
2011

# Report of Working Group on 4 'E's of Road Safety- Engineering (Vehicles) Submitted to Ministry of Road Transport & Highways, Government of India

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**Chairman- Working Group on Road Safety- Engineering (Vehicles)**

**Director, ARAI**

# Report of

# Working Group on 4 'E's of Road Safety- Engineering (Vehicles)

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# Chapter 1

## Objective and Executive Summary

Vehicles are the most important elements of roads and transportation. Vehicular and occupant safety has been always the focus area of all regulations in past. Vehicle Engineering in the global scenario has matured to a great extent. With the globalization of automotive sector, in Indian scenario also vehicle designs have more or less assumed standardized practices. Road safety is a shared responsibility of 4 'E's and vehicle engineering is one of them. Improvements in road designs and vehicle designs should go hand in hand and work towards enhancement of road safety.

Working Group on Road Safety- Engineering (Vehicles) therefore examined the aspects of vehicular and occupant safety during complete life cycle of the vehicle. As per the terms of reference, macro and micro dimensions of safety are captured in the chapter on Vision and Goals for the country. As an initial goal, India should target at reducing the rate of fatalities on road. As a long term plan, the country should work towards "vision zero".

Deployment of these goals and vision at vehicle engineering aspect are further detailed in respective chapters. Compliance to the safety standards at the time of vehicle construction is a continual and well established process. Over view of Safety Roadmap is given along with short term and long term engineering solutions as are envisaged for different categories of vehicles. Future area of work related to formulation of standards is also covered.

Periodic inspection of in-use vehicles for compliance to safety and emission norms assumes great importance in a country like India, where total useful life of vehicles is very high. With the initiative from Government of India, modest beginning is now made to set up computerized I&C centers in select cities. We have to still go a long way in order to achieve desired results of safety of in-use vehicles. Detailed action plan for country-wide implementation of I&C regime is laid out in the chapter- Safety of in-use vehicles. It also briefly outlines the requirement for End of Life Vehicle (ELV) regulations as a long term requirement in Indian scenario.

Accident data generation and analysis is expected to provide vital information to the policy makers, vehicle designers, users, insurance agencies and many more. In its current situation, this important aspect needs detailed scientific study. Existing manpower, available skill sets and infrastructure should be upgraded in order to support the growing need of scientific and factual data. Chapter on accident analysis provides review of international scenario and proposed action plan for India.

With the above comprehensive action plan for vehicular safety, country should also take advantage of large penetration of IT services and embedded electronics in transportation sector. Intelligent Transport System (ITS) is emerging a as a promising focus area. While the scope of the Working Group is restricted to vehicle engineering, the chapter on ITS provides brief information about possible technologies available in various applications. ITS is a multi-disciplinary subject and there is need to establish policy and targets for its implementation in a phased manner.

# Introduction and Background

## Chapter 2

**7/20/2011**

The Chapter gives background regarding formulation of the Working Group and its deliberations. It outlines the overall contribution of the group towards completion of task as per the terms of reference.

## Introduction and Background

### 1. Constitution of Working Groups on Road Safety

Government of India formulated 5 separate Working Groups on 4 'E's of Road Safety, i.e. Engineering, Enforcement, Education and Emergency care. The Office order and Terms of Reference is given in Annexure I of this chapter. Working Group on Engineering (Vehicles) was constituted as under:

| | | |
|---|---|---|
| i. | Sh. Shrikant R. Marathe, Director ARAI | Chairman |
| ii. | Sh. Vishnu Mathur, DG, SIAM | Member |
| iii. | Sh. U. Sudhakar Rao, ED, ASRTU | Member |
| iv. | Sh. Dinesh Tyagi, Director, iCAT | Member |
| v. | Sh. Vijay Khullar, President, UICBA | Member |
| vi. | Ms. Rashmi Urdhwareshe, Senior D.D., ARAI | Convener |

In addition to the members, the Working Group also received valuable support from experts and senior officers of Automotive Research Association of India (ARAI).

### 2. Deliberations

The Working Group held 2 formal meetings and other follow up discussions amongst members. Considering short time available for its deliberations, WG decided to effectively rely on telecons and emails and also take support from the experts available in ARAI. Accordingly, the committee appreciates the efforts of ARAI experts in giving detailed and studied reports on various topics that are covered in the report.

During the course of deliberations, Convener received specific request from one individual (Shri. Praveen Shetty, Mangalore) to co-opt him on the committee. However, in the interest of time it was decided to restrict his participation by way of specific suggestions on the topics under discussion. However, no specific suggestions were received from him.

The Working Group also noted the efforts going on in establishment of National Automotive Board (NAB) conceived by DHI, which is under approval by the Cabinet.

### 3. Brief Outline of Work

As per the terms of reference, members examined the overall gamut of vehicular and occupant safety and it was agreed to have following outline of work:

a. **Safety rules for Vehicle Construction and its approval (Present and future)-** Comprehensive plan for various categories (2 W, 3 W, small passenger vehicles, large

passenger vehicles, goods vehicles, agriculture tractors, CEVs and other special purpose vehicles should be outlined

b. **Safety aspects during complete life cycle of vehicles to be addressed**:


c. **Vehicle technology for sustainable mobility should be captured**- Eco-friendly vehicles, multi-modal transport approvals, ITS, state/ city specific plans, etc

d. **Establishing close link of following**:

i. Linkage of TA data with vehicle registration, inspection and end of life
ii. Accident data, analysis and its link to regulations
iii. International harmonization of safety regulations

**4. Report**

Working Group has consolidated its study on 5 major topics, namely:

1. **Safety Vision and Goals**- This chapter is aimed at conceiving an overall picture of vehicular and occupant safety as a short term as well as long term plan. While considerable ideas are drawn from other developed countries, their specific relevance in Indian scenario is thoroughly examined. Working Group also proposes specific long term and short term goals towards road safety.
2. **Safety Standards- Roadmap**- India has adopted step-wise approach to introduce mandatory safety standards for various categories of vehicles. Safety roadmap is also drawn in order to achieve harmonization with international safety regulations related to vehicle testing and approval. All the details regarding past, present and future implementation, are captured in the report. Specific recommendations are also made to cover the existing gaps effectively.
3. **Safety in vehicles-on road through I & C-** As a comprehensive plan for vehicular safety it is essential to effectively implement Inspection and Certification (I&C) program for all categories of vehicles. Proposed plan for country-wide implementation is detailed out. At a later date, the I&C program should also be also integrated with End of Life Vehicle
4. **Accident Investigation-** Accident data assumes vital importance in matters involving future policies, expansion plans, safety regulations, vehicle designs, etc. A structured and scientific approach is proposed to achieve the objectives.

5. **Intelligent Transport System (ITS)** - It is envisaged that there would be large penetration of electronics and IT in transportation. Summary of global scenario is captured and its potential in India is examined.

The report gives specific recommendations related to each one of the above aspects.

Government of India
Ministry of Road Transport & Highways
(Road Safety Cell)

1, Parliament Street,
Transport Bhawan,
New Delhi.

