Is there a way out for reducing mortality in India?

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ABSTRACT

India has the highest road fatalities rates in the world. Therefore India should make reduction of road fatality on war footings with immediate effect, since India is considered as road fatality capital of the world now. Lakhs of people are being killed on the roads every year, and doing nothing for decades indirectly implies we are not doing anything constructive to sort out the problem at hand. Out of three essential aspects of road transport, the cars coming on the roads offer reasonable safety except some of the low end cars, still being sold without airbags. There seems to be no strict regulation of this effect. Second aspect of road transport, i.e., the infrastructure is too weak in two respects. The national highways form 1.7% of the roads; carrying 40% of the traffic and the quantum of expressways are negligible part of it. India lacks skilled man power and lack of will for carrying out the massive work needed to convert existing national highways in to expressways. And finally the driver aspect is the most crucial, as 85% of the fatal crashes are attributed to drivers and there is no deterrence of law to control behaviour of drivers in India. The lack of control speaks clearly about ineffective traffic regulation.

1. INTRODUCTION:

About 1.2 million people die on the world's road on wheels every year and Indian roads account for 1, 30,000 lost lives per annum. Global Status Report on Road Safety 2013 by WHO[1] indicates that this is the third leading cause of death in the prime age group of 30-44 years.. This is of great concern to all professionals as to why this alarming road fatality does not come down despite the advances and discoveries in science and technology that are in vogue in the last decade.

The fatality rate expressed per 1, 00,000 vehicles for India is 116. The fatality rate per 1, 00,000 vehicles for 20 different countries average to 10 as shown in Table I. This implies that the fatality rate on Indian roads is over 20 times that of many of the developed nations.

This paper aims at getting a close up view of the issues facing the car owners choose Indian roads as robust means of transport with regard to safety.

Sr. Nos.	Country	Population, In Lakhs	Vehicle Population, Lakhs	Fatalities	Fatalities/ Lakh population	Fatalities /Lakh Vehicles
1	Australia	222.6	160.6	1363	6.1	8.5
2	Bangladesh	1487	16.2	2958	2	**182.6**
3	Belgium	107.1	70.5	840	7.8	11.9
4	Brazil	1949.5	648.1	37594	19.3	**58**
5	China	13489.3	2070.6	65225	4.8	**31.5**
6	Denmark	55.5	31.08	255	4.6	8.2
7	Egypt	811.2	58.5	7398	9.1	**126.5**
8	France	627.8	342.7	3992	11.6	11.6
9	Germany	823	501.8	3648	4.4	7.3
10	**India**	**12246**	**1149.5**	**133938**	**10.9**	**116.5**
11	Israel	74.2	24.6	352	4.7	**14.3**

12	Italy	605.5	525.8	4237	7.0	8.0
13	Japan	1265.3	898.7	7309	5.8	8.1
14	Malaysia	284	201.9	6872	24.2	34
15	Netherland	166.1	93.4	640	3.8	6.8
16	New Zealand	43.7	32.3	375	8.6	11.6
17	Norway	48.8	31.3	208	4.3	6.6
18	Pakistan	1736	78.5	5192	3.0	**66.1**
19	Poland	382.7	220.2	3907	10.2	17.7
20	Portugal	106.7	87.3	741	6.9	8.5
21	S.Korea (Republic)	481.8	197.1	5505	11.4	27.9
22	Singapore	50.8	9.45	193	3.8	20.4
23	South Africa	501.3	95.9	13768	27.4	**143.5**
24	Sri Lanka	208.6	39.5	2483	11.9	**62.8**
25	Sweden	93.8	52.3	266	2.8	5.1
26	Switzerland	76.6	55.2	327	4.3	5.9
27	UAE	75.1	22.6	826	11.0	**36.5**
29	U.K	620.3	351.7	1905	3.1	5.4
30	U.S.A	3103.8	2589.6	33808	10.9	13.1

TABLE I: Road Traffic Mortality rate per annum in various Countries
(Courtesy: WHO, Global status Report on Road safety, 2013)

Table 1.1 gives fatalities expressed in terms of population and no. of vehicles. Since India is a country with highest fatalities, it is mandatory for us to identify the factors causing such high fatalities as we are losing lakhs of lives every year on the roads so that we can identify means of reducing them.

1.1 Defining the Problem of Safety of Indian Road Transport:

Road transport is basically demarcated by three areas: The Car, Road infrastructure and the driver. All the three are physical aspects of the road transport system. All the three components of road transport is continuously interacting with each other during the travel duration and traffic regulation comes in between mainly for safety and ease of operation. Road fatalities in India are not coming down mainly because causes have not been identified and appropriate actions are not taken by the stake holders. Steven Levitt[2] 2001 asserts that increased seat belt usage and the proliferation of airbags are two factors that have been identified as contributing to declining death tolls on the roads.

