitted with imported make potentiometers too.

**(b) Investigation:**

Potentiometers used to be checked by ohm-meter (Resistance measurement) instead of voltage measurement as suggested in OEM manual. There is a need to ensure proper setting of potentiometer cam switch as recommended in OEM manual on a test jig. Overhauling of DBC should be carried out after 4.5 years of service.

In Neutral position of handle, normal voltage output of potentiometer should be 15V. Joint measurement carried out at ELS/GMO which indicated that in failed DBC resistance of potentiometer was recorded as open circuit instead of specified value of  $2750 \pm 30$  ohms. In other position of DBC handles, resistance values were within the specified limit.

**(c) Action Taken:**

- All indigenous potentiometers were replaced with imported make potentiometers.
- Modified Cam and Stop Plate were provided in new supplies.

- Zonal Railways should check the healthiness of potentiometer with resistance as well as voltage measurement method.

#### **2.5.4 On application of brake BP pressure not falling down which resulted in non-application of brake without any fault massage on DDS.**

**(a) Problem:**

On application of brake, BP pressure not dropping which resulted in non-application of brake without any fault message on DDS.

**(b) Investigation:**

- It has been noticed that solder joints of signal connector pin carrying transducer signal was found cracked and guiding strips were not intact in brake electronics rack of faulty locomotive.
- Improper fitment or frequent fitment / removal of brake electronics card without ensuring intactness of card insertion guide may lead to crack of solder joint in the back plane of electronics rack. Loss of control reservoir pressure transducer voltage signal will lead to non-application of service brake through DBC.



**(c) Action taken:**

- Thorough checking of solder joints of backplane of electronics rack by magnifying glass for any cracks, whenever rack is removed for any attention or during major schedule.
- Electronic cards should be thoroughly cleaned by dry air blowing during IOH/major schedule and tightness of screw holding brake electronics card, proper fitment of card insertion guide and condition of pins are to be checked whenever cards are replaced.

## **2.5.5 Interchangeability of PCB card and Electronic rack for imported/indigenous versions:**

### **(a) Problem:**

There are two types of brake electronics racks and cards are in service i.e. imported and indigenous rack along with imported/indigenous card. The indigenous card and indigenous rack are slightly shorter than imported ones. The indigenous cards fitted in indigenous rack work properly. However, problem may arise when indigenous cards are fitted in imported rack or imported cards are provided in indigenous rack.

### **(b) Investigation and action taken:**

To address the problem of interchangeability, spacers are provided in indigenous cards and insulation strips in the indigenous rack. With this modification, indigenous cards & racks are now completely interchangeable.

Electronic cards should be thoroughly cleaned and tightness of screws holding brake electronics rack should be checked during major maintenance schedule. Functional testing of E-70 brake system should be carried out on test bench.

## **2.5.6 Failure of Air flow Gauge (AFI):**

### **(a) Problem:**

Zonal Railways have reported the cases of breakage of air flow indicator gauge glass. AFI gauge is shown .



### **(b) Investigation:**

Failure analysis was carried out to understand the problem and observations are listed below:

- The inner polycarbonate glass thickness was 8mm.

- The gap between the outer Polycarbonate glass and the pointer measures 1.35 mm. When MR pressure was admitted into the HP port, the inner glass top surface was deflecting in a convex manner, resulting in a peak deflection of 2mm. Therefore at 9 bar pressure itself, the inner projected pointer was touching the inner glass which results in a continuous stress acting on the glass, consequently breaking the gauge glass.

**(c) Action Taken:**

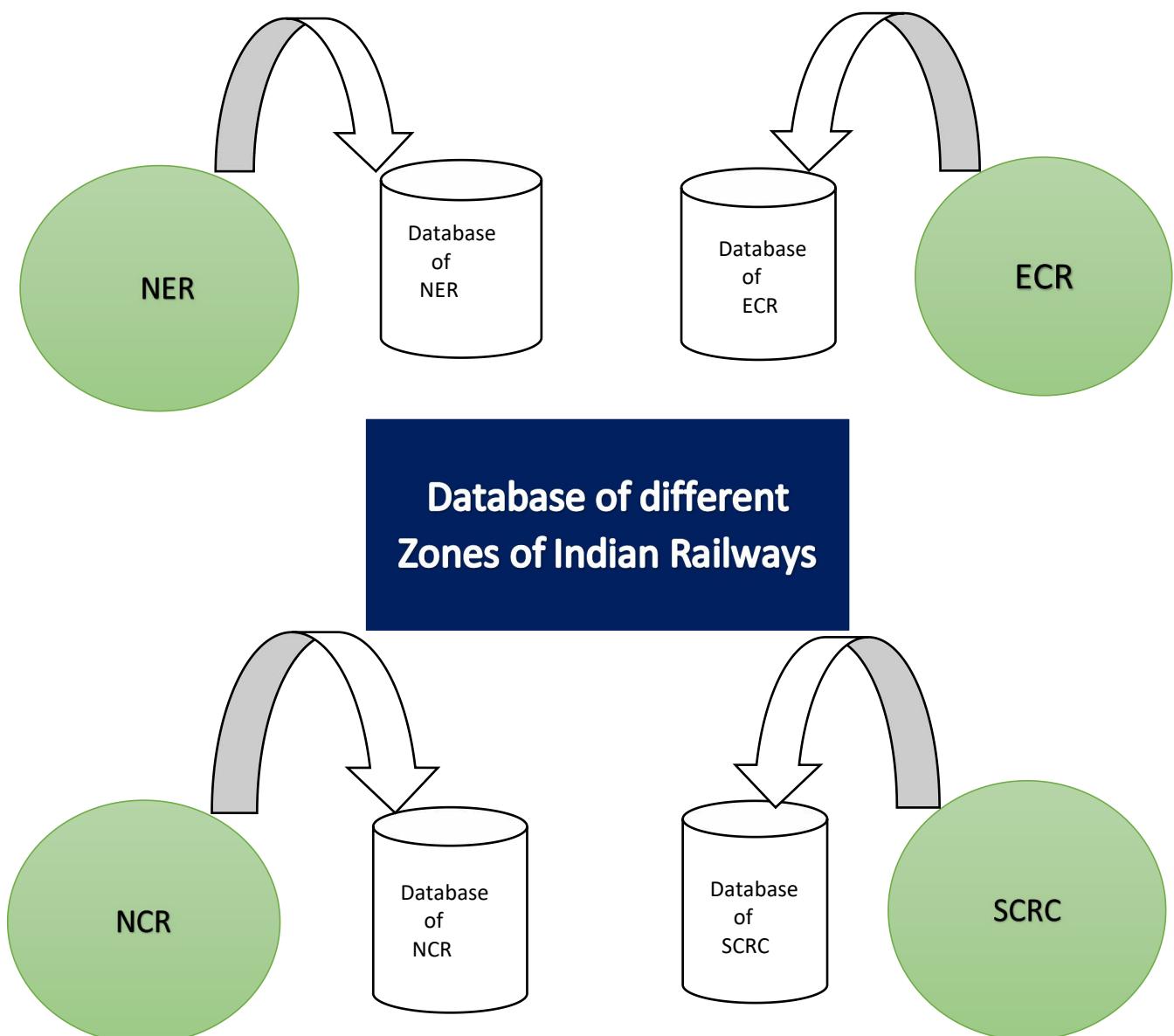
Design modifications were carried out as under:

- Thickness of polycarbonate glass increased from 8mm to 12mm.
- Inside chamber size reduced from 39-49 mm to 19-20mm
- The space between needle and glass is increased from 4.2mm to 5.5mm After this modification, no failure of modified AFI gauge has been reported by Railways. This modification has been done in E-70 as well as CCB brake system.

### 3.1 Distributed Database

Distributed database implies that a single application should be able to operate transparently on data that is spread across a variety of different databases and connected by a communication network as shown in below figure.

In this software Zones of Indian railways will keep the database of their respective divisions. In addition to that all the divisions will keep the database of their shed and workshops.



## **3.2 Client/Server System**

The term client/server refers primarily to an architecture or logical division of responsibilities, the client is the application (also known as the front-end), and the server is the DBMS (also known as the back-end).

A client/server system is a distributed system in which,

1. Some sites are client sites and others are server sites.
2. All the data resides at the server sites.
3. All applications execute at the client sites.

## **3.3 User Class and characteristics**

User of this software will be able to retrieve information about the different items and reports made on them from the database. Zonal headquarters are able to make changes in their respective divisions and also in division's respective sheds & workshops.

The system will support user privileges to the administration only , they change the data as well as add new entries to it or can change password to open logs of different division and product units.

## **3.4 Operating Environment**

- Python 3
- distributed database
- client/server system
- Operating system: Windows.
- database: sql+ database

# **Functional and Non functional Requirements Chapter 4**

## **4.1 Functional Requirements**

### **4.1.0 Login :**

Admin will be able to login and can make changes as per desire.

### **4.1.1 Dashboard :**

Admin will be able to view all the details in graphical form .He can also view pareto chart for analyzing failure in terms of percentage.

### **4.1.2 Directory/Home :**

In this section admin can view all the list of records based on the following selection made by admin(zone,section,item,calender year).The existing records fulfilling the selection criteria will be displayed here.

### **4.1.3 Change Password :**

Admin will be able to change password if desired.

### **4.1.4 Create a new section :**

Admin will be able to create a new section if desired.

### **4.1.5 Modify Existing section/Delete section :**

Admin can create new section by selecting Department Name & section code .Admin can also modify the existing sections and also can delete the existing system.

### **4.1.6 Create new item :**

From this section , admin can create a new item that will be listed section and also can delete the existing system.

