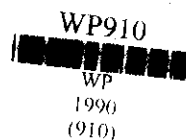


SAFETY MANAGEMENT IN TRANSPORTATION

By

Dilip Mathew
J.S. Chhokar
R. Jain
G. Raghuram



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INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD 380 015
INDIA

ABSTRACT

This paper presents a framework for identification and analysis of issues in Safety Management in Transportation. The paper analyses Safety Management in the three modes of transport namely Road, Rail and Air. Safety Management in each of these three modes is examined by

- (1) identifying the legislation governing the specific mode of transport
- (2) listing the various agencies involved in safety management and the roles and tasks of these agencies and their interface to other external agencies
- (3) analysis of the nature of accidents and international comparisons on salient parameters (wherever possible)
- (4) identifying remedial action possible for better safety management of the user and the vehicle and
- (5) analysis of the role of infrastructure and the enforcement agencies.

On all these dimensions, the paper presents the current state of affairs and suggests areas for improvement. The paper also raises issues relevant to safety management in these areas.

Safety Management in Road Transport

1.1.0 Introduction

This paper sets out to examine safety management in Road Transport.

Safety has been defined as the absence of danger. Since safety is compromised by accidents, it is obvious that it will be virtually impossible to achieve transport safety as an accident is defined by the International Labour Organisation as an "unpremeditated event resulting in a recognisable injury". Safety management is defined as the "achievement of safety through others" (Grimaldi & Simmonds).

According to the Association of Indian Automobile Manufacturers, 65 % of passenger kilometres in India are travelled by road. It is estimated that in 1990, about 815 billion passenger - kilometres will be generated by road traffic. Public transport (including auto-rickshaws) will account for about 80 % of this figure. About 70% of private transport will be performed on two-wheelers (AIAM, 1985).

Today, more than 17 million vehicles share about 1.7 million km. of road length. Single seater mopeds have to move alongside ten tonner trucks, bullock carts and bicycles, apart from buses, cars, scooters, pedestrians and processions. The heterogeneity of Indian traffic can probably not be matched anywhere else in the world. It is relevant to note here that it is on India's urban roads, which make up only 6% of the total road length that 75% of the accidents occur (Srinivasan and Chand, 1986).

1.1.1. Legislation governing road transport

Road transport in India till very recently was governed by the Motor Vehicles Act, 1939 and the M V Rules. In July 1989, the Motor Vehicles Act 1988 came into force. According to the Ministry of Surface Transport, the new Motor Vehicles Act was legislated to "provide for ever growing requirements of sophisticated technology, simplify procedures, promote road safety and pollution control."

1.1.2 Agencies Involved

There is a multiplicity of agencies that are involved in one way or another with the attempt to improve safety on the roads.

1.1.2.1 Ministry of Surface Transport (M.S.T)

This ministry has overall charge of road transport in the country. The Ministry has also set up a Road Safety Cell within its Transport Research division which is supposed to "co-ordinate and monitor implementation of the recommendations of the National Road Safety Council" (Ministry of Surface Transport, 1989).

1.1.2.2 Police

Traffic control and enforcement of traffic regulations is almost entirely the responsibility of the Police, though some volunteers do come to assist with peak traffic. In many major cities and some states, there is a separate traffic branch in the Police department.

The Police is also responsible for investigating motor accidents. As most policemen have not been given any special training in accident investigation, and given the prevalent educational levels of junior policemen, these investigations and the subsequent accident report may perhaps not be as professional as they could be.

1.1.2.3 Regional Transport Authorities

State governments set up Regional Transport Authorities and through them, the Motor Vehicles Department is responsible for registration of motor vehicles and the licensing of drivers. It is responsible for issuing and renewing certificates of roadworthiness. In short, this department is responsible for ensuring that both motor vehicles and their drivers are fit to use public roads.

1.1.2.4 Road design, construction and maintenance agencies

Almost all roads in this country are built by state and central governments through Public Works Departments. However in the case of National Highways, the National Highways Authority of India was recently set up to expedite action on road construction.

Roads in India are broadly classified into -

- a) National Highways
- b) State Highways
- c) District Roads

While detailed statistics are not available, it is reported that 1/3 of traffic as measured in tonne-kilometres uses National Highways.

1.1.2.5 National Road Safety Council

A National Road Safety Council headed by the Minister of Surface Transport was set up in 1988. All states are also expected to set up state road safety councils and many are reported to have done so. According to the Ministry of Surface Transport, "This type of institutional arrangements would facilitate in creating a general awareness of road laws and discipline among road users which would help to reduce the incidence of road accidents and keeping the death off the roads" (Ministry of Surface Transport, 1989).

According to the Road Safety Cell in the Ministry of Surface Transport, efforts to create road safety awareness was to be in the form of "issue of special postal cover, short duration educative films shown on Doordarshan and cinema halls throughout the country, publication of informative articles on road safety in all the leading English language and regional newspapers and through special drives to educate road users on roads" (Ministry of Surface Transport, 1989). However, according to a road safety expert, Prof. D. Mohan of IIT, Delhi, "posters and educational campaigns around the world have been shown to be not very effective in the absence of laws. The people who really need education are decision makers and policy makers and not the public."

The principal recommendations of this council which has been convened twice so far are:

- 1) At least one percent of revenue from Motor Vehicle taxes should be earmarked for road safety schemes.
- 2) A comprehensive and reliable database (of accidents) should be developed.
- 3) Truck parking complexes should be set up along National Highways.
- 4) Necessary educational schemes should be formulated and implemented to inculcate aspects of road safety in the minds of targeted groups like school children. Educational textbooks for children should contain a chapter on road safety.
- 5) State governments should undertake time bound programme to put up uniform road signs and signals on the highways, which should be completed by June 1989.

It is interesting to note that a draft constitution of this council was prepared by the Ministry of Transport in 1962. The scheme for the council and the draft constitution was approved by the Transport advisory council in 1963. It took 25 years before this council was finally set up.

1.1.2.6 National Transport Safety Board

The central government set up the NTSB in 1988. It was set up to provide recommendatory and advisory services to the transport industry on safety matters. It was wound up in April, 1990 barely two years after it was set up. There is not much evidence that the organisation ever played the sort of role envisaged by its proponents during its lifetime, which was that of an organisation modelled on the lines of the NTSB of the United States.

1.2.0 The nature of road accidents

Road accident fatalities are a universal phenomenon and have been occurring for decades. One of the first recorded fatalities took place in September 1889, when a chivalrous American was hit by a car as he was assisting a lady to alight from a trolley car in New York City.

Indian road casualty figures are in a class of their own. Reliable and adequate statistical information on the road safety situation is hard to come by. However, in 1988, the total number killed on Indian roads was estimated to be 49,200. It is reported that about 70% of this figure is made up of bicyclists, motorcyclists/scooterists and pedestrians (Mohan, 1988). The enormity of this appalling human toll comes into perspective when we see that this figure is roughly equivalent to that of a daily Boeing 737 crash round the year. Another measure of the magnitude of the carnage is that the number of murders added up to only 60% of the accident toll.

In 1987, the Minister of Surface Transport estimated that the cost of road accidents to the country was Rs. 600 crores. This was about 0.3% of India's 1985/86 G.N.P. In fact, this is likely to be a serious under-estimate. In 1983, it was estimated that the average cost per fatal casualty in Britain was Rs.55 lakh, while the cost for seriously injured and slightly injured casualties were Rs. 2.6 lakhs and Rs. 6000 respectively (O'Flaherty, 1986). According to the Transport Research Division of the Ministry of Surface Transport, there were about 40000 deaths and 170 000 injuries on the roads in 1985/86. Even assuming that Indian blood is worth only a tenth of the British variant, the figures the Minister quoted should have been of the order of Rs. 2,500 crores at a minimum.

Table 1.1 tabulates Indian road safety figures between 1979 and 1988.

Table 1.1

Year	No. of deaths
1979	22600
1980	24600
1981	28400
1982	30700
1983	32300
1984	34700
1985	39000
1986	39700
1987	44400
1988	49200

Source: Motor Transport Statistics, 1988/89

Within this set of figures, the risk faced by different types of road users differ considerably. As no such statistics for India exist, British statistics are presented below to give an idea of the differences in accident rates between various classes of road users.

Table 1.2

Casualty rates per 10 crore vehicle-Km., by class of road user (1983)

Casualty	Killed	All severities
Two-wheeled motor vehicle riders	13.6	932
Pedal cyclists	6.3	595
Car drivers	0.5	33
Heavy goods vehicle drivers	0.2	12
Bus drivers	0.1	15

Source: Road Accidents in Britain 1983

Table 1.3 gives a comparison of Indian road safety figures with those in other countries for a sample of countries around the world in 1980.

Table 1.3

Country	Number of motor vehicles(millions)	Deaths per 10,000 vehicles
India (1988)	14.6	34
Norway	n.a	2.3
Japan(1986)	70	1.4
England	17.4	3.0
U.S.A	144	3.3
Australia	6.5	4.7
F R G	24	4.8
Sri Lanka	0.17	34.5
Pakistan	n.a	93.5
Liberia	n.a	407.5

Source: Transport and Road Research Laboratory,U.K

The above information has been presented to underscore the fact that Indian road safety standards are much lower than in most countries. In spite of the numerous seminars and studies that have gone into the problem of Indian road safety, there appears to have been a continuous increase in the number of road accident fatalities. The steadily increasing number of fatalities has however gone largely unnoticed by the general public. Air and rail accidents that claim only a fraction of the lives road accidents do create great uproar and concern in the media and among the public. But road accidents appear to evoke much weaker reactions and almost appear to be accepted without murmur by people. As former U.S. President Lyndon Johnson said on this topic " The deadly toll of highway accidents is a problem where its very familiarity has bred either contempt or indifference. We cannot abolish the automobile, but neither can we ignore the problems that it brings to us. There is a responsibility here which we must face."