Vito Cerone[3] 2009 discusses about vehicle dynamic control for tracking the desired vehicle behaviour, which prevent skidding during the critical manoeuvres through the application of differential braking between right and left wheels in order to control yaw motion of the vehicle.

Shigeharu Miyata[4] 2010 describes the adaptive cruise control system (ACC) which reduces the driving burden on the driver. Road Accidents in India[5] 2012, by Ministry of Road Transport and Highways, gives an account of increasing road fatalities during the period from 2004 to 2009 for India. The report also shows decreasing road fatalities for China during the same period. Obviously China might be putting some efforts in the right direction to reduce the road fatalities and that might have resulted in reduction of fatalities more than half during the same period. It is to be noted that

only 50% of the Indian roads are paved. The surface quality is also important to reduce accidents on the roads. India has to answer as to how she will address the surface quality of roads.

Jugnoor,[6] 2006 specifies based on all India road data that 83% road accidents are due to driver's fault. This puts more emphasis on driver while driving, as we cannot discount the role the driver plays while driving the car, because he is the captain of the band whom he is moving through the car he is driving, the safety of their lives resting up on the split second decisions he is making while he is on the wheels.

1.2 Safety of Road Transport:

1.2.1 Design of Cars for safety:

Before going in to the safety aspects, it is necessary to know the big picture of road transport under consideration. As we have seen earlier, road transport system has three parts, the first is the vehicle (car) the second comes the infrastructure (road) and then the third is the operator (driver.). When we want to assess the overall safety of road transport, we need to look in to the safety provided by each of the three parts of the road transport, i.e., Cars, the road infrastructure and the driver.

Safety was considered as one of the important aspect of mass manufactured cars right from the beginning. Airbags and Seat belts were the earliest safety equipments designed for cars, almost a century before. Initially the research on safety of passenger or road user was focused on saving life during the crash by minimising the injury on person, during the crash.

We can say with confidence that most of the cars available in India were designed for safety. Those who cannot afford all preventive measures of controls fitted on their cars also have only 25% probability of fatality during a crash. Those who can afford all the controls have as low as 5% probability of injury. On the whole we can say that the cars on the road in India are of robust designs from the point of view of safety. Some of the low end cars are sold without airbags in order to boost up sales by the car manufacturers. This is still in practice in India, which naturally increases probability of fatality during a crash.

1.2.2 Design of Road Infrastructure for Safety:

Design and construction of road infrastructure were given due consideration, as most of the government revenue were utilised fully in providing this service to the tax payers. After the World War II, Organisation for European Economic Co-operation (OEEC), was established for implementing economic programs for the reconstruction of Europe. In 1961, the OEEC was reformed into the Organisation for Economic Co-operation and Development (OECD) and membership was extended to non-European states. In 1988, the OECD Road Transport Research Programme established the International Road Traffic and Accident Database (IRTAD) as a mechanism for providing an aggregated database, in which international accident and victim as well as exposure data are collected on a continuous basis.

1.2.3 Behaviour of Driver to enhance safety

The Driver is the most important dynamic aspect of road transport, who actually decides the movement of the vehicle every moment. The road is simultaneously used by numerous other drivers and all want to move at the fastest possible speed to reach their respective destinations. When we see the responsibility of the driver we can say that the lives of all those travelling with him is fully dependent on a 'single entity' whom we call the 'driver'. He, therefore, must be holding a valid driving license after undergoing the tests. Also his vision should be normal in all respects. Even though the car is equipped with different types of active and passive safety devices, he should know that these safety devices cannot replace a driver. The qualities that make a good driver are concentration, anticipation (defensive driving) skill, attitude, knowledge and self-discipline and well aware of the laws pertaining to traffic regulations. A robust driver is the one who can withstand the test of time with a longer record of driving in different regions of the nation with least involvement in accidents and he is also the one who does not take to alcoholic drinks during or before driving.

2.0 THE ASSESSMENT OF SAFETY OF ROAD TRANSPORT SYSTEM

Cars, road infrastructure and the drives all have to be robust to make the road transport system robust enough to offer a safe mode of transport for the road users. However this is said easier than done.
All the three have to be robust individually and also collectively, as each one interacts with the other continuously during the travel.

2.1 SAFETY FEATURES OF CARS AVAILABLE IN INDIA.

There are 30 global brands of cars available in India. And it works out to around 190 models in all that are procured and put on Indian roads. Of all these 20 brands form 80% of the cars moving on the roads.

2.1.1 Seat Belts and Airbags: Seat belts and Airbags are the two features that are available with every vehicle sold to the consumers. These two are mandatory on all cars. There are more than dozen aspects that give additional safety of the passengers for preventing accidents and reducing mortality during crash. These safety features will be discussed below.