### **4.1.7 Update item/delete item :**

Admin can edit/update existing item list and also he can delete the particular item from the list.

-477	Date of failure (dd-mm-yyyy)	Loco no.	Type of Loco	Railways	Shed	Type of failure	SIV sr. no.	Make /Model of SIV	Date of commissioning (dd-mm-yyyy)	Last inspection schedule	Date of last schedule inspection (dd-mm-yyyy)	last visit of loco at shed for attention of SIV
1	16/05/2018	22707	WAP4	NR	GZB	Line failures		AAL Generic	18/06/2018			
2	13/06/2018	22047	WAP1	NR	GZB	Line failures		SIE SCD	22/10/2006			
3	02/07/2018	22733	WAP4	NR	GZB	Line failures		AAL Generic				
4	02/07/2018	25004	WAP4	NR	GZB	Line failures		SIE SCD				
5	05/08/2018	22030	WAP1	NR	GZB	Line failures		SIE SCD				
6	04/09/2018	22035	WAP1	NR	GZB	Line failures		MEDHA				
7	01/11/2018	22043	WAP1	NR	GZB	Line failures		AAL Generic				
8	09/12/2018	22047	WAP1	NR	GZB	Line failures		SIE SCD				
9	05/02/2019	22036	WAP1	NR	GZB	Line failures		AAL Generic	25/02/2010			
10	05/04/2019	22040	WAP1	NR	GZB	Line failures	1042	Medha				
-89												
-88	12.04.18	22984	WAP4	WCR	ET	Any other type	2013L/258/10	HIND	17.04.14	IA	15/03/18	SCHEDULE
	15.04.18	22778	WAP4	WCR	ET	Line failures	STB0850563	SIE SCD	17.05.09	IA	18/02/18	SCHEDULE
									01.10.06			

#### 4.1.8 Add failure feature :

Admin can add all the possible failure feature of the particular item (for example : A.C control panel will have following feature : compressor contractor,condenser contractor , indicator Lamp,Timer ,M.S Switch etc. )

#### 4.1.9 Deleting failure feature :

Admin can delete any failure feature from the existing list.

#### 4.1.10 Item warranty :

In this section , admin can enter the warranty in front on every item.

#### 4.1.11 Add New Vendor/ Update vendor details :

Admin will enter the new vendor when required . Also admin can update the existing vendor details.

#### 4.1.12 Item vendor :

Admin will fill up a form which will be used to associate items with the vendors.Selecting an item provides the list of available vendors. Admin can check the vendors to select them to associate with the item add then click on the Save button.

#### 4.1.13 All zones report :

It will show the reports created in every zone.

#### **4.1.14 Print/View report :**

Admin will be able to view as well as print every report.

#### **4.1.15 Supervisor report :**

A separate report will be created by the head supervisor of every workshop/shed of their respective divisions.

## Generation of failure report

A report of equipment failure will be generated by respective departments(after the completion of data entry by the shed user,depot user and workshop user)which will be share by division to zonal HQ.

Department wise login and entry of data shall be relevant to it.

Shed, Depot and workshop will be provided with their individual logins and they can do data entry for Loco items , coaches and wagon.

While doing the real time data-entry(shed, depot and workshop) users can capture photo of failure items and can upload while filling up the data entry form.

**Failure monitoring system**

**Failure report for other than punctuality**

*Note:Fields marked with asterisk(\*)is mandatory to fill.  
Please fill Loco No.before filling any details in the form*

Loco Details	*Statistical	Non statistical	
1.Date of Failure	Type failure L/O*	Territorial Railway	Division*
<input type="text"/>	<input type="text"/> enter the failure type	<input type="text"/> -select zonal railway-	<input type="text"/> ---select division---
2.Loco Number*	Loco Class	Loco Type	
<input type="text"/>	<input type="text"/> --select Loco class--	<input type="text"/> --select Loco Type--	
3.Coaching/Freight	Date of Comm.of Loco	catagory of Failure	
<input type="text"/>	<input type="text"/>	<input type="text"/> --select catagory of loco--	
4.Holding Railway	Holding Shed		
<input type="text"/>	<input type="text"/> --select Holding shed--		

5.Last trip done?*	Last trip place*	Last trip date*
<input type="radio"/> Yes <input checked="" type="radio"/> No	<input type="text"/>	<input type="text"/>
6.Last Minor SCH Name	Last Minor SCH date	
<input type="text"/> --select SCH name--	<input type="text"/>	
7.Last Major SCH Name	Last Minor SCH date	Workshop*
<input type="text"/> --select SCH name--	<input type="text"/>	<input type="text"/> --select workshop--

### Equipment Details

8.Failed Equipments as per Shed *	<input type="text"/> ---select Shed Equipments---	
9.Type nad Version*	<input type="text"/> -----select version-----	
10.Sub Equipments*	<input type="text"/> -----select Sub Equipments-----	
12.Component/Minors Parts*	<input type="text"/> -----select Components-----	
13.Nature of Failure*	Responsibility*	Serial no. of failed Equipment
<input type="text"/> -----select Failure-----	<input type="text"/> -----select Responsibility-----	<input type="text"/> -----select Responsibility-----

### Vendor Details

15. Make of Equipment*	<input type="text"/> -----select-----	
16. Email of the Firm*	<input type="text"/>	Mobile of the Firm <input type="text"/>
17. Make ofthe Sub Equipment*	<input type="text"/> -----select-----	
18. Email of the Firm*	<input type="text"/>	Mobile of the Firm <input type="text"/>

### Failure Report & Analysis & Investigation Data

19. Modification Status	Modification	Modification Date*	Failure Report
<input type="radio"/> Applicable <input checked="" type="radio"/> Not Applicable	<input type="text"/>	<input type="text"/>	<input type="button"/> Choose File <input type="button"/> Upload
20. Brief Reason	Finding*	Action Taken*	Reliability Action Plan(if any)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="button"/> Submit <input type="button"/> Clear <input type="button"/> Cancel			

## Template of failure monitoring Form

## 4.2 Non Functional Requirements

### 4.2.1 ER Diagram :

The E-R Diagram constitutes a technique for representing the logical structure of a database in a pictorial manner. This analysis is then used to organize data as a relation, normalizing relation and finally obtaining a relation database.

1. **ENTITIES:** Which specify distinct real-world items in an application.

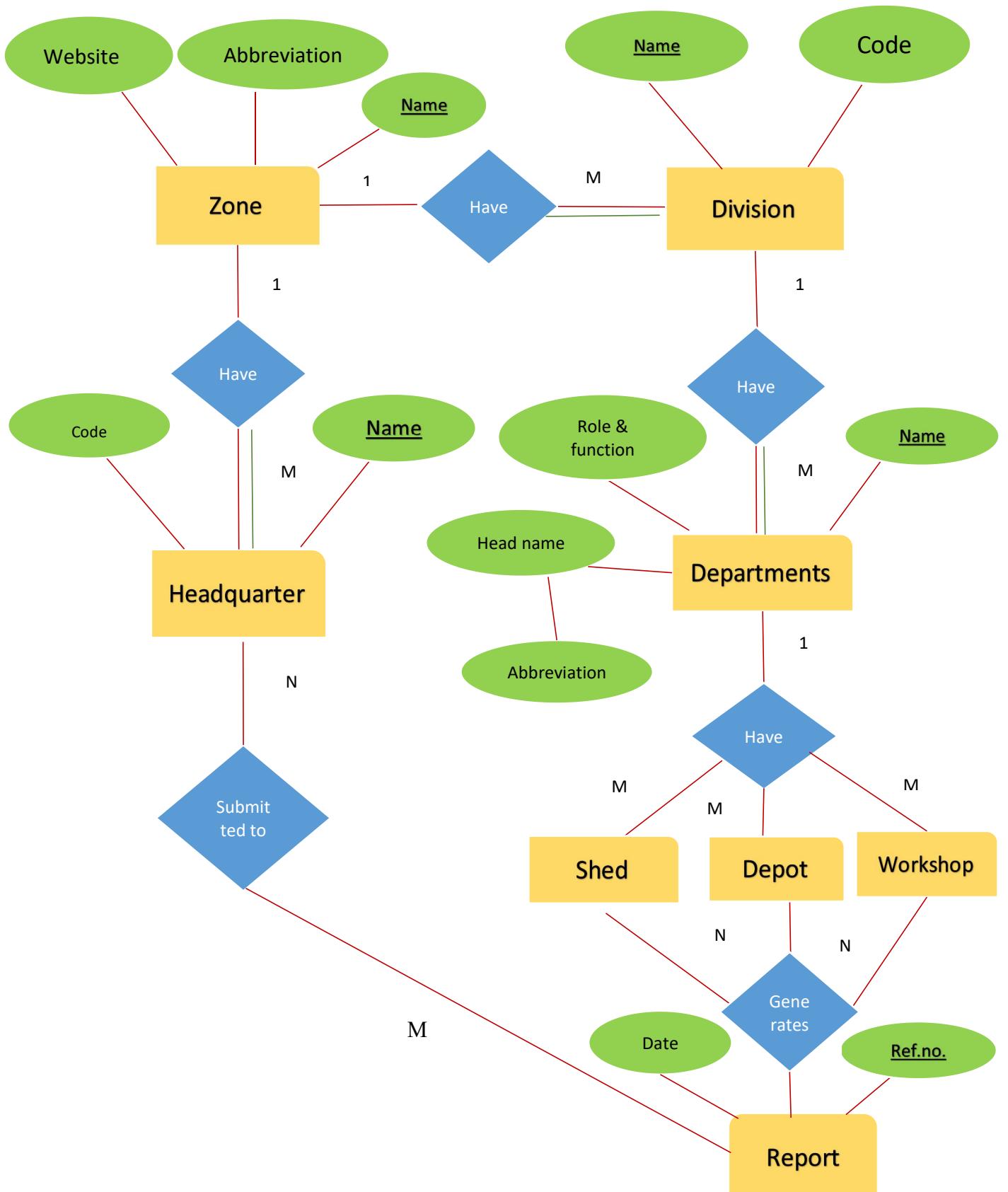
Entities present in the ER diagram below are Zone ,Division, Headquarter,Department , Shed, Depot, Workshop , Report.

