



The Human Intervention in Train Safety on Indian Railways

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SUMMARY

The main objective of this paper is to analyze the human intervention in train safety. Consequential accidents on Indian Railways during 2005-06 to 2009-10, indicate a total of 965 cases. Out of which 832 accidents recorded on human failure i.e. 86.21 percent. This need to be curbed. Human element continues to be the major contributing factor for train accidents. Safety is important as technology advancement increasing daily. Accidents in transportation industry happen every day and given bad impact to the industry. Public transports become an alternative to the urban people, as the traffic congestion getting worse today which will results on increasing number of locomotives, as to fulfil the service demands, at the same time will increase number of train drivers, shifts, rail traffic congestion and other challenges. Another important issue will rise from this situation; safety. It is important for us to understand and investigate the performance of the train driver in order to ensure safety. Human performance and reliability become very important today when error and accident causation sometimes were blamed to the human. The overall message from this paper is that railway accident investigations provide a useful source of data on human factors issues and their impact on railway safety.

INTRODUCTION

Indian Railways are not so aggressive in launching the high speed trains; IR is running the trains with a maximum speed of 150 Km/hr ensuring safety. Indian railways have a strong net work of loyal and committed workforce. Safety of travelling public and Goods has always occupied a centre stage in Indian Railways and a Safety Action Plan directed towards continuous reduction in risk level to customers has been envisaged in the form of Corporate Safety Plan (2003-13), which advocates for inculcation of safety culture on all fronts and development of man power using simulation, advanced multimedia & interactive training aids and also by conducting regularly safety seminars.

AN OVERVIEW OF THE SAFETY PERFORMANCE ON INDIAN RAILWAYS:

IR has delivered excellent safety performance during the past few years through its multi pronged strategies to curb collisions & derailments. The safety performance during the last 5 years on IR is summarized below: -

ACCIDENTS

For statistical and analysis purposes, the accidents are classified as “Consequential accidents”, “Indicative accidents”, “Other train accidents” and “Yard accidents”. The first three categories of accidents involve trains, but the last category deals with accidents occurring at shunting, loco and marshalling yards and do not involve trains. Though both consequential and other train accidents involve trains, the difference between the two categories is based on whether the repercussions of the accident – cost of damage, period of disruption and injury to persons – exceeded the specified threshold values.

These are further categorised as follows:

- Consequential Accidents: Collisions
Fire cases
Level Crossing accidents
Derailments
Miscellaneous cases
- Indicative Accidents: Averted collisions
Breach of block rules
Signal passing at danger

A study of the consequential accidents which occurred on the Indian Railways for the five year period from 2005-06 to 2009-10 indicates a total of 965 cases. Out of these total of 965 cases, accidents recorded due to human failure is 832 cases i.e. 86.21% were attributed to human failures. Railway employees were responsible for 431 cases (44.66% of total 965 cases) and balance 401 cases (41.55% of total 965 cases) were attributed to outsiders, failure of other than Railway staff.

The accident cases attributed to failure of equipment is 32 (3.31% of total), cases recorded under sabotage are 48 (4.97% of total), accidents recorded on combination of factors are 6 (0.62% of total), cases of incidental accidents are 35(3.62% of total) and 12 cases (1.24% of total) recorded were could not be established conclusively.

Table 2: Consequential Train Accidents during 2005-06 to 2009-10

Type of Accident	2005-06	2006-07	2007-08	2008-09	2009-10
Collision	9	8	8	13	9
	3.85%	4.10%	4.12%	7.34%	5.45%
Derailments	131	96	100	85	80
	55.98%	49.23%	51.55%	48.02%	48.48%
Manned Level Crossing Gate Accidents	10	7	12	7	5
	4.27%	3.59%	6.19%	3.95%	3.03%
Unmanned Level Crossing Accidents	65	72	65	62	65
	27.78%	36.92%	33.51%	35.03%	39.39%
Fire in Train	15	4	5	3	2
	6.41%	2.05%	2.58%	1.69%	1.21%
Miscellaneous	4	8	4	7	4
	1.71%	4.10%	2.06%	3.95%	2.42%
Total	234	195	194	177	165
Accident per million Kilometers	0.28	0.23	0.22	0.2	0.17