No. RT-25014/3/2011-RS

Dated 11th April, 2011

**ORDER**

**Subject: Constitution of separate Working Groups on Four E's of Road Safety i.e Engineering, Enforcement, Education and Emergency Care.**

In pursuance of the decision taken in the meeting of 12th National Road Safety Council held on 25.03.2011, it has been decided with the approval of the competent authority to constitute separate working groups on each of the four E's of Road Safety viz (i) Education (ii) Enforcement (iii) Engineering and (iv) Emergency care which would deliberate in detail and submit their recommendations on short term and long term measures for immediate implementation so as to curb road accident in the country. The composition of these working groups will be as under:

**I (a) Engineering (Roads)**

| | | |
|---|---|---|
| i. | Sh. A. V. Sinha, Retired DG(Roads )&SS, M/o RT&H | Chairman |
| ii. | Sh. R.P. Indoria, ADG (Roads) MoRT&H | Member |
| iii. | Sh.V. L. Patankar, Member (Technical) NHAI | Member |
| iv | Director CRRI, New Delhi | Member |
| v. | Sh.K. K. Kapila, Chairman, International Road Federation, New Delhi | Member |
| vi. | Shri Sudip Choudhary, SE (Planning), MoRT&H | Convener |

**I (b) Engineering (Vehicle)**

| | | |
|---|---|---|
| i. | Sh.S. R. Marathe, Director, ARAI, Pune | Chairman |
| ii. | Sh.Vishnu Mathur, DG, SIAM | Member |
| iii. | Sh.U. Sudhakar Rao, Executive Director, ASRTU | Member |
| iv | Sh.Dinesh Tyagi, Director, iCAT | Member |
| v. | Sh.Vijay Khullar, President, Upper India Coach Builders Association | Member |
| vi. | Ms. Rashmi Udhawereshe , ARAI | Convener |

**Enforcement**

| | | |
|---|---|---|
| i. | Dr. S.T. Ramesh, DG&IG, Karnataka | Chairman |
| ii. | Sh. Pradeep Srivastava, IGP, Chandigarh | Member |
| iii. | Sh. Deepak Upreti, Pr. Secretary and Transport Commissioner, Rajasthan | Member |
| iv | Sh.J.P. Gupta, Transport Commissioner, Gujarat | Member |
| v. | Sh.Satyendra Garg, Joint Commissioner of Police, Delhi | Member |
| vi. | Sh.Chittaranjan Dass, President of All India Federation of Goods Vehicles Association | Member |
| vii. | Sh. Babu Lal Choudhary, Rajasthan | Member |
| viii. | Sh.Rohit Baluja, President, IRTE | Member |
| vi. | Sh. Anand Prakash Director(RT) | Convener |

**Education**

| | | |
|---|---|---|
| i. | Sh.Pradeep Mehta, Secretary General, CUTS | Chairman |
| ii. | Dr. M. Rajaram, Transport Commissioner, Tamil Nadu | Member |
| iii. | Sh. Prince Singhal Founder CADD, Delhi | Member |
| iv | Sh. Vinayak Revankar, Kolhapur | Member |
| v. | Sh. Promod Bhasin, President Muskan,Rajasthan | Member |
| vi. | Representative of CBSE | Member |
| vii. | Sh. Aman Deep Singh Cheema | Member |
| viii. | Sh.Arvind Kumar, Advisor (TR) | Convener |

**Emergency Care**

| | | |
|---|---|---|
| i. | Dr. Shakti Kumar Gupta Head of the Department of Hospital Administration, AIIMS, New Delhi | Chairman |
| ii. | Shri Pradeep Mehta | Member |
| iii. | Dr. Arvind Thergaonkar, DDG,DGHS | Member |
| iv | Representative of NHAI | Member |
| v. | Dr. Narendra Kumar, Delhi | |
| vi. | Shri Chandmal Parmar, Chairman-Managing Trustee Kumari Rajshree Parmar Foundation, Pune | Member |
| vii. | Shri Anand Prakash, Director (RT) | convener |

2. The term of reference of each working group will be as under:-

i) Each Working Group will define the respective problematic area (with reference to road safety) and layout the Macro and micro dimensions with potential solutions.

ii) Suggest strategic steps for immediate implementation

iii) To identify critical issues

iv) To fix the targets and goals, both short term and long term ones, which could be implementable within the available manpower, resources and existing system.

v) To suggest best practices being followed by various Organizations, NGOs, State Governments or abroad in effectively controlling road accidents for their implementation in the country.

vi) Cross linkage with other Working Groups

3. TA/DA to the Members of the working group for attending the meeting will be borne by the respective departments/organizations/State Governments. TA/DA for the non official members will however be payable by the Ministry as per rules. As far as possible the meeting of the Working Group will be held at Transport Bhawan, New Delhi and the Chairman of the respective Working Groups may co-opt other members as deemed appropriate.

4. Each Working Group will submit its report to this Ministry within three months from the date of issue of order and also give a presentation in the next meeting of the National Road Safety Council.

( S.K. Dash)
Joint Secretary (Transport)

Copy to:

(1) Sh. A. V. Sinha, Retired DG(Roads )&SS, M/o RT&H
(2) Sh. R.P. Indoria, ADG (Roads) MoRT&H
(3) Sh.V. L. Patankar, Member Technical, NHAI
(4) Director CRRI, New Delhi
(5) Sh.K. K. Kapila, Chairman, International Road Federation, 208, Ashirwad Complex, D-1, Green Park, New Delhi
(6) Shri Sudip Choudhary, SE (Planning),MoRT&H
(7) Sh.S. R. Marathe, Director, ARAI, Pune
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(10) Sh.Dinesh Tyagi, Director, iCAT, Plot No.26, Sector-3, HSIDC, IMT Manesar, Gurgaon-122050, Haryana (India) New Delhi-110075.
(11) Sh.Vijay Khullar, President, Upper India Coach Builders Association
(12) Ms. Rashmi Udhawereshe , ARAI, Pune
(13) Dr. S.T. Ramesh, DG&IG, Banglore, Karnataka

(14) Sh. Pradeep Srivastava, IGP, Chandigarh
(15) Sh. Deepak Upreti, Pr. Secretary and
Transport Commissioner, Rajasthan, Jaipur.

(16) Sh.J.P. Gupta, Transport Commissioner, Gandhi Nagar, Gujarat
(17) Sh.Satyendra Garg, Joint Commissioner of Police,Delhi
(18) Sh.Chittaranjan Dass, President of All India Federation of Goods Vehicles Association, New Delhi
(19) Sh. Babu Lal Choudhary, Rajasthan
(20) Sh.Rohit Baluja, President, IRTE, B-128-130, DDA Shed, Okhla Indl. Area Phase-1, New Delhi-110020.
(21) Sh. Anand Prakash, Director(RT), M/o Road Transport & Highways
(22) Sh.Pradeep Mehta, Secretary General, CUTS, D-217, Bhaskar Marg, Bani Park, Jaipur-302016
(23) Dr. M. Rajaram, Transport Commissioner, Chennai, Tamil Nadu
(24) Sh. Prince Singhal Founder CADD, Delhi
(25) Sh. Vinayak N. Revankar, 96/2 A, Dudhail, Kolhapur
(26) Sh. Promod Bhasin, President, Muskan, Rajasthan
(27) Chairman, CBSE, New Delh.
(28) Sh. Aman Deep Singh Cheema, Batala
(29) Sh.Arvind Kumar, Adviser (TR), M/o RT&H
(30) Dr. Shakti Kumar Gupta, Head of the Department of Hospital Administration, AIIMS, New Delhi
(31) Dr. Arvind Thergaonkar, DDG,DGHS
(32) Chairman, NHAI
(33) Dr. Narendra Kumar, Delhi
(34) Shri Chandmal Parmar, Chairman-Managing Trustee Kumari Rajshree Parmar Foundation, Pune

**Copy also for information to:**

PS to Hon'ble Minister (RT&H)
PS to Hon'ble Minister of State (J)
PS to Hon'ble Minister of State (T)
PS to Secretary (RT&H)
PS to AS&FA

# Safety Vision and Goals

## Chapter 3

**7/20/2011**

This chapter highlights the overall vision of vehicle and occupant safety. It also aims at setting up short-term and long term goals at national level for enhancing road safety.