Actually the problems of road safety, far from being ignored have been studied exhaustively since the first conference on street and highway safety was held in the U.S in 1924, convened by the then Commerce Secretary, Herbert Hoover. A follow-up conference was held in 1926. The conclusions were that the motor vehicles and highways of the 1920's were built to the highest standards possible with the available technology and accidents could thus be blamed on careless, irresponsible or incompetent drivers, concluding that highway safety problems were essentially the result of driver behaviour.

It was at these conferences, held more than 70 years that the concept of the 3E's (Enforcement, Education and Engineering) emerged. However, Enforcement and Education were meant to be directed at the motorist while engineering was to be directed at highway improvements.

An overview of the types of road accidents and causes recorded in India in 1972 will give an overview of the nature of the problem. These causes are recorded below in Table 1.4

Table 1.4

		%
1.	Fault of driver	53.1
2.	Fault of pedestrian	9.1
3.	Mechanical defect in vehicle	3.4
4.	Fault of passenger other than driver	1.4
5.	Bad roads	1.2
6.	Bad weather	1.1
7.	Other causes	23.2
8.	Cause not known	3.9
		100.00

Source: Study Group on Road Safety, 1972.

1.3.0 Remedial Action Possible:

Action aimed at controlling accidents can be examined under following categories.

1. The Road User
2. The Motor Vehicle
3. Environment
4. Enforcement

1.3.1 The Road User

As can be seen from Table 4 the driver was held responsible for 53.1% of road accidents in India. It is essential to go beyond blandly restating the often repeated statement that drivers are ultimately to blame for most road accidents. The question should be raised as to what exactly happened that caused the driver to be involved in that accident. It is only when this question is answered that meaningful remedial action can be taken.

1.3.1.0.1 Training and Information

It is intuitively clear that a large number of accidents are due to poor training or lack of awareness. Several authorities believe that a significant majority of Indian drivers are quite simply ignorant of traffic rules and signs. All across the length of the country, it is almost essential to pay a bribe to get a license, however skilled a learner driver may be. In such a milieu, a large proportion of learner drivers do not even bother to undergo the test but get it through agents who procure licenses for a fee. Most learner drivers are content to learn the most basic manoeuvres and skills required to move a vehicle from one point to another. Both driving schools and private tutors do not feel the need to impart more than the most elementary knowledge of driving to learners.

The Central Road Research Institute, Delhi conducted a study to evaluate the knowledge of traffic signs of commercial drivers and found that only 10 percent could identify more than 4 traffic signs correctly. The Delhi Traffic Police in 1985 found that out of 41 driver training schools, only three had charts on road signs. In the others, the instructor did not know basic things about matters like road signs, right of way and lane driving.

The newly passed Motor Vehicle Rules tried to compensate for such lapses. When the rules come into force, driving schools will have to own their own training fields, Video recorders, TV and training films apart from basic materials like road signs.

The rules also require that to be eligible for a driving test, learners must have undergone a course at one of these approved

schools. The spirit behind the framing of such rules is commendable, but their practicability in India is open to serious question. These rules would obviously not apply to the millions of current license holders.

To make them unlearn their driving habits and to educate them properly would be a major task, but one that must be addressed as a matter of top priority if the accident rate is to be brought down.

According to Mr. M. Collins, Chief driving examiner of the U.K's Royal Society for the Prevention of Accidents " Training is needed to transform the learner driver into the technically adept, and the careless into the careful, but a strict and relevant test is also necessary to ensure that the teaching has been comprehensive and well learned. The purposes of a driving test are:

- to ensure that new drivers have reached a certain minimum standard.
- to set the standard to which instructors should teach

Certainly, everything follows from the test, which will determine the level of training."

But as Collins points out , in countries like India " examination of ability is inadequate, poorly conducted and fails to ensure competence in collision avoidance. The driving test places too much emphasis on the ability of the driver to carry out specific manoeuvres : a reverse through cones followed by a hill start on a loose surface may be useful manoeuvres but require no traffic sense, observation or anticipation. These latter qualities are essential at even moderate speeds in light traffic, and can only be tested by observed consistent performance on trafficked roads. Reasonable or even good control does not mean that a driver knows how to proceed correctly and safely in traffic."

Some problems such as these, he suggests the following steps:

1. Institution of a fair and standardised but strict driving test. Different tests should be specified for different classes of license. with a hierarchical system established so that prospective public service and heavy goods vehicle drivers must have held general licenses for a minimum period of time. Requirements for public service licenses should be particularly stringent. In all tests, standard forms should be used by the examiner and it should be made clear to those who fail the test why.
2. Recruitment and training of full-time examiners in examining techniques, with an emphasis on the ability of the examiner to deal with real traffic conditions.
3. There should be a higher level driving test, conducted by a suitable professional body. Those who pass this test should be entitled to lower insurance premiums.
4. Sufficient salaries to examiners to discourage corruption.

The first three suggestions are definitely capable of implementation in India. However, it must be pointed out that while the new Motor Vehicle Rules makes no mention of requiring any test of knowledge of the kind of manoeuvres which Collins talks about, the fact is that the licensing authorities in many places still consider it to be an intrinsic part of the Road Test. The suggestion regarding the making of PSV licenses very stringent is relevant in India as CRRRI studies show that buses and trucks have almost two-thirds share of accidents. Again, ASRTU studies reveal that in 70% of the accidents where PSV's are involved, drivers were at fault. It would also be relevant to mention here that the new Motor Vehicles Act gave 16 year - olds the right to ride gearless scooters. This is contrary to the trend in countries with serious safety programmes like the United Kingdom where children of that age are prevented from riding motorised two and three wheelers.

Collins emphasises that nothing is possible without properly trained and supervised instructors. He cites the case of Japan and West Germany which have reduced casualties by an integrated strategic plan which included an increased emphasis on driver training and professionalism of instructors. He suggests that the training should include systematic vehicle control, braking, steering and cornering technique, planning, positioning, observation and substantial experience in traffic. It is important to inculcate the attitude that danger from other road

users or from the neglect of one's own vehicle can be foreseen and prevented.

While motor drivers in both the unorganised and organised sector may be forced to attend training schools for at least basic training, the only way vulnerable groups like cyclists and pedestrians can be educated is through mass publicity methods. The authorities will have to do this in new and innovative ways as there is little evidence that the presently used methods such as Road safety weeks are having any impact.

1.3.1.0.2 Poor eyesight

Another problem with a significant proportion of drivers is poor eyesight. The bulk of Indian drivers are not well educated and do not pay much attention to their health. The Delhi Traffic Police conducted a surprise check on truck drivers and found that 69 per cent of them required spectacles to correct vision defects. 17 per cent of them had very advanced stages of cataract. (International Conference on Road Safety, 1986). Yet these men were driving 10 tonne trucks daily for a living all over the country. In this case the Delhi Police arranged for them to be provided with free spectacles, but it can be safely assumed that drivers with defective vision can be found in all parts of the country. Even in this case, it is not recorded whether the drivers were monitored by Delhi Police or any other body to ensure that they used the spectacles. The new Motor Vehicles Act insists on not just an eye-test but a thorough medical check-up.

However, according to Prof. D. Mohan, the only essential medical test required of able-bodied drivers is an eye-test. A WHO report which he quotes states that "experience from developed countries show that for private drivers there is no scientific evidence to justify the routine medical examination of drivers with a view to reducing injury producing accidents .. developing countries should not require routine medical examinations of private drivers."

1.3.1.0.3 Driver Fatigue

There are time limitations prescribed by law in India for drivers, but there is little or no enforcement. Private sector operators exploit this loophole to exploit their drivers. A study by the Delhi Traffic Police found that 84% of a sample of private operations drivers of Delhi Transport Corporation drove 16 - 18 hours a day with breaks of about five minutes between each trip. The law clearly states that daily working hours should not exceed eight for drivers. Such blatant violations of the law took place in the nation's capital, the seat of all regulators and enforcers. Medical science has documented in detail the correlations between driver fatigue and performance. In European countries, driver time limitations are observed very strictly with the aid of tachographs.

1.3.1.0.4 Drunken driving

It is widely reported that many drivers in India drive under the influence of alcohol. Alcohol "makes a person less sensitive to and aware of sensations of various kinds. It also prolongs the reaction times to sensations of sight, touch and hearing. Again, it impairs night vision" (O'Flaherty, 1986).

No empirical studies were located on the correlation between the incidence of drunken driving and safety figures in India, but it must be pointed out that the law till very recently did not lay down any alcohol limits for drivers and so there were no regulatory mechanisms to check drunken driving.

The newly enacted Motor Vehicle Act provides for legal blood alcohol limits beyond which it is illegal to drive. Previously, when no such limits were prescribed, it was found by a study in Delhi that 27.7% of drivers during night hours had consumed alcohol. Another study of drivers at night in a dry city, Madras by the CRRRI revealed that 64% had a blood alcohol content greater than 0.05 per cent.

These studies were conducted about 20 years ago. Society has become more permissive since then and it can be expected that levels of alcohol intake will not have reduced.

While several committees have been pointing out the dangers of allowing liquor shops along highways, trying to control the supply side of the equation by prohibiting construction of liquor shops is not likely to improve the situation as new off-highway sources are bound to start up.

In this context, the relatively new phenomenon of widespread drug abuse must be pointed out. This is a matter of concern as drug abuse is said to be particularly common among members of less-economically well off groups who also make up a substantial proportion of Indian commercial drivers. This is one field where strict enforcement has the potential for yielding quick results.