2. **PROPERTIES/ATTRIBUTES:** Which specify properties of an entity and relationships.Attributes used in the ER diagram are

- **Zone** - Name , Abbreviation , website
- **Division** - Name , Code
- **Department** -Name , Role and Function , Head name , Abbreviation
- **Headquarter** - Name , code
- **Report** - Date , Ref no.

3. **RELATIONSHIPS:** Which connect entities and represent meaningful dependencies between them.

- **Have**
- **Submitted to**
- **Generates**



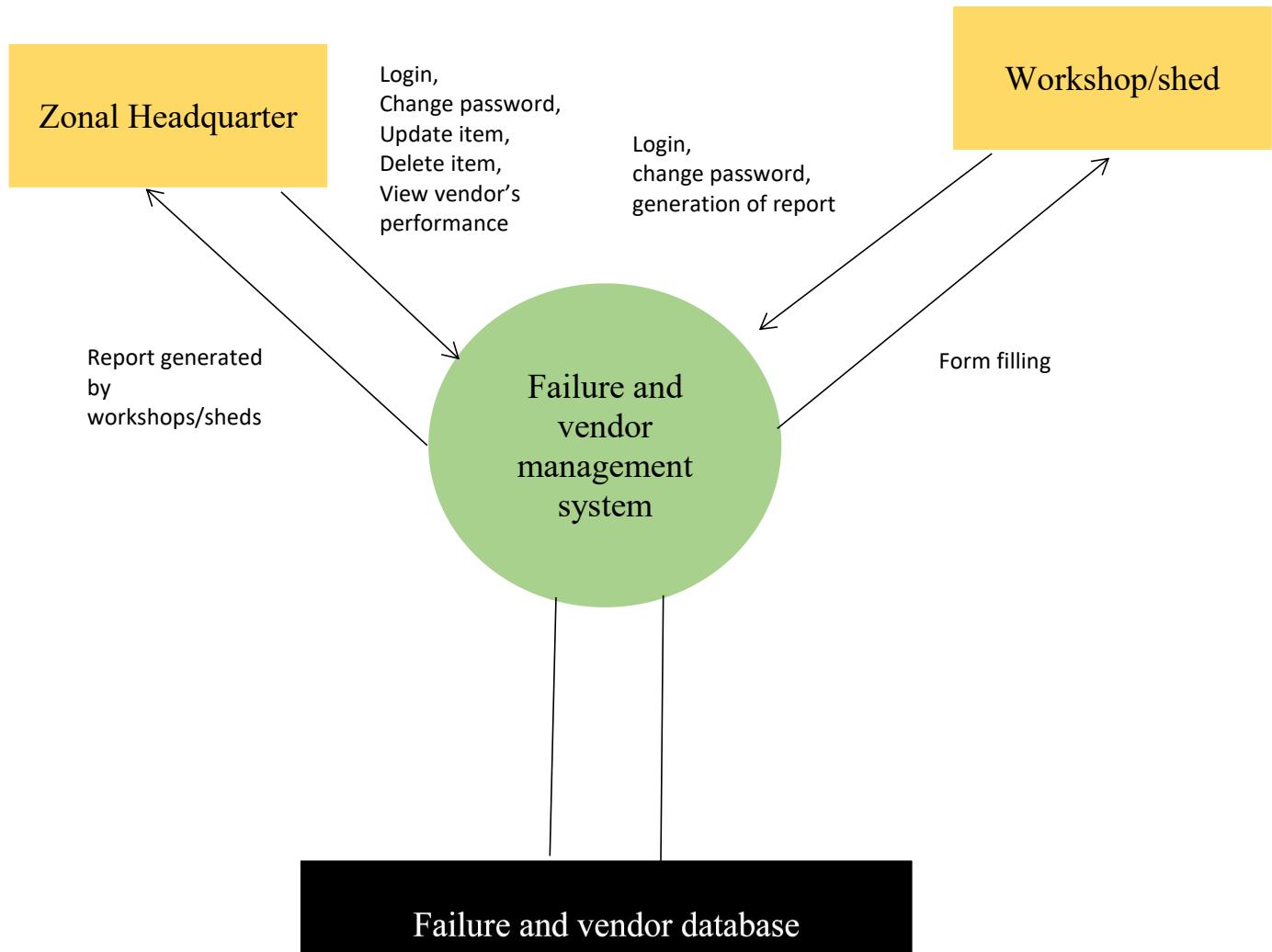
**ER Diagram of the Failure and Vendor Management System**

## 4.2.2 NORMALIZATION

The basic objective of normalization is to reduce redundancy which means that information is to be stored only once. Storing information several times leads to wastage of storage space and increase in the total size of the data stored.

If a database is not properly designed it can give rise to modification anomalies. Modification anomalies arise when data is added to, changed or deleted from a database table. Similarly, in traditional databases as well as improperly designed relational databases, data redundancy can be a problem. These can be eliminated by normalizing a database.

### 4.2.2 Flow Diagram



### **4.2.3 Availability Requirement**

The system is available 100% for the user and is used 24 hrs a day and 365 days a year. The system shall be operational 24 hours a day and 7 days a week.

### **4.2.4 Efficiency Requirement**

Mean Time to Repair (MTTR) - Even if the system fails, the system will be recovered back up within an hour or less.

### **4.2.5 Accuracy**

The system should accurately provide real time information taking into consideration various concurrency issues. The system shall provide 100% access reliability.

### **4.2.6 Performance Requirement**

The information is refreshed depending upon whether some updates have occurred or not in the application. The system shall respond to the member in not less than two seconds from the time of the request submittal. The system shall be allowed to take more time when doing large processing jobs. Responses to view information shall take no longer than 5 seconds to appear on the screen.

### **4.2.8 Reliability Requirement**

The system has to be 100% reliable due to the importance of data and the damages that can be caused by incorrect or incomplete data. The system will run 7 days a week, 24 hours a day.

## **4.2.9 SAFETY REQUIREMENTS**

If there is extensive damage to a wide portion of the database due to catastrophic failure, such as a disk crash, the recovery method restores a past copy of the database that was backed up to archival storage (typically tape) and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backed up log, up to the time of failure. Security systems need database storage just like many other applications. However, the special requirements of the security market mean that vendors must choose their database partner carefully.

## **CONSTRAINTS**

Any update or removal of any item should be clearly mentioned on the interface so that there won't be any sort of confusion for the authority using the software.

# Code and Output of different pages of the Software

## 1. Main Page

```
import tkinter as tk
from tkinter import*
import random
import time
import tkinter.scrolledtext as tkst
from tkinter import filedialog
window5 = tk.Tk()
window5.geometry("1600x1300+0+0")
window5.config(bg="black")
canvas5 = tk.Canvas(window5,bg="black")
f5 = tk.Frame(canvas5,width=1932,height=1300,bg="black")

scroll5 = tk.Scrollbar(window5, orient='vertical', command=canvas5.yview)
scroll5.pack(side=tk.RIGHT, fill=tk.Y)

canvas5.configure(yscrollcommand=scroll5.set)
canvas5.pack(fill=tk.BOTH, expand=1)
canvas5.create_window((0, 0), window=f5, anchor='nw')

def on_frame_resized(self, event=None):
    canvas5.configure(scrollregion=canvas5.bbox("all"))

window5.bind('<Configure>', on_frame_resized)
window9 = Frame(f5,bg="white",width = 1100,height=1300,relief=SUNKEN)
window9.place(x=80,y=10)
def homeoption():
    window = tk.Tk()
    window.geometry("2000x4000")
    window.title("list of zonal railway")
    window.config(bg="black")
    scrollbar = Scrollbar(window)
    scrollbar.pack(side = RIGHT, fill = Y)
    f1 = Frame(window,width =
1000,height=900,relief=SUNKEN,bg="white")
    f1.place(x=100,y=10)
```

```

label1 =tk.Label(f1,text="List of Zonal Railways in
India",padx=20,pady=20,font = ('Times New Roman',
36,),bg="white",fg="blue",width=40,height=1,relief=SUNKEN,borderwidth=0)
label1.place(x=10,y=0)
label2 =tk.Label(f1,text="S.No.",font = ('Times New
Roman',18),padx=20,pady=20,bg="white",fg="black",width=5,height=0,relief=
SUNKEN,borderwidth=1,)
label2.place(x=20,y=100)
label3 =tk.Label(f1,text="Zonal Name",font = ('Times New
Roman',18),padx=20,pady=20,bg="white",fg="black",width=15,height=0,relief
=SUNKEN,borderwidth=1,)
label3.place(x=130,y=100)
label4 =tk.Label(f1,text="Abb.",font = ('Times New
Roman',18),padx=20,pady=20,bg="white",fg="black",width=10,height=0,relief
=SUNKEN,borderwidth=1,)
label4.place(x=375,y=100)
label5 =tk.Label(f1,text="Headquarters",font = ('Times New
Roman',18),padx=20,pady=20,bg="white",fg="black",width=10,height=0,relief
=SUNKEN,borderwidth=1,)
label5.place(x=550,y=100)
label6 =tk.Label(f1,text="Divisions",font = ('Times New
Roman',18),padx=20,pady=20,bg="white",fg="black",width=15,height=0,relief
=SUNKEN,borderwidth=1,)
label6.place(x=725,y=100)
label7 =tk.Label(f1,text="I",font = ('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
label7.place(x=20,y=170)
label8 =tk.Label(f1,text="Central",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
label8.place(x=130,y=170)
label4 =tk.Label(f1,text="CR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
label4.place(x=375,y=170)
label5 =tk.Label(f1,text="Mumbai",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
label5.place(x=550,y=170)
label6 =tk.Label(f1,text="Mumbai, Bhusawal, Pune,\n
Solapur,Nagpur",font = ('Times New

