5.1 Vision 2020

The process of drafting Vision 2020 is well underway. We need to think of a structure for the document that would align our objectives with the appropriate strategies on people, structure, technology, processes, communication and growth to create the requisite synergy for shifting the orbit of the department altogether. It is time to deliberate upon how the various elements of the vision document should be arranged and put together for an aesthetically pleasing and a well-structured vision document.

Perusal of the Vision/ Strategic Planning documents of various countries as well as the recently released vision statement of the Indian Railways reveals that these documents are in the form of booklets rather than pamphlets; containing detailed, unambiguous notes on their objectives and strategies. We need to prepare a vision document which would reflect our vision, mission, values, objectives, strategies and milestones for measuring our achievement against the set goals. In other words, we need to know:

(i) where we stand today
(ii) where we aspire to go
(iii) Strategies we need to follow to attain our aspirations
(iv) Important milestones on our way to achieve the ultimate vision
(v) Mechanism in the form of an Oversight Board for each of the stated goals to make periodic evaluation and take us back to the stated path in case we stray.

The cover page of the vision document may contain a pictorial representation/photographic collage connected with the Department’s projected status in the
year 2020. A tagline or a catchphrase could be given to the document that would help us to stand committed to the cause. Vision 2020: “It is time to think the Unthinkable” is one such suggestion for consideration of the drafting committee.

Table 5.1: Contents of VISION 2020

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Chapter</th>
<th>Content of the Chapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Message from Honorable Finance Minister/Revenue Secretary/ Chairman CBDT/ Member (R)</td>
<td>Message could be from any or all of the fore-mentioned officials.</td>
</tr>
<tr>
<td>2</td>
<td>Vision</td>
<td>This would contain the vision of the Department in a nutshell in 4 to 5 sentences. It would give the gist of the aspirations contained in Vision 2020.</td>
</tr>
<tr>
<td>3</td>
<td>Mission</td>
<td>This would define the fundamental role of the Department basically describing the reason for its existence. It will also state in brief how the Department will go about in achieving the vision.</td>
</tr>
<tr>
<td>4</td>
<td>Changing scenario/</td>
<td>This would incorporate the changing</td>
</tr>
<tr>
<td></td>
<td>developments taken into account while preparing the Vision 2020</td>
<td>scenario and the environment in which the department operates, developments that have taken place in the intervening period which have been taken into account while preparing Vision 2020.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5</td>
<td>Stakeholders in Vision 2020 and need for a strong partnership</td>
<td>This would be a write up on the different stakeholders and stress their importance for the success of Vision 2020. This would also emphasize the importance of forging partnership and co-operation amongst the stakeholders for achieving the Vision 2020.</td>
</tr>
<tr>
<td>6</td>
<td>Review of Vision 2010</td>
<td>This would be a brief review of the achievements of objectives contained in Vision 2010.</td>
</tr>
<tr>
<td>7</td>
<td>Objectives/ Goals and Strategies/ Means</td>
<td>This would contain a detailed note on various strategies relating to People, Structure&amp; Process, Technology, Communication and Quality and Growth. This section would specify in detail the objectives/ goals of each strategy. It would also contain a detailed note on the means to achieve the objectives</td>
</tr>
</tbody>
</table>
set therein. This section would form the bulk of the Vision document as each Objective/Goal and the Strategies/Means would be in detail and would form separate chapters.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td><strong>Expenditure Budgeting and Performance</strong></td>
<td>Linking a strategy with the expenditure budgeting exercise would ensure proper resource allocation and the outcome related to the strategy. It would also stress the importance of achievement of our goals vis-à-vis the budget allocated.</td>
</tr>
<tr>
<td>9</td>
<td><strong>Oversight Board</strong></td>
<td>Favorable outcome is the ultimate test of choosing the correct strategy. The identification of the executing agencies along with the oversight board would help not only fixing responsibilities for execution but also monitoring of the outcome. Clearly specifying Time limits/milestones for each of the objectives/goals would render professionalism to the project management process.</td>
</tr>
</tbody>
</table>

Important milestones could be clearly stated for each of the stated projects for achieving a set of objectives. This process would ensure that the short term
objectives are aligned with the long term objectives of the department. Some of
the suggested initiatives that are likely to come up in the coming decade could
be specified as per the annexure. (The timelines are only hypothetical). These
are purely indicative, only key strategic areas could also be considered rather
than focusing on a large number of areas. All the goals mentioned in the
annexure are also illustrative only. Suggestions for goals and milestones are
solicited.

