Safety as Key Business Theme! - Indian Railways Perspective

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1.0 INTRODUCTION

Railways have come to be recognized as the safest mode of mass transportation on account of inherent characteristics of the system. Railway managements have zealously guarded this image over the ages. Safety has thus come to be recognized as the key issue for the railways and one of its special attributes. No railway system can survive by ignoring this vital aspect as safe and timely transit is not only significant for passenger traffic but also for transportation of materials, in to-days highly competitive environment. Safety ranks highest among the factors in selection of a mode of transportation - above the cost and transit time. Accidents hurt business not only in the immediate context but also in the long run and ultimately only those means of transport flourish which are perceived to be safe. It is, therefore, the key performance index which the top managements need to monitor along with productivity. The two can not be divorced from each other and are, in fact, end products of the business activity in a transport organization which it needs to pursue to excellence.

2.0 INDIAN RAILWAYS- Building the Nation

The foremost task for the Indian Railways after independence in 1947 was to strengthen and modernize its infrastructure not only to support the economic development in the planned era but also to rid the system of obsolesce and poor maintenance. 1950s were primarily devoted to pulling up arrears in maintenance of track, signaling and rolling stock besides providing small rail links to the heavy industries like steel plants that were being set up. The inputs given by the nation for renewals and restoration not only brought about an improvement in productivity but also helped bring down the incidence of accidents on the Railways to a great extent. Number of accidents on Indian Railways came down from 8481 in 1950-51 to 2131 in 1960-61. Derailments which constituted bulk of the accidents came down from 7527 to 1415 over the same period. There was also appreciable reduction in the number of collisions, although there was increase in the categories of 'fire in trains' and level crossing accidents. The unrelenting efforts of Indian Railways in strengthening the infrastructure and modernizing it have led to substantial improvement in the safety performance in subsequent decades, which primarily forms the basis of this paper.

3.0 INDIAN RAILWAYS – Mega-size Railway System

Indian Railways operate on continental and gigantic dimensions with nearly:

- 63112 route kms
- 39900 Passenger vehicles
- 7681 locomotives
- 215 thousand wagons

- 6850 block stations
- 1472 thousand work force
- 120 thousand bridges
- 16750 manned level crossings
- 20600 unmanned level crossings
- 97 loco sheds
- 50 workshops and production units
- 318 carriage and wagon maintenance depots
- Rs. 520 million expenditure on staff per day
- Rs.1 billion revenue expenditure daily.

And daily transport output is approximately:

- 2 Million Train Kms.
- 14 Million Passengers
- 1.5 Million Tonnes freight loading
- 8700 Passenger trains run
- 5700 Freight trains run

4.0 WHAT IS SAFETY?

Safety is basically the product of good practices at all levels of functioning i.e. design, manufacturing, maintenance and operations. Safety is compromised when the laid down standard practices are infringed. First symptoms of deterioration in the safety performance are evidenced by the increase in the number of failures. Overlooking these warning signals can be disastrous as each of these is an accident waiting to happen. Accidents and assets failures lead to hold ups, missing of schedules and disrepute amongst the customers, which affect the business adversely.

4.1 Although no technology is fail-proof, an error rate, howsoever small, being inherent in any man-machine system, reliability of the equipment is the most important factor in the efficiency and safety of a transport system. Objective of the various research organizations is to develop equipment and systems which have near zero level of failure rate. Side by side with the induction of advanced technology, it is imperative that the same is maintained properly and replacements, renewals made as and when needed. If the accidents have to be minimized, it is imperative that the equipment in use is always kept in fine fettle.

4.2 Over the last decade or so for which data is available, Indian Railways have laid special emphasis in improving health of the infrastructure and rolling stock. While steam traction, which was highly fault prone has been completely phased out from the main line operations, induction of modern technology and initiation of various measures have brought down the failures of diesel and electric locomotives on line to just about one third. Four-wheeler freight wagons which were primarily equipped with screw couplings and vacuum brake system have been almost phased out. Small population of four-wheeler tank wagons that still exists is being moved in close circuits and under surveillance. All new rolling stock is being manufactured with more efficient air brake system and existing rolling stock with adequate residual life is being retrofitted to air brake in the workshops. These steps have also brought down cases of poor brake power, train partings and coach detachments very substantially. Failures of electric traction equipment have been contained despite substantial growth through induction of modern technologies. Failures of signaling and interlocking gear have been controlled substantially by accelerated re-placement of mechanical signaling with improved systems of panel interlocking and route relay interlocking. Over the period, signaling and interlocking aids like track circuiting, block proving axle counters, and solid state technology have been inducted into the system to minimize incidence of accidents due to failures on the part of Station staff. Almost all high density routes have been provided with modern signaling equipment. Bulk of the failures in signaling gear are therefore, from the low density sections,