## Chapter 3

## Safety Vision and Goals

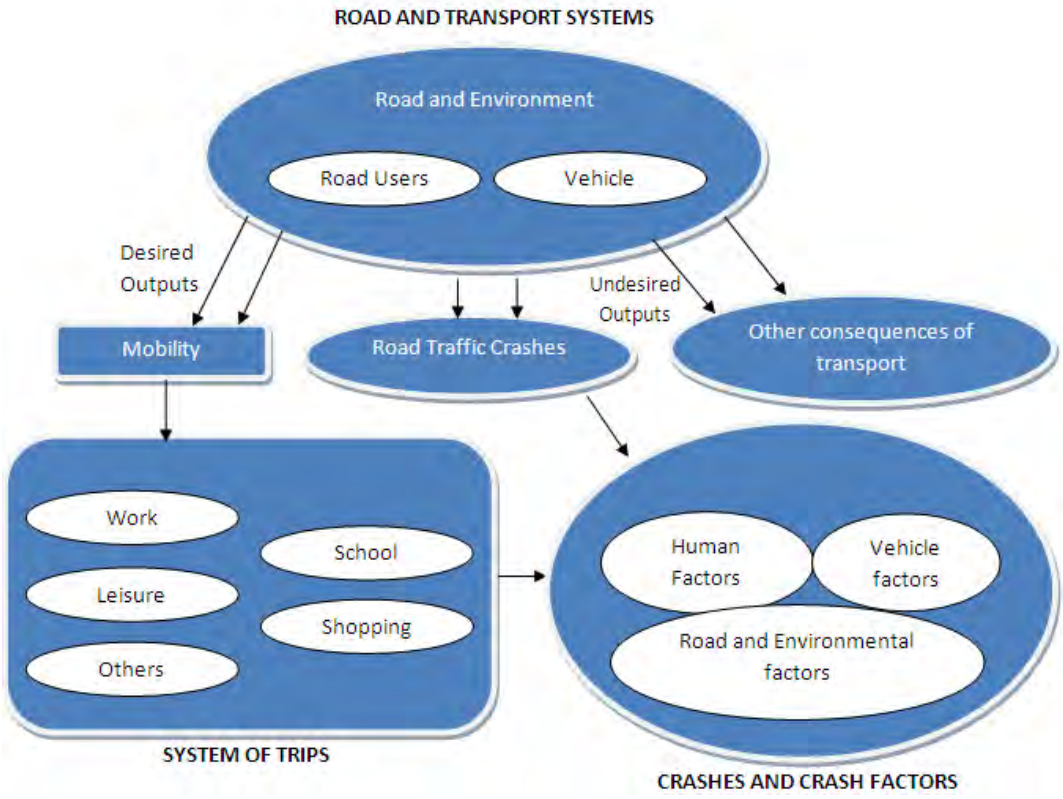
### 1. Introduction

While the need for the mobility is well understood, the phenomenal growth in the vehicle population with lagging infrastructure is producing lot of undesirable outputs, challenging the very sustainability of the Mobility Industry. Safety on the road is one of the biggest challenges of the era. Various components of safety can be listed as:

- Road Safety
- **Vehicular Safety**
- **Occupant Safety**
- Environmental Safety

This report focuses on Vehicular and occupant safety

The challenge of improving safety calls for multi-disciplinary efforts. The overall system approach required to be addressed to improve safety can be well understood with the flow chart below.




***The overall System Approach of Mobility – desired and undesired outputs***

While addressing the engineering aspects of the 4Es, it will be pertinent to look at the Haddon Matrix which gives an analytical approach towards the factors influencing Road Safety.

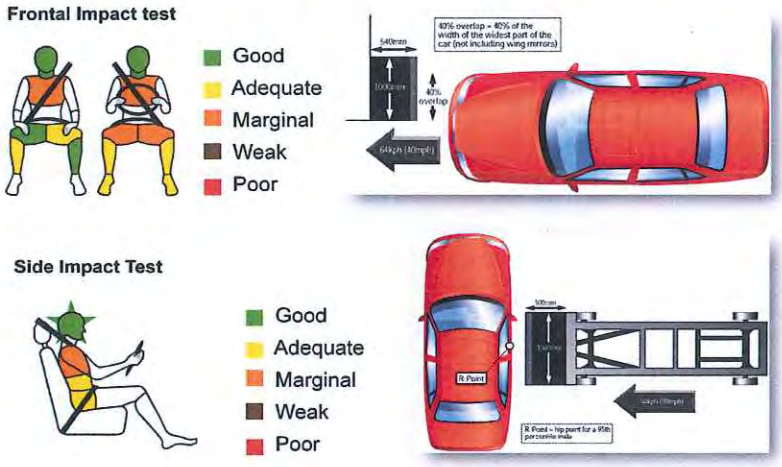
| FACTORS | | | | |
|---|---|---|---|---|
| PHASE | | HUMAN | VEHICLES AND EQUIPMENT | ENVIRONMENT |
| PRE-CRASH | CRASH PREVENTION | • Information<br>• Attitudes<br>• Impairment<br>• Police Enforcement | • Roadworthiness<br>• Lighting<br>• Braking<br>• Handling<br>• Speed Management | • Road Design and Road layout<br>• Speed Limits<br>• Pedestrian Facilities |
| CRASH | INJURY PREVENTION DURING THE CRASH | • Use of Restraints<br>• Impairment | • Occupant restraints<br>• Other safety devices<br>• Crash protective design | • Crash-protective roadside objects |
| POST-CRASH | LIFE SUSTAINING | • First-aid skill<br>• Access to medics | • Ease of access<br>• Fire risk | • Rescue facilities<br>• Congestion |

***Haddon* Matrix**

**2. World Scenario**

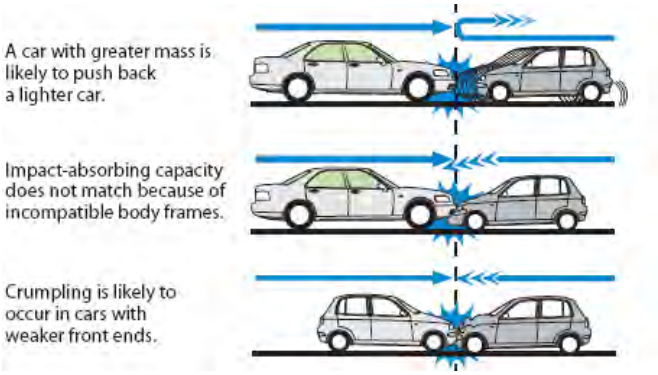
- Most of the Safety Regulations have been implemented in Europe and USA.
- While the regulations have addressed only on minimal safety, the advanced countries have gone ahead with Consumer driven safety ratings like New Car Assessment Programs (NCAP).
  a. Euro NCAP
  b. ANCAP
  c. JNCAP