5.2 Highlights of Vision 2020 Indian Railways

VISION 2020 will address four strategic national goals:

Inclusive development, both geographically and socially;

Strengthening national integration;

Large-scale generation of productive employment; and

Environmental sustainability.

Basic Approach:

1. Growth with Jobs and not Jobless Growth. Productive employment
opportunities must be created for all able-bodied Indians, especially for our
youth and preferably in their own habitats.

2. Reducing hazardous carbon emissions that have triggered climate change.

3. Gross Revenue of the Indian Railways has remained at a level of around
1.2% of India's GDP over the last 10 years. Our Vision is to take it to 3% in the
next 10 years.

4. Segregation of freight and passenger services, creation of adequate capacity
and rising of speeds of both services would be a key challenge if Indian
Railways are to retain their market share and improve upon it.
5. To realize this potential, the Indian Railways must achieve annual growth of 10% over the next 10 years. Vision proposes to add 25,000 kms of New Lines by 2020, supported by government funding and a major increase in Public Private Partnerships (PPPs). This includes the completion of the backlog of 11,985 kms of lines already sanctioned.

**Capacity Augmentation:**

6. Major augmentation of capacity through doubling and quadrupling of lines, complete segregation of passenger and freight lines on High Density Network (HDN) routes, substantial segregation on other routes, and electrification on busy trunk routes.

7. More than 30,000 kms of route would be of double/multiple lines.

8. More than 6,000 kms would be quadrupled lines with segregation of passenger and freight services into separate double-line corridors.

9. Maximum speed of passenger trains would be raised from 110 or 130 kmph at present to 160-200 kmph.

10. Maximum speed of freight trains would be raised from 60-70 kmph to over 100 kmph.

11. Gauge conversion programme would be completed.

12. 3,000 kms of routes would be electrified.

13. At least 4 high-speed rail projects to provide bullet train services at 250-350 kmph.

14. India's National Highway network comprising 2% of the country's road system carries 40% of the traffic and is already under strain. Finding land to
meet the ever-rising requirements of road expansion and resources to meet the rising cost of fossil fuels will impose prohibitive costs on the economy.

**Safety:**

15. At level crossings which account nearly 70% of fatalities in Railway accidents, advanced technologies will be used.

16. Road transport accounts for a significant share of the emission of greenhouse gas (CO2) and other pollutants. In the year 2007, more than 1, 13,000 people were killed and 5, 13,000 were injured in road accidents in the country.

17. In contrast, Indian Railway's safety record has been very impressive, and improving. In the year 2008-09, there were 177 accidents (down steadily from 320 in 2003-04) and 207 persons were killed. With well-planned and directed investments, Railways can be made virtually accident-free.

**Passenger Service:**

18. By 2020, Railway's passenger services would be transformed from a supply- constrained business to a state of availability on demand. Quality of services in terms of punctuality, safety, security, sanitation, cleanliness and amenities at stations and onboard, catering and other value- added services (pre-boarding and post -disembarkation) would be upgraded to match the best in the world.

19. Number of passengers carried by IR will grow from 8200 million in the year 2011-12 to 15180 million in the year 2019-20 and Passenger KM in billion will grow from 1100 to 2360 during the same period.
20. The trunk routes of the railways comprising merely 16% of the network carry more than 50% of the traffic.

21. Improvement of speed to 160-200 kmph on segregated passenger corridors would be necessary.

22. Introduction of new suburban trains in Mumbai with regenerative braking features saving up to 35-40% of the energy.

23. For the development of Metro rail service a separate Indian Railways Metro Development Authority could be formed for this purpose.

24. Production of passenger coaches must go up from the present level of 2500 per annum to at least 5000 per annum within the next 3 years to begin with and further to 10,000 per annum. It will not only satisfy the demand for rail travel fully in the country but also make India an export hub for modern passenger coaches.