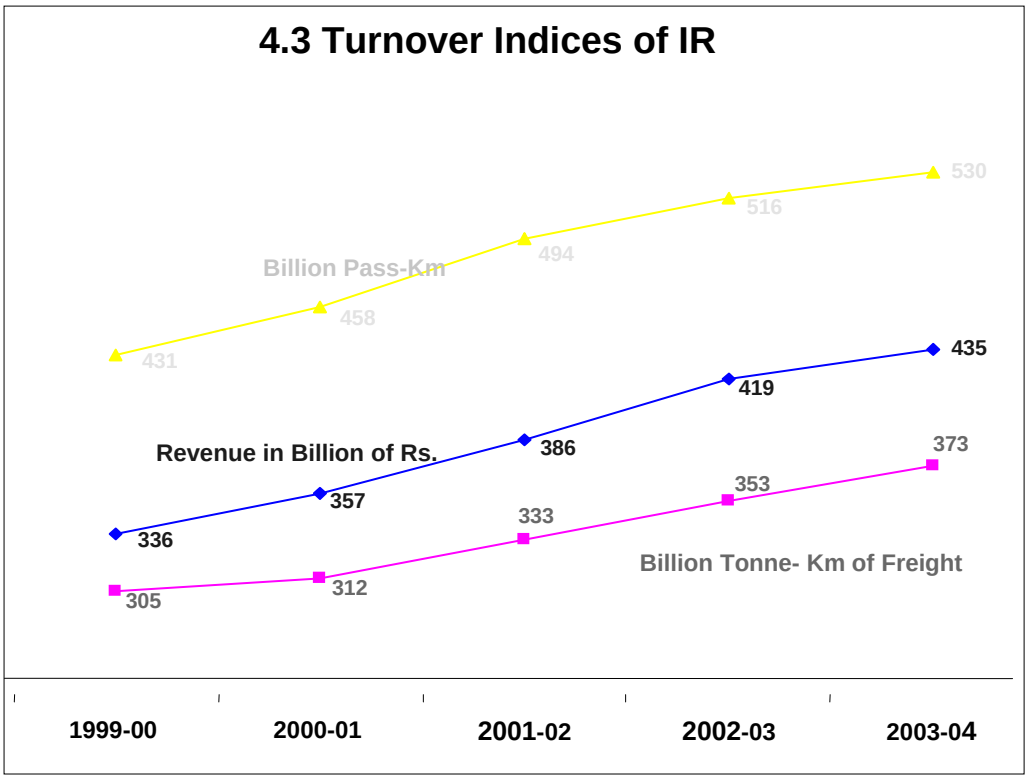
which still have mechanical semaphore signaling systems. Number of failures of track have gone up which is primarily attributable to substantial growth in the number of welds, more prone to failure, with progressive growth in long welded rails and aging effect on AT welds.

Table No. 4.2

EQUIPMENT FAILURE ON INDIAN RAILWAYS

YEAR	RAIL	Diesel Locomotives	Electric Locomotives	Wagons	Poor Brake Power	Train Parting	Coaches Detachments	OHE	Signals
91-92	7129	13609	8112	92798	3449	2142	573	1093	236289
92-93	6590	12753	7957	60983	4671	1989	579	778	206608
93-94	4184	11822	7047	71549	3314	1749	602	655	198445
94-95	2980	10220	6219	58415	3188	1583	604	382	161395
95-96	2810	8474	5891	44242	3458	1423	432	256	139730
96-97	2965	7625	4956	37150	3140	1313	361	169	125259
97-98	2672	7077	4686	23490	2367	1172	250	163	111014
98-99	3852	6347	4035	17631	1428	1135	200	144	100554
99-00	8416	5703	3806	13529	868	1034	169	166	118397
00-01	10660	5389	3685	8782	474	1081	230	503	132735
01-02	10678	4808	3211	7209	259	1013	194	309	121242
02-03	10374	4416	2976	5796	164	826	148	651	110640
03-04	8613	4301	2929	4586	60	688	156	475	117240

4.3 As a result of upgradation of the infrastructure, there has been consistent improvement in asset failures despite steady growth in volumes of business both on freight as well as passenger segments resulting in high growth in revenue as can be seen from graph 4.3:



While freight in terms of billion tonne kms grew by 21.5 %, growth in the passenger traffic over the same period has been 18.4 %. Growth in the revenue has been of the order of 31.8 %.