```

```

Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)

    label6.place(x=725,y=170)
    label7 =tk.Label(f1,text="2",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)

    label7.place(x=20,y=220)
    label8 =tk.Label(f1,text="East Central",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)

    label8.place(x=130,y=220)
    label9 =tk.Label(f1,text="ECR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)

    label9.place(x=375,y=220)
    label5 =tk.Label(f1,text="Hajipur",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)

    label5.place(x=550,y=220)
    label6 =tk.Label(f1,text="

Danapur,Dhanbad,Mughalsarai,\nSamastipur,Sonpur",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)

    label6.place(x=725,y=220)
    label7 =tk.Label(f1,text="3",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)

    label7.place(x=20,y=270)
    label8 =tk.Label(f1,text="East Coast",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)

    label8.place(x=130,y=270)
    label4 =tk.Label(f1,text="ECoR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)

    label4.place(x=375,y=270)
    label5 =tk.Label(f1,text="Bhubaneswar",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)

    label5.place(x=550,y=270)
    label6 =tk.Label(f1,text=" Khurda Road,
Sambalpur,\nVisakhapatnam",font = ('Times New

```

```

Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)

    label6.place(x=725,y=270)
    label7 =tk.Label(f1,text="4",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)

    label7.place(x=20,y=320)
    label8 =tk.Label(f1,text="Eastern",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)

    label8.place(x=130,y=320)
    label4 =tk.Label(f1,text="ER",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)

    label4.place(x=375,y=320)
    label5 =tk.Label(f1,text="Kolkata",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)

    label5.place(x=550,y=320)
    label6 =tk.Label(f1,text="Howrah, Sealdah, Asansol,\n Malda",font =
('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)

    label6.place(x=725,y=320)
    label7 =tk.Label(f1,text="5",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)

    label7.place(x=20,y=370)
    label8 =tk.Label(f1,text="North Central",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)

    label8.place(x=130,y=370)
    label4 =tk.Label(f1,text="NCR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)

    label4.place(x=375,y=370)
    label5 =tk.Label(f1,text="Allahabad",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)

    label5.place(x=550,y=370)
    label6 =tk.Label(f1,text="Allahabad, Agra,\n Jhansi",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)


```

```

label6.place(x=725,y=370)
label7 =tk.Label(f1,text="6",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
label7.place(x=20,y=420)
label8 =tk.Label(f1,text="North Eastern",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
label8.place(x=130,y=420)
label4 =tk.Label(f1,text="NER",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
label4.place(x=375,y=420)
label5 =tk.Label(f1,text="Gorakhpur",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
label5.place(x=550,y=420)
label6 =tk.Label(f1,text="Izzatnagar, Lucknow,\n Varanasi",font =
('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
label6.place(x=725,y=420)
label7 =tk.Label(f1,text="7",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
label7.place(x=20,y=470)
label8 =tk.Label(f1,text="North Western",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
label8.place(x=130,y=470)
label4 =tk.Label(f1,text="NWR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
label4.place(x=375,y=470)
label5 =tk.Label(f1,text="Jaipur",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
label5.place(x=550,y=470)
label6 =tk.Label(f1,text="Jaipur, Ajmer, Bikaner,\n Jodhpur",font =
('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
label6.place(x=725,y=470)

```

```
label7 =tk.Label(f1,text="8",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
    label7.place(x=20,y=520)
    label8 =tk.Label(f1,text="Northeast Frontier",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=520)
    label4 =tk.Label(f1,text="NFR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=520)
    label5 =tk.Label(f1,text="Guwahati",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=520)
    label6 =tk.Label(f1,text="Alipurduar, Katihar, Lumding,\nRangia,
Tinsukia",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
        label6.place(x=725,y=520)
    label7 =tk.Label(f1,text="9",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
        label7.place(x=20,y=520)
    label8 =tk.Label(f1,text="Northern",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=520)
    label4 =tk.Label(f1,text="NR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=520)
    label5 =tk.Label(f1,text="Delhi",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=520)
    label6 =tk.Label(f1,text="Delhi,Ambala,Firozpur,\n
Lucknow,Moradabad",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
        label6.place(x=725,y=520)
```

```

label7 =tk.Label(f1,text="10",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
    label7.place(x=20,y=570)
    label8 =tk.Label(f1,text="South Central",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=570)
    label4 =tk.Label(f1,text="SCR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=570)
    label5 =tk.Label(f1,text="Secunderabad",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=570)
    label6
=tk.Label(f1,text="Hyderabad,Guntakal\nGuntur,Nanded,Vijayawada",font =
('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
    label6.place(x=725,y=570)
    label7 =tk.Label(f1,text="11",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
        label7.place(x=20,y=620)
    label8 =tk.Label(f1,text="South East Central",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=620)
    label4 =tk.Label(f1,text="SCER",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=620)
    label5 =tk.Label(f1,text="Bilaspur",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=620)
    label6 =tk.Label(f1,text="Bilaspur, Raipur,\n Nagpur",font = ('Times
New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
        label6.place(x=725,y=620)

```

```

label7 =tk.Label(f1,text="12",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
    label7.place(x=20,y=670)
    label8 =tk.Label(f1,text="South Eastern",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=670)
    label4 =tk.Label(f1,text="SER",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=670)
    label5 =tk.Label(f1,text="Kolkata",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=670)
    label6 =tk.Label(f1,text="Adra, Chakradharpur,\n
Kharagpur,Ranchi",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
        label6.place(x=725,y=670)
    label7 =tk.Label(f1,text="13",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
        label7.place(x=20,y=720)
    label8 =tk.Label(f1,text="South Western",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=720)
    label4 =tk.Label(f1,text="SWR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=720)
    label5 =tk.Label(f1,text="Hubli",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=720)
    label6 =tk.Label(f1,text="Hubli, Bangalore,\n Mysore",font = ('Times
New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
        label6.place(x=725,y=720)

```

```

label7 =tk.Label(f1,text="14",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
    label7.place(x=20,y=770)
    label8 =tk.Label(f1,text="Southern",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=770)
    label4 =tk.Label(f1,text="SR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=770)
    label5 =tk.Label(f1,text="Channai",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=770)
    label6
=tk.Label(f1,text="Madurai,Palakkad,Salem,\nTiruchchirapalli,Thiruvanathapuram",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
    label6.place(x=725,y=770)
    label7 =tk.Label(f1,text="15",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
        label7.place(x=20,y=820)
    label8 =tk.Label(f1,text="West Central",font= ('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
        label8.place(x=130,y=820)
    label4 =tk.Label(f1,text="WCR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
        label4.place(x=375,y=820)
    label5 =tk.Label(f1,text="Jabalpur",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
        label5.place(x=550,y=820)
    label6 =tk.Label(f1,text="Jabalpur, Bhopal,\n Kota",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
        label6.place(x=725,y=820)

```

```

    label7 =tk.Label(f1,text="16",font=('Times New
Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN,border
width=1,)
    label7.place(x=20,y=870)
    label8 =tk.Label(f1,text="Western",font=('Times New
Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN,border
width=1,)
    label8.place(x=130,y=870)
    label4 =tk.Label(f1,text="WR",font = ('Times New
Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN,border
width=1,)
    label4.place(x=375,y=870)
    label5 =tk.Label(f1,text="Mumbai",font = ('Times New
Roman',14),bg="white",fg="blue",width=17,height=2,relief=SUNKEN,border
width=1,)
    label5.place(x=550,y=870)
    label6 =tk.Label(f1,text="Mumbai Central, Ratlam,\nAhmedabad, Rajkot,
\nBhavnagar,Vadodara",font = ('Times New
Roman',14),bg="white",fg="blue",width=23,height=0,relief=SUNKEN,border
width=1,)
    label6.place(x=725,y=870)
    window.mainloop()

label1 =tk.Label(window9,text="Failure Reporting And Vendor
Performance\nManagement Application\n",padx=20,pady=20,font = ('Times
New Roman',
36,'italic'),bg="white",fg="black",width=40,height=3,relief=SUNKEN,borderw
idth=0)
label1.place(x=50,y=50)
loginbutton =
tk.Button(window9,text="Login",padx=10,pady=10,borderwidth=2,font=('Time
s New Roman',16),height=1,width=10).place(x=15,y=220)

dashboard = tk.Button(window9,text=
"Dashboard",padx=10,pady=10,borderwidth=2,font=('Times New
Roman',16),height=1,width=10).place(x=180,y=220)

homebutton =
tk.Button(window9,text="Home",padx=10,command=homeoption,pady=10,bor
derwidth=2,font=('Times New
Roman',16),height=1,width=10).place(x=345,y=220)