25. Delhi-Mumbai and Delhi-Kolkata will become an overnight service.

26. Induction of light-weight stainless steel coaches, Double-decker coaches and longer trains, Increased production of high-horse power, fuel-efficient diesel locomotives and Induction of new-generation locomotives and rolling stock

27. Saving up to 15% of energy through a improved energy efficiency in both traction.

28. Annual reduction of 0.14 million tonnes of CO emissions.

29. Journey on Indian Railways pleasant- fast, punctual, comfortable, clean, and, indeed, memorable.

30. It will be our endeavor to see that no train traveler has to wait for more than 5 minutes for getting a ticket even in the unreserved category.
31. For the year 2008-09, estimated losses on passenger business amounted to roughly Rs.14,000 crore, a loss of 18 paisa per each passenger kilometer run (more than 40% of the cost) is not sustainable.

**Freight Traffic:**

32. Freight services would be transformed by segregation of freight and passenger corridors, construction of dedicated freight corridors, improving the speed of transit, cost-efficiencies in bulk transport and meeting the needs of customers in terms of service delivery, logistics services, transit time and tariff.

33. Originating freight loading will increase from 1010 MT from the year 2011-12 to 2165 MT in the year 2019-20 and Net Tonne KMs in billions will increase from 656 to 1407 during the same period.

34. The Vision targets a significant reversal of the erosion of market share, lost to the road sector in the past, and will take Railway's share in the freight movement from 35% at present to at least 50%.

35. Annual procurement of wagons would go up from the level less than 25,000 wagons now to a level of round 75,000 wagons in four wheeler units.

36. Two Dedicated Freight Corridors on the Eastern (Ludhiana-Dankuni) and Western (Mumbai-Delhi) routes would be operational well before 2020.

37. Plan to start work on four more DFCs, namely North-South (Delhi to Chennai) and East-West (Howrah to Mumbai Southern (Chennai to Goa) and East-Coast (Kharagpur to Vijaywada).

38. In Parcel service fivefold increase in ten years from the present level of around Rs. 1600 crore per annum.
39. Heavy-haul freight operations are common in USA, China and Russia with trains carrying in excess of 20,000 tonnes each compared to 5000 tonnes in India.

**Telecom & IT:**

40. Railways can also think of launching a separate TV channel to disseminate information and earn revenues through advertisement.

41. Tap revenue generation potential in the telecom and IT sector, using the 64,000-km long 'right of way' for laying optic fibres, signalling towers and other infrastructure assets that Indian Railways owns.

**Technological Excellence:**

42. Design of modern coaches including Double Decker coaches.

43. Re-design of second class coaches to make them more comfortable.

44. Design of high-capacity wagons.

45. Reduction in cost of operations by enhancing productivity and asset life.

46. Track, signalling and rolling stock including predictive and diagnostic tools, anti-collision devices and protection of level crossings for improvement in safety and reliability of operations to achieve zero accidents and zero failure in equipments.

47. Raising the speed of trains.

48. Improvement of the interface with passengers and freight customers.

49. Ticketing through mobile phones.

50. Improvement of control and voice/video communication to aid IT applications across the Indian Railways.
51. A satellite-based train tracking system to provide real-time information on train location and other train related information to passengers through a variety of devices including mobile phones.

52. Green toilets in all coaches

53. Mechanical cleaning of trains, stations and platforms with requisite training to railway employees to use technology for maximum recycling of water.

54. Waste management, with the aim of achieving "near-zero waste", by adopting the principle of 3-Rs - Reduction, Recycle and Reuse.

Organisational Reforms:

55. Railway research centres should attract hundreds of young and talented persons with fresh minds, ready to tackle the most difficult challenges

56. Our Vision is not to privatize but to enhance the effectiveness and accountability of the Railway organization through necessary reforms at all levels of Indian Railways within the Government framework.

57. As a Government organization, we are proud of the 1.4 million committed and dedicated employees of Railways.

58. As a corporate policy, Indian Railways has set itself a goal of 1% reduction in the sanctioned strength per annum, assuming a 3% annual natural attrition, to reach an equilibrium level of right-sized staff-strength

Investment:

59. It has been tentatively assessed that 64% of the investment of roughly Rs.14,00,000 crore needed for augmentation of capacity, upgradation and modernization of Railways in the next 10 years could be mobilized by
Railways through surpluses from high growth in freight and passenger traffic, supported by prudent borrowing and use of PPP initiatives.

60. Need for Government to set up an Accelerated Rail Development Fund (ARDF) to finance the remaining 36% to the tune of Rs. 5 lakh crore to be spent over the next 10 years.

61. The shelf of ongoing projects is huge and Railways would require resources of the order of more than 1,43,000 crore to merely complete the projects on hand.