Table 3: Causes of Accidents during 2005-06 to 2009-10

Cause	2005-06	2006-07	2007-08	2008-09	2009-10
Failure of Railway staff	120	85	87	76	63
	51.28%	43.59%	44.85%	42.94%	38.18%
Failure of other than Railway staff	86	84	81	75	75
	36.75%	43.08%	41.75%	42.37%	45.45%
Failure of equipment	8	9	9		6
	3.42%	4.62%	4.64%	0.00%	3.64%
Sabotage	6	8	7	13	14
	2.56%	4.10%	3.61%	7.34%	8.48%
Combination of factors	0	1	0	4	1
	0.00%	0.51%	0.00%	2.26%	0.61%
Incidental	11	7	8	5	4
	4.70%	3.59%	4.12%	2.82%	2.42%
Could not be established conclusively	3	1	2	4	2
	1.28%	0.51%	1.03%	2.26%	1.21%
Under Investigation	0	0	0	0	0
	0.00%	0.00%	0.00%	0.00%	0.00%
Grand Total	234	195	194	177	165

* Provisional

Rail passengers deserve safe and comfortable travel. Safety is a necessary mandate for running trains. With the untiring endeavour of the railway family to address human failure and technical deficiencies, there has been a significant reduction in the incidence of rail accidents. Even though the volume of passenger and freight traffic increased manifold, the number of consequential train accidents per million train kilometre has decreased from 0.41 in 2003-04 to 0.13 at the end of 2011-12. The target of bringing this figure to 0.17 by 2012-13, stipulated under the corporate safety plan introduced since 2003 was surpassed in the year 2011-12 itself. Railways strive to work towards a zero accident situation.

The Committees headed by Dr. Anil Kakodkar and Sh. Sam Pitroda have laid down a roadmap for improving safety and bringing about modernisation of Railways. While some of the recommendations of the two Committees have been taken up for implementation, the rest are under active consideration of the Ministry.

HIGHLIGHTS OF THE RAILWAY BUDGET 2013-14 PARTICULARLY IN TERMS OF SAFETY

- Making a corporate safety plan for a ten year period (2014-2024)
- Elimination of 10,797 level crossings during the 12th Plan and no addition of new LC's to the IR system henceforth.
- Introduction of Train Protection Warning System (TPWS) on Automatic Signaling Systems.
- Rigorous trials of the indigenously developed Train Collision Avoidance System.
- Using 60kg rails, 260 meter long welded rail panels and improved flash butt welding technology.

- Introduction of Self Propelled Accident relief Trains (SPART) with speed potential of 160/200 Kmph on trial basis with a view to putting in place a fast and reliable disaster management system.
- Introduction of crash worthy LHB coaches with anti-climb feature.
- Rehabilitation of identified 17 distressed bridges over next one year.
- Provision of comprehensive fire and smoke detection systems.
- Provision of portable fire extinguishers in Guard-cum-Brake Vans, AC Coaches and Pantry Cars in all trains.
- Use of fire retardant furnishing materials in coaches.
- Four companies women RPF personnel set up and another 8 to be set up to strengthen the security of rail passengers, especially women passengers.
- Recruitment of RPF with 10% vacancies reserved for women.
- Five fellowships in national universities to be instituted to motivate students to study and undertake research on IR related issues at M.Phil and Ph.D. levels.
- Setting up of a chair at TERI promoting railway related research to reduce carbon footprint.

WHY ERRORS TAKES PLACE

- Bench marking system in railways to decide the number of staff required for train operation ignored the quality of work
- Economy and efficiency override the main aspect of Safety in the Train Operations
- Optimum utilization of crews and thereby extended run increased the work load
- Ergonomical issues of loco pilot
- SPADs (Signal passing at danger) are the major causes for collisions in railways
- Physical /Mental Stress/Fatigue of loco pilots lead to passing signal at danger (SPAD)
- High Attrition rate of Loco Pilots and that lead to high turnover of Loco Pilots in the railway industry lead to shortage of hands in safety category staff
- Communication Problems
- Inadequate level of training of railway staff
- Applying the Short-cut methods by the staff
- Who went wrong approach rather than what went wrong approach

Benchmarking

In recent years, during annual cadre review, bench mark system is used as basic principle to decide the number of staff required for train operation. In which the quality of work is totally ignored. The less number of staff utilized in one of the areas of Indian Railways will be applied to all other areas blindly without assessing the actual requirement. Result of which, even in safety categories like station masters, loco running staff etc. required leave reserve and trainee

reserves are not maintained. Despite mandatory Refresher Courses, Pre Promotion Courses, Loco Running Staff like categories have to undergo training on various locomotives. Hence minimum 10% trainee reserve must be maintained apart from leave reserve. Required man power should be assessed as and when new trains are introduced. Any lapse in Man Power Planning will lead to human failure.