```

```
changepassword = tk.Button(window9,text= "Change  
password",padx=10,pady=10,borderwidth=2,font=('Times New  
Roman',16),height=1,width=10).place(x=510,y=220)

newsec = tk.Button(window9,text="Add new  
section",padx=10,pady=10,borderwidth=2,height=1,font=('Times New  
Roman',16),width=10).place(x=675,y=220)

newitem = tk.Button(window9,text= "Add new  
item",padx=10,pady=10,borderwidth=2,height=1,font=('Times New  
Roman',16),width=10).place(x=840,y=220)

update_or_delete_item = tk.Button(window9,text="Update or delete  
item",padx=10,pady=10,borderwidth=2,height=1,font=('Times New  
Roman',16),width=14).place(x=450,y=420)

add_failure_feature = tk.Button(window9,text= "Add failure  
feature",padx=10,pady=10,borderwidth=2,height=1,font=('Times New  
Roman',16),width=12).place(x=15,y=320)

delete_failure_feature = tk.Button(window9,text= "Delete failure  
feature",padx=10,pady=10,borderwidth=2,height=1,font=('Times New  
Roman',16),width=14).place(x=210,y=320)

item_warrenty= tk.Button(window9,text= "Item  
warrenty",padx=10,pady=10,height=1,font=('Times New  
Roman',16),width=10,borderwidth=2).place(x=430,y=320)

addnewvendor_or_updatenewvendor = tk.Button(window9,text= "Add or  
update new vendor",padx=10,pady=10,height=1,font=('Times New  
Roman',16),width=18).place(x=600,y=320)

itemvendor= tk.Button(window9,text= "Item-vendor",padx=10,pady=10,height=1,font=('Times New  
Roman',16),width=10,borderwidth=2).place(x=865,y=320)

allzonereport= tk.Button(window9,text= "All zone  
report",padx=10,pady=10,height=1,font=('Times New  
Roman',16),width=15,borderwidth=2).place(x=680,y=420)

printviewreport = tk.Button(window9,text= "Print or view  
report",padx=10,pady=10,height=1,font=('Times New  
Roman',16),width=14,borderwidth=2).place(x=15,y=420)
```

```

supervisorreport= tk.Button(window9,text= "Supervisor
Report",padx=10,pady=10,height=1,font=('Times New
Roman',16),width=14,borderwidth=2).place(x=230,y=420)
label500 =tk.Label(window9,text=
"failure and vendor management application system is needed to ease the
reporting of different failures occurring in railways on \ndaily basis and to
present a report along with the image of the failed/damaged part of the
machinery to the zonal HQ.The system is based on the relational database of
headquarters of different \nzones and their workshops.We will have database
server supporting hundreds of divisions of Indian railways.\nThis software is a
protocol for the failure and vendor management system and is limited with the
railway premises.This has been implemented under the guidance \nof RDSO
officials .\n ",font = ('Times New Roman',
14),bg="white",fg="black",width=100,height=20)
label500.place(x=30,y=490)
label1501 =tk.Label(window9,text="copyright@KM Sakshi Verma 2019",font
= ('Times New Roman',
18),bg="white",fg="black",width=90,height=2,borderwidth=0)
label1501.place(x=0,y=1200)
window5.mainloop()

```

```

frontpage.py - C:/Users/KIIT/Desktop/SAKSHI/rdso project/frontpage.py (3.7.3)
File Edit Format Run Options Window Help
import tkinter as tk
from PIL import ImageTk,Image
from tkinter import*
import random
import time
window = tk.Tk()
window.geometry("4000x4000")
background_image=ImageTk.PhotoImage(file="C:/Users/KIIT/Desktop/SAKSHI/rdso project/train1.jpg")
background_label = tk.Label(image=background_image,width=20,height=10)
background_label.image = background_image
label0 =tk.Label(window,font = ('Arial', 30,'italic'),fg="white",height=210,image=background_image,bg="white")
label0.grid(row = 1, column =1)
label1 =tk.Label(window,text="Failure Reporting And Vendor Performance\nManagement Application\n",padx=20,pady=10)
label1.grid(row = 1, column =2)
window.title("Failure Reporting And Vendor Performance Management Application")
window.config(bg="white")

loginbutton = tk.Button(window,text="Login",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman',16),height=2,
dashboard = tk.Button(window,text= "Dashboard",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman',16),height=2,
homebutton = tk.Button(window,text="Home",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman',16),height=2,
changepassword = tk.Button(window,text= "Change password",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman',
newsec = tk.Button(window,text="Add new section",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman',
newitem = tk.Button(window,text= "Add new item",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman',
update or delete item = tk.Button(window,text="Update or delete item",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman',

```

Fig 5.1

```

frontpage.py - C:/Users/KIIT/Desktop/SAKSHI/rdo project/frontpage.py (3.7.3)
File Edit Format Run Options Window Help
dashboard = tk.Button(window, text= "Dashboard",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman' ,16),height=2,wi
homebutton = tk.Button(window, text="Home",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman' ,16),height=2,wi
changepassword = tk.Button(window, text= "Change password",padx=10,pady=10,borderwidth=2,font=( 'Times New Roman' ,16),height=2,wi
newsec = tk.Button(window, text="Add new section",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman' ,16),height=2,wi
newitem = tk.Button(window, text= "Add new item",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman' ,16),height=2,wi
update_or_delete_item = tk.Button(window, text="Update or delete item",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman' ,16),height=2,wi
add_failure_feature = tk.Button(window, text= "Add failure feature",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman' ,16),height=2,wi
delete_failure_feature = tk.Button(window, text= "Delete failure feature",padx=10,pady=10,borderwidth=2,height=2,font=( 'Times New Roman' ,16),height=2,wi
item_warranty= tk.Button(window, text= "Item warrenty",padx=10,pady=10,height=2,font=( 'Times New Roman' ,16),width=10,font=( 'Times New Roman' ,16),height=2,wi
addnewvendor_or_updatenewvendor = tk.Button(window, text= "Add or update new vendor",padx=10,pady=10,height=2,font=( 'Times New Roman' ,16),width=10,font=( 'Times New Roman' ,16),height=2,wi
itemvendor= tk.Button(window, text= "Item-vendor",padx=10,pady=10,height=2,font=( 'Times New Roman' ,16),width=10,font=( 'Times New Roman' ,16),height=2,wi
allzonereport= tk.Button(window, text= "All zone report",padx=10,pady=10,height=2,font=( 'Times New Roman' ,16),width=10,font=( 'Times New Roman' ,16),height=2,wi
printviewreport = tk.Button(window, text= "Print or view report",padx=10,pady=10,height=2,font=( 'Times New Roman' ,16),width=10,font=( 'Times New Roman' ,16),height=2,wi
supervisorreport= tk.Button(window, text= "Supervisor Report",padx=10,pady=10,height=2,font=( 'Times New Roman' ,16),width=10,font=( 'Times New Roman' ,16),height=2,wi
window.mainloop()