**Public Private Partnership:**

62. To achieve the mammoth task Railway has set itself, it has to concentrate on its core activity of creation of railway infrastructure and operations and forge partnerships with private sector to do the rest. The challenge of project execution and efficient provision of service cannot be accomplished without involving private sector in a big way.

**5.3 The Human Element in Train Safety on Indian Railways:**

Indian Railways is the second largest Railway network in the world with a total of about 63,200 route-kms of track. A major portion of the track is on broad gauge (1,676 mm), but some portions are still on meter gauge (1,000 mm) and certain limited stretches on narrow gauge. High density and suburban routes totaling around 28% of the route-kms of the track is electrified at 25 kV, 50 Hz. Railways is the single largest employer in India with around 1.5 million staff working in the 16 zonal railways, five production units and other ancillary units including the R&D establishment, training institutes etc.
For effective management of this network, the Railway is split into 16 Zones. Each of these zones is further divided into divisions – ranging from three to six per zone. A matrix structure of organisation is adopted for the management with three levels of administration – The Railway Board at the apex, followed by the Zones and Divisions. Each level has its own administrative head – Chairman at the Board level, General Managers at Zonal level and Divisional Managers at divisional level. They are assisted by functional department heads. The functional departments also have their hierarchy at the three levels. 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 1999 to 2004 indicates that 1,717 cases out of a total of 2,021 cases i.e. 84.9% were attributed to human failures. Out of the 1717, Railway employees were responsible for 1,175 cases (58.1% of total) and balance 542 cases (26.8% of total) were attributed to outsiders.

Southern Railway – one of the sixteen Zonal Railways – has a total 5,209 route-kms which constitutes 8.2% of the total route-kms of Indian Railways. With a mix of 3,222 route-kms of Broad gauge and 1,977 route-kms of Meter gauge tracks, Southern Railway can be considered as a representative sample of the Indian Railways for analysis of accident cases and the involvement of human element.

The accident cases attributed to “other persons” (other than Railway employees) are mostly those at level crossing gates and a few miscellaneous cases and fires. While there has been a steady reduction in the number of train accidents, the percentage of cases attributed to human element remains more or less steady.
Dependence on Human Element:
If such a high percentage of train accidents are caused due to human element, why is there so much dependence on the human element? The following are the reasons for large level of human intervention affecting train operations in India:

1. 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. Developmental activities naturally tend to get a lower priority. Signaling works for improving the train operations are taken up only on a limited scale. Most of the advanced technologies for reducing dependence on human element will need to be imported, funds for which are limited. Driving of trains is currently fully on manual control, except for some warning devices on very limited sections. Similarly at many of the stations, track circuiting/interlocking is not available and obstruction-free tracks for dealing with trains is required to be ensured physically.

2. Equipment Failures
Even in areas where equipments have replaced or reduced dependence on human element, it has become necessary to revert back to manual intervention
during emergencies arising out of equipment failures. Such provisions have been made to enable movement of trains even under failure conditions, provided certain procedures and safeguards are observed. Typical cases are failure of signals and points, failure of level crossing gate interlocking, failure of certain equipments which could be temporarily bypassed or isolated in locomotives etc.

a. Level Crossings

Level crossings constitute another major concern for safety in train operations in India. Vehicles on two, three, four and multiple wheels ply across the length and breadth of the country powered by motors, humans as well as animals and a majority of them have scant knowledge of or regard for road safety rules. There are about 41,000 road crossings across the 63,000 route-km of railway tracks, but there could be several more unauthorised and unofficial crossings. Even considering the official figure, one could expect a level crossing at an average of every 1.5 kms of track. Combined with the fact that almost 60% of these level crossings are unmanned and without any gates, the level of dependence on the road users to prevent a collision is quite high. Even though the balance 40% is manned, full protection in the form of interlocking with the signals is available for only about 15% of the total population. This leaves 25% of the total level crossings with manual operation and dependence on the gatekeeper. The close intervals of level crossings also puts a tremendous physical and psychological pressure on the loco drivers, who are required to constantly keep a watch on some possible trespass and have to keep whistling frequently and continuously. Statistics indicate that even though the level crossing accidents constitute only 16% of the total number of accidents, 46% of the total casualties due to train accidents
are on account of level crossing accidents, and needless to say, most of them would be the road users.