On the name of economy and optimum utilization of crews

In recent days, the crew links of mail and express trains are tightened in the name of optimum utilization of crews and thereby extended run increased the work load. The reduction of rest period in between two spells of duties, less availability in the head quarters/home causes accumulated fatigue among the drivers causes micro sleep. Lack of sleep due to continuous night duties lead to cumulative sleep deficit. To overcome the effect of these night shifts require at least two days rest and should avoid an early shift on their return to work.

Number of respondents has opined that on the pretext of implementing bench marking lot of pressure is being imposed on workmen. Respondents were of the opinion that as they are working under stress and other compulsions there is every possibility of committing serious errors.

Hours of Employment

Hours of Employment Regulation is part and parcel of the Indian Railway Act. All railway employees are guided by these Rules in the subject of their hours of duty and rest. Under the pretext of the exceptional of work, employees especially field staff in whose hands are reposed the safety of the trains are forced to work even beyond 12/16 hours mainly due to short of hands. Drivers, Guards, Station Masters, Cabin men, etc are some of the categories to whom working even beyond 12/16 hours is nothing unusual. Various Committees were formed to go into the Railway Accidents whenever major rail accident occurs and these committees have laid due and adequate emphasis that a limit must and should be laid in regard to maximum limit of working hours to Loco Running Staff.

Ergonomical issues of Loco Pilots (ergonomic design of loco cabs)

A Driver needs higher degree of alertness and concentration throughout the journey as he is running a train in higher speeds on track where sudden obstruction is very much a possibility and the train has no chance to stop suddenly like road vehicles. Inadequately maintained and designed driving cabs with louder noise, uncomfortable seating arrangement, non-functional safety equipments like speedometer, wiper, insufficient focusing of head light etc., are a sufficient distraction. Mainly absence of toilet in locomotive (not even Urinal) make the crew to control nature's call for longer time and this will result in distraction of Driver is anybody's imagination.

The uniformity of driving equipments like A9, SA9, Throttle and Speedometers and the side of driving control stand develops a reflex among the Loco Pilots and if disturbed the reflex action is also disturbed. A Loco Pilot regularly driving right hand side has an assessment of distance of sighting the signals first but when driving from left occasionally the first sighting point and distance is lost and the reflex action also is delayed which is a safety hazard. Both horns are to be located above the headlight at extreme ends of the loco to avoid noise pollution in the driving cab and rebound echo sound with coaches. The seats with back rests should be fitted in position such as the A9, SA9 are reachable for operation from driving seat like a car. The long hood working of WDP4 locos should be avoided as there is no visibility.

Signal Passing at Danger

In recent accidents, SPADs are the major causes for collisions. Whenever there is SPAD a case Railway Administration widely spreads “the drivers were well within their stipulated duty hours and had proper rest before they commenced duty. On Indian Railways, all trains other than the suburban services (diesel or electrical multiple units) are provided with a driver and an assistant, which greatly reduces the chances of the driver passing a signal at danger due to carelessness or lapse of concentration.”

But there have been cases across the world where the drivers under stress or other compulsions have committed serious errors. In the case of the train crew, one wonders what is that makes the drivers pass a signal at danger. As it is quite obvious that locomotive crew very well know that they may themselves be the first victim of their own mistakes and there cannot be a greater deterrent than the fear of losing one's own life, they figure in a quite few accidents. It stands to a reason therefore that a driver would not consciously pass a signal at danger and one is lead to conclude that there must be some other factors beyond his control when he does so.

“Who went wrong approach” rather than “what went wrong approach” of Railways across the world

In Railways across the world accident enquiry system ends with “Who went wrong” approach and instead it should be “What went wrong” approach. Human Failure may include absent mindedness, forgetfulness, an error of judgment, or drowsiness (due to audio-monotony of the sounds of the running train or other similar factors); at times it may be momentary mental blankness or fatigue due to inadequate rest, in yet other cases it may be mental anxiety of some kind, possibly arising from family worries or other domestic problems of stresses and tensions on the mind on account of the fast changing matrix of their living conditions.