5.0 INDIAN RAILWAYS – In Perennial Quest for Safety

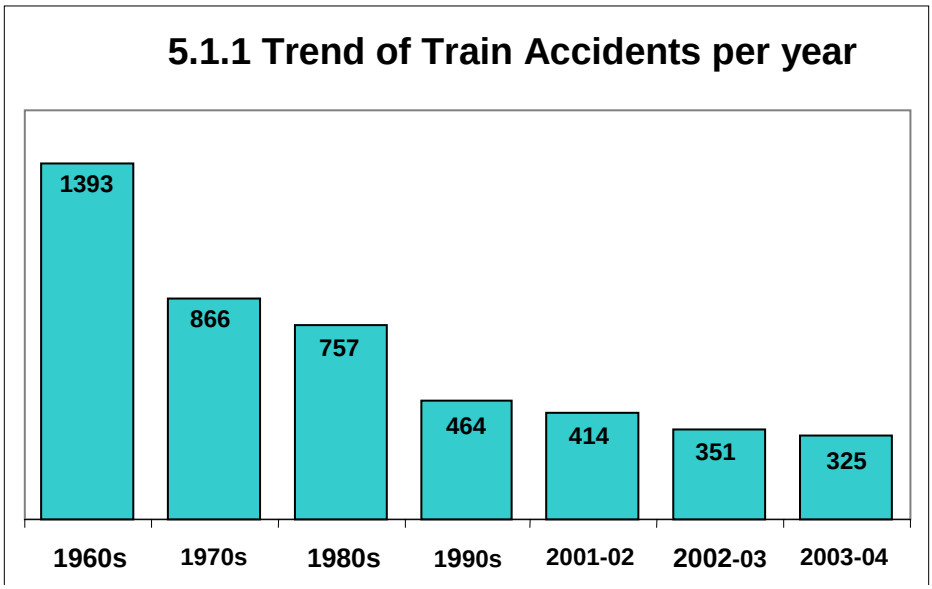
5.1 With such a massive utilisation of assets, safety is of paramount importance not only for its sake, but also for operational efficiency. Hence, the highest priority is accorded to safety and the rail mode continues to be the safest means of transportation

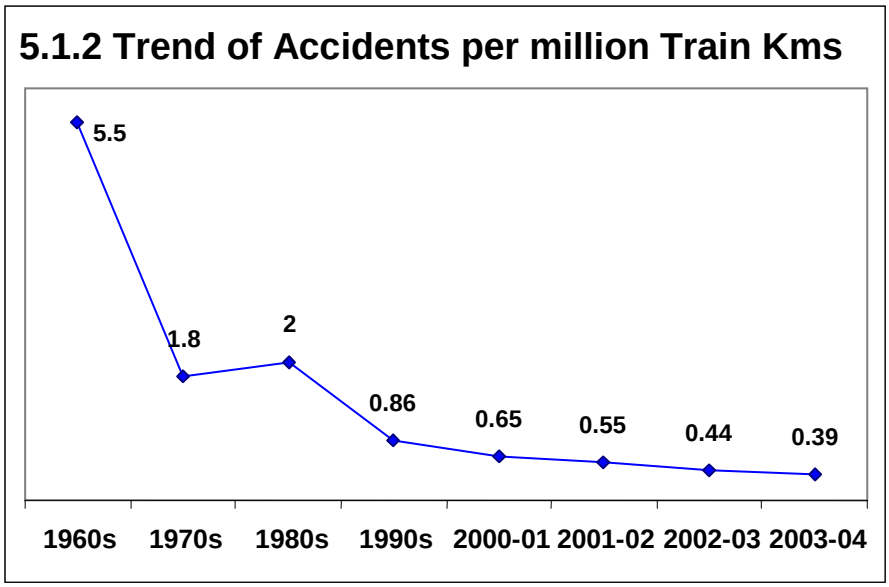
for public. Indian Railways have always considered Safety as the key business objective at all levels of management. No compromise is tolerated in Safety of Rail users and investment has been done in all possible areas which could enhance safety in working of Indian Railways. From time to time, Indian Railways have been periodically getting its safety preparedness reviewed by expert committees headed by eminent personalities, mostly retired judges/chief justice of Supreme Court of India.. Following 4 committees have scrutinised IR safety in last four decades:

- **Railway Accident Committee-1962 (Kunzru Committee)**
- **Railway Accident Inquiry Committee-1968(Wanchoo Committee)**
- **Railway Accident Inquiry Committee 1978 (Sikri Committee)**
- **Railway Safety review Committee-1998 (Khanna Committee)**

Major recommendations of first three committees have been implemented and implementation of recommendations of Khanna committee is underway.