**EuroNCAP TEST REQUIREMENTS – *Beyond Regulations***




- Impact of globalized product has enhanced the safety.
- Innovations and new technologies providers are fully exploited for increasing the overall safety of both occupant and vulnerable road users. Example: Advanced Restraint Systems, Adaptive Cruise Control, Anti-Skid Braking, Night Vision, Lane Departure Warnings, etc.
- Various national level policies on reducing fatalities have driven the collective and collaborative initiatives amongst the various manufacturers and research houses, resulting into reduced rate of fatalities year on year. Examples:
    a. Vision Zero is a road traffic safety project started in **Sweden** in 1997 which aims to achieve a highway system with no fatalities or serious injuries in road traffic. Many other countries have definite target to reduce fatalities and Road Accident Injuries.
    b. In **Japan**, a succession of five-year fundamental traffic safety programmes and targets, the first of which began in 1971, has reduced the number of road traffic fatalities from 16,765 in 1970 to 6,871 in 2005.
    c. In the **Republic of Korea**, national road safety campaigns have reduced the number of road traffic fatalities from 13,429 in 1991 to 6,563 in 2004.
    d. In 1972, **Australia** became one of the first countries to introduce compulsory seat belts in passenger. This resulted in a 40 to 60 per cent reduction in the risk of injury or death.
- Government interventions based on sound data and cost benefit analysis have resulted into positive results.
- Future Focus of highly Motorized Countries:
    a. Vehicle-to-Vehicle compatibility: In vehicle-to-vehicle crashes, it is often the case that one vehicle sustains greater damage (usually resulting in greater injury to its

occupants) because of differences in mass, size and geometry—including, among other factors, body shape, ride height and bumper height.




***Examples of Incompatibility in Car-to-Car Collisions***

b. Intelligent Traffic Systems to improve the traffic situation

**3. Indian Scenario**

- In India most of regulations have been aligned with ECE Regulations.
- Regulations related to
    a. **Active Safety** like, Braking, Lighting and Signaling Devices, Visibility, Conspicuity, Tyre Safety, Audible Warning Devices, Safety Glazing & Mirrors.
    b. **Passive Safety** like, Safety Belts and their Anchorages, Seats and their Anchorages, Collapsible Steering, Interior Fittings, Under Run Devices for Commercial Vehicles, Super Structure for Buses, Survival Space Assessment for Commercial Vehicles have been mandated.
- In spite of large number of safety regulations had been notified, implementation on the road is still lagging.
- Regulations related to occupant safety and Crashworthiness are yet to be implemented.
- Commensurate testing and R&D facilities are being setup under Government of India NATRiP initiative.
- Accident Research Centre has been also visualized but work has to commence.
- The road safety working groups around the country have started activities in pockets.
- Public awareness in road safety is increasing thereby creating collective will to prioritize the issue.
- The high cost of road crashes, fatalities and injuries to the economy is now well understood.
- **India contributes 8% fatalities with only 1% vehicle population contribution.**
- **75% of victims are vulnerable road users (Pedestrians and two wheeler users).**
- **As per the detailed age profile of accident victims other than the drivers available for the year 2009 it is observed that the age group (25-65 years) accounted for the**

**largest share of 53% of total road accident casualties followed by the age group (15-24 years) with a share of about 30%. Hence, about half of the road traffic casualties are in the age group (25-65 years), which is the key wage earning age group. The loss of the main earning member can be disastrous, leading to fall in income of the household and lower living standards.**

- Amongst the vehicle category - trucks, tempos, tractors and other articulated vehicles accounted for the highest share in total road accidents (22.6%) followed by two wheelers (22.4%), cars, jeeps and taxis (20.6%), buses (8.7%), auto rickshaws (6.9%) and other motor vehicles (10.9 %) in 2009.

## 3.1 Extract of Indian Safety Scenario *(Reference: WHO Report on Global Status on Road Safety)*

| INSTITUTIONAL FRAMEWORK | |
|---|---|
| **Lead agency** | Department of Road Transport and Highways |
| Funded in national budget | Yes |
| **National road safety strategy** | Yes[a] |
| Measurable targets | n/a |
| Funded | n/a |

[a] Not formally endorsed by government.

| NATIONAL LEGISLATION | |
|---|---|
| **Speed limits set nationally** | No (subnationally) |
| Local authorities can set lower limits | Yes |
| Maximum limit urban roads | n/a |
| Enforcement[b] | n/a |
| **Drink–driving law** | Yes |
| BAC limit – general population | 0.03 g/dl |
| BAC limit – young or novice drivers | 0.03 g/dl |
| Random breath testing and/or police checkpoints | Yes |
| Road traffic deaths involving alcohol | — |
| Enforcement[b] | 0 1 2 **3** 4 5 6 7 8 9 10 |
| **Motorcycle helmet law** | Yes |
| Applies to all riders | Yes[c] |
| Helmet standards mandated | Yes |
| Helmet wearing rate | — |
| Enforcement[b] | 0 1 **2** 3 4 5 6 7 8 9 10 |
| **Seat-belt law** | Yes |
| Applies to all occupants | Yes |
| Seat-belt wearing rate | — |
| Enforcement[b] | 0 1 **2** 3 4 5 6 7 8 9 10 |
| **Child restraints law** | No |
| Enforcement[b] | n/a |

[b] Enforcement score represents consensus based on professional opinion of respondents, on a scale of 0 to 10 where 0 is not effective and 10 is highly effective.
[c] Some exceptions.

| VEHICLE STANDARDS | |
|---|---|
| **Car manufacturers required to adhere to standards on** | |
| Fuel consumption | No |
| Seat-belt installation for all seats | No |
| **ROAD SAFETY AUDITS** | |
| Formal audits required for major new road construction projects | No |
| Regular audits of existing road infrastructure | No |
| **PROMOTING ALTERNATIVE TRANSPORT** | |
| National policies to promote walking or cycling | Yes |
| National policies to promote public transportation | Yes |

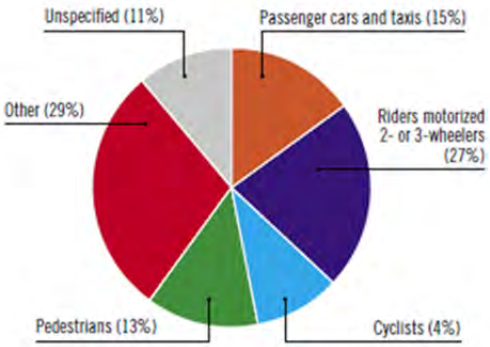
| POST-CRASH CARE | |
|---|---|
| Formal, publicly available pre-hospital care system | Yes |
| National universal access number | Yes |

— Data not available.
n/a Data not required/not applicable.

| DATA |
|---|
| **Reported road traffic fatalities** (2006) 105 725[d] (84% males, 16% females) |
| **Reported non-fatal road traffic injuries** (2006) 452 922[e] |
| **Costing study available** Yes (deaths and injuries) |

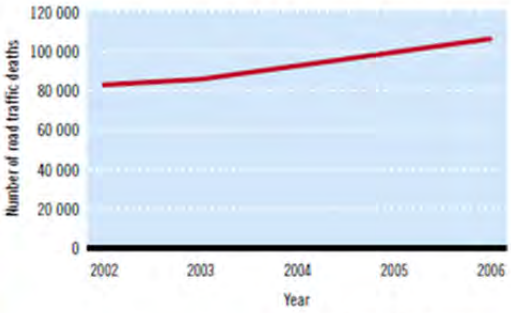
[d] Police data, defined as died within 30 days of the crash.
[e] Police data.

### DEATHS BY ROAD USER CATEGORY




Source: "Road Accidents in India 2006." Ministry of Shipping, Road Transport and Highways

### TRENDS IN ROAD TRAFFIC DEATHS




Source: National Crime Records Bureau

| REGISTERED VEHICLES | |
|---|---|
| 72 718 000 total (2004) | |
| Trucks and Lorries | 3% |
| Light motor vehicles (goods and passengers) | 5% |
| Buses | 1% |
| Two wheelers | 71% |
| Cars, jeeps and taxis | 13% |
| Tractors and trailers | 6% |
| Other | 1% |

Data cleared by the Ministry of Health and Family Welfare.