Short-cut methods

Short-cut methods are generally resorted to by the train operating staff mainly for the three following reasons or a combination of these:

- to save time
- to avoid complicated procedures
- to avoid physical work

With a great deal of importance being attached to punctual running of trains and statistics being monitored on various causes leading to loss of punctuality to train services, there is a general tendency to resort to short-cut methods to save time. Such short-cut methods are predominantly observed when there is an equipment failure and following the laid down procedures for train operation under such circumstances involve more time.

Communication problems

India is a large country with a wide variation in regional languages and 22 languages have been recognized by the Indian constitution. Railways being under the Central Government, the employees from a certain region may get posted to work at a region where the local language is entirely different. This person may not even be able to have basic communication with the locals, let alone have meaningful conversations or dialogues. When such persons have to work as Station masters or Loco drivers, there is always a chance of improper verbal communication affecting safety of train operations. Even though *Hindi* and English are used as the common link languages, there could still be problems in communication since most of the staff working as points-men, level crossing gatekeepers etc., are from the local areas with limited educational qualifications having knowledge of the local language alone.

Even in cases where there is no language problem, there have been cases of miscommunication between staff directly involved in train operations. Such staff includes controllers, station masters, level crossing gatekeepers, and shunting staff. The problem gets pronounced when there is an equipment failure when verbal communication and clear understanding by both the parties on either end becomes absolutely essential for safe operation of train services. During December 2004, there was a head-on collision between an express and a passenger train killing more than 30 persons on the Northern Railway. The cause has been identified as miscommunication between two station masters in granting/taking line clear for trains during a block instrument failure caused due to a cut in the communication cable.

Voice recorders have recently been provided to record conversation between station masters and section controllers. These will largely help in analysing failures after the damage has been created, rather than prevent the damage itself. To a limited this will help in improving safety, since the concerned persons know that their conversations are getting recorded and hence will tend to observe the set procedures and rules more carefully.

High Attrition rate of Loco Pilots:

The attrition rate is very high in safety category post like Loco pilots, being the present Y-generation is more ambitious in career and also the lucrative jobs in the market, competitive pay packages attract the Y-generation to leave the railways. Majority ALPs leaving are the Engineering Graduates. The reason for high attrition is the nature of work in terms of unusual duty hours and lacking work-life balance. If we provide a good job description to ALPs we can retain them. That's the reason Indian railways are preferring to take only ITI candidates as ALPs. But here due to lack of technological knowledge possessing by this ITI qualified ALPs railways is facing trouble in training them. Abundant engineering graduates available in the Indian job market. The knowledge of ITI qualification to loco pilot is not sufficient to meet the requirements in the technological knowledge point of view. To meet the knowledge requirements in terms of technology, it is better to take only engineering Graduates as Assistant loco pilots, so that they can cope-up to the latest technologies and they can be better utilised for the future requirements like running the high speed trains by ensuring safety.

ISSUES OF HUMAN ELEMENT (LOCO PILOT) IN INDIAN RAILWAYS

Job Description of Indian Loco- Pilots: (Work to be performed):

The Loco Pilot category is directly responsible for the running of trains. Running duties demand continued attention and alertness. The element of Stress combined with uncertain hours of work entailed in the performance of running duties over long periods of time tend to have a deleterious psychosomatic effect on their health. There is a slowing down of reflexes with the passage of time making them vulnerable to operational lapses.

Loco Pilots need to possess the following skills:

- Good mechanical knowledge.
- Good hands-eye co-ordination.
- The ability to concentrate for long periods of time.
- Physical stamina.
- Good memory.
- Flexibility.
- Excellent awareness of health and safety regulations and emergency procedures.
- A responsible attitude.
- Good judgment and decision-making skills.
- Reliability.