5.1.1 As result of regular review and initiatives undertaken Safety on IR has improved considerably by way of continuous reduction in train accidents despite manifold increase in traffic as can be seen from graphs 5.1.1 & 5.1.2:





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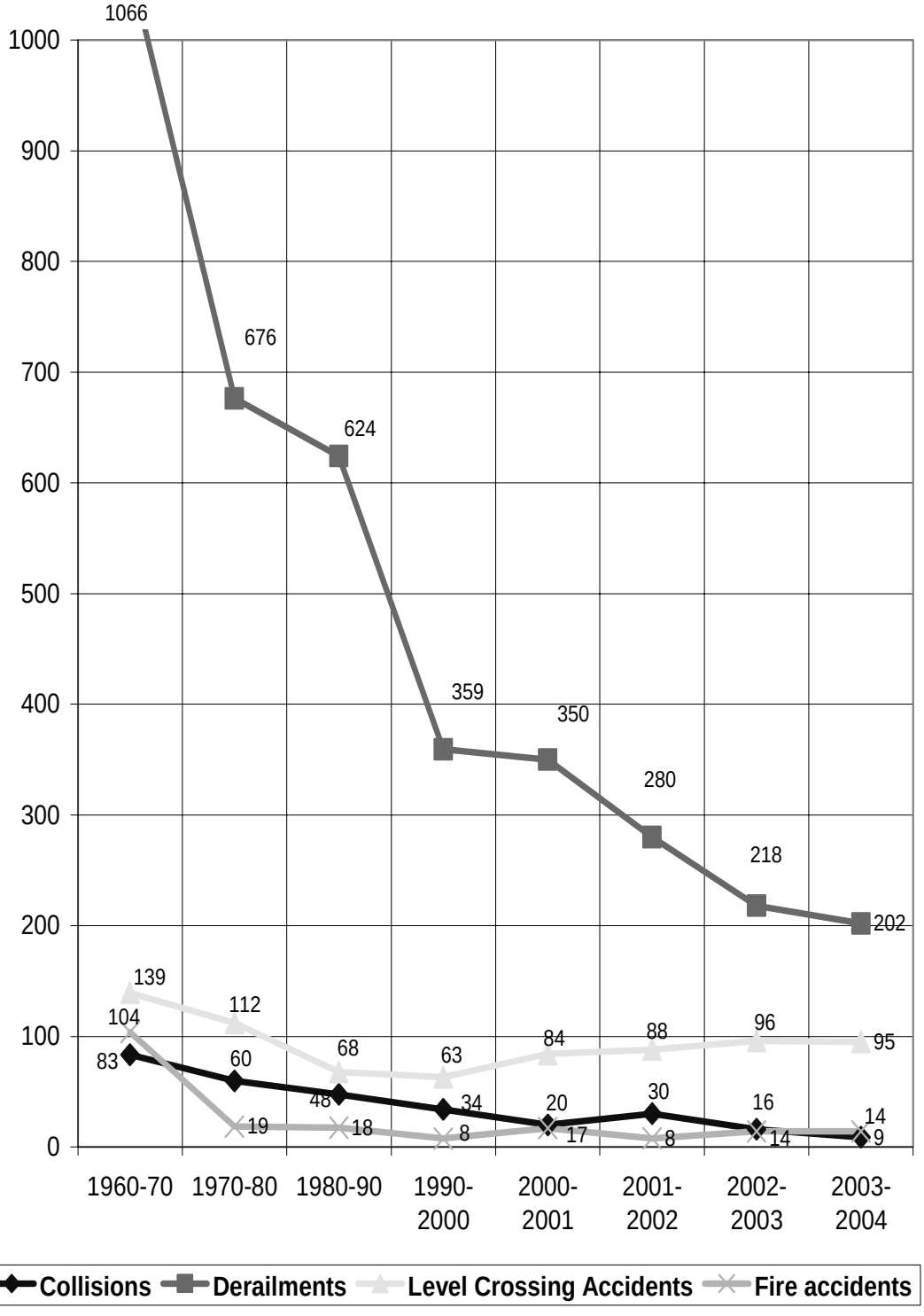
5.1.2 As can be seen from the graph 5.1.2, Accidents per million train Km., a composite index of safety, dropped sharply from 5.5 in 1960s to a figure of 0.39 in 2003-04. IR has thus taken long strides in improving safety of rail travel.