A **seat belt**, also known as a **safety belt**, is a vehicle safety device designed to secure the occupant of a vehicle against harmful movement that may result during a collision or a sudden stop. Seat belts limit the forward motion of an occupant, stretch to absorb the energy to lengthen the time of deceleration in crash, reducing the loading on the occupant's body. These prevent occupants being ejected from the vehicle and ensure that they are in the correct position for the operation of the airbags. Steven D Levitt[2] 2001 finds that by wearing seat belt reduces the likely hood of mortality by roughly 60% and airbags reduce mortality by around 16% in direct-frontal impacts. Cameron

S.Crandall[5] 2000 asserts that driver air bags independently reduced head on passenger car crash mortality by 25% and wearing seat belts mortality reduced by 75%.

2.1.2 Electronic Stability Control:

Vito Cerone[3] 2009 developed a Vehicle Dynamic Control (VDC) system for tracking the desired vehicle behaviour. A 2-DOF control structure is proposed to prevent vehicle skidding during critical manoeuvres through the application of differential braking between the right and left wheels in order to control yaw motion. The main goal of vehicle yaw stability control systems is to compensate for the driver's inadequacy and generate a control yaw moment through either steering or braking control inputs or both. Yaw stability control systems have been established as safety feature. They generally provide control action which prevents the vehicle from under or over steering in a handling manoeuvre particularly on a low friction coefficient surface.

2.1.3 Adaptive cruise control:

Shigeharu Miyata[4] (2010) describes the Adaptive Cruise Control system (ACC), a system which reduces the driving burden on the driver. The ACC system primarily supports four driving modes on the road and controls the acceleration and deceleration of the vehicle in order to maintain a set speed or to avoid a crash. This paper proposes more accurate methods of detecting the preceding vehicle by radar while cornering, with consideration for the vehicle sideslip angle, and also of controlling the distance between vehicles. By making full use of the proposed identification logic for preceding vehicles and path estimation logic, an improvement in driving stability was achieved.

2.1.4 Forward collision avoidance system:

Lee and Peng[7] (2005) mentioned that the leading vehicle acceleration is a critical step for developing practical collision warning/avoidance systems. Good estimation of relative acceleration is the key to reduce the false alarm of FCWS. Using the same forward-looking sensors, these pre-crash warning systems alert drivers with visual or auditory cues when the vehicle is getting too close to the one in front.

2.1.5 Autonomous braking:

If the driver doesn't respond to the warning, some systems are able to brake automatically to prevent a collision or lessen the impact. Systems that combine forward-collision warning and auto-brake are the most effective. Any of the advanced emergency breaking systems (AEBS) tested are capable of significantly reducing the severity of rear end collisions.

2.1.6 Other Active Safety Controls:

Pedestrian Detection, Lane Departure Warning, Driver Drowsy Detection and Drunken Driving detection system are some of the active safety controls available which prevent a crash and minimise injuries during the travel.

2.2. INFRASTRUCTURE FOR ROAD TRANSPORT

2.2.1 National High ways and Express ways: In India and China.

Padma S[8] reported that, National Highways in India account for less than 2% of the road net work and they carry 40% of the transport. Ruikar[9] reported that the road transport fatality on National High ways in India is 37% of total road transport fatalities of all roads in India. If 2% of the roads account for 37% of the fatalities, then it is necessary to construct these roads with limited access for entry and exit. In other words, these roads should be express ways. The high traffic density on these could be attributed as one of the major causes of fatal crash on these highways. The number of vehicles also increases by 10% per annum in the last 5 years and may continue to be so in future. But qualities of roads to withstand higher capacities of vehicles were not constructed. The Express ways constructed in India is very small (1200 km) or negligible part 79,200 km of National Highways.

Coming to China, it has 1, 04,000 km of express ways constructed so far. Though India had constructed 21,300 km of 4 and 6 lane National Highways, converting them in to express ways is likely to take several decades, due to rampant corruption and lack of man power.

Now we can look at the fatalities per 1, 00,000 vehicles. India has 116 fatalities as against 31 in China. China and India are similar when it comes to total population and number of registered vehicles. But the fatality rate is approximately one fourth that of India. From table II with regard to effectiveness of law enforcement in speed, drunk driving, and seat belt usage for both India and China, there is hardly any difference. Therefore infrastructure remains as the major differentiating factor between India and China.

India and China were at the same stage in number of Traffic fatalities[5] in the year 2004, perhaps China had 20% more fatalities than India as can be seen from Fig.2.. Only difference that happened during this period in China was growth of infrastructure, i.e., China has added 1, 04,000 Km of expressways, which brought the road mortalities to one fourth that of India. This is a commendable achievement and this need to be duplicated in India.