1.3.1.0.5 Rash and negligent driving

Rash and negligent driving is reported to be the most common cause of accidents. The Study Group on Road Safety, Government of India (1972), felt that while wilful neglect of the rules of the road may be ascribed to some drivers, good, sparsely trafficked roads and inadequate enforcement are contributory factors. Traffic rules are not strictly followed - signals are ignored, corners cut while making turning movements, queues are

jumped by overtaking from the wrong side, lane discipline is not followed. Overspeeding is also reported to be a cause, but empirical data was not available. In any case, it must be pointed out that there are no clearly laid down speed limits in the country. It is left to the individual states to fix speed limits. In the case of Ahmedabad, speed limits have been placarded in peeling paint in some not easily visible locations such as the Vasna octroi naka and a corner of Delhi gate. Even here, the speed limits are confusing, as different vehicle categories have different speed limits.

A major advance in road safety management will be made when the Central Government lays down clear, mandatory and enforceable speed limits that will be applicable nation - wide. One of the principal facts established by research is the clear correlation between lowering speed limits and reducing road casualties.

"Average speed is a critical factor in accident causation - the percentage drop in fatalities can be 2 to 4 times the percentage drop in mean speeds" (Mohan, 1988). The new Act has a provision for requiring buses and trucks to be fitted with speed governors. If this is made compulsory, the enforcement task of the police will be considerably reduced .

1.3.1.1 Pedestrians

They tend to be the worst sufferers in road accidents, though statistics regarding the Fatality Index , i.e. the proportion of deaths per pedestrian involved are not reported. The Central Road Research Institute has estimated that pedestrians are involve in 30 to 35 per cent of accidents in India. It is reasonable to expect that pedestrians are even more ignorant of traffic rules and regulations than drivers. Lack of pedestrian facilities such as over/under bridges and zebra crossings is also another problem . Even where over/under bridges are available, they are not used as fully as they should be due to the inconvenience involved. In countries with better developed road safety systems, the pedestrian has legal priority at zebra crossings and once a pedestrian steps on one, all drivers have to give way (Federal Republic of Nigeria, 1980). In India, the pedestrian has to scramble here too as hardly any driver even slows down.

1.3.1.2 Cyclists

This is also an extremely vulnerable group. Again, there are no accurate statistics regarding the proportion of total fatalities cyclists account for, but the Central Road Research Institute estimates that cyclists are involved in 25 to 35 per cent of accidents .

In India, most cyclists do not feel the need to acquire a knowledge of traffic rules, regulations and signs. Many accidents take place primarily because of cyclists riding without lights, reflectors or bells and with poor or no tyre treads . They make

turning movements without giving any hand signals, catch hold of fast moving vehicles to get towed and carry unwieldy weights. It has been suggested by experts that bicycles should be compulsorily painted in high-visibility colours like yellow or orange.

1.3.1.3 Motorised Two-wheeler riders

According to British statistics, the risk of a two-wheeler rider being killed per kilometre travelled is about 27 times that of the chance of a car driver being killed. There are several studies that show that the use of properly strapped helmets saves lives. Strict enforcement of the law on wearing helmets can be expected to reduce the number of two wheeler deaths. Another measure that has been suggested is to make it compulsory for two-wheelers to have headlights switched on during daytime also.

An observation of two-wheeler riders will show that they tend to exhibit rash and negligent riding habits. This combined with the fact that they have little or no physical protection in the case of an accident on their inherently unstable machines make them an extremely casualty-prone group.

1.3.2 The Motor vehicle

1.3.2.1 Motor Vehicle Construction standards

It has been known for quite some time now that it is possible to design vehicles to improve the chances of occupant survival after an accident. According to an internal report of General Motors in 1964, "Results from instrumented (controlled) impact tests indicate that nearly all impacts are survivable, even those against fixed barriers. The deceleration of the occupant depends on a number of factors - but the most important is effective restraint."

The human body is known to be capable of surviving large forces due to abrupt deceleration, and survival at a deceleration exceeding 40g has been demonstrated. Since most motor accidents involve much lower decelerations, it is clear that even very severe accidents are occupant-survivable provided the vehicle is safely designed.

According to the Cornell Aeronautical Laboratory, there are three general requirements for collision protection in a vehicle.

They are:

- 1) A sound outer shell structure which will retain its structural integrity under impact - and absorb as much energy as possible - without allowing undue penetration of the striking

possible - without allowing undue penetration of the striking object into the passenger compartment.

2) Elimination from the interior surfaces of the shell any hard, sharp projections or edges and the prevention of vehicle components (such as steering columns and engines) from penetrating into the compartment; the application of energy absorbing materials to reduce impact forces on the human body at all probable points of contact with these surfaces.

3) Provision of passenger restraint systems, not necessarily restricted to seat belt devices, to prevent or minimise relative body motion and abrupt contact with the interior of the automobile, at the same time inducing little or no physiological damage to the passenger due to the operation of these restraint systems.

The second condition is of great relevance for public transport vehicles in India as their passenger compartments are largely in a poor state of repair.

In the U.S, according to Mr. Ralph Nader's book "Unsafe at any speed", "There is a remarkably wide consensus among automobile safety specialists that engineering safety remedy is more effective, cheaper and more easily implemented than trying to correct drivers failures."

Under the Motor Vehicles Act 1988, Govt. has the power to regulate vehicle construction standards by imposing norms on aspects of car design and assembly. However no standards as such have been laid down. A Safety and Pollution standards committee was constituted under the aegis of the Automotive Research Association of India (ARAI) in 1983 by the Department of Heavy Industry which comes under the Ministry of Industry and Company Affairs. This committee was asked to suggest standards to "reduce malfunction and premature failure" of basic automotive systems like brakes, steering, etc.". Car construction standards was outside its scope. The report was submitted in July 1985 along with the ARAI's drafts for about 24 or so standards which dealt with items like hand controls, wipers, horns, brakes, etc. A standard was mooted for testing car doors against side impact. Seatbelts were mentioned as a low priority item while head restraints which guard against whiplash in case of a collision from the rear was not even mentioned. Two serious recommendations were made :

a) The centre should assume powers to force automobile manufacturers to conform to laid down norms. This has been done now as mentioned earlier.

b) A Safety laboratory should be set up, probably with a view to advance Indian automotive safety engineering capabilities. The

ARAI has been entrusted with this, it is understood. Knowledgeable observers however have doubts as to whether the trained manpower exists in India to carry out any meaningful work, considering that even automobile manufacturers have rather limited expertise even in basic matters like engine development, tooling and body styling.

The Bureau of Indian Standards has set up a committee on Automotive Safety and Pollution (No. EDC 101). Its task is to "rationalise the draft standards submitted by the ARAI to make them practical for implementation." The most optimistic estimates of when these standards will be incorporated into Indian vehicles is about 1990/1992.

The new Motor Vehicle Act is silent about which body would be responsible for establishing and enforcing safety standards. It would be instructive to examine the way the U.S laid down safety policy. In 1966, the National Traffic and Motor Vehicle Safety Act was passed and it was with this that regulation of Motor vehicle safety in the U.S actually began. The National Highway and Traffic Administration (NHTSA) was created and mandated to establish safety standards to which the manufacturers of motor vehicles sold in the U.S had to conform.

However, it must be pointed out that the same degree of emphasis given to improving crashworthiness of vehicles in the U.S should not be given in India. Whereas in the U.S, about 70% of road fatalities are occupants of vehicles on the highway, about 70% of road fatalities in India are pedestrians and cyclists.

1.3.2.2 Maintenance and Inspection

It is reported that many vehicles do not conform to the requisite standards of roadworthiness. Even commercial vehicles which are issued certificates of roadworthiness may not be roadworthy as there are ways to get such certificates for vehicles which would not pass the requirements of a roadworthiness test. The new Motor Vehicle Act

1.3.2.3 Malpractices in Vehicle usage

Overloading has been observed to be the primary course of a significant number of accidents. Commercial operators in general are in a very low margin business and have a strong incentive to overload. The present M V Act which prescribes stringent penalties for overloading may help to alleviate this problem if it is implemented effectively.

1.3.3 The Environment

1.3.3.1 Roads

In India, poor roads are reported to be a significant factor in several accidents. However, some experts point out that some of the most negligent and reckless driving takes place on India's best roads. The point to be made is that improvements in geometric, construction and maintenance standards may be able to reduce accident rates to a certain extent.

An example of the way construction of roads was altered to reduce accidents is given below. According to British accident statistics, about two-thirds of fatal and serious accidents in urban areas and about one-thirds of accidents in rural areas occurred at or within 20 feet of junctions. Hence, an obvious place to concentrate engineering improvements is at junctions. During British studies of the patterns of accidents, it was observed that a right-hand splayed junction was safer than a left-hand splayed junction. Based on this, roads built subsequently used right hand splayed junctions where possible.

It is important to emphasise that detailed studies should be undertaken on the incidence of accidents in India before making changes in geometric standards. This is because the pattern of accidents in India are very different from that in Western countries. For example, 71% of two-wheeler accidents in India occur on straight roads and only 21% at junctions whereas abroad, the majority occur at junctions.

According to the 'Study group on Road Safety', Road deficiencies that cause accidents and are amenable to improvements are:

Highways

City Roads

-
- | | |
|--|--|
| 1. Single lane pavements | 1. Inadequate roadways width |
| 2. Poor shoulders | 2. Lack of proper footpaths and pedestrian crossing facilities |
| 3. Non standard pavement widths | 3. Lack and non-uniformity of traffic control devices. |
| 4. Isolated sharp corners | 4. Inadequate street lighting. |
| 5. Poor road junctions | |
| 6. Poor and slipping road surface | |
| 7. Lack of warning signs | |
| 8. Deficient approach section to large towns | |
| 9. Railway crossings | |
| 10. Narrow bridges | |

Source: Study group on Road Safety, 1972

1.3.3.2 Road User's Code

One of the most egregious failures in India is the absence of a Road User's Code that lays down in clear, illustrated detail the duties and obligations of drivers and pedestrians, the traffic signs, symbols and markings and the regulations that govern the use of the road. It has been left to entrepreneurs to cash in on this gap by producing such books which are generally of indifferent quality. Such codes exist in many countries around the world and it should be a relatively easy task to put together an Indian code, drawing from the best features of these codes.