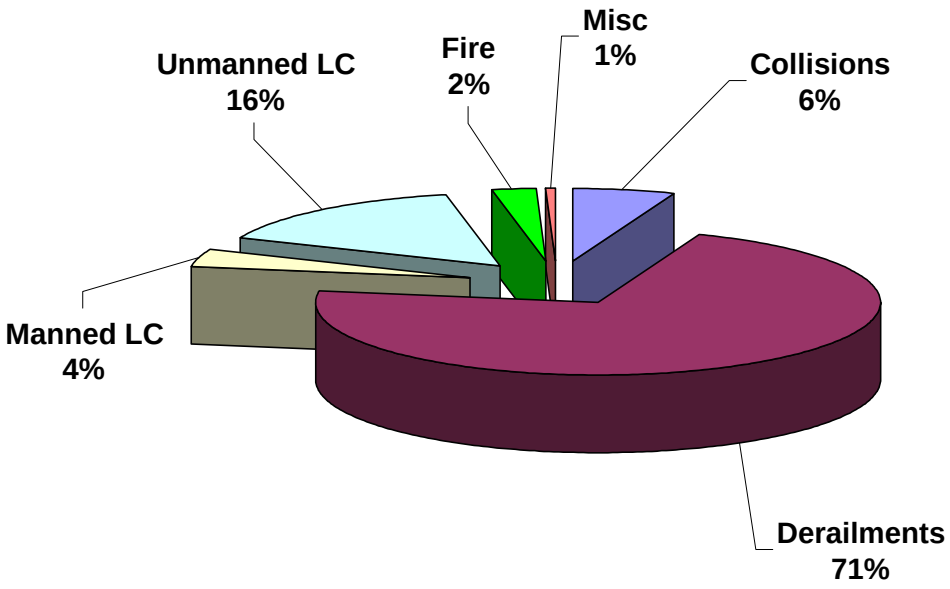
5.2 Category-wise share of consequential train accidents is important to comprehend potential hazards of different type of accidents and efforts made to contain each type separately. Looking at different categories of accidents in graph No. 5.2 , derailments which form bulk of them, have come down from 1066 per year in the sixties to 202 in 2003-04, collisions which are the most serious type have come down from 83 per year in the sixties to 9 in 2003-04. Fires in trains have also registered substantial decline from 104 to 14 per year in the period under study. Level crossing accidents have not shown much improvement. Railways have no control over the road users whose failures lead to almost all such accidents. Also, there has been phenomenal growth in the number of road vehicles in the period under study.

5.2 Type wise Accidents on IR since 1960 to 2004



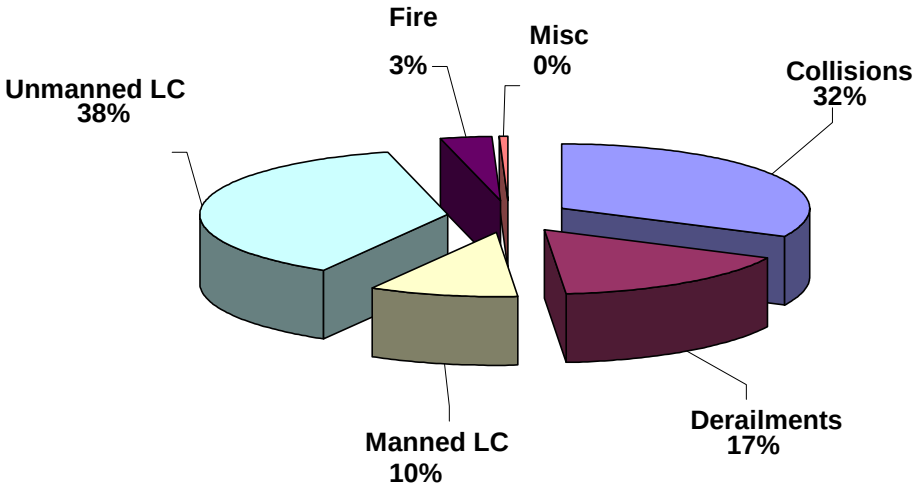
5.2.1 During the last decade (1993-94 to 2003-04) derailments were a major contributor (71%) in the total tally. These were followed by level crossing accidents (20%). Collisions and 'fire in trains' accounted for 6% and 2% respectively

5.2.1 Type wise Accidents per Year (1994-95 to 2003-04)



5.3 In any plan for prevention of accidents and minimising their impact, saving of human lives must merit highest consideration. Collisions are the most dreaded accidents for any railwayman. On Indian Railways collisions accounted for 6% of the accidents of which only 4% involved passenger carrying trains, but these resulted in 32% of the total casualties. Accidents at level crossings accounting for 20% of the total accidents on IR were responsible for 48% deaths. Derailments though constituted bulk (71%) of the train accidents, these accounted for 17% of the casualties.