2.2.2 Relative Measure of Safety of Road Infrastructure

We see the safety of road infrastructure of country is assessed based on population and the number of vehicle registered with in that country. There are two figures to assess the fatality rates per lac of population and fatality per lac of vehicle. Since the vehicle to population ratio of European nations are between 50-70% and many of the Asian countries have vehicle population 10-15%. Therefore, inter-national comparison of the data may not give the level of safety associated with the specific nation.

Therefore, for comparison to be meaningful, we need to see that either the vehicle to population ratio or the actual population should be very close to each other.

For e.g.,India has a fatality of 10.9 per lakh of population and 116 per lakh or vehicles. China has fatality of 4.8 per lakh of population and 31.5 per lakh of vehicles. Both has population close to each other, 1.22 and 1.33 billion respectively.

The vehicle to population ratio is 10% and 15% respectively.

If F_p = Fatality per lakh population Fv=Fatality per lakh vehicle

Then the Fatality Index, $\mathbf{F_i} = \sqrt{\mathbf{F_p}\ \mathbf{F_v}}$

Then we will be able to compare the F_i directly with other nation, only thing we need to see that the vehicle to population ratio is fairly close to each other.

1. Between Israel and UAE, Israel is safer 2.5 times safer as compared to UAE
2. Compared to Cambodia, Israel is 3.5 times safer.
3. China is 3 times safer than India.
4. Sri Lanka is 2 times safer than South Africa
5. Brazil and Russian roads are equally safe.
6. Pakistan roads are 1.5 times safer than Vietnam

2.2.3 Scope of Saving Lives on Indian Roads:

We have now learnt that by expressing the fatality per lakh or population or per lakh of vehicles does not allow us to know how safe our roads are as compared to other countries.

But when we create an index, F_i which is square root of both this population based($F_{p)}$ and vehicle based (Fv), we can now arrive at a common base for comparison, though it is conceptualised ratio, still it provides us some sound basis of comparison in the absence of data based on full usage of vehicle in terms of kilometres. Such data is still not collected by most of the countries excepting countries which are members of OECD.

The lowest value of Index F_i found in the members of OECD countries, with F_p =5 and F_v=5.