## 4. Proposed Road Safety vision and goals of India

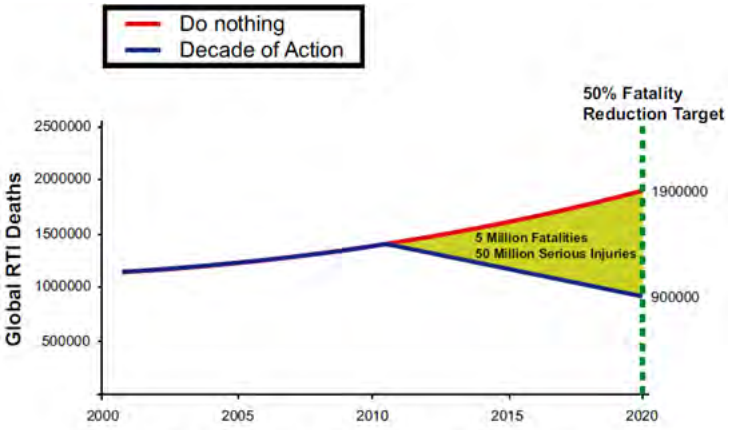
### 4.1 Vision

To reduce the fatalities and injuries due to Road Traffic Accidents by 4E (Engineering, Enforcement, Education and Emergency Medical Services).

### 4.2 Goals

- **Stage I Goal** (2011-2020): Reduce the increasing rate of fatalities
- **Stage II Goal** (2020-2030): Reverse the trend of fatalities and injuries over next decade
- **Stage III Goal** (2030 and beyond): "Vision Zero" to pursue no road fatalities or road accident injuries.

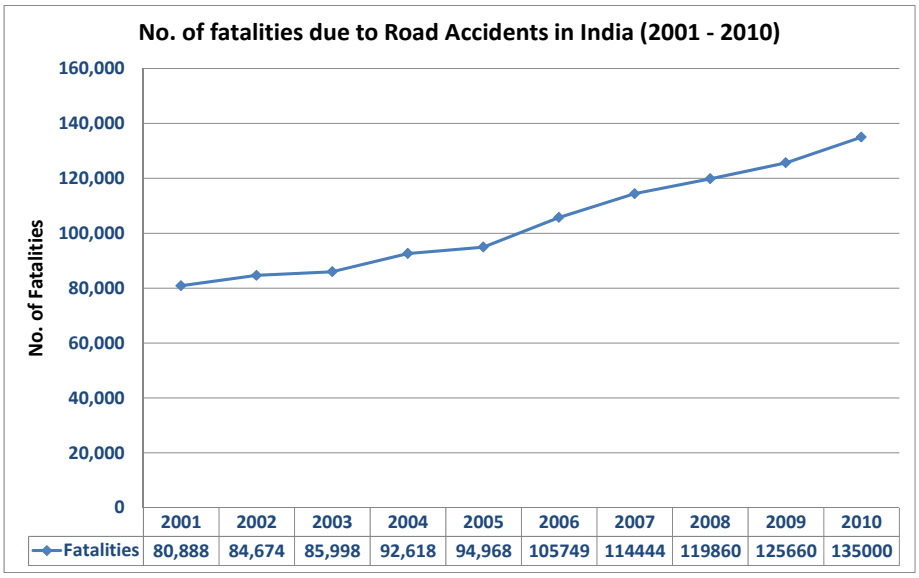
The Global Road Traffic Incident (GTI) deaths clearly show an increasing trend in number of fatalities and serious injuries (Ref: UN Decade of Action for Road Safety 2011-2020).




*Global RTI Deaths & Serious Injuries trends*

It can be seen from the Graph *(Global RTI Deaths & Serious Injury trends)* that, with the right action, up to 5 million lives could be saved and 50 million injuries prevented during the next decade. This would represent a reduction of about 50% on the predicted global death toll by 2020. As advanced countries have been successful in reversing the trend of the fatality, the onus is on developing countries like India to control the fatalities.

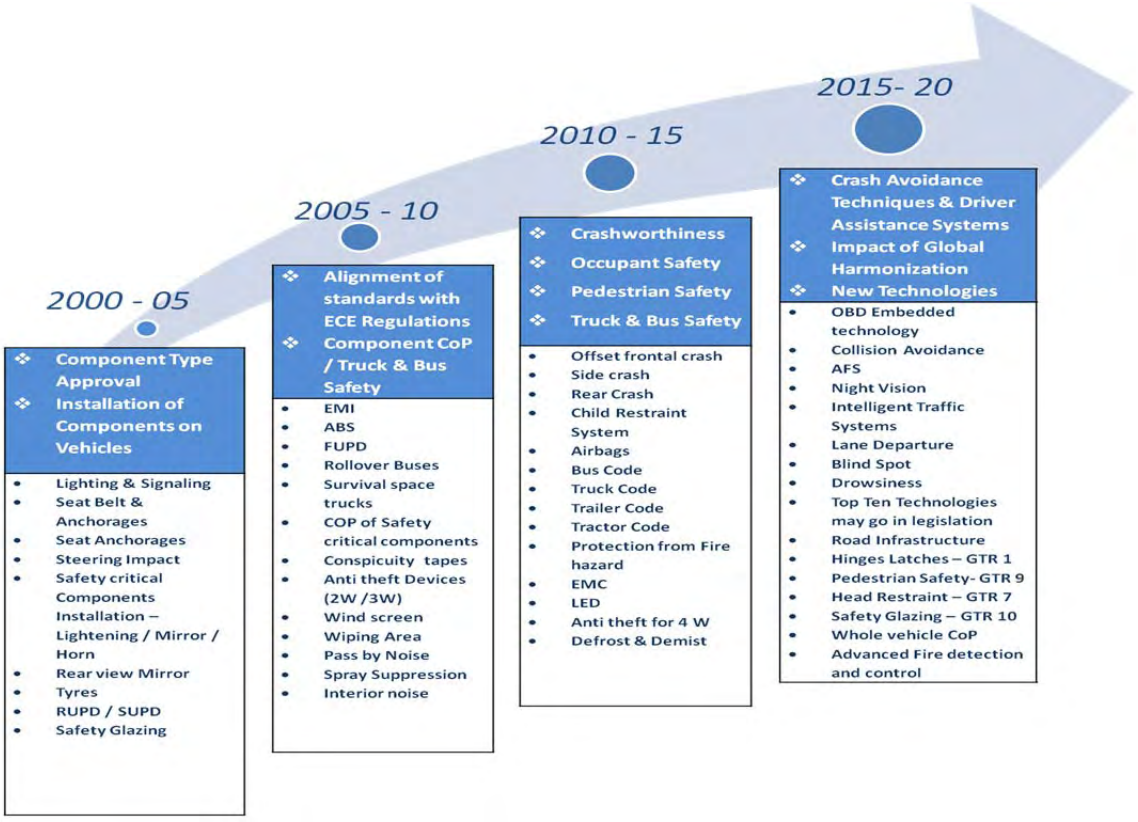
In Indian context, the data available on fatality from MoRTH report clearly shows the urgent action warranted. *(Value of 2010 updates from latest report of National Crime Records Bureau or NCRB)*




***Rising Trend of Indian Road Fatality in the decade (2001- 2010)***

## 5. Safety Roadmap of mandatory standards

In this regard a self-explanatory macro picture of Safety Road Map has been captured covering every five years and the focus areas of Vehicular Safety which are addressed or being addressed. Details about Safety Roadmap are given in Chapter 4.