5.3 Casualties in Train Accidents (1994-95 to 2003-04)



6.0 Corporate Safety Plan

With view to accelerating the pace of the safety drive Indian Railways formulated a 10-year Corporate Safety Plan, which was presented to the National Parliament in August, 2003. This plan envisages achieving following broad objectives:-

a) To achieve reduction in rate of accidents per million train kilometers from the present level of 0.44 to 0.17 by the year 2013

b) Implement measures to reduce chances of passenger fatalities substantially in consequential train accidents by 2013.

c) Focus on development of manpower through major improvements in working environment and training to reduce the accidents attributable to human failure by 40% by 2013.

d) Achieve safety culture on all fronts including maintenance depots, worksites, stations, controls etc.

e) Progressively achieve an environment of "Fail-proof" from the present "Fail-safe" system of asset failures by upgrading the systems by 2013

f) Prioritization of safety related projects

g) Implementation of accepted recommendations of Railway Safety Review Committee 1998 at an accelerated pace.

To ensure that financial constraints do not inhibit the implementation of the Plan, fund requirement for the Safety enhancement works, as outlined in the Plan, has been identified as Rs.318 billion including Rs.170 billion Special Railway Safety Fund already committed.

6.1 Collisions being worst type of accidents are sought to be completely eliminated by 2013. Various initiatives taken to minimize chances of human error that can lead to collisions, include improving brake power of the trains through progressive use of air brake system, bogey-mounted brakes, disc brakes and improvements in signalling infrastructure - 2500 of 4700 interlocked stations are fully track circuited. Auxiliary Warning System has also been installed over about 500 kms. including heavy urban area of Mumbai.

Biggest initiative underway in prevention of collisions is introduction of Anti Collision Device (ACD) developed indigenously. Anti Collision Device (ACD) works on a satellite based Global Positioning System (GPS) and Angular Deviation Count principle for identification of track lay out. It is intelligent microprocessor based equipment, consisting of a central processing unit, a global positioning system and a digital modem for communication with other ACDs. There are two types of ACD equipments viz. 'mobile ACDs' for locomotives and brakevans and 'stationary ACDs' for Stations and level crossing gates. All the ACDs interact with each other and exchange information within their radio zones upto 3 kms. and results of ACD interaction lead to a decision whether the loco ACD shall apply brakes or not.

6.2 There are about 38000 level crossings on Indian Railways, of which 16,750 are manned. All the accidents at un-manned level crossings take place on account of failure on the part of the road users as evidenced the world over. While manning does

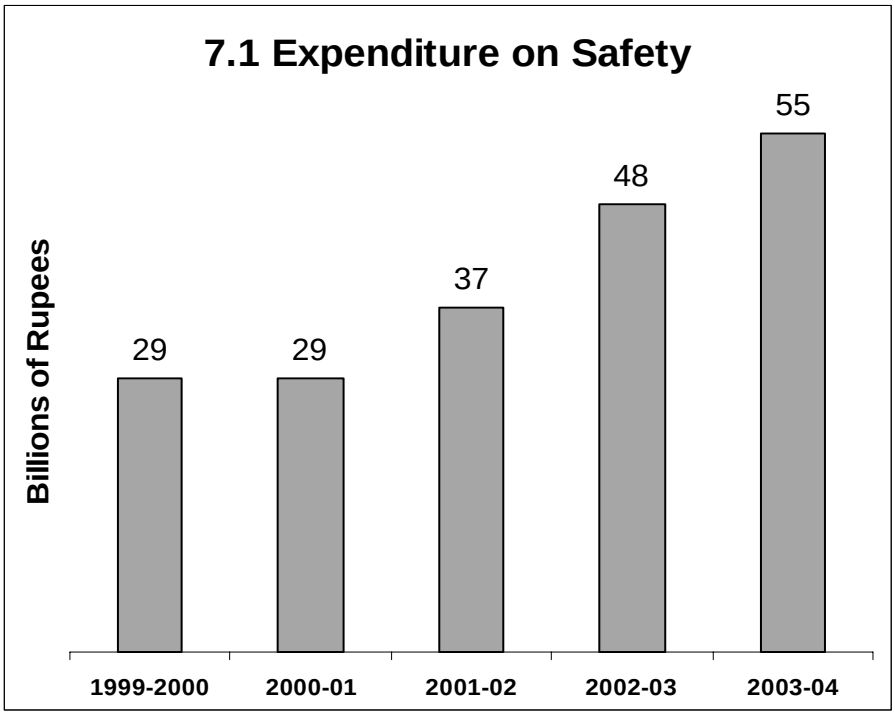
bring down the accidents, it has other limitations of causing unduly long detentions to road users apart from problems of finding resources for the purpose particularly when most of these level crossings exist in sparsely inhabited remote locations. Although massive inputs in providing grade separators (road-over-bridges/under passes), manning and interlocking with signals and telephones have been provided, the problem of negligence on the part of the road users is virtually beyond reasonable control. Since 1990-91, 203 grade separators have been provided, 1435 level crossing gates have been manned and 1747 level crossing gates have been interlocked. As most of these accidents lead to heavy casualties, involvement of Government agencies and NGOs is being resorted to educate and counsel road users.