b. **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, signaling 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. Such lapses could be in the form of digging close to running tracks, working of earth moving machinery close to running tracks without blocking them, inadequate protection while working above the tracks, use of material trolleys on running tracks without adequate protection, blasting of rocks close to the tracks etc.

c. **Contribution of Passengers and Others**
Railways are part of the day-to-day life for many in several parts of the country. They commute to their places of work and back, carry materials inside the passenger and luggage compartments and even carry out their business inside the compartments. With the high volume of passenger traffic handled, it is practically impossible for a physical check of their luggage to prevent carrying of inflammable materials. A large number of persons earn
their living by doing unauthorized vending inside the train compartments using open stoves and similar items which could cause a fire accident easily.

Why Lapses Occur

d. Inadequate level of training

Inadequate training is a major cause that leads to human errors leading to train accidents. This factor could be pervasive in all areas, whether it is direct train operations, maintenance of equipments which have direct impact on safety or even road users. Training on Indian Railways was not traditionally an area of strength, for many years. Most of the staff received formal training only in a limited manner, while major part of the work was learned informally on the job. After a person gets into the job, further refresher trainings and advanced trainings were also not mandatory and the availability of such training was also limited.

e. 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. Another typical case
of time saving is use of short-cut methods at manned but non-interlocked level crossing gates. Here, the function of ensuring closure of the gate prior to admitting train into the block section is left to the gatekeeper and the station master. The gatekeeper is expected to close the gate and give a confirmation over telephone to the controlling station master, who permits movement of the train. How short-cuts in this area could lead to disastrous situations can be seen from the following case study.

This particular level crossing gate is located near Tirunelveli Junction of Trivandrum division of Southern Railway across a reasonably busy road. To avoid long duration of closure of the gate and build up of road traffic on either side, the gatekeepers at this gate had a practice not to close the gate in advance before giving authority to the station master at Tirunelveli Junction for permitting trains to enter into the block section. They used to have a rough calculation of the time of arrival of the train at the gate based on the time of departure given by the station master of the adjacent station and close the gate just in time. Probably this used to work quite fine till the fateful day on 8th October 2003. As per the usual practice, the gatekeeper had given the authority to the station master without closing the gate and a passenger train was approaching Tirunelveli around 01.00 hours at a speed of 60 kmph. At that moment, a trailer truck loaded with a heavy earth moving bulldozer was trying to get across the open gate, but unfortunately got stuck exactly at the middle of the track. All efforts to get the trailer truck moving failed and its driver got down and ran away after seeing the approaching train. The gatekeeper had neither time nor presence of mind to give any kind of warning to the train. The driver of the train had hardly any time to react after seeing the trailer stuck at the middle of the track and the engine rammed into the
trailer. The diesel engine of the train derailed and capsized by the side of the track. A few of the coaches also derailed, but did not capsize. The driver of the train could come out of the capsized engine, but his assistant was not so lucky. He was trapped inside the engine and as ill-luck would have it, the engine caught fire. Those who gathered around were mute spectators when the assistant driver was burned to death inside the cabin. Twenty passengers/railway staff in the derailed coaches also sustained injuries.

New equipments and gadgets are getting introduced into the train operations, mainly from the point of view of improving safety by reducing the human element. While these equipments have definitely improved the levels of safety, failure of such equipments calls for the entire operations to be taken over on manual mode by the train operating staff. Existing system on Indian Railways permit train operating to be taken over through manual means by following certain laid down procedures and issuing manually generated permits. Such failures include block failures, signal failures, track circuit failures, level crossing gate failures etc. The detailed procedures laid down to ensure absolute safety even under such abnormal conditions, are at times very elaborate and complicated. Since many of these requirements may not appear to be essential at first look, there is a tendency to avoid going through the entire procedures. These short-cuts, though may not create an accident situation every time, there could be an odd combination of certain factors, which finally result in an accident. It could also be that the detailed procedures and documentation are correctly followed for dealing first few trains after the failure, but are relaxed or diluted as the period of failure gets prolonged.
Over and above the documentation, many of the detailed procedures laid down involve walking distances along the track in the yard, applying clamps at the points and piloting the trains. This involves manual labour, which normally the station staff are not required to do. Combined with adverse weather conditions, staffs are known to adopt short-cut methods at times, under such situations. A recent accident case on Southern Railway due to adoption of short-cut method during a construction work avoiding the laid down procedure is given below:

On 08.11.2004, track electrification work was in progress in one of the sections. The contact and catenaries wires were already strung and the usual practice for connecting these two by droppers was by using a “ladder trolley”. This is a simple mechanism of a ladder to reach the overhead wires mounted on a four wheeled trolley pushed along physically and also could be lifted off the track by three or four men. Two such trolleys were working with traffic block protection. The normal practice was for the site supervisor to communicate with another supervisor available at the station, who will issue necessary documents for cancelling the traffic block. But there was a certain understanding between the two supervisors, not covered by the set procedures that, in case there was no communication from the filed the man at the station was to assume that the block stood cancelled at the end of the allotted time. On the fateful day, there was a communication problem between the two supervisors since the work was at a location where the track was in a cutting and the VHF communication set was not getting the signals. The site supervisor instead of ordering the ladder trolleys off the track at the end of allotted time was walking along the track to try and get the VHF signal at some distance. In the meantime, the block was cancelled by the man at the
station since he did not get any communication and an express train was sent into the section. The staff working on the ladders hardly got time to get down, but could not remove the trolleys after seeing the approaching train. The driver of the train also could not apply brakes and control the train, since the work spot was just after a curve. The trolleys got hit by the engine and were dragged along the track for some distance before getting thrown sideways. Two of the passengers who were sitting with their hands on the window ledge got hit by the parts of the damaged ladder trolley and were grievously injured. In most of the sections, check for complete arrival of trains at stations prior to clearing of block sections is required to be verified physically by the station staff. Where visibility of the last vehicle from the station/cabin is good, this could be accomplished by signals, but wherever the visibility is poor, complete arrival is required to be obtained by someone physically going to the train guard in the last vehicle. Possibility of using short-cut methods in this area is quite high.

f. 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 staffs include 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.

Rules are clearly laid down for exchange of complete messages between the staff dealing with train operations, but many a time short forms or abridged version of the full message is communicated resulting in misinterpretation of the message.

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.
Physical or mental stress is identified as one of the causes for human lapses. Though widely believed to be one of causes leading to drivers passing signal at danger, it has generally been found that in most of the cases of signal passing at danger, 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 where the drivers under stress or other compulsions have committed serious errors as could be seen from the following case study:

A 4800 tonne goods train hauled by double headed 4000 HP electric locomotives was trying to negotiate a mild gradient under wet/greasy rail conditions. The driver was to sign-off at the next station, hardly a few minutes away and he had some private programmes lined up after duty. The last thing he wanted was a train stalling. Though there was wheel slipping, he just ignored the warning and kept powering without realising the damage it was doing to the track. After continuously trying for some time he was successful in getting the train to move ahead. He did not realise that the rail below all the twenty four wheels of the locomotives (the locomotives had Co-Co wheel configuration) had got grooved to the extent that almost the entire rail head was gone. He did not even bother to report the wheel slip at the next station while signing off. For the entire train it was a lucky escape since there were no derailment even after all the wagons had passed over the grooved rail
head. Nor did the guard observe any unusual jerk when the last vehicle in which he was travelling passed over the damaged rail. Luck held out even longer since the following train was an Express train and it too passed over the spot without any derailment, but the driver did experience heavy jerk and made a report at the next station.

Slackness or carelessness in handling works along the track is also known to cause accidents. Many of the major works along the track are carried out under traffic block conditions and there is always a pressure to complete the work within the allotted time. Though mechanisation of track maintenance is picking up, there is still a preponderance of manual labour in these areas, with inherent inaccuracies and limitations. Not restoring the track parameters to normal before permitting the traffic can result in derailments. These could be due to carelessness or lapse of concentration due to physical fatigue at the end of the work.

h. **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. Some of the cases where lack of awareness could create train accidents are listed below:

Digging close to the tracks without proper protection, sometimes combined with some heavy rains could cause track to sink and result in a derailment.
Contractors’ staff engaged in carrying out works on the track or in its vicinity interfering with track without proper authority or supervision or without imposing necessary speed restrictions.

Moving of road vehicles or construction equipment close to the running tracks (both by railway staff and outsiders) causing infringements.

Road vehicles trying to get across the track at level crossings without barriers, on the face of approaching trains. Drivers of such road vehicles fail to judge the speed of the trains and do not realise that trains cannot brake within short distances unlike road vehicles.