**6. Engineering solutions and enabling technologies for improving vehicular and occupant safety**

It is understood that the challenge of Road Safety can be met only by simultaneous and coordinated Multi prong approach of 4Es (Engineering, Enforcement, Education and Emergency Medical Services). The summary of major engineering solutions and enabling technologies for improving safety can be categorized according to the priorities as Short Term (3-5 years), Intermediate (5-10 years) and Long Term (>10 years) as given in Table I below:

**Table 1**

| **ENGINEERING SOLUTIONS AND ENABLING TECHNOLOGIES FOR IMPROVING SAFETY** | | |
|---|---|---|
| **TIMELINE** | **PASSIVE SAFETY** | **ACTIVE SAFETY and GENERAL SAFETY** |
| **SHORT TERM (3-5yrs)** | **Two Wheelers**<br>o Setting and enforcing mandatory use of crash helmet- Bicycle and Motorcycle Helmets.<br>o Development of Lighter and Ventilated Helmets to increase the usage.<br>o Use of Proper Rider Gear<br>**3 Wheelers**<br>o Improve Driver seat<br>o Occupant safety and comfort<br>**Passenger Cars & Utility Vehicles**<br>o Safety Belts for all vehicle occupants<br>o Safety Belt Reminders<br>o Crashworthy vehicle structures<br>o Car occupant protection<br>o Frontal and side impact protection<br>o Occupant restraints like Airbags, Air-curtains, and Head Restraint with controlled backset for avoiding whiplash injuries.<br>**Commercial Vehicles**<br>o Retrofitting Under Run Devices for in-use Heavy Commercial Vehicles<br>o Bus Code implementation and accreditation of Bus Body Builders to bring uniformity in the bus body design and enhance safety and comfort to the passengers.<br>o Mandatory use of Tachographs | **Visibility & Conspicuity of Vehicles**<br>o Night Vision<br>o Visibility Enhancement by use of cameras<br>o Daytime running lights<br>o Use of reflective tyres<br>o High-mounted stop lamps in cars<br>o Improving the visibility of non-motorized vehicles<br>o Improving visibility for 3 wheelers<br>o Conspicuity of Pedestrian and Vulnerable Road users<br>o LED technology with less power consumption allowing daytime running of head lamps<br>**Stability & Braking**<br>o Anti-Skid braking (ABS)<br>o Tire Pressure Monitoring<br>**Use of Speed Limiting Devices and Functions**<br>o Setting and enforcing speed limits<br>o Speed enforcement on rural roads<br>o Speed limiters in heavy goods and public transport vehicles<br>o Electro-magnetic Compatibility (EMC) |

<table>
<tr><td></td><td>o Fire protection in buses</td><td></td></tr>
<tr><td></td><td colspan="2">o Component CoP testing for all safety critical components</td></tr>
<tr><td rowspan="2">INTERMEDIATE (5-10yrs)</td><td>Pedestrian Safety<br>o Safer car fronts to protect pedestrians and cyclists<br>o Safer bus and truck fronts<br>Child Restraint Systems<br>o Safer Child Seats for children of all age groups<br>Commercial Vehicles<br>o Truck Code implementation<br>o Trailer Code implementation<br>Agricultural Tractors and Construction Equipment Vehicles<br>o Rollover Protective Structure along with Safety Belts for tractors<br>o Falling object protective structures with enclosed cabin.<br>o To enhance safety requirements for Construction Equipment Vehicles and Off Road Vehicles under CMVR certification.</td><td>Use of Speed Limiting Devices and Functions<br>o Speed Gun<br>o Speed cameras<br>Crash Avoidance Systems<br>o Collision Avoidance Techniques like lane departure warning, Adaptive Cruise Control, Adaptive Front Lighting<br>o Advanced Vehicle Stability Control technologies like Electronic Stability Control (ESC)<br>General requirements<br>o Alcohol interlocks<br>o Safety against displaced luggage</td></tr>
<tr><td colspan="2">o Quality marking for Safety critical vehicle components.<br>o CoP of all Safety critical components based on volumes of production.</td></tr>
<tr><td rowspan="2">LONG TERM (>10yrs)</td><td>Vehicle Compatibility<br>o Design of the vehicle structure for colliding partners’ safety<br>Advanced Restraint Systems<br>o Adaptive Head Restraint<br>o Smart Restraint Systems sensitive to occupancy and its Anthropometry<br>Vehicles to Road Furniture Interaction<br>o Protection against roadside objects like Poles, Trees and narrow objects<br>o Development of Road Restraint Systems<br>Indian NCAP System– beyond regulations<br>o Introduction of Indian NCAP for evaluation and overall safety rating of vehicles</td><td>Driver Assistance Systems<br>o Drowsiness Alarm<br>o Vehicle to Vehicle Communication<br>o Intelligent Transport Systems for better traffic management</td></tr>
<tr><td colspan="2">o Whole vehicle CoP implementation</td></tr>
</table>

# Safety Standards- Roadmap

## Chapter 4

**7/20/2011**

Several safety standards for approval of vehicles are notified under CMVR from time to time. The Road map of safety regulations was drawn in order to plan the activities related to type approval of various categories of vehicles.

## Chapter 4

## Safety Standards Roadmap

### Introduction

After the Motor Vehicle Act, 1988 came into force, rules were framed by the Ministry of Surface Transport (MoST). These rules were issued as notification no. GSR 590(E) dated 2nd of June 1989, and were titled as Central Motor Vehicle Rules, 1989, generally referred to as CMVR.

The Chapter 5 of CMVR was devoted to construction, equipment and maintenance of motor vehicles. Even though the technical requirements related to safety specified in these rules were elementary and prescribed in general only those covered by the earlier Bombay Motor Vehicles Act, the CMVR had the following major initiatives:

a) Spelt out mass emission norms for various categories of vehicles (Rule 115-4, 115-5).
b) Brought in the concept periodic checking of emission from vehicles, Idling CO for petrol, and smoke from diesel vehicles (Rule 115-2).
c) Laid the base for mandating standards for safety critical components (Rule 124).
d) Prescribed the system of a certification of a prototype by notified agencies before a vehicle could be marketed. (Rule 126 of CMVR).

### 1. Formulation of Safety Standards in India

Task was taken up to formulate national testing and approval standards on vehicular safety and emissions. The framework of vehicle type approval and certification was similar to ECE. Accordingly, policy was adopted to formulate our standards on the basis of ECE regulations or EEC directives (as appropriate) while keeping the Indian perspective in mind.