6.3 Derailments which though account for proportionately less casualties have serious impact on operational efficiency and reliability. With the focused attention on human resource, technological upgradation and modern maintenance practices, the present level of human failures causing derailments is bound to improve substantially. With phasing out of derailment-prone and less reliable 4-wheeler tank wagons from the fleet, investments being made through SRSF/DRF into rehabilitation of track and rolling stock etc., and anticipated improvement in the skills and quality of manpower through enhancement of HRD, it is feasible to attain a substantial reduction in derailments.

6.4 Based on the above mentioned strategy the Corporate Safety Plan envisages reduction of accidents on Indian Railways by the year 2012-13 substantially. Collisions are targeted to be completely eliminated. Derailments will come down by 60% and Fire accidents by 80%. It has not been possible to project assured improvement in level crossing accidents as there is no control over the circumstances that lead to such accidents.

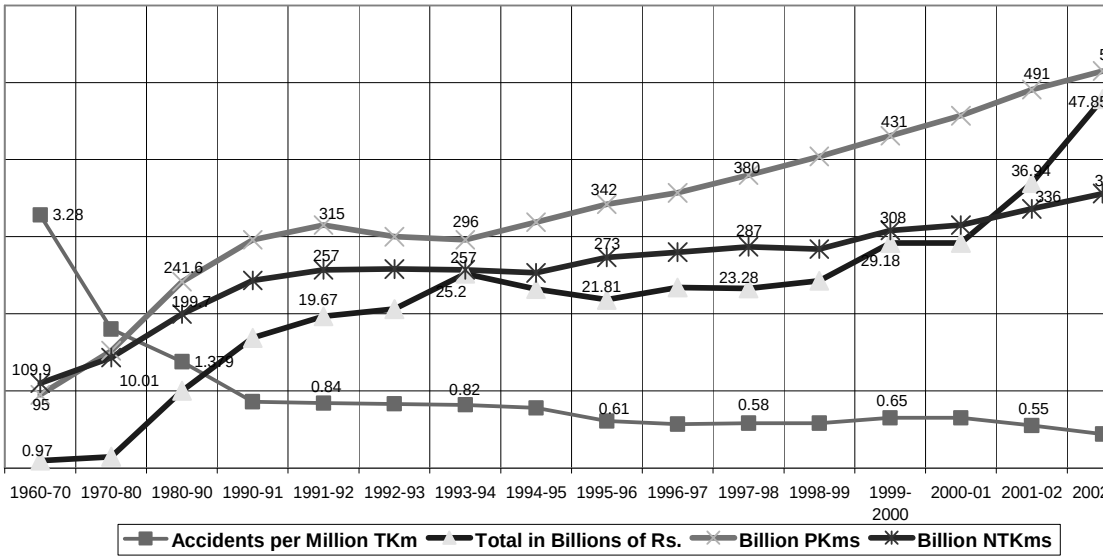
7.0 IMVESTMENT IN SAFETY IMPROVES PRODUCTIVITY