Luggage porters after loading parcels inside the luggage compartments, inadvertently leaving cigarette butts inside, causing fire accidents.

Enterprising unauthorized outsiders carrying out catering business inside the coaches using portable stoves, causing fires.

Carrying of explosive or inflammable material inside the coaches, which accidentally catch fire. There was even one case reported where Railway staff carrying “Thermit welding” components (used for rail welding) inside the coach got accidentally ignited.

Letting animals to graze close to railway tracks. There have been cases of derailments due to running over cows/buffaloes/donkeys etc. The following case indicates that even Railway employees are at times not fully aware of the consequences of some of their actions which could lead to accidents.

On 15.06.2005, a Self-propelled track machine was approaching Shoranur Junction station on Palghat division of Southern Railway. Shoranur is a three-way junction station with one by-pass line also. Track machines while running between stations are also operated by the machine operator and not by
regular Loco drivers. The track machine was to be regulated before entry into the yard, to facilitate dispatch of another train. Due to space constraints in the yard, the particular stop signal was placed on the right hand side, as against the normal convention of left side. However, there are several identified locations where the signals have been permitted to be on the right hand side, mainly due to space constraints. While the Loco drivers have a regular system of “Road learning”, to make them fully aware of the section topography, location of signals, level crossings, visibility etc., for the track machine operators, this system was not really followed in true spirit. The loco drivers who are familiar with the section would have seen the signal and stopped, but the track machine operator who was not fully familiar with the section did not stop his machine at the stop signal, but proceeded into the yard. It was only the act of an alert cabin-man who hand-signalled the track machine to a stop and also stopped the train from the opposite side, which prevented a possible collision.

3. Steps for Eliminating Human Errors
a. Training

Over the years, various committees which were set up to inquire into major Railway accidents and Railway safety in general, have come out strongly about the need for training as an important tool for improving the levels of Railway safety. Based on these recommendations, several important steps have been initiated to improve the training of safety category staff. The other initiatives taken to improve the quality of training include:

Setting up of specialised training institutes and equipping them with modern teaching aids and models
Laying down certain levels of mandatory training courses at initial recruitment and promotional stages as well as refresher courses

Special allowance and long tenure for the instructors at the training institutes to bring in more talent and also to provide incentive

Conduct of safety seminars and workshops at local levels where case specific items of current interest along with relevant case studies could be discussed.

With technology taking over the role of human element and more and more of equipments coming into the scene, training of the persons operating and maintaining these items assumes paramount importance. In the years to come, training of Indian Railways will need to be organised on the following lines to ensure that its employees have full knowledge on these equipments and have the necessary skills to operate and maintain them.

With more of sophisticated equipment coming into the Railway system, there will also be a need to go in for out-sourcing the training to the Original equipment manufacturers/suppliers - in deviation to the current practice of developing in-house training facility for these equipments.

One of the major drawbacks in imparting training to staff is their movement to a centralised training institute for a specified period, combined with the logistic problems of their boarding, lodging etc. One solution could be to have mobile training cars which could be equipped with the teaching aids and models and moved to locations having staff concentration, along with qualified instructors. The categories of staff that could get covered with this type of training would be trackmen, level crossing gatekeepers, carriage and
wagon fitters, signal maintainers etc. Training can be given to the staff based at these locations in batches, even using some of the equipments and other infrastructure they are already using at their work-spots for practical demonstrations.

There is a need for changing over from the conventional “chalk and talk” method of training to more of visual mode. For imparting training on working with equipments and mechanisms, a combination of actual equipment combined with audio-visual presentations and computer simulated models can be adopted for more effective instruction. For training on rules and procedures also audio-visual presentations on case studies and computer simulated models could be employed which could further develop into group discussions and case analysis. This will ensure more of trainee involvement and stimulate the thinking process.

Staff requirement in many areas are calculated without taking care of the training need which at times leads to the persons not getting released for training due to staff shortage. Calculation of staff requirement of safety categories must include the training man-days also to overcome this problem.

As on date, no special language courses are prescribed for the safety category staff as part of their training, to give them working knowledge of local languages. Considering the importance of verbal communication, especially during emergency situations, it is considered essential to have a special language course for certain safety category staff in the language of the region where they are required to work.
Locomotive simulators have been recently introduced in a limited manner and these could be further developed for all types of locomotives and electric/diesel multiple units. Working on these simulators can give the drivers much more experience and confidence in dealing with different types of real life situations. Which may not be possible with on-the job training over a limited period of time?