1.3.3.3 Paucity of medical facilities

One of the many reasons for lower fatality rates in developed countries is the excellent and prompt medical attention available to accident victims. In India, where facilities can at best be said to offer a lower level of service than elsewhere, the problem is compounded by the reluctance of third-parties to ferry accident victims to hospitals due to concern that they will become tangled in red tape. Even if action is taken to remove this obstacle, it must be pointed out that ideally, victims of serious accidents should be moved by medical professionals only.

1.3.3.4 Lack of a reliable and accurate data base

What little road safety statistics as exist in the country are unreliable and poorly put together. Information of the most essential nature is not even publicly reported. It has long been recognised in developed countries that a good statistical data base will help in improving road safety.

According to Mr. M. McDonald of the Transportation Research Group, University of Southampton, U.K., the main uses of a road safety data base are:

- a) The provision of a general overview of the road accident situation
- b) The identification of vulnerable groups of road users
- c) The identification of physical circumstances with high accident levels
- d) The determination of appropriate national measures
- e) The monitoring of the effectiveness of accident countermeasures

McDonald suggests that a first step in creating an adequate database is to ensure that the police are provided with an easy-to-use accident report form which have a minimum of subjective questions.

The Indian Roads Congress did come out with a format for reporting accidents, but only the Delhi Police used it after making some modifications. Other police forces said that the form was too cumbersome to be practical and declined to use them.

1.3.4 Enforcement

Enforcement of traffic laws has a tremendous role to play in improving road safety. It would be obvious to even the most casual observer, that in India, traffic laws are obeyed more in the breach than in the observance. This phenomenon is not unique to India. The U.K's Transport and Road Research Laboratory (TRRL) says that "in many third world cities, driver behaviour at traffic signals, pedestrian crossings and priority junctions is particularly poor. Traffic laws in developing countries are widely disregarded and the law makers have not been able to obtain the same respect for traffic laws as other laws." The police appears to concentrate enforcement activities on violations such as parking offences, possession of driving papers, which important as they are, can hardly be said to contribute much to road safety. It is essential that this attitude changes. As Sir John Waldron, the Ex-Commissioner of London's Metropolitan Police says "The moral issue posed by problems of crime and traffic differs, but it would be unrealistic not to recognise that the effect of motor traffic on the community in terms of death and injury, of aggravation of the

human lot and of economic loss far exceeds in severity that resulting from crime."

In India, we had about 49,200 road deaths and about 30,000 murders in 1988. Yet, road safety is a matter that hardly anyone talks about.

Enforcement should primarily be to achieve the safe movement of all road users. According to a consultant in Road Safety, Mr. A. Charlton, enforcement is meant to:

- Prevent violations of traffic laws
- Persuade road users to avoid traffic offences
- Apprehend and punish traffic law offenders

As mentioned earlier, the new Motor Vehicles Act has been drawn up with very laudable intentions. But it has generated substantial controversy as many of the provisions are seen by the public as unnecessary and pointless. According to Charlton "Before any law is introduced, it is necessary for it to be seen as viable by the majority of people. One way to achieve this is to enlist the support of as many organisations as possible when the drafting process is taking place, e.g. motoring organisations, transport associations, relevant government departments and vehicle manufacturers and the police. In this way, a good cross-section of opinion is obtained and the worst pit-falls are avoided in the drafting process." This sound advice would undoubtedly have helped the bureaucrats who framed the new Motor Vehicle Act and Rules.

According to Charlton "Enforcement should be uniform and consistent across the whole country and applied equally to all users. What is even more important than the rules is the way they are enforced. Only when traffic laws are seen to be universally enforced, will there be any improvement in road safety and reasonable compliance by members of the public." In India, there are a few major barriers to uniform and consistent enforcement. The first and most obvious is the degree of corruption prevalent at the frontline of enforcement. The second is the fact that in India the cynical saying, "law makers are law breakers" holds a lot of water. There is a general feeling, based on empirical evidence, that well connected people can get away with violations of the law of the land. The third barrier is the abysmally low lack of awareness among law enforcement officers about road safety and the need to enforce regulations that would improve safety. Correcting this will require a substantial amount of de-training and then correct training. A handbook of the type issued to police officers in the U.K, which provides a concise illustrated account of what is required will prove to be of great use here. Yet another problem is the slow pace at which the overburdened legal system moves. While there are some mobile courts, offences that are tried before it are generally for those that involve violation of laws that are meant to ensure free flow of

traffic, rather than road safety. If such violators do not get off the hook through extra-legal means, their cases tend to drag on for lengthy periods in the courts. It is thus essential that means for speedy dispensation of justice are evolved and implemented.

According to Charlton "It may well be that effective traffic law enforcement can make the greatest single contribution to road accident reduction in developing countries."

1.4.0 Conclusions

The road safety situation in India can be improved, provided that there is will and seriousness on the part of the policy makers and implementers. So far these qualities have been conspicuous by their absence. For example, not a single one of the recommendations of the National Road Safety Council (itself started 25 years after it was decided to set it up) appears to have been carried out so far.

Extremely useful work has been done in India and several countries abroad in this field. If the results of these studies are implemented with due application of mind, there are prospects of a fall in the accident rate. Japan, for example, had a very poor road safety record 32 years ago. But following a concerted intervention by the concerned government agencies, Japan now has one of the best safety records in the world. The fatality rate improved from 23.4 deaths per 10,000 vehicles in 1959 to 1.4 deaths per 10,000 vehicles in 1986 (Murata, 1989). There is no doubt that conditions in India are vastly different from that in other countries. Socio-cultural conditions in India make it very difficult to apply solutions developed in other countries without any modifications. A glaring example of differing conditions is the almost complete absence of courtesy and consideration for others, two of the prime qualities required of a safe road user. But it is definitely not beyond the capability of the concerned government agencies to take care of such constraints, given appropriate political will and support from the policy makers. Financial resources are certainly not a problem, if the Road Safety Council recommendation to earmark 1% of road transport revenue for safety is implemented. In 1988/89, this could have provided about Rs. 60 crores. This is not to underestimate the task that will be involved.

Just one example of what perhaps can be done is to convince the Minister concerned that there are many means at his disposal to bring down the accident rate and that immense political dividends can be gained if a Road Safety drive under his leadership is successful.

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SAFETY MANAGEMENT IN AIR TRANSPORT

2.1.0 Introduction

According to the Department of Civil Aviation, about 9 billion passenger kilometres were performed by the nation's domestic carriers in 1987-88.

The most important guiding principle in air transport is supposed to be safety. It is for this reason that air transport is subject to more extensive and complex regulation than any other commercial undertaking internationally. Safety is supposed to be given prime importance by the various participants in the air transport industry.

There is considerable room for improvement in the way safety is managed in the Indian air transport industry.

2.1.1 Legislation

Air Transport in India is primarily governed by the following legislation - Aircraft Act 1934, Aircraft Rules 1937, Air Corporations Act 1953, International Airports Authority Of India Act 1972 and National Airports Authority Act 1985. Standards and Recommended practices of the International Civil Aviation Organisation are also applicable in India.

2.1.2 Organisations involved

The organisations involved in the conduct of air transport operations can be categorised into the following :

1. Manufacturers
2. Operators
3. Providers of infrastructure/services
4. Regulators

2.1.2.1 Manufacturers

In India, air transport is conducted using aircraft designed and manufactured in several foreign countries. India does not and will not in the foreseeable future possess either the capability or the resources to produce safe, economic passenger aircraft.

The manufacturers whose aircraft are used in India are:

- a) Airbus Industrie (Anglo-French-German - Spanish Consortium)
A 300's , A310's and A 320's manufactured by this company are used by Air India and Indian Airlines.
- b) Aerospatiale (France) - Dauphin helicopters are used by Pawan Hans .
- c) Boeing (U.S) - 737' and 747's are used by Air India and Indian Airlines.
- d) Dornier (Germany) - Do 228's are used by Vayudoot.
- e) Fokker (Netherlands) - F 27's are used by Vayudoot.
- f) Hindustan Aeronautics (India) - 748's are used by Vayudoot (Ex-Indian Airlines). The 748's were built under license in Kanpur from the defunct Hawker Siddely of Britain which is now a part of British Aerospace. HAL also assembled 5 Dornier Do 228's for Vayudoot.
- g) McDonnell Douglas (U.S): This is the successor company to Douglas Aircraft Company. The Douglas DC-3 Dakota is still being used in India by some private operators for chartered flights.
- h) Westland (U.K) - WG.30 is used by Pawan Hans.

2.1.2.2 Operators

The operators in India are (a) Air India

(b) Indian Airlines

(c) Vayudoot

(d) Pawan Hans

(e) Assorted Private Operators

Details of the fleet of the airlines in 1989 is presented below.

- a) Air India owned 12 Boeing 747, 3 Airbus A 300 and 6 Airbus A 310's. They also operate 1 Boeing 747 and 1 Il-76 on lease for air cargo. In winter, an Aeroflot Ilyushin - 62 flies on the Moscow run. They operate to 6 stations in India and about 25 abroad.

b) Indian Airlines owned 10 Airbus A 300's, 19 Airbus A320's and 24 Boeing 737's, 4 HS 748's and 4 F 27's. The airline operates to 61 stations in India and 10 abroad.

c) Vayudoot owns 4 Fokker F 27's, 11 HAL 748's and 10 Dornier 228's. All the F27's and 748's were transferred from Indian Airlines. A few aircraft are almost permanently on ground and have been cannibalised.

d) Pawan Hans owned a fleet of 19 Westland WG.30 and 25 Aerospatiale Dauphin helicopters. Their principal operations are for ONGC's Bombay High Offshore field. It also has some island services and services in mountainous regions. A number of helicopters are on the ground with various problems.

e) Assorted private operators carry out charter flights and the euphemistically titled "air-taxi operations". The aircraft used range from DC-3 Dakotas to Boeing 737's.