Responsibilities of loco pilots:

The job of a Railway Driver demands hard work and great presence of mind along with courage to handle diverse conditions. For this one should have discipline, patience, responsibility, punctuality, commitment, courage and above all self-confidence. The job requires lots of hard work, stamina, alertness of mind, adaptability to follow difficult time schedules too. But the main and remarkable, highly appreciable role of Railway drivers is the only who works with full honesty, in day & night, in heavy cold, hot & Rainy weather

The typical tasks undertaken by Loco Pilots are:

- Before starting the train/locomotive read safety circulars, safety bulletin, technical circulars, driver instruction, caution order, and divisional circulars.
- Before starting the train/locomotive read the caution order carefully in which sectional track work progress with temporary speed restriction is mention.
- Before starting the train/locomotive check the repair book (log book) of loco about any remark for any locomotive trouble.
- Before starting the train/locomotive check the oil level (diesel, lube oil, compressor oil in case of diesel locomotive and transformer oil, GR oil, compressor oil, exhaustor oil in case of electric locomotive) and time to time during the run (One time during about 100 kilometers, it depends on drivers' mind).
- After coupling with the train check brake pipe pressure continuity test with guard.
- After getting departure signal, loco pilot must start the train and run the train as per the aspect of station signals.
- Loco pilot must have sharp look out. While on run he must observe all permanent & temporary speed restrictions.
- Loco pilot must always ready to notice:-
 - Any track defect through jerk or lurch,
 - Any unusual with self or others train. He must be mentally prepared for precautionary remedies as per the general & subsidiary rules and accident manual directives. It itself is sufficient to mental stress of loco pilots.
- Checking the engine and general state of the train prior to starting each journey.
- Maintaining an awareness of track conditions and weather conditions.

- Following signals (Averagely there are signals after every 1.5 Kilometer distance).
- Following safety regulations at all times.
- Keeping the train under control and at the appropriate speed at all times.
- Keeping control of instruments including brakes.
- Maintaining an awareness of emergency procedures.

- Stopping the train at the appropriate stops on each schedule.
- Keeping a record of any Problems.

Cab Conditions:

The heavy noise, dust pollution, excess heat, high voltage electricity in the electric locomotive and diesel smell in the diesel locomotive are contributing to early fatigue to the crew.

- **Noise** - The noise level in a diesel locomotive is about more than 100 decibels which is 25 decibels more than **maximum allowed limit of 75 decibels by the Industrial Pollution Control Board**. The heat, diesel smell, noise from the engine room comes to the driving cab as the doors in the driving cab are not designed sound proof. To overcome this problem the locomotive cab has to be air-conditioned so that fatigue will not attack the drivers and they can concentrate on their duties properly and ensure safety of trains. (*FIRE Quarterly Magazine*, Aug.2012).
- **Temperature** - Due to heavy night duty feeling cold or rain or hot sun in summer when normal temperature up to 46 to 48 degree, in locomotive, temperature increases up to temperature 54 to 56 degree centigrade, i.e. adverse weather conditions. **Comfortable Room Temp. Considered 25 degree centigrade**. Driver's efficiency is bound to suffer if the temperature of cab is either too low or too high (*FIRE Quarterly Magazine*, Aug.2012).
- Pollution and high voltage electricity. It has an adverse impact on the physical and mental health of drivers.
- Bad wiper, not properly functioning during rainy and foggy season, so poor visibility during raining and foggy.
- No voice recorders in the cab for recording the shortcomings and calling out of signals (just like black box in flights).
- Loco-Pilot seat quality poor (normally without back rest provision).
- No natural calls facilities (no toilets available).
- Sometimes After repairing chairs are in bad conditions, fan and lights are not properly working. It means there are no more/sufficient spare parts available.
- Poor lighting (without proper lighting, eye damage will occur. it is essential to the health, safety and efficiency of drivers).
- Commonly no air-conditioning.
- In diesel locomotive, seat position is very bad. Track not seen properly while loco pilot seated. Therefore he performs his duty always in standing position.

Nature of Duty of Loco Pilots:

Critical Duty of Loco Pilots:

- The introduction of Shadabdi/Rajdhani/Duranto Express trains forces the Loco Pilot(Mail) to run between the stations even without a scheduled stopping for a minute for longer distance about 400 Kms at a stretch.