Therefore, $F_i = \sqrt{F_p\ F_v} = \sqrt{5x5} = 5$ for OECD countries

F_i (India)=35.45, F_i (OECD)=5 F_i(India)/F_i(OECD)= 7.09

This means, minimum fatality India can expect will be 1/7.09= 0.14

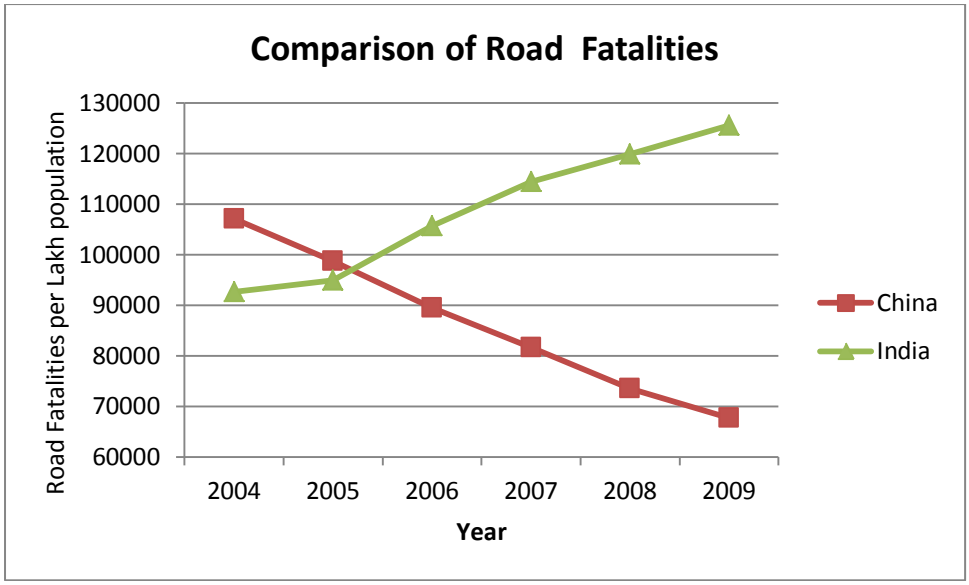

Fig.1 Traffic Fatalities in India and China during 2004-09

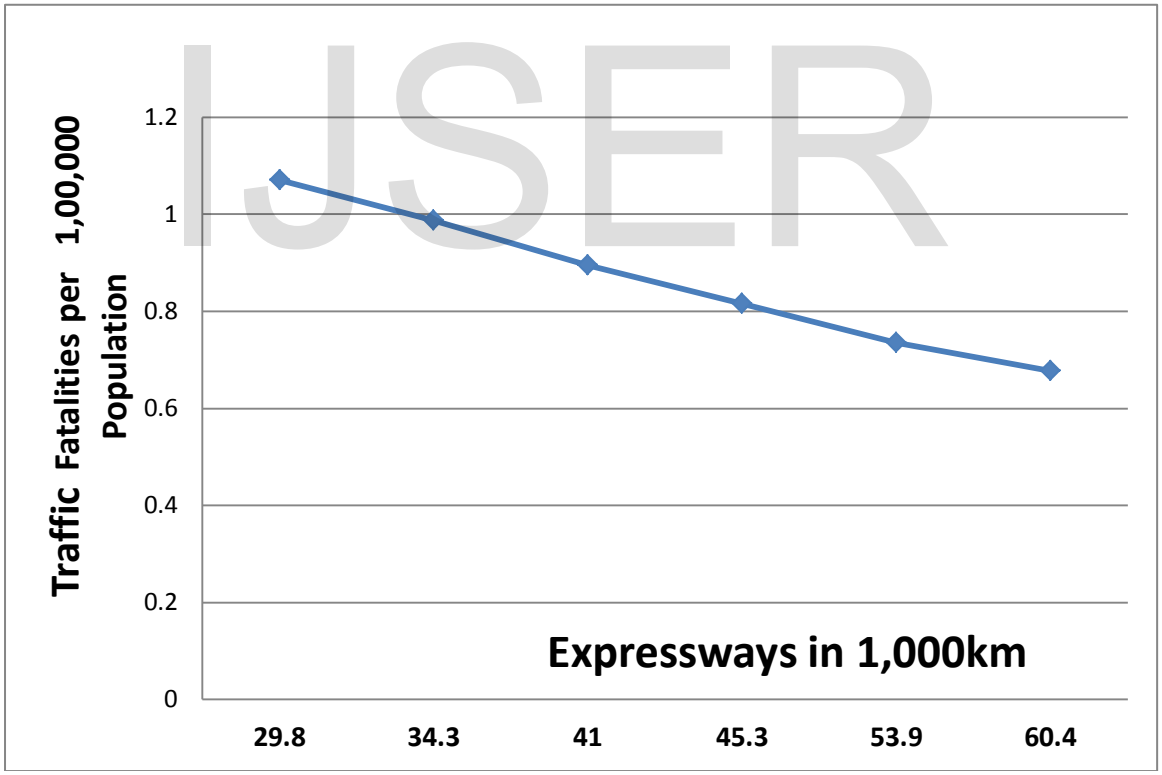

Fig. 2. Correlation between Traffic Fatalities and Expressways added in China year wise.

Table II : Arriving at an Index as Relative Measure of Fatalities

Sr. Nos.	Country	Population, In Lakhs	Vehicle Population, Lakhs	Fatalities	Vehicle/ Population ratio- V_r	Fatalities/ Lakh population F_r	Fatalities /Lakh Vehicles F_v	$F_i=\sqrt{F_r F_v}$
1	Australia	222.6	160.6	1363	0.72	6.1	8.5	7.2
2	**Bangladesh**	**1487**	**16.2**	**2958**	**0.011**	**2**	**182.6**	**19**
3	Belgium	107.1	70.5	840	0.658	7.8	11.9	9.6
4	**Brazil**	**1949.5**	**648.1**	**37594**	**0.332**	**19.3**	**58**	**33.45**
5	Russia	1420	433	26567	0.3	18.7	**61.4**	33.9
6	**China**	**13489.3**	**2070.6**	**65225**	**0.153**	**4.8**	**31.5**	**12**
7	Denmark	55.5	31.08	255	0.558	4.6	8.2	6.06
8	Egypt	811.2	58.5	7398	0.072	9.1	**126.5**	33.9
9	France	627.8	342.7	3992	0.546	11.6	11.6	11.6
10	Germany	823	501.8	3648	0.609	4.4	7.3	5.7
11	**India**	**12246**	**1149.5**	**133938**	**0.094**	**10.9**	**116.5**	**35.5**
12	Israel	74.2	24.6	352	0.33	4.7	**14.3**	8.2
13	Italy	605.5	525.8	4237	0.868	7.0	8.0	7.5
14	Japan	1265.3	898.7	7309	0.71	5.8	8.1	6.85
15	Malaysia	284	201.9	6872	0.71	24.2	34	9,07
16	Netherland	166.1	93.4	640	0.56	3.8	6.8	5.08
17	New Zealand	43.7	32.3	375	0.74	8.6	11.6	10
18	Norway	48.8	31.3	208	0.64	4.3	6.6	5.32
19	Pakistan	1736	78.5	5192	0.045	3.0	**66.1**	14
20	Poland	382.7	220.2	3907	0.575	10.2	17.7	13.4
21	Portugal	106.7	87.3	741	0.818	6.9	8.5	7.65
22	S.Korea (Republic)	481.8	197.1	5505	0.41	11.4	27.9	17.8
23	Singapore	50.8	9.45	193	0.186	3.8	20.4	8.8
24	**South Africa**	**501.3**	**95.9**	**13768**	**0.19**	**27.4**	**143.5**	**62.7**
25	**Sri Lanka**	**208.6**	**39.5**	**2483**	**0.189**	**11.9**	**62.8**	**27.3**
26	Cambodia	140	16.5	1818	0.12	12.9	**98**	35.5
27	Sweden	93.8	52.3	266	0.557	2.8	5.1	3.8
29	Switzerland	76.6	55.2	327	0.72	4.3	5.9	5.03
30	UAE	75.1	22.6	826	0.3	11.0	**36.5**	20.0
31	U.K	620.3	351.7	1905	0.567	3.1	5.4	4.1
32	**U.S.A**	**3103.8**	**2589.6**	**33808**	**0.834**	**10.9**	**13.1**	**11.9**
33	**Mexico**	**1134**	**309**	**37594**	**0.27**	**15.7**	**57.7**	**30**
34	**Vietnam**	**878**	**331**	**11029**	**0.037**	**12.56**	**33.3**	**20.4**