2.1.2.3 Providers of Infrastructure/Services:

In India, these are:

- a) National Airports Authority (NAA)
- b) International Airports Authority of India (IAAI)
- c) Indian Air Force (IAF)
- d) Indian Navy (IN)
- e) Indian Meteorological Department
- f) Security Services

a) The National Airports Authority is responsible for running 57 domestic aerodromes, 28 civil enclaves as well as a number aeronautical communication stations. It is responsible for the planning, design, construction and maintenance of runways, aprons, terminals and ancillary buildings. In addition, NAA is responsible for planning, procurement, installation, inspection, maintenance and operation of radio navigation aids, communications systems and visual aids all over the country. It is responsible for provision of air traffic control services in India and for the establishment of air routes across Indian air space. It is responsible for provision of emergency services at its airports and civil enclaves (Department of Civil Aviation, 1989). NAA was carved out of the Directorate General of Civil Aviation in 1986.

b) International Airports Authority of India was set up in 1972 to manage the 4 international airports. It will take over Trivandrum Airport in December 1990. It is currently responsible for planning, construction and maintenance of the runways, taxiways, aprons, terminals and ancillary buildings at Bombay, Delhi, Calcutta and Madras airports (Department of Civil Aviation, 1989). It is also responsible for provision of emergency services. A special feature, however, is that vital safety services like air traffic control, landing and aids at these airports are the responsibility of the National Airports Authority.

(c) & (d) Both the Indian Air Force and the Indian Navy provide access to their aerodromes for use by the National Airports Authority. The National Airports Authority is said to have civil enclaves at such places. As these aerodromes have been designed primarily for use by the defense forces, facilities and services provided by them are of an inferior standard to that required for safe air transport operation. NAA is responsible for upgradation to air transport requirements. Emergency services are also supposed to be provided by the National Airports Authority.

e) Indian Meteorological Services:

Weather is an important element in air transport. Each airport has weather minima below which it closes down. Similarly, en-route weather conditions would dictate the actual track to be followed. Weather forecasting and information services are provided by the Indian Meteorological Department which now comes under the Ministry of Science & Technology.

f) Security services: This is provided under the guidance of the Directorate of Civil Aviation Security, Ministry of Civil Aviation. Air transport is unique among transport modes in the sense that protection from terrorists and hijackers assumes an important role here. Actual implementation and enforcement is carried out by the state or Union Territory Police concerned. There is also an advisory committee on Civil Aviation Security headed by the Secretary, Ministry of Civil Aviation which takes policy decisions and is described as the apex body on security matters.

2.1.2.4 Regulatory Agency:

The Directorate General of Civil Aviation (DGCA) with its Headquarters at Delhi is the agency entrusted with safety regulation of the Indian air transport industry.

According to the Ministry of Civil Aviation, the DGCA is supposed to be broadly responsible for the following activities.

- 1) Formulation and implementation of standards of airworthiness applicable to all civil aircraft registered in India.
- 2) Certification of aircraft operators and licensing of air crew and airports.
- 3) Investigation into air accidents and incidents.

The DGCA's regulatory function is supposed to be performed by the following directorates.

- i) Directorate of Airworthiness (Inspection)
- ii) Directorate of Airworthiness (Manufacturing & Engineering)
- iii) Directorate of Training & Licensing
- iv) Directorate of Regulation and Information
- v) Directorate of Flight operations
- vi) Directorate of Air Safety

As mentioned earlier, air transport is meant to operate under stringent safety regulations. Even in the home of free enterprise, the U.S., safety has not been left to market forces. Internationally, minimum safety standards are agreed by the International Civil Aviation Organization (ICAO) with its headquarters in Montreal. Standards are laid down as Annexes to the convention on International Civil Aviation, which contain Standards and Recommended Practices. Each country is supposed to have a safety regulatory agency of its own, which should set standards that would conform to or exceed those laid down by ICAO. A safety regulatory agency's responsibility is supposed to cover all aspects of air transport - the men, the machines and the operating environment. It *inter alia* is supposed to ensure that key personnel like pilots are properly trained and medically fit, and that the maintenance engineers are competent to perform their duties. Pilots and engineering staff must pass DGCA's training and examination requirements and hold valid licenses.

The agency is also supposed to ensure that the aircraft are built in accordance with standards laid down governing design, materials, workmanship, manufacture, and performance of airframes, engines, avionics and furnishings. These standards are contained in Airworthiness Codes. Two principal codes are the United States Federal Airworthiness Requirements (FAR's) and the U.K.'s Civil Airworthiness Requirements (CAR's). Though DGCA is supposed to be responsible for formulating standards of airworthiness in India, in practice they actually use either the U.S. standards or the U.K. standards. The exception is in the case of Agricultural aircraft where Australian standards are used. In Europe, Joint Airworthiness Requirements (JAR's) have recently been introduced which have been formulated jointly by the regulatory agencies of some countries together.

In the case of a new aircraft type, the rules state that when the regulatory agency is satisfied that the manufacturer has conformed to the set standards and it is mechanically sound and fit to fly, a Type Certificate is issued. All aircraft of the same type require a Certificate of Airworthiness. Since most aircraft in Indian Air Transport are imported, the operator presents the Certificate of Airworthiness and the Type Certificate along with associated certification data from the country of manufacturer. An Indian Certificate of Airworthiness is then issued for the aircraft which is renewable annually. In developed countries like Britain, air transport operators have to prove to the regulatory agency that it has the qualified staff, financial wherewithal, equipment and expertise to operate safely, before permission to operate is granted. There is no evidence that there is any similar provision being enforced in India. It must be pointed out that aircraft with All Up Weight above 15,000 Kg. are required to be maintained by a maintenance organisation approved by the DGCA. The Quality Control Managers of the approved organisation are supposed to be responsible to DGCA for compliance with the requirements. This practice of delegating responsibility is done as with the complexity of modern aircraft and the large number in operation, it would not be practicable for DGCA to go into the fine details of aircraft maintenance and overhaul. However DGCA is ultimately responsible for policing the operators maintenance practices. It must be mentioned that in this respect, the relationship between regulatory agencies and operators is similar all over the world.

2.2.8 The Nature of aircraft accidents

The DGCA requires that they should be notified in the event of accident in which there are deaths or injuries or when substantial damage occurs. Hence such accidents are called notifiable accidents. Indian Airlines has had an average of 10 notifiable accidents per year since its formation. (Barnwal)

There have been several studies into the pattern of accident causes. One such study, attributed the frequency of accident causes in the manner presented below.

Table 2.1

Causes	Percentage
Cockpit Crew	60
Aircraft	15
Weather	4
Airport/ ATC	4
Maintenance	2
Miscellaneous/Unknown	15

To give an idea of the safety record of air transport, the accident records of a number of airlines are presented below.

Table 2.2

Airline accident records
(1970-1984)

Airline	Fatal accidents per million flights
Air Canada	
Air France	1.10
Air India	0.50
American Airlines	9.80
British Airways	0.40
Cathay Pacific	0.90
Egypt Air (1972-1983)	0.00
Japan Airlines	10.80
KLM	3.70
Lufthansa	1.00
Pan Am	0.40
Singapore Airlines (1972-1984)	2.60
Swiss Air	0.00
TAROM (Romania)	0.00
THY (Turkey)	20.00
United	12.00
	0.30

Source: Derived from ICAO Statistics

2.3.0 Remedial action possible

All the airlines in India have a poor safety record in comparison to most international airlines. Indian Airlines is known to have had 16 fatal air crashes since its formation, while the similar figures for Air India, Vayudoot and Pawan Hans are 4, 2 and 4 respectively.

Possible remedial steps are examined under the following categories.

2.3.1 Cockpit crew

The term 'pilot error' is used very freely after air crashes, especially in mass media. As in all other modes, the human element appears to be allotted immediate responsibility for most accidents. This tendency has been around almost from the beginning of Air Transport. It was felt in 1908 that Orville Wright's airmanship might have been at fault in the first fatal air crash. Often, no effort is made to probe beyond the immediate and readily obvious cause of the accident.

According to Lloyd and Tye (1983), in many accident investigations they have studied, "Although the cause of accident may have been designated as Pilot Error, the arrangement of the controls or their method of operation was such that taking account of human fallibility or Murphy's law, the accident was one day bound to happen."

There are varying opinions on the extent to which pilots are responsible for accidents. According to Capt. H. Vermeulen, a former head of the International Federation of Airline Pilots' Associations, it is surprising that the pilot's profession appears to be the only one which has a tailor-made expression which can readily be used after a crash. Mr. Shaw, the former Technical Director of the International Air Transport Association said that "Most 'Pilot error' accidents happen not out of sloppiness, carelessness or disobedience but because we on the ground have laid booby traps for them into which they have fallen."

However, Capt. Caesar, Lufthansa's General Manager Flight Operations Inspection says that "Nearly all the landing accidents on the industry's files could have been avoided, either by better mental preparation and more appropriate actions, or by a diversion (to another airport). False pride, self-esteem, overconfidence, macho behaviour or just carelessness led to the wrong decision." An example of 'overconfidence or macho behaviour' led to the Boeing 737 crash in 1973 at Delhi. The pilot attempted to land below weather minima. Another plane

landed just ahead of him under similar conditions .

An evaluation of 83 pilot error accidents conducted by G.C. Wansbeck quoted in 'Pilot Error', Ed. by R. Hurst, about 20 years ago produced the following table of causes :

Table 2.3

Improper flight technique	-	15
Over confidence	-	16
Insufficient care	-	18
Other causes	-	34

As it has been obvious for some time now that the human element has been the ultimate link in the error chain which leads to accidents, the study of the Human Factors that have an impact on safety has gained a lot of importance and much valuable research has been done in this field.

Its twin objectives can be seen as the effectiveness of the system, which includes safety and efficiency and the well-being of the individual.