Case Study.1: When loco pilot working on high speed train, he have to work for 400 to 500 km at a stretch without any halt. During the run he cannot even release his urinal pressure. In NAGPUR DIVISION, when loco pilots booked to work RAJDHANI EXPRESS ex Nagpur to Bhopal, there are 265 signals and the running time given is 330 minutes. It means averagely after every 1 minute & 22 seconds loco pilots must ready to observe signal. There are 296 gates (manned/ unmanned) in the same section. It means after every 1 minutes & 11 seconds loco pilot must be prepared to observe gates condition. In addition to this loco pilot must also observe self train track, over head equipments as well as adjacent track and check the train if passing on adjacent track. He must also sharp attention on his locomotive performance. Loco pilot must take learning of road and signals with their proper locations, stations halts, level crossing gates (signaled and non- signaled gates, manned or unmanned gates).

- Following signals (Averagely there are signals after every 1.5 Kilometer distance and gates averagely after every 1.3 km). **If he ignores any red signal and crossed it (while any accidents occurred or not), Railway takes very strict action against him normally removal from service.**
- Moreover the provision of modern gadgets in the locomotive like VCD, TPWS, ACD Loco Pilot (Mail) needs to pay sustained concentration on them apart from driving. The sustained attention of Loco Pilot (Mail) has increased manifold as the speed/load increases with changes taken place in signaling system like double distance, Automatic Signaling System and IB signals.

Case Study.2 Rear-end Collision of Train No.3148 Dn Uttar Banga Express with Train No.3404 Dn Vanachal Express at Sainthia Station of Bardhaman – Rampurhat Station of Howrah Division of Eastern Railway on 19-07-2010.

Cause of Accident: As per findings of CRS in the inquiry report, the accident was caused due to (a) failure of train crew of 3148 Dn to control the train on the face of home signal at 'ON' position and overshooting it at high speed and (b) the failure of the cabin master of west Cabin of Sainthia to isolate the occupied line by setting the points.

- Passengers died -66 Injured -90, LP and ALP of 3148 Dn had expired in the accident, the cabin master was removed from service, and the Guard of 3148 Dn was suspended.

Case Study.3: Rear-end collision of 16591 Hubli – Bangalore City Hampi Express with a Stationary Goods Train at Penukonda Station of Bangalore Division of South Western Rly on 22-05-2012

Cause of Accident: As per the findings of CRS/Southern circle, the accident was caused due to train no.16591 express passing the Home signal of Penukonda station at 'danger' and due to non-setting of point no.63 on Road-2 against the line which was occupied by MNGT 'N' Goods train. This accident is classified under the category of 'Failure of Railway Staff'.

- Persons died -25, injured -54.
- Primary responsibility: LP and ALP/mail of 16591/Exp and SM/Penukonda

- Loco pilot must have sharp look out. While on run he must observe all permanent & temporary speed restrictions.
- There is no upper limit in the railways rulebook on the number of night duties to be done by the railways driver. Despite data from major rail accidents, pointed to the fact that most mishaps take place between early morning and late night. The weekly rest provisions for Railways drivers are vague. Faced with a severe staff shortage(now 60,000 loco drivers and there is 20% vacancy in the 82,000 sanctioned posts), coupled with the fact that most trains run also during night hours, railways is being forced to put most of its drivers on night duty for long periods. (www.indian railway driver information, 2012).

Case Study.4: For instance, the Railways driver roster for Hampi Express which collided with a stationary train suggests that the driver had run 23 trains in 19 days of which 12 were full-night, three half-night and seven full-day duties. This means the driver had undisturbed sleep is only seven days in the past three weeks. They (Railway's Drivers) are not allowed to break for food, refreshment or answer nature's call during duty hours. Duty of loco pilots is very much strenuous (www.indian railway driver information, 2012).

Case Study.5: The Chennai Beach-Vellore Electric Multiple Unit (EMU) Train No 66017 hit the Arakkonam-Katpadi passenger Train No 56007, waiting for a signal at the Chitheri station around 9.30 p.m. Tuesday dated 13th Sep 2011. The accident happens on Arakkonam – Katpadi Section of Chennai Division of South Eastern Railway.

Cause of accident: Southern Railway General Manager said the MEMU driver had apparently ignored the signal and speed restrictions.

Case Study.6: In the recent SPAD cases, it has been observed that Drivers who have been inducted departmentally and who are performing duty after availing head quarter rest are more prone to commit SPAD. The inquiry revealed that the loco pilot had remained absent for about a month and that (On the duty day when he commits SPAD) was his first trip after joining duty. It has been observed that drivers who are performing duty after availing head quarter rest or joining after prolonged leave or absence are prone to commit SPAD.