Sr. Nos.	Country	Fatalities	Fatalities/ Lakh population	Fatalities /Lakh Vehicles	Speed Law-Effectivness (0-10 Scale)	Drunk Driving-%	Seat Belt Effectiveness (0-10 Scale)
1	Australia	1363	6.1	8.5	8	**5.8**	**7**
2	Belgium	840	7.8	11.9	6	**25**	**5**
3	China	65225	4.8	**31.5**	**4**	**3**	**2**
4	Denmark	255	4.6	8.2	5	**20**	**2**
5	France	3992	11.6	11.6	**9**	**30.8**	**9**

6	Germany	3648	4.4	**7.3**	**-**	**38.5**	**-**
7	India	133938	10.9	**116**	**3**	**-**	**2**
8	Israel	352	4.7	**14.3**	**4**	**10**	**8**
9	Italy	4237	7.0	8.0	7	**-**	**6**
10	Japan	7309	5.8	8.1	7	**6.3**	**7**
11	Malaysia	6872	24.2	34	5	**23.3**	**4**
12	Netherland	640	3.8	6.8	7	**20**	**7**
13	New Zealand	375	8.6	11.6	8	**32**	**9**
14	Norway	208	4.3	6.6	7	**15**	**8**
15	Poland	3907	10.2	17.7	5	**9.4**	**6**
16	Portugal	741	6.9	8.5	8	**31**	**8**
17	S.Korea (Republic)	5505	11.4	27.9	8	**16.5**	**8**
18	Singapore	193	3.8	20.4	7	**11**	**8**
19	Sweden	266	2.8	5.1	6	**22**	**7**
20	Switzerland	327	4.3	5.9	7	**17**	**7**
21	U.K	1905	3.1	5.4	-	**19**	-
22	U.S.A	33808	10.9	13.1	-	**32**	-
			AVG*	**9.9**	**7**	**20**	**7**

AVG* - This average does not include data pertaining to India or China

(Courtesy: WHO, Global status Report on Road safety, , 2013)

Speed and Seat belt enforcement-Scale-0 to 10

Table III Traffic Mortality rate and Effectiveness of Law Enforcement

Sr. Nos.	Country	Population, In Lakhs	Vehicle Population, Lakhs	Fatalities	Vehicle/ Population ratio- V_r	Fatalities/ Lakh population F_p	Fatalities /Lakh Vehicles F_v	$\sqrt{F_p F_v}$
1	**Bangladesh**	**1487**	**16.2**	**2958**	**0.011**	**2**	**182.6**	**19**
2	**Brazil**	**1949.5**	**648.1**	**37594**	**0.332**	**19.3**	**58**	**33.45**
3	Russia	1420	433	26567	0.3	18.7	**61.4**	33.9
4	**China**	**13489**	**2070.6**	**65225**	**0.153**	**4.8**	**31.5**	**12**
5	**India**	**12246**	**1149.5**	**133938**	**0.094**	**10.9**	**116.5**	**35.5**
6	Malaysia	284	201.9	6872	0.71	24.2	34	9,07
7	Netherland	166.1	93.4	640	0.56	3.8	6.8	5.08
8	**Vietnam**	**878**	**331**	**11029**	**0.037**	**12.56**	**33.3**	**20.4**
9	Pakistan	1736	78.5	5192	0.045	3.0	**66.1**	14
10	S.Korea (Republic)	481.8	197.1	5505	0.41	11.4	27.9	17.8
11	Singapore	50.8	9.45	193	0.186	3.8	20.4	8.8
12	**South Africa**	**501.3**	**95.9**	**13768**	**0.19**	**27.4**	**143.5**	**62.7**
13	**Sri Lanka**	**208.6**	**39.5**	**2483**	**0.189**	**11.9**	**62.8**	**27.3**
14	Cambodia	140	16.5	1818	0.12	12.9	**98**	35.5
15	UAE	75.1	22.6	826	0.3	11.0	**36.5**	20.0
16	Israel	74.2	24.6	352	0.33	4.7	**14.3**	8.2
17	**Mexico**	**1134**	**309**	**37594**	**0.27**	**15.7**	**57.7**	**30**
18								

Table IV: Fatality Index for comparison of Safety of roads between nations.