One of the effects of the human factors studies is the attention now being paid to the psychological make-up of the flight crew applicant. Organisation's in the developed world now say that the basic character of applicants for crew positions is very important in determining how disciplined their behaviour would be in an essentially repetitive job, and their ability to cope in an emergency. (Flight International, 25 April - 1 May 1990).

One of the major programmes in this regard was initiated in the U.S. by the National Aeronautics and Space Administration into 'Human factors in Aviation safety programme' about 20 years ago. According to NASA, the most common areas of flight crew failures related to aviation safety are:

1. Preoccupation with minor mechanical problems
2. Inadequate leadership
3. Failure to delegate tasks and assign responsibilities
4. Failure to set priorities
4. Inadequate monitoring
5. Failure to utilise available data
6. Failure to communicate intent and plans

It must be mentioned that there are problems which are not readily visible such as the question of fatigue. In India, till today the Flight and Duty Time Limitations have not been statutorily established. In the case of Indian Airlines, the flight crew operate on the basis of an agreement signed with the unions in 1965. This agreement lays down a limit of 65 hours of

a month. Interestingly, pilots in the management cadre say the 1965 agreement does not affect them and they fly aircraft well beyond the the 65 hour limit. At least one air crash in India has been blamed primarily on the DGCA for not having laid down legally enforceable flight time limits. The Department of Civil Aviation said in 1988 that a committee had been set up to examine the question of FDTL's. The results of the committee's efforts do not appear to have been revealed to anyone yet.

Another issue is that of training and maintaining of pilot competence. As mentioned earlier, there is a Flight Operations Directorate in the DGCA. However, there is not a single pilot in this Directorate capable of piloting any of Air India's or Indian Airline's aircraft. This automatically means that there is not a single person in the DGCA capable of monitoring the competence of Indian pilots. Neither is there anyone qualified to ensure that statutory flight documents are adequate to meet safety requirements. As the Appuswamy Report (Government of India, 1978) noted 'Flight manuals, operations manuals, the Minimum Equipment List and cockpit check list are being approved by Inspection Directorate which does not have professionally oriented officers to handle such functions.' It also added that 'the lack of control on operational activities is a serious deficiency and therefore a separate directorate should be set up.'

At present, flight crew competence is self-regulated by the airlines for all practical purposes, with the DGCA designating Examiners and Check pilots. It must be mentioned that the Government accepted the need to staff the operations directorate properly with professionals in 1975. 15 years later, the acceptance has not been implemented. About two years ago, about five pilots from the three main operators were made members of the Operations Directorate on a part-time basis. The extent to which these five pilots will be able to check the proficiency of more than a 1000 pilots is not clear.

Training is again self-regulated for all practical purposes. This is another field in which the presence of qualified and experienced DGCA staff to oversee training-related matters would be useful. For example, questions have been raised about the suitability and adequacy of the training provided to Indian Airlines' crew by Airbus. Indian Airlines' crew were provided with 28.5 hours of conversion training on the simulator. British Airways however ensured that their pilots received 45 hours. It has been pointed out by some experts that it would not be right to administer one standard conversion (from flying one aircraft type to another) course to pilots who would be arriving at the training base with vastly differing backgrounds. 'Flight International' commented that it was not right to convert a pilot to fly one of the latest aircraft who has previously flown only aircraft designed and built in the 1960's and 1970's using the

same minimum list of simulator exercises used to convert a pilot with extensive experience of more recently built aircraft which are highly automated.

2.3.2 Maintenance

An issue that is frequently raised is whether poor aircraft maintenance practices and use of ageing aircraft lead to accidents. This question has been brought to the fore following the well publicised partial break-up of some aircraft in flight. Lufthansa's technical chief, R. Abraham says that 'There is no such thing as an old aircraft if it has been properly maintained'. Again there have been reports of maintenance violations and departures from the approved maintenance schedule approved by the DGCA. While there is no doubt that such practices would lead to a lowering of safety standards, since there is very little authentic material readily available to substantiate such reports, this paper will not examine the matter. It must however be pointed out that powerful regulatory bodies such as the Federal Aviation Administration of the United States have well developed deterrents to act as a strong disincentive for non-compliance with approved maintenance schedules.

2.3.3 Design and manufacturing

In India, the regulatory agency has almost no control over safety aspects relating to design and manufacture of aircraft. Hence, this paper will not study this issue in detail, apart from pointing out that it is possible to make the cabin much safer in the event of an air crash by providing stronger seats and better designed seatbelts. Current airworthiness requirements only call for seats to be able to withstand forces up to 9G. The situation currently is that we have 40G people in 20G airplanes sitting in 9G seat and restraint systems. (Mohler, 1969)

A large number of fatalities in air crashes are due to the poor impact tolerance of seats and seat-belts, which give way at deceleration levels far below what the human body can take, causing the body to hit obstructions such as the seat ahead, or catapulting the passenger away from the seat, usually with grave consequences. Apart from making seats and seatbelts stronger, another improvement that experts have suggested is making the seats face rearwards.

According to the NTSB of the U.S., between 1970 and 1980, there were failures in the cabin furnishings which killed and injured passengers and blocked emergency escape in 58% of survivable accidents. Another problem is the material used in cabin furnishings which give off highly toxic gases when on fire.

2.3.4 Airports

Airports are supposed to be licensed by DGCA according to Rule 86 of the Aircraft Rules, 1937. The purpose of this requirement is to ensure that Aerodromes used for air transport operations meet standards regarding physical characteristics, aerodrome marking and lighting, visual approach aids, landing and navigational aids and emergency services. The National Airports Authority has however gone on record that its airports are not licensed as they are government owned. Even in the case of airports owned by agencies other than the NAA or IAAI, a casual approach to the licensing requirement has been observed. The license of Bangalore Airport which is owned by Hindustan Aeronautics expired in 1961, but this fact only came out after an accident there in February, 1990.

Airports are supposed to be provided with certain navigational aids such as Instrument Landing System's and visual aids such as Visual Approach Slope Indicators. Standards relating to the provision of such aids have been agreed to under the guidance of the International Civil Aviation Organisation. India has accepted that all ICAO standards and recommended practices are applicable here. However, in 1988, 48 Indian Airlines stations were deficient in physical characteristics and 21 had inadequate navigational aids, while 32 had inadequate visual aids. (Mathew, 1988)

The importance of airports having properly trained and equipped safety services is borne out by a study conducted by the British Civil Aviation Authority. A summary of the findings is presented as Table 2.4. This study examined 172 accidents to large air transport aircraft between 1982 and 1985. 69% of the accidents took place at an airport. In spite of this, the death toll in accidents was unacceptably high, despite the presence of rescue services close at hand. For example, in the Ahmedabad air crash which took place just 2.5 kilometres outside the airport, post-mortem examination of the bodies revealed that 75% of the fatalities were caused by 'shock due to burns.'

Table 2.4

Number of accidents --	172
Number of survivable accidents --	92
Number of fatalities in survivable accidents --	2624
Number of fatalities in survivable accidents due to fire --	1236

Source: Civil Aviation Authority (U.K)

According to Annexure-14 of ICAO relating to airports, each airport is required to establish an emergency plan commensurate with the level of aircraft operations and activities at the airport. The purpose of the airport emergency plan is to minimise

the effects of an emergency, particularly with respect to the preservation of life. ICAO has given detailed directions on what the contents of an emergency plan should be.

ICAO recommends that an emergency plan be tested by full scale emergency exercises using all facilities and associated agencies at intervals not exceeding one year. From the evidence presented at various Courts of Inquiry into air crashes, it has come out time and again that such exercises are hardly ever carried out. In the case of Ahmedabad airport, it came out that no emergency plan existed. There is no reason to believe that Ahmedabad airport was the sole exception.

It is of paramount importance that airport emergency services are well equipped and trained and in a state of alertness for any eventuality. According to the Authors of 'Airport Planning', Ashford and Wright, "Disaster scale accidents at airports seldom occur. Safety in aviation, however, requires a continuous alertness to the possibility that a serious accident will occur unexpectedly at any time and will require a rapid and expert response from the airport rescue and fire fighting services. The ability to respond promptly can be achieved only through pre planning and training."

2.3.5 Users:

In the air transport industry, the user comes into the picture mainly in the event of an emergency. As mentioned earlier, a substantial number of crashes are survivable ones and there is a reasonable chance of escaping alive from a crash if emergency systems and services work as they should. But the user has a role to play as he must make sure he knows what to do in the event of an emergency. It is known that most passengers neither read the safety pamphlet in front of them nor pay any attention to the cabin crews instructions on what to do in an emergency. An extreme case of a passenger actually contributing to an accident comes from the accident to a Saudia Lockheed Tristar en-route from Riyadh to Pakistan.

Shortly after take-off, a passenger lit a stove and accidentally got some furnishings on fire. The fire quickly spread and the pilot radioed a May day and was granted immediate landing clearance. He landed the plane safely. However, it was reported that all the passengers were fighting with each other to get out without any of them knowing how to open the exits. The crew were unable to get near the exits to open them. The end-result was that all 302 lives were lost in an aircraft which from the wheels to the fuselage was in perfect condition after landing.

2.3.6 Accident Investigation

At present, all accidents are investigated by an Inspector of Accidents from the Air Safety Directorate of the DGCA. If the government decides to set up a Court of Inquiry, the Inspector's report is taken as a crucial piece of evidence and the report is tested to see if it accords with the facts available in court. If new evidence is brought forward, it is also placed on record. It has been pointed out by several expert and Parliamentary committees that as the Air Safety Directorate is part and parcel of the DGCA, it would not be in the interest of obtaining the truth where lapses on the part of DGCA contributed to the accident, to allow the Air Safety Directorate to conduct the investigation.