- While operating Electric locomotives, they perform his duty in always standing position, because visibility effected due to bad seat position. Track not seen properly in seating conditions. Due to high speed and continuous running train Loco-Pilots are extremely tired. Their eyes and Heart are more affected.

Ergonomical/health/work-life balance/well-being issues of loco pilots

- Irregularities in lunch and dinner
- Irregularities in sleep
- Disturbed sleep
- Sleep disorder
- Work under pollution and high voltage electricity
- Due to heavy night duty feeling cold or rain or hot sun in summer when normal temperature up to 46 to 48 degree, in locomotive, temperature increases up to temperature 54 to 56 degree centigrade, i.e. adverse weather conditions.
- Noise level more than 100 decibels
- Insufficient facilities in running room
- Unhygienic water and meal atmosphere
- Suffer from stress related disease (hypertension, diabetes, frequent headaches etc.)
- No any calendar day rest provision, so that they may fulfill their family and social obligations.
- All their personal work has to be done by availing leave, or between short spells in between duties, which creates mental agony, losing concentration in running duties (*IRE Quarterly Magazine*, Aug.2012).
- Do not spend sufficient time daily with his family members (including wife, child/children, and older parents).
- Always miss out quality time with his family and friends because of nature of work.

DEPENDENCE ON HUMAN ELEMENT

- Limited Financial Resources
- Contract Works Executed by Outside Agencies
- Equipment Failures
- Level Crossings
- Contribution of Passengers and Others
- Lack of awareness of consequences

Limited Financial Resources

One of the primary and major reasons for dependence on human element in train operations is limited financial resources and technology. The Railways have to necessarily meet the bill for wages, operating expenses, pension obligations, materials for maintenance of assets dividend liabilities etc., and at the same time provide for replacement of over-aged assets. Next priority is the funding for on-going/new projects. With the Indian Railways being fully under the control of the Government and funding cleared by the Parliament, demands from various quarters will need to be accommodated while these projects are approved. Most of the advanced technologies for reducing dependence on human element will need to be imported, funds for which are limited. The major revenue to IR is getting from Goods trains. Goods trains are golden trains in IR. The immediate competitor to railways in passenger segment is buses running by the state transport corporations. It is observed that there is huge gap between the railway fares and bus fares. It is observed that IR is increasing the fares of AC Chair Car, 1st AC, 2nd AC, 3rd AC and Non AC reservation category. It should increase the fares in the intercity like expresses, superfast passengers and also in local trains (which is the large revenue segment area) to meet the safety expenditure. It is better to run the railways like joint sector, so that IR can also go for FDIs. And at the same time some more non-core areas in IR are urgently need to be outsourced. But outsourcing the core safety areas is again a hazard to safety issues.

Contract Works Executed by Outside Agencies

Many works associated with the running tracks are getting executed by outside agencies through works contracts. These include works connected with track doubling, electrification, signalling and telecommunication etc. Most of the works are further sub-contracted by the main contractors. Many of the contract staff engaged for such works have limited knowledge or understanding of the railway safety related precautions. Even after incorporating sufficient clauses in the contract agreements to ensure protection of running trains, if adequate level of supervision from the Railways' side is not provided, there could be lapses and careless working which could endanger the safety of trains.

Level Crossings

Automatic horns should be provided at the **gate and stations** and these horns should be made operated by sensors, so that we effectively avoid the accidents at the gate and stations. The sound frequency of horns of locomotive should also be altered by taking the advices from sound engineers.

Lack of awareness of the consequences

Generally such cases are associated with persons other than Railway staff, who are not fully aware of the consequences of certain acts, which they may not consider as a serious safety hazard. There

have been cases of Railway staff also creating accidents through their acts without realising the consequences.

ISSUES TO ADDRESS TO ELIMINATE HUMAN ERRORS

- Technology Up- gradation to minimise human intervention in train safety
- Safety related voluntary retirement scheme should be encouraged
- Restrict the crew to work extended hours and ensure safety
- Advanced technologies should not increase stress and strain on loco pilots
- To ensure safe train working, there should not be more than two consecutive nights working with an interval of 2 days between them.
- The duty hours of Mail / Express/Pass crews/Motorman should be confined to 6 hours. There should be a break of at least one hour for Motorman in a spell of 6 hours duty.
- The duty hours of the freight crew excluding the time allowed i.e. 30 minutes ON/OFF for preparatory and complementary work shall be 7 hrs.
- Weekly limit of 40 hours for Loco Running Staff.