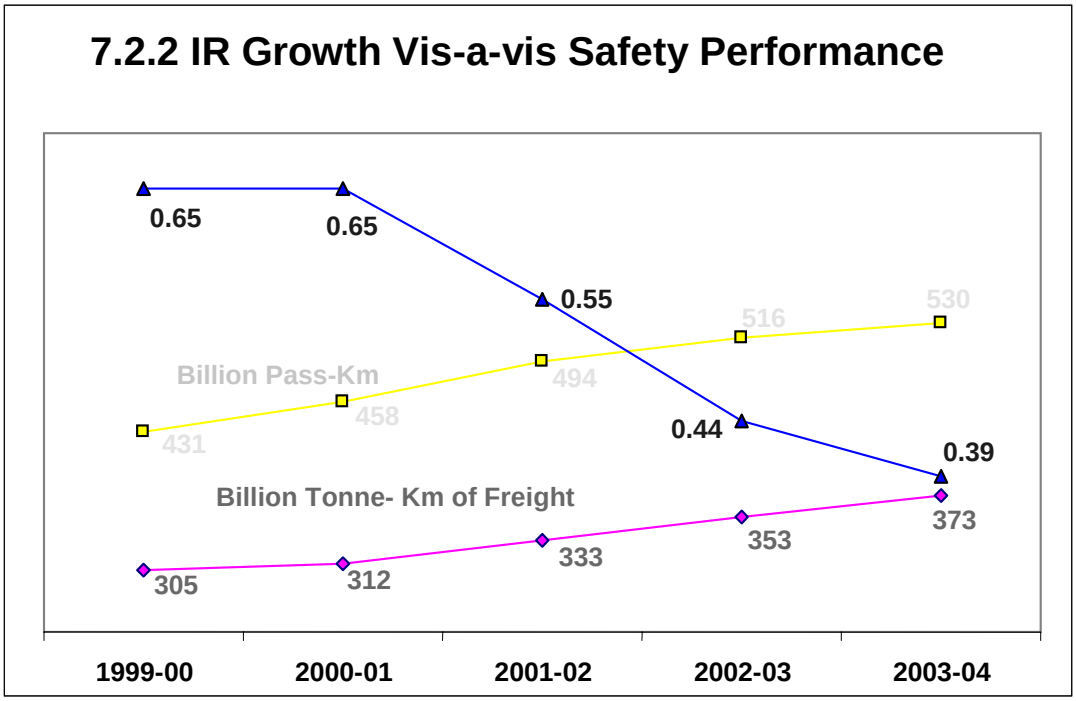
7.1 Indian Railways is placed in a peculiar situation in as much as it is not entirely free to revise fares and freight rates commensurate with the variations in cost of inputs. While rate of increase in cost is dictated by a multiplicity of factors beyond the control of the Railways, there is a strict parliamentary control over the fixation of tariff, which is generally done as an annual exercise with prior approval of Parliament. The compulsion of democratic pulls and pressures compel the Railway management to carry certain sections of traffic far below the cost of carriage resulting in the exercise of budget making a super balancing act. The special efforts have, therefore, to be made to ensure that adequate provision is made in the annual budget for replacement and renewals highlighting this inadequacy. From time to time special expedients have, therefore, to be resorted to wipe out the arrears in renewals. One such effort has been in the recent past to create Special Railway Safety Fund of Rs.170 billion giving much needed impetus to the renewal of assets and technology inputs. The level of expenditure on safety related works including renewals of assets during the last five years has more than doubled as may be seen from graph 7.1:



7.2 Safety related inputs have been provided to Indian Railways steadily apart from inputs for capacity enhancement. While these have led to Indian Railways carry higher volume of traffic from year to year, there has been gradually decline in the number of accidents as would be clear from the graph no. 7.2.1 & 7.2.2.

7.2.1 Expenditure on Safety, growth in Goods & Passenger Traffic Vis-a-Vis Accidents per Million TKm





7.3 The efficacy of safety related inputs can be illustrated from another example at micro level. Delhi-Mughalsarai is an important rail corridor on Indian Railways connecting coal mines, steel plants, and host of industrial units in the eastern part of the country to the economically rich northern India including the national capital. The section is double line, electrified equipped with modern signaling systems and deals with heavy passenger as well as freight traffic. Table 7.3 gives the yearwise expenditure on safety, traffic carried in million train kms and accidents per million train kms.

Table No. 7.3

Year	Expenditure on Safety In Crores of Rs.	Million TKm	No. of accidents	Accidents per Million TKm
1991-92	83.5	30.47	12	0.39
1992-93	76.45	30.07	22	0.73
1993-94	50.73	28.98	22	0.76
1994-95	29.61	31.88	25	0.78
1995-96	37.7	31.27	11	0.35
1996-97	36.78	31.84	21	0.66
1997-98	31.39	33.16	10	0.30
1998-99	43.83	33.46	7	0.21
1999-2000	70.71	33.83	12	0.35
2000-01	91.68	33.85	6	0.18
2001-02	22.19	34.75	12	0.35
2002-03	18.32	36.67	6	0.16
2003-04	31.24	38.04	5	0.13

Relationship of figures in different columns is not established on year to year basis. However if trends are studied over groups of years, better statistical appreciation can be perceived. With steady inputs into safety related works over these years the number of accidents has come down from an average 20 per year from 1991-92 to 94-95 to about 7 per year after 2000-01. During the subject period, there has been growth in traffic from 30.47 million train kms. in 91-92 to 38.04 million train kms. in 2003-04, representing a growth of about 25%. Number of accident per million train Kilometres has come down from 0.39 to 0.13.

8.0 Conclusion

Investment in safety is a good business proposition. No service industry can hope to grain and sustain customers if it is not concerned, rather particular, about the safety of its customers. Inputs from upgradation and maintenance of operational infrastructure have been inducted into the system on IR over the last few decades with a fair degree of regularity. Not only had the safety performance of the system improved substantially but also the productivity. Barring just a few years when IR had to defer payment of dividend, which was also made up in subsequent years, the

organization has declared profit and paid dividend regularly on the capital employed despite discharging a number of social obligations imposed on it traditionally.

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