```

Fig 5.2

## Output :

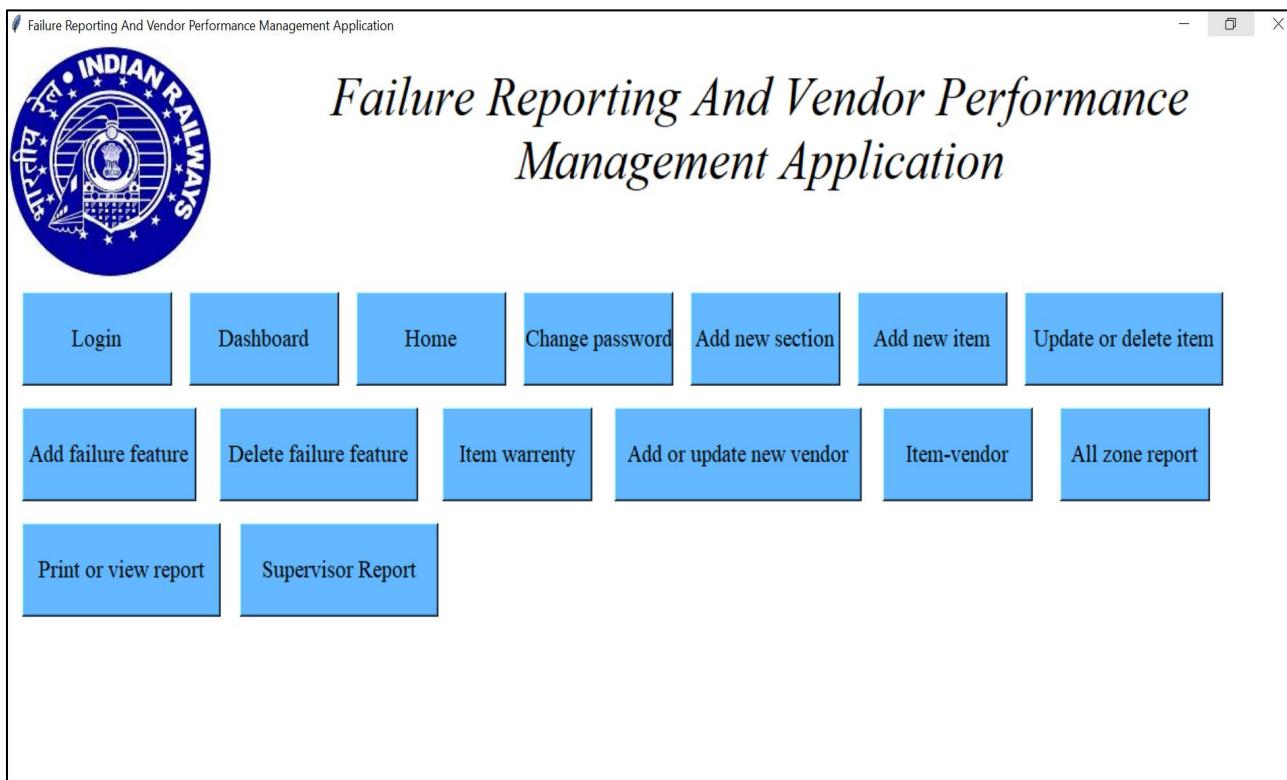


Fig 5.3

## 2. Failure monitoring System

```
f.py - C:\Users\KITT\Desktop\SAKSHI\rdso project\f.py (3.7.3)
File Edit Format Run Options Window Help
import tkinter as tk
from tkinter import *
import random
import time
import tkinter.scrolledtext as tkst
from tkinter import filedialog
window = tk.Tk()
window.geometry("1600x2000+0+0")
window.config(bg="black")
canvas = tk.Canvas(window,bg="black")
f3 = tk.Frame(canvas,width=1932,height=2000,bg="black")

scroll = tk.Scrollbar(window, orient='vertical', command=canvas.yview)
scroll.pack(side=tk.RIGHT, fill=tk.Y)

canvas.configure(yscrollcommand=scroll.set)
canvas.pack(fill=tk.BOTH, expand=1)
canvas.create_window((0, 0), window=f3, anchor='nw')

def on_frame_resized(self, event=None):
    canvas.configure(scrollregion=canvas.bbox("all"))

window.bind('<Configure>', on_frame_resized)
f1 = Frame(f3,bg="white",width = 900,height=2000,relief=SUNKEN)
f1.place(x=150,y=10)
label1 = tk.Label(f1,text="Failure monitoring system",font = ('Times New Roman', 30),bg="white",fg="black",width=30)
label1.place(x=20,y=50)
label2 =tk.Label(f1,text="Failure report for other than punctuality",font = ('Times New Roman', 24,'bold'),bg="white",fg="black",width=30)
label2.place(x=30,y=110)
label3 =tk.Label(f1,text="Note:Fields marked with asterisk(*)is mandatory to fill.\n\nPlease fill Loco No.before submit",font = ('Times New Roman', 14),bg="white",fg="black",width=30)
```

Fig 5.4

```
f.py - C:\Users\KITT\Desktop\SAKSHI\rdso project\f.py (3.7.3)
File Edit Format Run Options Window Help
division_name=["mumbai"]
label4 =tk.Label(f1,text="Loco Deatils",font=('Times New Roman', 16),padx=10,bg="white",fg="black",width=10,heig
label4.place(x=30,y=210)
label5 =tk.Label(f1,text="*Statistical",font = ('Times New Roman', 16),bg="white",fg="black",height=2,relief=S
label5.place(x=300,y=210)
label6 =tk.Label(f1,text="Non statistical",font = ('Times New Roman', 16),bg="white",fg="black",height=2,relief=S
label6.place(x=550,y=210)
label7 =tk.Label(f1,text="1.Date of Failure",font=('Times New Roman', 14),padx=10,bg="white",fg="black",height=2
label7.place(x=30,y=260)
E1=Entry(f1,bd=2,width=25,font=('Times New Roman', 14),insertwidth=8,bg="white",justify='right')
E1.place(x=40,y=310)
label8 =tk.Label(f1,text="Type failure L/O*",font=('Times New Roman', 14),padx=10,bg="white",fg="black",height=2
label8.place(x=300,y=260)
variable = StringVar(f1)
variable.set("enter the failure type")
w1 = OptionMenu(f1, variable, *Failure_type)
w1.config(bg="white",width=20)
w1.place(x=300,y=310)
label9 =tk.Label(f1,text="Territorial Railway*",font=('Times New Roman', 14),padx=10,bg="white",fg="black",widt
label9.place(x=520,y=260)
label10 =tk.Label(f1,text="Division*",font=('Times New Roman', 14),padx=10,bg="white",fg="black",width=15,heig
label10.place(x=670,y=260)
variable1 = StringVar(f1)
variable1.set("-select zonal railway-")
w2= OptionMenu(f1, variable1, *territorial_name)
w2.config(bg="white",width=20)
w2.place(x=520,y=310)
variable4= StringVar(f1)
variable4.set("----select division--")
```

Fig 5.5

Failure monitoring system

## Failure report for other than punctuality

*Note: Fields marked with asterisk(\*) is mandatory to fill.  
Please fill Loco No. before filling any details in the form*

Loco Details	*Statistical	Non statistical
1.Date of Failure	Type failure L/O*	Territorial Railway
<input type="text"/>	<input type="button" value="enter the failure type --&gt;"/>	<input type="button" value="--select zonal railway-- &gt;"/> <input type="button" value="...select division-- &gt;"/>
2.Loco Number*	Loco Class	Loco Type
<input type="text"/>	<input type="button" value="--select Loco class-- &gt;"/>	<input type="button" value="--select Loco Type-- &gt;"/>
3.Coaching/Freight	Date of Comm.of Loco	category of Failure
<input type="text"/>	<input type="text"/>	<input type="button" value="--select category of loco-- &gt;"/>
4.Holding Railway	Holding Shed	
<input type="text"/>	<input type="button" value="--select Holding shed-- &gt;"/>	

Fig 5.6

4.Holding Railway	Holding Shed	
<input type="text"/>	<input type="button" value="--select Holding shed-- &gt;"/>	
5.Last trip done?*	Last trip place*	Last trip date*
<input type="radio"/> Yes <input type="radio"/> No	<input type="text"/>	<input type="text"/>
6.Last Minor SCH Name	Last Minor SCH date	
<input type="button" value="--select SCH name-- &gt;"/>	<input type="text"/>	
7.Last Major SCH Name	Last Minor SCH date	Workshop*
<input type="button" value="--select SCH name-- &gt;"/>	<input type="text"/>	<input type="button" value="--select workshop-- &gt;"/>
<b>Equipment Details</b>		
8.Failed Equipments as per Shed *	<input type="button" value="--select Shed Equipments--- &gt;"/>	
9.Type nad Version*	<input type="button" value="--select Shed Equipments--- &gt;"/>	
10.Sub Equipments*	<input type="button" value=".....select Sub Equipments----- &gt;"/>	
12.Component/Minors Parts*	<input type="button" value=".....select Sub Equipments----- &gt;"/>	

Fig 5.7

**Vendor Details**

15. Make of Equipment\*

16. Email of the Firm\*  Mobile of the Firm

17. Make of the Sub Equipment\*

18. Email of the Firm\*  Mobile of the Firm

**Failure Report & Analysis & Investigation Data**

19. Modification Status      Modification\*      Modification Date\*      Failure Report

Applicable

Not Applicable

20. Brief Reason      Finding\*      Action Taken\*      Reliability Action Plan(if any)

Fig 5.8

### 3. Zonal List Page

```
zonallist.py - C:\Users\KIIIT\Desktop\SAKSHI\yrdso project\zonallist.py (3.7.3)
File Edit Format Run Options Window Help
import tkinter as tk
from tkinter import*
import random
import time
import tkinter.scrolledtext as tkst
window = tk.Tk()
window.geometry("2000x4000")
window.title("List of zonal railway")
window.config(bg="black")
scrollbar = Scrollbar(window)
scrollbar.pack(side = RIGHT, fill = Y)
f1 = Frame(window,width = 1000,height=900,relief=SUNKEN,bg="white")
f1.place(x=100,y=10)
label1 =tk.Label(f1,text="List of Zonal Railways in India",padx=20,pady=20,font = ('Times New Roman', 36,),bg="white")
label1.place(x=10,y=0)
label2 =tk.Label(f1,text="S.No.",font = ('Times New Roman',18),padx=20,pady=20,bg="white",fg="black",width=5,height=2)
label2.place(x=20,y=100)
label3 =tk.Label(f1,text="Zonal Name",font = ('Times New Roman',18),padx=20,pady=20,bg="white",fg="black",width=10,height=2)
label3.place(x=130,y=100)
label4 =tk.Label(f1,text="Abb.",font = ('Times New Roman',18),padx=20,pady=20,bg="white",fg="black",width=10,height=2)
label4.place(x=375,y=100)
label5 =tk.Label(f1,text="Headquarters",font = ('Times New Roman',18),padx=20,pady=20,bg="white",fg="black",width=10,height=2)
label5.place(x=550,y=100)
label6 =tk.Label(f1,text="Divisions",font = ('Times New Roman',18),padx=20,pady=20,bg="white",fg="black",width=10,height=2)
label6.place(x=725,y=100)
label7 =tk.Label(f1,text="1",font = ('Times New Roman',14),bg="white",fg="black",width=10,height=2,relief=SUNKEN)
label7.place(x=20,y=170)
label8 =tk.Label(f1,text="Central",font = ('Times New Roman',14),bg="white",fg="blue",width=23,height=2,relief=SUNKEN)
label8.place(x=130,y=170)
label4 =tk.Label(f1,text="CR",font = ('Times New Roman',14),bg="white",fg="black",width=17,height=2,relief=SUNKEN)
```

Fig 5.9

## Output

List of Zonal Railways in India				
S.No.	Zonal Name	Abb.	Headquarters	Divisions
1	Central	CR	Mumbai	Mumbai, Bhusawal, Pune, Solapur,Nagpur
2	East Central	ECR	Hajipur	Danapur,Dhanbad,Mughalsarai Samastipur,Sonpur
3	East Coast	ECoR	Bhubaneswar	Khurda Road, Sambalpur, Visakhapatnam
4	Eastern	ER	Kolkata	Howrah, Sealdah, Asansol, Malda
5	North Central	NCR	Allahabad	Allahabad, Agra, Jhansi
6	North Eastern	NER	Gorakhpur	Izzatnagar, Lucknow, Varanasi
7	North Western	NWR	Jaipur	Jaipur, Ajmer, Bikaner, Jodhpur
9	Northern	NR	Delhi	Delhi,Ambala,Firozpur, Lucknow,Moradabad
10	South Central	SCR	Secunderabad	Hyderabad,Guntakal Guntur,Nanded,Vijayawada Bilaspur, Rajour,
..	..	..	..	..