Technology Up-gradation

One way of controlling the human element in accidents is to eliminate the need for human intervention in train operations and bring in more of automation. Quite a few such steps have been taken on Indian Railways and several more have been identified for implementation in a phased manner. Some of the items which are under trial/development prior to their large scale adoption are mentioned below:

- Train Protection and Warning System (TPWS)
- Train Actuated Warning Device (TAWD)
- Anti-Collision Device (ACD)
- Block Proving Axle Counters (BPAC)
- Vigilance Control Device (VCD)

With more sophisticated equipments and automation coming in, there is also a need for the following parallel activities to make these works effectively and reliably:

- Proper technical specifications, vendor development and quality control for better reliability of the equipments.
- Proper systems of periodic and break -down maintenance attention for these items.

- Adequate training facilities for the staff engaged in operation and maintenance of the equipments.

Safety related voluntary retirement scheme should be encouraged

The Railway Board themselves states that why Safety related Voluntary Retirement Scheme introduced to Running Staff. The reasons quoted reads as - The scheme will to safety categories viz, Drivers (excluding Shunters) and Gangmen whose working has a critical bearing on safety of train operations and track maintenance. The scheme has been framed on the consideration that with advancing age, the physical fitness and reflexes of staff of these categories deteriorates, thereby causing a safety hazard.

Restrict the crew to work extended hours and ensure safety

And sometimes it is unavoidable situation, because in the middle of the section it is difficult to arrange the relief crew, due to the non-availability of roadway to reach the station. Such situation compelled the crew to work extended hours. Of course the interest of the crew (loco pilot) is also there in some cases in continuing the long hours of duty due to the monetary benefit getting in the form of over time (OT) allowance. Here rail industry has to take the appropriate steps and avoid the extended hours in the interest of public safety.

Advanced technologies should not increase stress and strain on loco pilots

There is a hypothesis that the technological up-gradation in Railway has lessened the work of Railway Staff generally. But in no way this modernization has helped the Loco Running Staff and reduced their work load and responsibility attached to the job but increases it many fold. The Loco Pilots managing super fast trains at a speed ranging from 120 to 160 kmph require very quick reflexes than earlier. Added to these, most stringent safety norms and procedures also increase the work load considerably. Therefore modernization in Railways has in no way lessened the work load and responsibility of Loco running staff rather skill work, stress and strain has increased manifold than earlier; and more modernization is going to be introduced. A reasonable job evaluation ought to be undertaken to assess increase in work, stress and strain.

VARIOUS STUDIES AND REPORTS REGARDING NIGHT DUTIES:

Psycho-Technology on Indian Railways – RDSO, Ministry of Railways, Lucknow:

“The element of stress or fatigue caused to Mail Express Drivers due to high speed and hours of duty was investigated in an experimental study. The 39 findings indicate that mid night – early morning time zone produces greatest stress on Drivers as their mental alertness shown slackening during these hours. The working on the Second Consecutive night has been found to further dampen the mental alertness, making Drivers vulnerable to operational lapses”.

Encyclopedia of Social Science, Pfizer Ltd., (V) its workmen (SC) LLJ 1963. I page 543:

“Persons working during day light hours is normal and those who are working during nights is abnormal”.

Conclusion

Human element continues to be the major contributing factor for train accidents. In spite of several new initiatives and efforts, scope exists in many areas of train operation on Indian Railways where new technology and automation could reduce dependence on Human element. It is observed from the results of the study that there is a positive and significant association between working unusual hours by pilots and its impact on the health and work life balance of loco pilots. In addition, the results of this study reveal that restless and working unusual hours significantly affect the employees' health and well being. Nevertheless training, providing work-life balance to safety category staff will be the main area of concentration for reducing accidents due to Human failure. The financial constraints shouldn't be an impediment to grant duty hours, rest and periodical rest not only for the benefit of the worker but for the safety in train operation and public good. Railways trying to solve these serious issues, but it is still continuing and more effort needed. Work life-balance of a railway driver is most important for the safe journey of passengers. So that, Crores of passengers reach their destination safely.

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