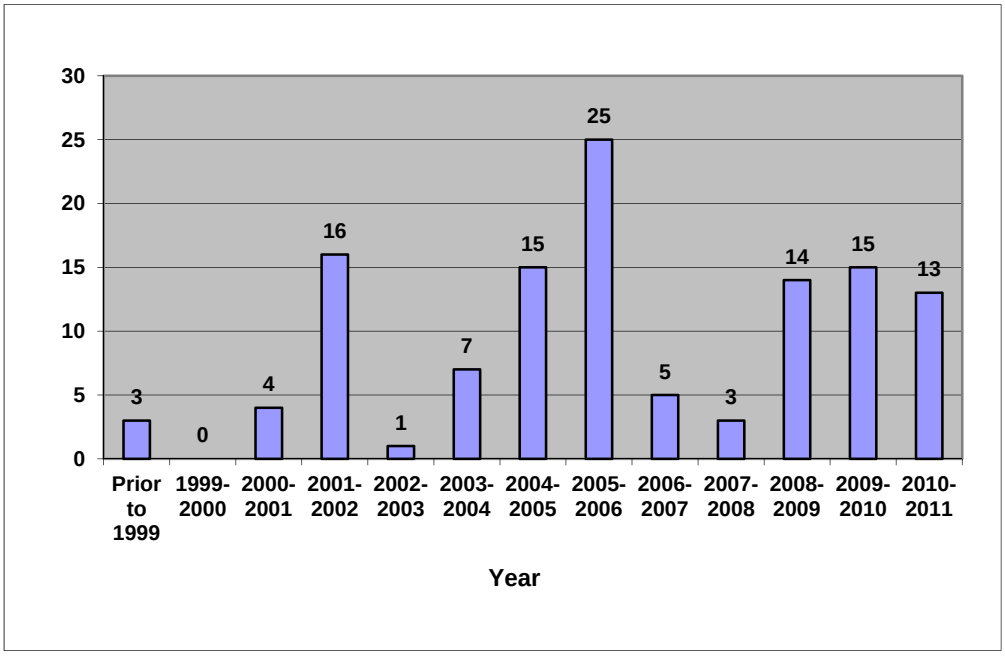
1.1 **CMVR- Technical Standing Committee (CMVR-TSC)-** Based on the recommendation of the sub-committee on CMVR, a permanent Technical Standing Committee was

constituted by MoST in January 1997. This Committee continues to function till date and advises MoRT&H on various technical aspects related to CMVR. This Committee works under the Chairmanship of Joint Secretary (Road Transport) and it has representatives from various stakeholders like government ministries, Bureau of Indian Standards (BIS), Testing Agencies, industry representatives from Society of Indian Automobile Manufacturers (SIAM), Automotive Component Manufacturers Association (ACMA) and Tractor Manufacturers Association (TMA) and representatives from State Transport Departments. The Committee has played a major role in development of the Safety Regulations for vehicles and auto components in India.

**1.2 Automotive Industry Standards Committee (AISC)-**

CMVR-TSC is assisted in drafting the technical standards related to Safety by another Committee called the Automobile Industry Standards Committee (AISC) having members from various stakeholders. This Committee was constituted by MoRT&H in the year 1997 and is chaired by Director (ARAI).

The progress of release of AIS standards by AISC is as depicted in the graph 1 below:




**Graph 1- Annual Progress of publication of AIS standards**

(Source: AISC Secretariat)

## 2. Vehicle Type Approval as per safety norms

Vehicle Type Approval and certification was made mandatory in the country since year 1991. Basic safety requirements at component level and vehicle level, mass emission norms and other performance tests were notified at that time. Prior to this period, vehicles were tested and approved for merely as per Roadworthiness test procedure.

The decade 1991 to 2000 saw major impetus to the automotive industry, which was also linked with introduction of several safety standards. Figure 1 below indicates linkages between evolutionary phases, policies and regulations.

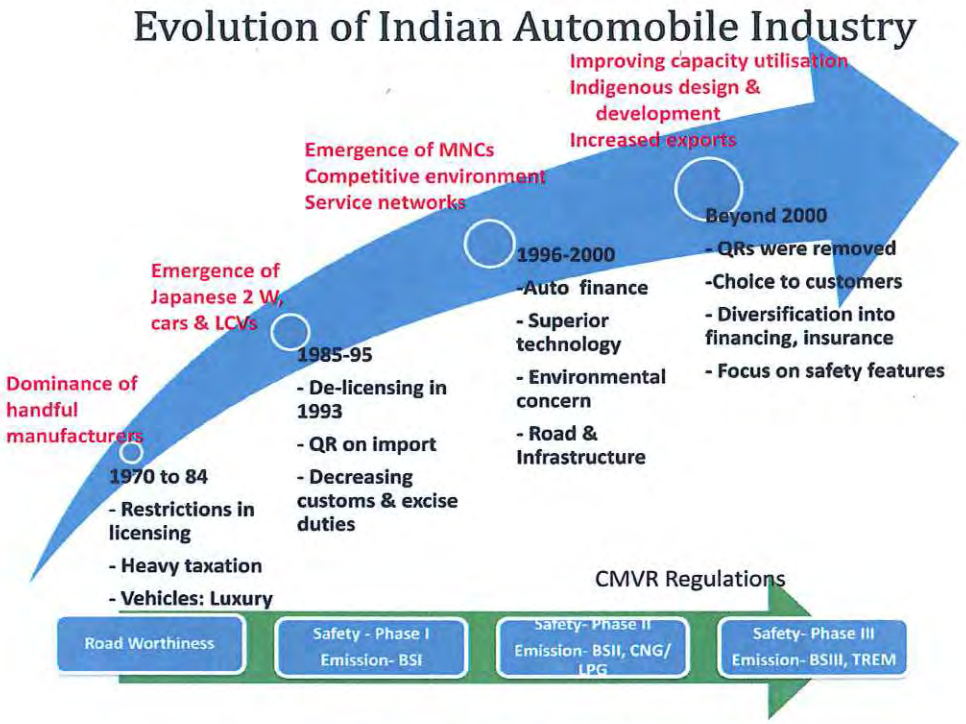



**Figure 1 (Source: ARAI)**

Over last 2 decades several safety and emission standards were implemented in a phased manner. These standards are based on corresponding ECE regulations, EEC directives or other relevant international references. Post 2000, need was felt to accelerate the process of catching up with ECE regulations and a comprehensive plan was undertaken under NATRiP to enhance the existing testing facilities and also to

establish multiple test centers across the country. Simultaneously **Safety Roadmap** was also established in order to take planned steps for notifying safety standards.

### 2.1 Phase-wise implementation of safety standards

During the decade 2001 to 2010, several safety standards were mandated under CMVR. Phase-wise implementation was aimed at gradually improving the safety performance of the vehicles at type approval level by giving fair chance to the domestic auto industry to graduate to use higher technology.

Some of the highlights of this step-by-step implementation are:

1. **Years 2002-04**

| All Categories | 2/ 3 wheelers | 4 wheelers | Gensets/ CEVs |
|---|---|---|---|
| •Hydraulic Brake Hoses<br>•CNG/ LPG safety standards<br>•Horn installation<br>•Gradeability<br>•Radiated EMI<br>•Rear View mirrors<br>•Plastic Fuel Tanks | •Tell tales and controls<br>•Lighting / light signalling devices<br>•Pillion hand holds<br>•Fuel Tanks<br>•Rear view mirror<br>•Steering effort<br>•High speed braking | •Wind screen wiping<br>•Advance warning triangle<br>•Seat Belts, belt anchorages and seats for M1<br>•Steering effort<br>•Brakes<br>•High speed braking<br>•RUPD<br>•SUPD<br>•Power steering (N3)<br>•Lighting / light signalling devices | •Bulbs (CEVs)<br>•Lighting/ Light signalling devices (CEVs)<br>•Noise level (Genset) |

**(Source: CMVR-TSC Secretariat)**

2. **Years 2004-05**

   a. Safety standards for Agriculture Tractors:

      - Steering effort
      - Tyres
      - Brakes
      - Turing Circle Diameter
      - Pass by noise
      - Bulbs