What has also come out clearly in courts of inquiry is the shortage of qualified and experienced staff in the Air Safety Directorate. In the case of the Bangalore crash, the Inspector of Accidents told the court that he knew virtually nothing about the systems of the A320 aircraft which was to be examined at the time he was appointed to investigate the crash. Yet he managed to submit a report within a month of the accident, which was in such close agreement with Airbus Industrie's report on the accident that allegations were made that the Inspector's report had effectively been written by Airbus Industrie. In the Ahmedabad air crash, egregious mistakes and omissions were made in the report of the operations group which accused the cockpit crew of committing certain errors of procedure. However, it came out in the inquiry that these 'errors' were in fact the procedures expected of a safe cockpit crew. Incidentally, this report was signed by persons whose designation would imply that they were among the most competent in the country on matters of air safety, such as Deputy DGCA and Deputy Director, Air Safety of Indian Airlines. In some Courts of Inquiry, the proceedings at times degenerated to the level of a brawl over issues which could easily be settled by independent experts. It has been felt by some observers that the presence of lawyers in what are essentially technical matters is not only unnecessary, but possibly counter-productive. According to Mr. W. Tench, the former Head of the Air Accident Investigation Branch of the U.K.'s Department of Transport, "Lawyers are trained for and used to an adversary system - where they act either for the prosecution or plaintiff, or for the defence - and seem always to see things in terms of guilt or innocence. They are also aware that a big aircraft accident enquiry is the preliminary to much subsequent civil litigation, and that if they can persuade the court to a point of view favourable to their client, they can be paving the way to considerable financial benefit at a later stage. The primary consideration of establishing the cause of the accident with a view to preventing similar accidents in the future is not the motivating force behind the legal advocate. Other

shortcomings of the public enquiry system include a presumption, by lawyers, of knowledge in highly specialist areas when in fact often miss the very point which their technical advisers are putting to them. Their tendency is to concentrate on the matters they understand and ignore those that they don't. Lawyers acquire a smattering of technical jargon and by using it to each other create the impression that they have a full comprehension of the subject. Lawyers can waste an enormous amount of time on irrelevant issues because it seems to them that certain trivial points ought to be important". Again, the Courts of Inquiry are conducted by judges who are non-technical men who frequently do not grasp technical points that are being discussed.

There is a strong case for making the air safety branch independent of the Ministry of Civil Aviation. Judging from the unprofessional way in which some inquiries have taken place, there is an even stronger case for obtaining the assistance of experts from countries with well developed accident investigation abilities such as the U.K, U.S, Canada and Australia or from the International Civil Aviation Organisation.

2.3.7 Directorate General of Civil Aviation

From the description of the many lacunae in safety practices detailed above, it is clear that DGCA cannot be said to be carrying out its responsibilities in the manner expected of a safety regulatory agency. There may be several reasons for this. An obvious one is that for the most part, the regulating organisation and the regulated agencies are arms of the same ministry. Another one is the chronic under-staffing of DGCA, though steps were initiated to recruit staff to strengthen the Airworthiness division recently. Other possible reasons are of the nature brought out in a recent study on the functioning of NASA. "Regulators' definitions of what is a problem and the relative seriousness of problems are shaped by their informants. Second, informational dependencies tend to generate continuing relationships that make regulators vulnerable to co-operation. Regulators may take the point of view of the regulated because they develop sympathy and affinity for them, compromising the ability both to identify and report violations. Finally the situation is ripe for intentional distortion and obfuscation by the regulated, for informational dependencies prevent regulators from detecting falsification." (Vaughan, 1990)

The DGCA does not appear to have ever taken any serious action against an airline or airport management for safety lapses. The U.S.'s powerful regulatory agency, the FAA metes out economic and administrative punishment and even certificate suspensions and revocations to violators of established safety standards. For example, it fined Eastern Airlines about \$10 million in 1985 and suspended the license of PBA for non-compliance with regulations.

2.4.0 Conclusions

According to 'Air Transport World' of December 1988, "In assessing whether a system is safe, accidents by themselves cannot tell the whole story. Particularly in aviation, where accidents fortunately are rare, it cannot be assumed accidents would occur as soon as safety standards fall". As a member of the U.S. National Transportation Safety Board, J. Lauber, says "An accident is clear evidence that safety is lacking, but by itself, the absence of an accident does not demonstrate that safety is achieved. An accident is only the final, most visible event in a process of safety decline."

According to the report on 'British Air Transport in the Seventies', "It is at least arguable that a proper assessment of safety records and certainly a proper assessment of the validity of an air safety system, requires information about all those occasions where safety is endangered even to a limited extent. The circumstances which convert a dangerous situation into a substantial accident may well be largely a matter of luck".

With a view to obtaining a better view of the level of safety in air transport operations, the DGCA has identified about 74 specific incidents which should be reported to them, and defined an incident as an occurrence other than an accident which affects or could affect the safety of the air craft operation. Unfortunately, this requirement is hardly ever observed. This is because of the fear of punitive action or embarrassment in front of colleagues. A practical alternative has been developed in some developed countries. In the U.S., the Aviation Safety Reporting Scheme was instituted in 1976 by NASA. The ASRS programme recognises that it is unrealistic to expect to obtain meaningful and adequate information for analysis of human behaviour and lapses in human performance while at the same time holding the threat of punitive action against the person making the report. Hence, air crew are expected to send information on incidents where safety was compromised. Confidentiality is assured and so there is no disincentive for the crew to share their experiences for expert analysis and dissemination to the widest possible audience through a newsletter. In this way, interested flight crew learn from the experiences of others. There is a similar scheme in the U.K which is administered by the Royal Air Force Institute of Aviation Medicine. It should be possible to institute a similar scheme under the umbrella of a respected and competent organisation in this country which is perceived by airline employees to be fair and independent. It must be stated here that none of the organisations involved in air safety currently qualify for such a role.

There have been very detailed and extensive human factors studies conducted in the developed countries, which have provided much useful insight into the question of the human element in aircraft accidents. While some of the lessons have been applied in some parts of the developed world, human factors specialists complain that much more can be done to implement the recommendations that their studies have produced. In India the degree of application of such studies is lower than in developed countries.

According to Prof. E. Edwards, a British Human-Factors Expert, who specialises in pilot error "the 'largest cause' of serious air line accidents could be considerably reduced if the vast bank of existing human factors research is used. The fact that 70% of serious air line accidents are blamed on pilot error is not a reflection of the pilot's ability but of accident investigators themselves. The term 'pilot error' is of no help in accident investigation because though it may indicate when in a system a breakdown occurs, it does not indicate why". This complaint is a recurring theme in all modes of transport. The point that requires constant re-emphasis is that it is essential to go beyond attributing accidents or safety lapses to the human element alone. In this context, ICAO's Manual of accident investigation gives some guidance regarding the way accident investigators should approach their task. According to this document: "If human error appears as a possible cause of the accident, all factors which may have influenced the actions should be examined. The inquiry should not cease, if or when it is established an error has been made: the inquiry should endeavour to establish why the error occurred. Poor design, indifferent human engineering, inadequate or improper operational procedures could well have confused or misled the person. Experience has shown that the majority of accidents have been caused or compounded by human error; often by circumstances which were conducive to human error; this applies to design, manufacture, testing, maintenance, inspection and operational procedures both ground and air. Identification of this element is frequently difficult but it may be revealed by careful, skillful and persistent investigative methods."

It must be emphasised that short comings and lacunae in the air safety system have built up over a long period and will not be easy to remove. An integrated approach has to be taken which will cover all the organisations that are involved in Indian Air Transport. Paramount attention will have to be paid to human resources, both at the selection stage and in the matter of ensuring continuing proficiency. This will obviously apply primarily to flight crew, engineering staff, air traffic control staff and to staff in the regulatory and accident investigation organisation.

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Safety Management in Rail Transport

3.1.0 Introduction

Rail is the most widely used mode of transport for long-distance journeys in India . It used to account for the major portion of surface travel measured in passenger kilometres till the 1970's when it was overtaken by road transport.

In 1988-89, Rail traffic accounted for 263.7 billion passenger kilometers and 230.1 billion net tonne kilometers of freight traffic . A total of 3,500 million passengers travelled in 1988-89 and there were 244 fatalities in 545 accidents.

There is a general perception among the public all over the world that rail travel, while being a safe mode of travel, is not as safe as it could be. This concern for safety is not new. Queen Victoria, Empress of India once wrote to the British Prime Minister , Ewart Gladstone expressing her concern for railway safety. The first rail accident took place in 1830 during the opening ceremony of the Liverpool and Manchester Railway , when 'The Rocket ' hit a Member of Parliament , Mr. W. Huskisson who had disembarked from the inaugural train to stretch his legs . The Hon'ble MP went down in history later that evening as the first rail fatality .

3.1.1 LEGISLATION GOVERNING RAIL TRANSPORT

Rail transport in India is now governed by the Indian Railways Act, 1989 . Under the authority of this Act, a set of General Rules is published to cover virtually every aspect of operations on the railway. According to Y.Mathur writing in 'Indian Railways, Nov. 1984' " these rules have evolved over a period of time, often on the basis of lessons learnt from accidents."

Mathur adds that " The basic theme of the operating rules is to provide for checks and counter checks so that a solitary mistake should not result in a mishap".

3.1.2 Agencies involved

The Indian Railways is one of the largest railways in the world and carried about 3500 million passengers and 300 million tonnes of freight in 1988/89. But it is largely self regulating. However, in the case of major accidents the Commissioner of Railway Safety which is under the Administrative Control of the Ministry of Civil Aviation investigates the accident. The CRS is also responsible for approval of newly laid track for commercial use. The reason for giving the responsibility for investigation to an outside body is the laudable one of ensuring independence.

But it must be pointed out that the 1988 Kollam accident where the CRS recorded the cause of the accident as a tornado exposed this office to considerable ridicule and serious questions were raised about the independent nature of its functioning. According to H.C. Johari writing in the 'Hindu' "The time has come to reorganise the Commission of Railway Safety so that it is more objective in its approach and more conscious of its duties to the travelling public".