Fig 5.10

## 4. SIV FAILURE

```
add_update.py - C:\Users\KII\Desktop\SAKSHI\rdso project\add_update.py (3.7.3)
File Edit Format Run Options Window Help
from tkinter import*
import tkinter.messagebox
import venddatabase

class Vendor(tkinter.Frame):
    def __init__(self,root1):
        self.root1 = root1
        super(Vendor, self).__init__()
        self.root1.title("vendor management")
        self.root1.geometry("1350x750+0+0")
        self.root1.config(bg="white")
        vendor_name = StringVar()
        vendor_id = StringVar()
    #=====Frames=====
    def iEXIT():
        iEXIT=tkinter.messagebox.askyesno("vendor management","confirm if you want to exit")
        if iEXIT>0:
            root1.destroy()
            return

    def addData():
        if(len(vendor_id.get())!=0):
            venddatabase.addvendor(vendor_id.get(),vendor_name.get())
            vendorlist.delete(0,END)
            vendorlist.insert(END,(vendor_id.get(),vendor_name.get()))
    def DisplayData():
        vendorlist.delete(0,END)
        for row in venddatabase.viewData():
            vendorlist.insert(END,row,str(row))
```

Fig 5.11

-477	Date of failure (dd-mm-yyyy)	Loco no.	Type of Loco	Railways	Shed	Type of failure	SIV sr. no.	Make /Model of SIV	Date of commissioning (dd-mm-yyyy)	Last inspection schedule	Date of last schedule inspection (dd-mm-yyyy)	last visit of loco at shed for attention of SIV
1	16/05/2018	22707	WAP4	NR	GZB	Line failures		AAL Generic	18/06/2018			
2	13/06/2018	22047	WAP1	NR	GZB	Line failures		SIE SCD	22/10/2006			
3	02/07/2018	22733	WAP4	NR	GZB	Line failures		AAL Generic				
4	02/07/2018	25004	WAP4	NR	GZB	Line failures		SIE SCD				
5	05/08/2018	22030	WAP1	NR	GZB	Line failures		SIE SCD				
6	04/09/2018	22035	WAP1	NR	GZB	Line failures		MEDHA				
7	01/11/2018	22043	WAP1	NR	GZB	Line failures		AAL Generic				
8	09/12/2018	22047	WAP1	NR	GZB	Line failures		SIE SCD				
9	05/02/2019	22036	WAP1	NR	GZB	Line failures		AAL Generic	25/02/2010			
10	05/04/2019	22040	WAP1	NR	GZB	Line failures	1042	Medha				
-89	12.04.18	22984	WAP4	WCR	ET	Any other type	2013L/258/10	HIND	17.04.14	IA	15/03/18	SCHEDULE
-88	15.04.18	22778	WAP4	WCR	ET	Line failures	STB0850563	SIE SCD	17.05.09 01.10.06	IA	18/02/18	SCHEDULE

Fig 5.12

-477	Date of failure (dd-mm-yyyy)	Loco no.	Type of Loco	Railways	Shed	Type of failure	SIV sr. no.	Make /Model of SIV	Date of commissioning (dd-mm-yyyy)	Last inspection schedule	Date of last schedule inspection (dd-mm-yyyy)	last visit of loco at shed for attention of SIV
	11.03.19	22786	WAP4	SR	AJJ	Punctuality	08Q0339	SIE SCD	20.03.2009	TOH	02.03.2019	SCHEDULE
	18.03.2019	22845	WAP4	SR	AJJ	Line failures	02S0502	SIE SCD	01.02.2010	IC	07.03.2019	SCHEDULE
-87	19.04.18	23306	WAG5	WCR	ET	Any other type	STB04R0410	SIE SCD	18.02.10	IA	16/02/18	SCHEDULE
-86	21.05.18	23486	WAG5	WCR	ET	Any other type	1035	MEDHA	22.07.10	IA	05-08-2018	SCHEDULE
-85												
-84	11.06.18	22927	WAP4	WCR	ET	Any other type	OB180110736	AAL Generic	27.06.12	IC	05-05-2018	SCHEDULE
-83	23.06.18	22763	WAP4	WCR	ET	Line failures	OB1801211026	AAL Generic	27.06.12	IC	06-01-2018	SCHEDULE
-82	06.07.18	23573	WAG5	WCR	ET	Shed Finding	OB1801211025	AAL Generic	24.03.10	IA	12.05.18	SCHEDULE
-81	15.07.18	23557	WAG5	WCR	ET	Line failures	2009B/10898/03	HIND	26.02.10	IC	04-07-2018	SCHEDULE
	16.07.18	23566	WAG5	WCR	ET	Line failures	OB1800805013	AAL Generic	14.05.10	IB	08.05.18	SCHEDULE

Fig 5.13

Date of last visit of loco at shed (dd-mm-yyyy)	Brief description and Driver's report	Investigation report with history( if any) and root cause in brief	Name of major component failed	Name of sub-component failed	Whether under warranty or AMC	Date when loco taken under AMC ( if taken) (dd-mm-yyyy)
01.10.18	Battery Charger not working	Software updated	Software error		No	
10.10.18	SIV voltage fail	QCON timer timer defective	QCON Timer		No	
14.09.18	SIV ramp up	Rectifier assembly defective	Rectifier assembly		No	
20.10.18	SIV NOT PICKNING UP	SIV INPUT VOLTAGE LOW. SMPS CARD REPLACED	SMPS CARD		No	
11.09.18	Input Fuse fail	SCR defective and same replaced	SCR		No	
10.10.18	Battery charger output fail	Battery charger output fail	Battery charger		No	
12.10.18	Battery charger output fail	Battery charger output fail	Battery charger (Nashik)		No	
15.11.18	SIN internal fault	Input fuse and Crow bar thyristor card and same replaced	Input fuse and Crow bar thyristor card		No	
07.12.18	Battery charger output fail	Battery charger output fail	Battery charger (Nashik)		No	
13.12.18	SIV INTERNAL FAULT	INVERTER DRIVER CARD TT -1669 REPLACED	inverter card		No	
13.12.18	SIV INTERNAL FAULT	03 nos output CT and 03 nos inverter driver card replaced	inverter card		No	
04.01.19	Battery Charger sometime not working	Battery Charger defective, conventional charger provided	Battery Charger		No	
13.11.18	Inverter over temperature	MCB found tripped same bypassed	MCB		AMC	04-08-2018
23.01.19	SIV internal fault	Firm engineer checked at CKP SIV working found normal	NIL		AMC	02-01-2019
12.01.19	SIV not picking up on load	M-1300 card main control card replaced	M-1300 Card		No	
23.12.18	SIV internal fault	M-1300 card main control card replaced	M-1300 Card		No	
19.03.19	SIV Internal fault, Fan fault	Cooling fan replaced at Vidhya vihar	Cooling fan		No	
23-01-2019		M/s ME/DHA representative checked the SIV thoroughly but nothing abnormal was observed. As precaution, MCU (Main Control Unit) Card (Removed – 1385, Fitted – 2054) was replaced. When Loco was charged, "BLSI not enabled" message was coming at SIV display.	Misc	VCF	AMC	10-04-2018
09.01.2019	SI unit not starting	found Inverter Power Supply card and Analog card defective.	Misc	Analog card	AMC	10-04-2018

Fig 5.14

## 5. State Of Modification

MCU Card – Provision of higher rating MCU card ( The material will be provided by firm on FOC basis)					Repair failed MC
AAL	Population	Implemented	Balance	Remarks if any	Population
CR/AQ	25	25	0	Completed	0
CR/BSL	40	40	0	completed	0
CR/KYN	4	4	0		0
ER/HWH	1	1	0	0	-

Fig 5.15

## 6. Failure Mode Page

Failure modes of 1000 lpm																	
S No	Failure Mode	BSL															
		M/s ELGI TRC1000				TRC 1000 MNUG				M/s AIML				M/s Saber Dais			
		17-18	18-19	17-18	18-19	line failures	Shed arising	line failures	Shed arising	Line failures	Shed arising						
1	Safety valve																
2	Valve defect																
3	LP cylinder head broken																
4	HP cylinder head broken.																
5	Crank shaft broken																
6	Connecting rod broken																
7	Oil ingress																
8	Oil seal broken.																
9	Motor earth / burnt / open																
10	Bearing loose/defective/noisy																
11	Crankcase defective																
12	Bearing / HP piston seizure																
13	Disc valve carbonized and produced abnormal sound	1															
14	Coupling failure		2														1
15	Water entry																
16	Others defects																
<b>Total Failures</b>		<b>1</b>	<b>2</b>	<b>0</b>	<b>3</b>	66	66	70	70	0	0	0	0	18	18	15	15
<b>Population</b>		522	522	444	444												
<b>FRPCPY</b>		0.19	0	0	0												

Fig 5.16

S No	Failure Mode	GMO															
		M/s ELGI TRC1000				TRC1000 MNUG				M/s AIML				M/s Saber Dais			
		17-18	18-19	17-18	18-19	line failures	Shed arising	line failures	Shed arising	Line failures	Shed arising						
1	Safety valve	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Valve defect	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0
3	LP cylinder head broken	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	HP cylinder head broken.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Crank shaft broken	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Connecting rod broken	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Oil ingress	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Oil seal broken.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Motor earth / burnt / open	1	0	3	0	2	0	2	0	0	0	0	0	0	0	0	0
10	Bearing loose/defective/noisy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Crankcase defective	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Bearing / HP piston seizure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Disc valve carbonized and produced abnormal sound	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Coupling failure	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Water entry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Others defects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Failures</b>		<b>2</b>	<b>5</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>0</b>								
<b>Population</b>		112	112	112	112	17	17	17	17	0	0	0	0	0	0	0	0
<b>FRPCPY</b>		1.8	4.5	2.7	0.0	11.8	17.6	11.8	0.0								