The following Conclusions can be made from this table. IV

That means, almost 86% of the lives of 1.33 lakh people die on Indian roads can be saved.

Therefore the maximum scope for saving lives from Indian roads is 1, 14,000.

This figures are alarming, Lakh of people's lives lost on Indian Roads could be saved if there is earnest attempt to improve upon road infrastructure and driver aspect, because these two are the most neglected areas during the last two decades.

2.2.4 Why India is sluggish on developing road infrastructure unlike its neighbour China:

It is clear that India is stuck up when it deals with the idea of infrastructure development. It is because India's conceptualisation of road pricing is still in the dark, though she had already dealt with this issue successfully in the past on smaller scale.

McKincy report 2013, on Infrastructure Productivity, discusses about Economics of road pricing in detail. Road pricing is not about raising the revenue; it s a strategy to reduce congestion by affecting both the supply and demand of the road space. When the capacity of an infrastructre asset is constrained, the introduction of pricing helps to determine where ,when and how to add capcity and to monetize the benefits of that new capacity.The more widely this pricing is implemented across facilities, the lower these prices can be.

Robin Lindsy[10] ,2006 discusses the broad merits of road pricing which economist agree, there is no consensus on the best way to set prices, how to address equity concerns, or how to spend the revenue raised. Nor is there consensus on the case for road privatisation. Another relatively under exploited funding system is property value capture. The most prominent form of this is the acquisition and later, sale or lease of excess land.

2.3 DRIVER ASPECTS FOR SAFETY:

Jagnoor[6] specifies that all India road data confirms that 83% of the accidents were due to driver's fault. The most common form of infringement of traffic regulation is drunk driving and speeding. In addition drivers are also found to use mobile and electronic devices for messaging or talking while driving.

2.3.1 Strict regulation in assessing fitness for issuing driving license for driver and Vehicle.

1. The driving license test should adopt digitalized process to prevent human intervention.
2. Fitness certification for the vehicle should be digitalised after testing in a laboratory.
3. Cancellation of license upon violation of traffic regulation. Those violating the laws need to cease driving on the roads.

India has 1000 Regional Transport Offices issuing driving licenses. On an average 40 licenses are issued per day. This requires ample man power for testing, which is very much less than required. Digitalising the process of assessment has ample no. of sensors fitted on tracks that assess how many times the candidate fails to follow the norms during the driving test. Once the rules are set for passing the test, eliminating the human involvement eliminates possibilities of corrupt practices that are rampant in the current method of issue of driving license today. Within a week after the new P.M had

taken charge and before the announcement of ministers heading the various portfolios, accidental death of a minister on New Delhi Road had become a real eye opener. Focus on road death had become one of the highest priorities of the PMO and we can hope to see drastic changes in the RTO practices in the days to come.

2.3.2 Heavy vehicle restriction on road.

Ulf Bjornstig[11] (2008) reported that annual number of passenger car occupant deaths per 100,000 cars in car–truck/bus collisions has remained unchanged since the 1980s, but in car–car collisions it has decreased to one third of its former level. As crash objects, trucks and buses killed five times as many car occupants per truck/bus kilometre driven as did cars.

Since heavy vehicles, ie trucks, buses, and tractors kill 5 times more than passenger cars, it is necessary to reduce the number of heavy vehicles or phase out, reduce the timing of plying heavy vehicles or assign the heavy vehicle to least congestion periods. Speed limits for heavy vehicles should be lower than passenger cars on expressways and it would be better if they are assigned to separate lane where ever it is possible.

2.3.3 Corruptions In Road Transport Sector

Transparency International India[12] initiated a field study to know the extent and nature of corruption in the trucking operations in 2007. In all 1222 truck drivers at 12 trucking centres were interviewed out of 16 major trucking hubs in the country, besides officials, experts and senior executives of trucking companies and truck operators associations.

The study indicated that the truckers are required to pay bribes at every stage of their operations.

It starts with getting registration and fitness certificate, issuance and renewal of interstate and national permits. The reason for paying bribe while on the road , include plying overloaded trucks, traffic violations, parking at no parking places or entering no entry zones and in payment of taxes and tolls and other taxes like Octroi and sale tax. Lack of proper documents or use of alcohol by truck drivers are other reasons for paying bribe. It is estimated that Rs.79, 000/ is paid by a single truck and the total amount works to Rs. 222 bn.(Rs.22,200 Cr). This practice is highly institutionalized, because truck drivers get some kind of “receipt” in the form of stickers or token which allow them hassles free movement.