The concept of training will also need to be extended to the contractors' staff who may be involved in carrying out works in close proximity to the Railway tracks or works which may affect the train operation in any manner. Such works will need to be identified and a system of training and authorising the personnel involved in this area for safe working could be introduced.

As far as road users are concerned, while proper training for crossing of railway tracks will need to be incorporated as part of issuing the driving license, Railways can conduct contact programmes with road users where they could be collected as a group such as automobile associations/clubs, bus drivers of public transport systems etc. There is also a plan to “catch them young” by introducing the subject of railway safety as one of the topics under “Civics” in the curriculum of schools.

b. Reducing or Coping up with Physical and Mental Stress
Over a period of time, considerable efforts have been made to improve the working condition of Loco drivers. These are mainly in the form of –
ensuring limitation of continuous working hours
ensuring adequate rest in between two periods of duty
providing proper accommodation away from home where they break off
providing ergonomic design of loco cabs

It is also important to improve the mental state of the drivers since their lapses due to mental stress could be most disastrous. One step in this direction is to provide training in “Yoga” and “Meditation” to the drivers. These techniques are known to have not only helped many in remaining stress-free but also to improve their physical health. Facilities are also provided for them to practice the same at the “Running rooms”, which are the places where the crew on duty take rest away from home. While on one hand, the working environment of the loco drivers is getting enhanced, on the other hand it is also ensured that they do not over-indulge themselves. There is an established system for checking whether they are sober before signing on and signing off, as also during the duty hours.

c. 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) – to prevent trains passing signals at danger. Signal aspects are sensed through track belies and train speed controlled to avert a situation of trains ignoring the signal aspects. Helps to reduce the dependence on loco driver

Train Actuated Warning Device (TAWD) – for sensing an approaching train two kms ahead and to sound an audio-visual warning device at level
crossing gates (mainly unmanned ones). Helps to reduce accidents at level crossings by giving adequate warning to road users.

Anti-Collision Device (ACD) – A GPS-based device developed by Konkan Railway Corporation (a Public sector unit of Government of India), which is expected to sense the location of trains and stop trains which are out of normal course and thus prevent collisions. This again helps to reduce dependence on Loco drivers.

Block Proving Axle Counters (BPAC) – for ensuring complete arrival of trains at stations before permitting next train to enter the block section. Eliminates dependence on the guard and station staff for the same function.

Vigilance Control Device (VCD) – to check the alertness of the loco drivers.

In addition to the above, various types of track machines have also been employed not only to reduce dependence on the human element but also to enhance the productivity and quality of work.

With more sophisticated equipments and automation coming in, there is also a need for the following parallel activities to make this work 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.
d. **Simplification of Rules and Procedures**

Laying down Rules and Procedures is a very tricky subject. For making sure that the accidents do not happen due to lapses, enough fool-proof precautions are required to be laid down. But if these procedures are not easy to implement practically, there will always be a tendency to adopt short-cut methods. Further, more of paperwork will tend to make it counter-productive. With more and more of automation being introduced, need for laying down procedures to be adopted for operating trains during their failure also will be on the increase.

Considering the above, the procedures will need to be framed to make their implementation practical, at the same time making sure that the safety of train operations is not compromised. In addition, it will also be necessary to constantly review such procedures to ensure that these are being followed without difficulty and they do not just remain on paper.

e. **Funds**

Finally, coming to the most vital element involved in all developmental activities is the availability of adequate funds. During the year 2002, it was observed by a Committee set up to review the subject of Safety of train operations in Indian Railways on a whole that several over-aged assets require immediate replacement and there is need for bringing up safety enhancement equipments. Based on the recommendations, a one-time grant of Rupees 170,000 million (Approx. USD 3,800 million) called the Special Railway Safety Fund (SRSF) was made available to the Indian Railways by the Government, to be utilised over a five year period from 2002-2007. Many of the safety enhancement works currently undertaken are under this fund.
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. While introducing such technologies, adequate stress is also required to be laid on the reliability of the equipments, since the equipment failures would re-introduce the dependence on Human element multi-fold. Nevertheless, training will be the main area of concentration for reducing accidents due to Human failure.