Fig 5.17

## 7. Vendor's Performance by Pareto Chart

```
dashboard.py - C:\Users\KIIT\Desktop\dashboard.py (3.7.3)
File Edit Format Run Options Window Help
import pandas as pd#data analysis
import matplotlib.pyplot as plt#plotting
from matplotlib.ticker import PercentFormatter
g=pd.read_excel('C:/Users/KIIT/Desktop/vendor.xlsx',na_values=['NA'],skipinitialspace=True)
g = g[g.filter(regex='^(?!Unnamed)').columns]

g= g.sort_values(by='defected items',ascending=False)
g["cumpercentage"] = g["defected items"].cumsum()/g["defected items"].sum()*100
fig, ax = plt.subplots(figsize=(20, 10))

ax.bar(g['vendor name'],g['defected items'], color="C0")
ax2 = ax.twinx()
ax2.plot(g['vendor name'],g["cumpercentage"], color="C1", marker="D", ms=7)
plt.setp(ax2.get_xticklabels(), rotation=80, horizontalalignment='right')

ax2.yaxis.set_major_formatter(PercentFormatter())
ax2.tick_params(axis="y", colors="C0")
ax2.tick_params(axis="y", colors="C1")
plt.show()
```

Fig 5.18

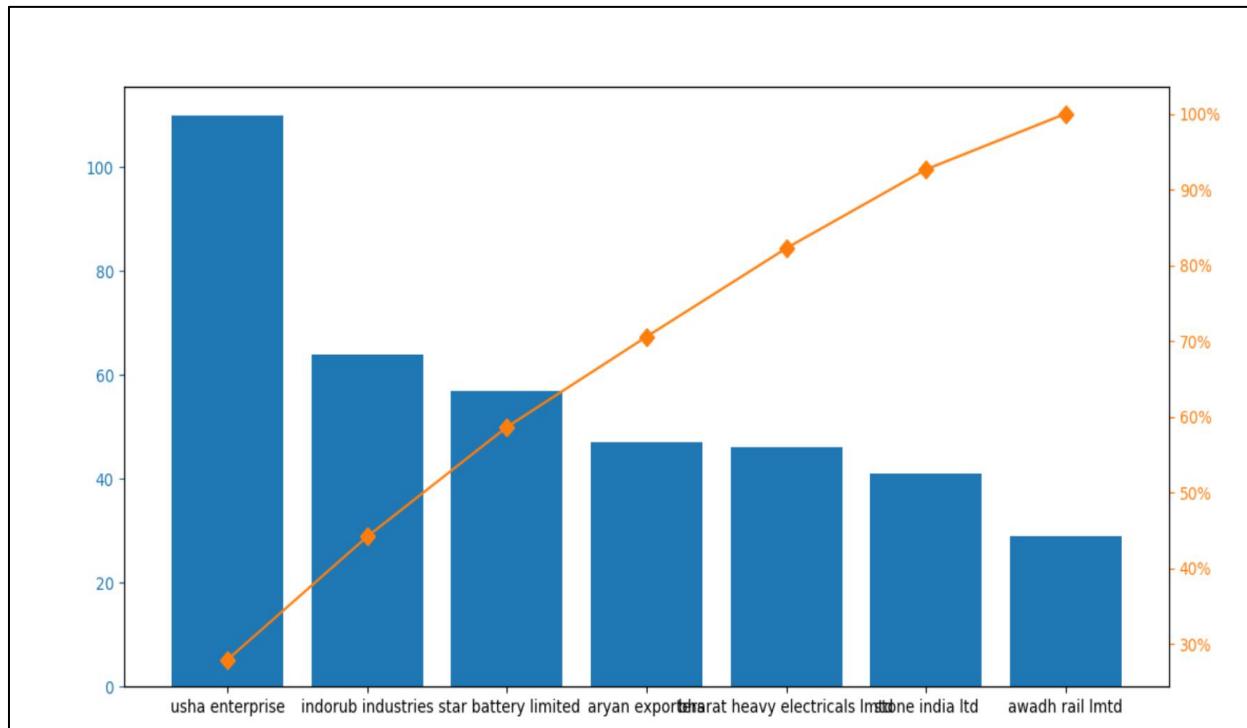


Fig 5.19

## 8. Login Page



```
*login.py - C:\Users\KII\Desktop\SAKSHI\rds project\login.py (3.7.3)*
File Edit Format Run Options Window Help
import tkinter as tk
from PIL import ImageTk,Image
from tkinter import*
import random
import time
window = tk.Tk()
window.geometry("4000x10000")
window.title("login Page")
window.config(bg="white")
class LoginFrame(tk.Frame):
    def __init__(self, master):
        super().__init__(master)

        self.label_username = tk.Label(self, text="Username")
        self.label_password = tk.Label(self, text="Password")

        self.entry_username = tk.Entry(self)
        self.entry_password = tk.Entry(self, show="*")

        self.label_username.grid(row=0)
        self.label_password.grid(row=1)
        self.entry_username.grid(row=0, column=1)
        self.entry_password.grid(row=1, column=1)
        self.logbtn = tk.Button(self, text="Login", command=self._login_btn_clicked)
        self.logbtn.grid(columnspan=2)

        self.pack()

    def _login_btn_clicked(self):
```

Fig 5.20



```
*login.py - C:\Users\KII\Desktop\SAKSHI\rds project\login.py (3.7.3)*
File Edit Format Run Options Window Help
        self.entry_username = tk.Entry(self)
        self.entry_password = tk.Entry(self, show="*")

        self.label_username.grid(row=0)
        self.label_password.grid(row=1)
        self.entry_username.grid(row=0, column=1)
        self.entry_password.grid(row=1, column=1)
        self.logbtn = tk.Button(self, text="Login", command=self._login_btn_clicked)
        self.logbtn.grid(columnspan=2)

        self.pack()

    def _login_btn_clicked(self):
        # print("Clicked")
        username = self.entry_username.get()
        password = self.entry_password.get()

        # print(username, password)

        if username == "admin" and password == "password":
            tm.showinfo("Login info", "Welcome John")
        else:
            tm.showerror("Login error", "Incorrect username")

lf = LoginFrame(window)
window.mainloop()
```

Fig 5.21

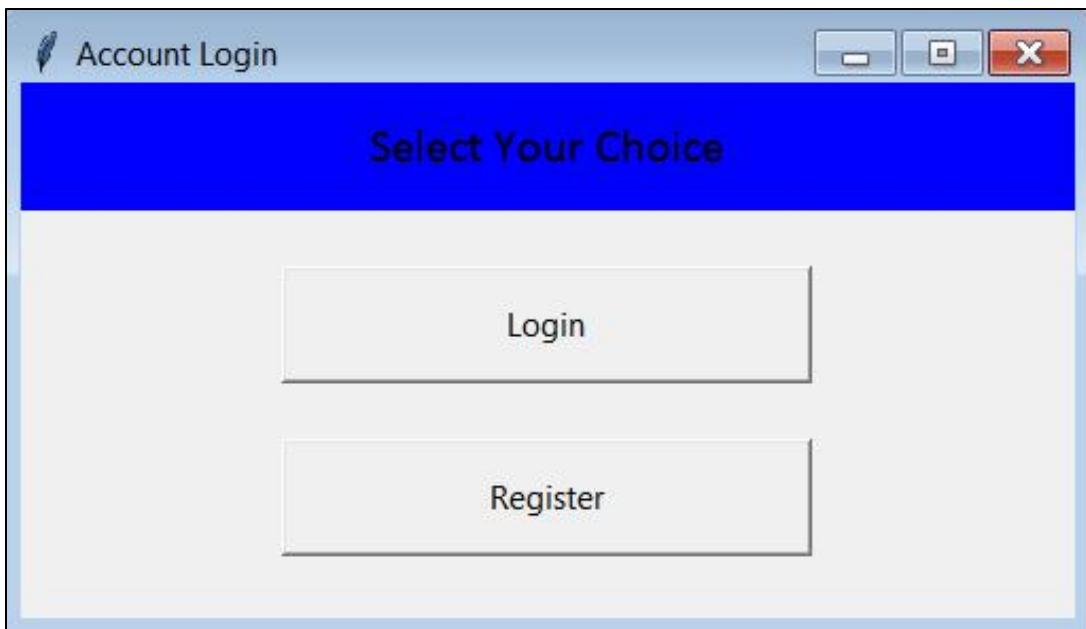


Fig 5.22

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## **Conclusion**

Indian Railways, as an organization is a very vast center of different software in itself. Today the digital world is getting its roots, grabbing the new era more firmly. We think that our training was an success and we think that Indian Railways was an excellent training institute for inquisitive emerging software engineers. In Indian Railways, training is given to engineering aspirant desiring to secure future in the dynamic world of Telecommunication.

The main achievements of the training at Indian Railways are that we got familiar with the latest software developing skills. The main achievement could be said to get knowledge about recent technologies of software development. We got experience as to how to organize the things. After the completion of the training we consider ourselves capable of facing any other challenge of that type. The training at Indian Railways cultivated the zeal of inquisitiveness and the excitement to know more than more about this field in limited duration.