There is a Safety Organisation which was set up nearly 30 years ago. This organisation's members are posted from Divisional level all the way up to Railway Board level. The Organisation is supposed to play a very prominent role. Some of its duties are:

- A) To ensure that rules pertaining to operations and maintenance of equipment are clear and comprehensive and are understood and practiced by railwaymen.
- B) To carry out frequent field checks to ensure compliance with safety rules
- C) To counsel staff in safety matters
- D) To ensure staff are duly trained in their jobs and attend periodic safety refresher courses.

However, it was noted by a committee of inquiry that the Safety Organisation was becoming a place where unwanted railwaymen could be shunted to away from main line rations. It was also pointed out that the safety organisation was not doing what it was set up for, but was duplicating the safety efforts of the various other departments.

3.2.0 The nature of Railway accidents

The Kunzru committee of Inquiry (1962) defined an accident as 'any occurrence which does or may affect the safety of the Railway - its engines, rolling stock, permanent way or works, passengers or railway staff on duty'.

Indian Railways categorise their rail accidents into the following categories:

3.2.1 Consequential Train Accidents

These are accidents to trains which result or may result in casualties and damage to railway property. Examples are: collisions between trains, derailments, on board fires and collisions between trains and motor vehicles at level crossings.

3.2.2 Indicative accidents

These are infractions of rules which create serious risk without actually causing an accident. The Railway Board claims indicative

accidents are viewed with the same seriousness as consequential accidents. Examples are: passing of signals at danger, averted collisions and break of block rules prescribed for running of trains.

3.2.3 Miscellaneous Accidents

These include: trains running over trespassers and animals, trains running over obstruction without any derailment, attempted train wrecking detected and rectified in time or detected after passage of trains without a mishap actually occurring (fishplate removal, bombs etc.), fire on board causing less than Rs. 500/= damage, collisions between trains and push trolleys, fires at stations, bridges, viaducts etc.

Table 3.1 presents statistics relating to the rate of accidents on Indian Railways.

This table shows that both the fatality rate and the number of accidents has been showing a declining trend.

Table 3.1

Year	Accidents	Accidents per Million Train Kilometres	Deaths	Deaths per 10 Crore Passenger Kilometres
1979-80	900	2.83	282	0.142
1980-81	1013	2.00	244	0.117
1981-82	1130	2.20	436	0.197
1982-83	797	1.50	58	0.026
1983-84	768	1.40	87	0.039
1984-85	812	1.50	194	0.086
1985-86	717	1.30	77	0.032
1986-87	644	1.10	114	0.044
1987-88	604	1.00	216	0.080
1988-89	545	0.90	244	0.093

Source: Annual Reports, Indian Railways.

For comparison, the figures for a number of foreign railways are given below for 1982.

Table 3.2

Railway	Number of collisions and derailments per million train kilometers	Casualties per million passengers carried
French National Railways	0.72	0.22
British Rail	1.41	0.04
Japanese National Railways	1.22	0.06
German Federal Railways	1.87	0.27
Pakistan Railways	2.36	3.8
Indian Railways (1988/89)	0.9	0.07

Source: International Conference of Railway Associations.

3.3.0 Factors identified as causes of accidents

Table 3.3 gives the causes attributed to accidents for a five year period between 1984/85 and 1988/89.

Table 3.3

Causes of accidents on Indian Railways (1984/85 - 1988/89)

	Total	Percentage
Human failure		
Railway staff	2168	65.26
Others	332	9.99
Equipment failure		
Rolling stock	398	11.98
Track	130	3.91
Signal & Telecomm.	5	0.15
Sabotage	46	1.38
Combination of factors	29	0.87
Incidental	146	4.39
Cause not established	66	1.99
Under Investigation	2	0.06
Total	3322	100.00

Source: Annual Reports, Indian Railways

Indian Railways have conducted three major inquiries into the question of safety on the rails. The inquiry teams were made up of experts and a brief summary of their observations and recommendations on ways of improving safety is presented below.

The inquiry committees were:

1. Railway Accidents Committee 1962 under the Chairmanship of Shri Kunzru.
2. Railway Accidents Inquiry Committee 1968 under the Chairmanship of Shri Wanchoo.

3. Railway Accidents Inquiry Committee 1978 under the Chairmanship of Shri Sikri.

Each of these Committees comprised Railway Experts and they produced their reports after studying thoroughly the way the Railways was being operated with a view to determining if there were loopholes in the safety network.

As in all other modes of transport, the major share of accidents is attributed to human failure.

According to the Sikri Committee, the main factors responsible for these accidents are:

- a) Poor personnel management.
- b) Lack of discipline and erosion of authority.
- c) Plurality of trade unions.
- d) Category-wise unions' associations.
- e) Supervisors as members of the staff unions.
- f) Lack of will on the part of senior officers to deal firmly with current workers due to intervention of unions.
- g) Pressure from political quarters.
- h) Poor machinery for redressal of genuine grievances.
- i) Reservation of posts during promotion for scheduled caste and tribes.

However, The Railway Reforms Commission (1982) noted that 'while human failure has been recognised as being responsible for the maximum number of consequential accidents, no lasting solutions appear to have been evolved. We have gathered an impression that accident inquiries have often ended after explaining the cause as human failure and have failed to come to grips with the real causative factors, even when such human failures have been repetitive. We feel that this problem has to be considered in depth.'

The Railway Reforms Committee headed by Shri Sarin (1982) noted that in many cases recommendations that had been accepted had not been implemented. There were instances where even after directions were issued by the Railway Board, action was not taken at the lower levels. Obviously safety aspects cannot be improved unless a serious effort is made at all levels to implement the

recommendations. The methodology of acceptance and implementation of the recommendation, pertaining to safety definitely requires improvement.

The Committee suggested that as "as many recommendations have suffered in the field because of procedural delays, it would help if for implementing a recommendation, the expenditure, where possible is quantified right at the acceptance stage. Even in the case in which the expenditure has to be spread over a period, money sanction should issue along with the acceptance order."

3.3.1 Important recommendations that have not been implemented

A number of recommendations made by inquiry committees have not been implemented.

Some unimplemented recommendations are outlined below which are potential causes of accidents.

3.3.1.1 Speedometer on Locomotives

The Wanchoo committee had recommended that all locomotives working on trains must be equipped with speedometers. It was also suggested that a more suitable and reliable type of speedometer-cum-recorder is manufactured indigenously and brought into use.

In spite of this, the Sikri Committee was constrained to note that "The Railway Board's claim in this regard is not corroborated by the information supplied by the Railway".

"The speedometers usually go out of order within a few days and the speedometer repair sections were unable to cope with the workload".

The seriousness of this lacunae can be noticed when it is observed that out of 19 accidents investigated by the Commission of Railway Safety, unsatisfactory maintenance and non-provision of speedometers had come in for severe criticism in six cases.

It goes without saying that train drivers would not find it easy to observe speed limits and train schedules without a reliable speedometer. It would be too much to expect him to compute speeds with the aid of distance markings on culverts and his watch.

3.3.1.2 Examination of Coaching Stock

The inadequate number of washing and pit lines with ancillary facilities has also come in for criticism as this leads to difficulties in examining and maintaining coaching rakes properly.

It should be noted that a number of accidents were attributed to defects in carriages.

3.3.1.3 Brake Power

The Wanchoo Committee that the availability of required brake power was essential for safe operation and recommended 85 percent effective vacuum brake cylinder on all broad gauge trains. It was noted by the Sikri Committee that most trains did not have the requisite percentage of effective brake cylinders.

3.3.2 Measures being taken by Indian Railways

According to the Indian Railways 1989/90 yearbook, Railways have been giving 'an increasingly high priority to safety of operations' and cites the following as being important steps taken to further improve safety.

- 1) Increased emphasis on renewal of track and rehabilitation of bridges.
- 2) Introduction of modern technology like Panel interlocking, Track circuiting, axle counters and colour light signalling to reduce dependence on the human element.
- 3) Modernisation of workshops to improve quality of maintenance.
- 4) Psychological tests for drivers, ASM's, pointsmen both at induction and after the age of 45.
- 5) Revamping of training of staff through adoption of modern teaching aids.
- 6) Intensive field inspections, counseling of staff, safety campaigns.
- 7) Training of trainers.

3.3.3 Conclusion

At least on paper, Indian Railways is extremely well organised on the safety front. As seen from the tables above, Indian Railways appears to have a very good safety record now in comparison to some of the major railways of the world. Every railwayman, from top to bottom has been explicitly mandated to ensure safety on the rails. G.R 211 assigns the duty of securing safety to 'every railway servant'. The Railway Act lays down penalties for railwaymen who endanger safety. Apart from that, the duties of various functionaries such as guards, station masters etc. during

the post-accident phase are clearly laid down.

However, it must be pointed out that some people with long railway experience would not agree that the Indian Railways are doing every thing possible to control accidents. According to Mr. Nair writing in 'The Hindu' of 3/1/89, 'The safety rules make good reading, but their studied ambiguity and impracticability for high speed performance make them sound as if they are devised more with a mind to facilitate booking the staff for delinquency, than helping speed and safety exist in consort'.

There are strong grounds to thoroughly examine the functioning of the Commissioner of Railway Safety particularly with regard to the question of its preparedness to perform objective and unbiased investigations of rail accidents.

In the same way that accidents are attributed to human failures, human failure must be held responsible for the delay in improving safety on the rails still further. The Railway Reforms Committee reviewed the status of the way safety measures were carried out in Indian Railways and concluded that the review 'indicated a lack of seriousness in tackling safety measures and the relatively low priority this subject appears to have received. It also shows compromises made due to extraneous factors like inadequate outlays, lack of indigenous capabilities etc. .'. The committee went on to suggest that the recommendations of earlier inquiry committees which had not been implemented so far 'should be implemented on a priority basis as the penalties for non-observance are high.'

It was not possible to examine the current status of implementation of these recommendations or the present state of safety management in Indian Railways within the scope of this study.

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