3. DIGITAL SURVEILLANCE IN INDIA (I.T.S)

Intelligent Transport System (ITS) should be in place for facilitating traffic regulations, which has the following benefits to road users: (1)Reduce the Crashes up to 40%(2)Reduce the travel time by 60%.(3)Reduce cost of Freight mgmt Systems by 35%(4)Increased reliability with automatic vehicle location (5)The investment, ITS pay back in 2 years.

3.1 DIGITAL SURVEILLANCE IN BANGALORE AND MUMBAI

1. 173 Surveillance Cameras in Bangalore and 225 CCTV cameras in Mumbai
2. CCTV Cameras with Auto No. Plate Recognition (ANPR)
3. Surveillance automatically detects incidence, reports Traffic Mgmt.
4. Send offence notification to road users automatically
5. First it detects the offence, then identifies the offender no. plate (ANPR)

One false move or broken signal, and you could find a summons at your doorstep from the traffic police, in a few days. Several traffic officers are on the lookout of those breaking traffic rules, you may find their names in the traffic manual. New Delhi is toying with the idea of going for automated traffic management systems (ATMS).

4.0 ASSESSMENT OF SAFETY OF INDIAN ROAD TRANSPORT

Robust Design of Road Transport requires all three aspects, the car, infrastructure and the choice of driver have been ascertained strictly by analysis based on facts. To this end, data collection is being carried out for ascertaining Robustness of road transport in providing safety of passengers in all four aspects of (1) Design of the vehicle (2) Design of Infrastructure and (3) Driver aspect (4) Traffic Regulation.

The framework for robust design of road transport is shown in Fig.

Jugnoor[6] considers 83% fatal crashes are due to driver's fault. Driver aspect of the vehicle is the most crucial one, because despite the vehicle safety is 73% and infrastructure safety is less than 30%. The traffic regulation is most ineffective in India, due to rampant corruption at issue of driving license and also vehicle testing. The RTOs in India in all cities are yet to follow ethical practices to bring down traffic deaths due to drunken driving; lane crossing and speeding beyond the limits is wide spread on Indian roads. Pervasive education of drivers are not yet planned to bring them to follow safe driving practices. We can therefore say that driving safety in India is less than 15%.

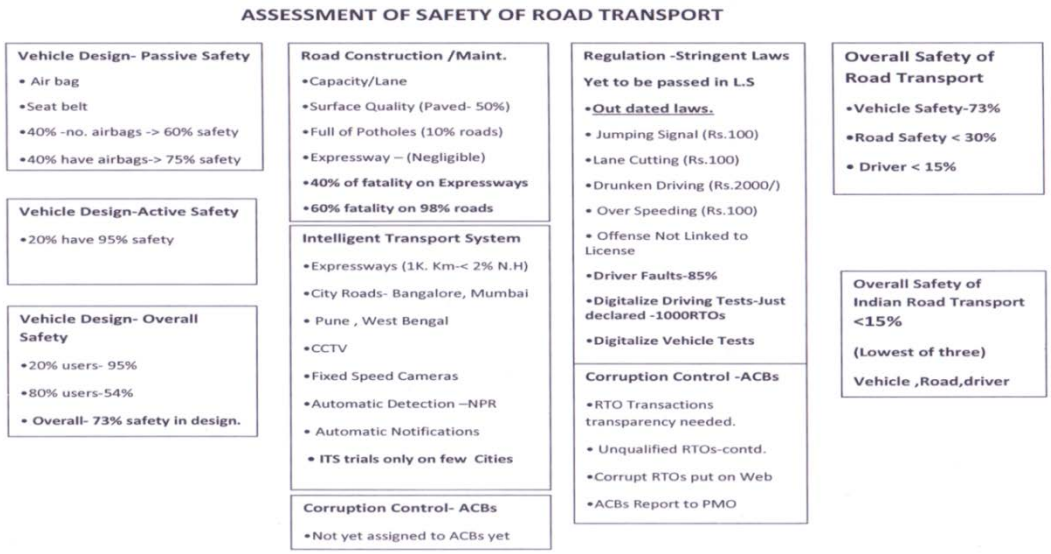

Fig. Assessment of Safety of Road Transport in India

6.0 CONCLUSION

Safety of road transport in India is having maximum fatality in the world. It has been found that out of the three components car is designed for safety close to 73%. The infrastructure has many flaws, like expressways not developed, I.T.S is just introduced in couple of cities, only 50% of the roads are paved, right type of pavement is not used.

Infrastructure safety is not greater than 30%.Driver aspect is totally ignored, as there is least regulation. Still 85% of the causes for crash are driver's faults. Therefore we can say that the safety of Indian Road transport is not greater than 15%.

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