- Brake hoses/ brake fluid
- Tow hooks
- Fuel Tank
- Wheel nuts, hub caps

b. Construction Equipment vehicles
- Lighting / Light signalling devices

### 3. Years 2005-07

| General | 2/ 3 wheelers | 4 wheelers | Agri. Tractors/ Power Tillers |
|---|---|---|---|
| •Automotive bulbs<br>•Safety of Battery operated vehicles<br>•Pass by noise<br>•Flammability<br>•Tyres<br>•Retro-reflectors | •Wind screen wiping<br>•Brakes | •CSFC for heavy vehicles<br>•Spray suppression<br>•Interior fittings for M1<br>•Interior noise<br>•ABS (for select categories)<br>•Automatic Wear Adjustment for brakes<br>•Field of vision (M1) | •Lighting/ Light signalling devices (tractors)<br>•**Power tillers:**<br>•Noise<br>•Bulbs, Lighting/ Light signalling devices<br>•Turning circle<br>•Retro-reflectors<br>•Tyres<br>•Brakes<br>•Gradeability |

**(Source: CMVR-TSC Secretariat)**

### 4. Years 2007-09

| General | 2/ 3 wheelers | 4 wheelers |
|---|---|---|
| •Hand holds (3 and 4 wheelers) | •Wheel rims<br>•Protective devices against un-authorized use | •Seats ( other than M1)<br>•Accreditation of Bus Body Builders<br>•Survival space (N)<br>•Bumpers (M1)<br>•Strength of super-structure (M2, M3)<br>•Foot controls |

**(Source: CMVR-TSC Secretariat)**

**5. Years 2009-10**

| General | 4 wheelers | Agri. Tractors |
|---|---|---|
| •Type Approval & CoP of Components<br>•Vehicle Classification<br>•Vehicle Identification Number (VIN) | •Manufacturer's plate (N)<br>•FUPD (N2, N3)<br>•Temporary cabin for drive away chassis<br>•Retro-reflective markings (N, M3, M3, trailers)<br>•Dimensional requirements for front row bench seat (N, M2, M3) | •Rear warning triangle<br>•Braking system for tractor-trailer combination (Now postponed) |

**(Source: CMVR-TSC Secretariat)**

## 3. Present Scenario of safety regulations in India

As a result of comprehensive efforts at all levels, presently India is at a respectable level of regulations as compared to ECE regulations and other countries. Comparative position with respect to various categories of vehicles is briefly described below:

### 3.1 Two and Three wheelers

Indian 2 and 3 wheeler industry is quite peculiar on account of its usage, designs and utilization. 3 wheelers are predominantly used as cost effective public transportation system. Accordingly our safety standards are more or less at par with equivalent EEC requirements. **Table I** given at the end of this chapter gives the comparative position of mandatory standards with respective to EEC Directive.

### 3.2 Four Wheelers

Indian 4 wheeler sector is at different level of alignment with ECE. Passenger car standards are more or less at par (except for crash and EMC requirements).

In commercial vehicle sector, bus standards are recently formulated and are under implementation.

For goods vehicles, standards are being upgraded in planned manner.

**Table II**details out the Indian regulatory position for various categories like M1, M2, M3 (for passenger vehicles and N1, N2, N3 (for goods vehicles)

### 3.3 Agriculture Tractors

Safety standards for agriculture tractors are based on EEC directives. Considering Indian specific scenario, certain requirements like driver cabin, seat belts, etc. are not mandated at the moment. **Table III** indicates the current Indian mandatory requirements with respect to EEC directives.

### 3.4 Automotive and Agriculture Trailers

For safer good transportation, it is essential to lay down safety standards for passive devices like trailers. AISC has now formulated Agriculture Trailer Code as well as Automotive Trailer Code, which would be implemented in next phase.

### 3.5 Construction Equipment Vehicles

Certain minimum safety requirements are currently specified for CEVs, while they ply on roads. These standards are related to safety of components (horn, mirror, lighting systems, safety glass, etc) and performance of vehicles (such as noise, brakes, speed, turning circle, etc).

In addition to establishing mandatory norms for above major categories, need was felt to introduce safety requirements for other specific industry sectors also. Accordingly standards are also notified for power tillers, retro-fitment of CNG and LPG kits on in-use vehicles and Battery operated vehicles.

## 4. Future Safety Standards

Vehicle category-wise norms which could be implemented in next 5 years are as indicated below. It is expected that by the year 2016, these safety standards would be implemented.

**2 wheelers**

- Electromagnetic compatibility (EMC)
- Spray suppression
- Day time running lamps

**3 wheelers**

- Electromagnetic compatibility (EMC)
- Driver seats

**4 wheelers: M1 Category**

- Advanced Braking System
- Head on, offset front al and side crash
- Head restraints with controlled back-set
- Electromagnetic compatibility (EMC)
- Child Restraint
- Vehicle alarm system & protection against unauthorized use
- Hybrid vehicles

**4 Wheelers- Buses**

- Bus code
- School bus
- Sleeper coaches
- Protection against unauthorized use
- Electromagnetic compatibility (EMC)
- Hybrid vehicles
- Fire protection
- Advanced Braking Systems

**4 wheelers- Goods vehicles**

- Truck code
- Automotive trailer code
- Rear marking plates
- Protection against unauthorized use
- Electromagnetic compatibility (EMC)
- Close coupling and mechanical coupling devices
- Advancd Braking System
- Retrofitment of underrun protection devices on in-use vehicles

**Agriculture Tractors**

- Agriculture Trailer Code
- Rear vision
- Field of vision
- Attendant/ passenger seat
- Ballast mass
- ROPS
- Mechanical coupling
- Tractor identification number
- Symbols and color codes

**(Source: CMVR-TSC Secretariat)**

## 5. Safety Standards beyond 2016

Work should be taken up to address safety standards for future technology vehicles. Work should be also taken up to address safety of other areas like Construction Equipment Vehicles (CEVs), Special Purpose Vehicles, hydraulic trailers, Multi-modal transport vehicles, ITS, inspection & testing of in-use vehicles, etc. Extensive work should be taken up regarding standards related to re-cycle ability & re-usability of vehicles.

**Table I**

**Comparison of Type Approval Requirements in Europe (EEC) and India (CMVR) for L Category Vehicles**

(Ref. ANNEX I of repealing council directive 92/61/EC on Type Approval of two or three-wheel motor vehicles)

| Sr. No. | Subject | India (CMVR)- Vehicle sub-category | | | Remark |
|---|---|---|---|---|---|
| | | L1 | L2 | L5 | CMV Rule(AIS/IS) |
| 1 | Category of vehicle | √ | √ | √ | GSR 784 (2), AIS-053 |
| 2 | Maximum torque and maximum netpower of engine, whether this is of the SI or CI type orelectric | √ | √ | √ | 115 (TAP 115/116 & IS 14599)<br><br>RT-11036 /16 / 97 |
| 3 | Anti-tampering measures for mopeds and motorcycles | ------- | -------- | -------- | |
| 4 | Fuel tank | √ | √ | √ | 124(25) |
| 5 | Traction battery | | | | AIS-048 proposed for notification |
| 6 | Maximum design speed of the vehicle | √ | √ | √ | AIS-007, Table 1 |
| 7 | Masses and dimension | √ | √ | √ | 95 (IS 11825) |
| 8 | Coupling devices and their attachment | ------- | -------- | -------- | |
| 9 | Anti-air pollution measures | ------- | -------- | -------- | |
| 10 | Tyres | √ | √ | √ | 95 (IS 15627) |
| 11 | Braking system | √ | √ | √ | 96(4) (IS 14664) |
| 12 | Installation of lighting and light-signalling devices | √ | √ | √ | 124(24) (AIS-009) |
| 13 | Lighting and light-signalling devices on the vehicle the mandatoryor optional presence of which is laid down in the installationrequirements | √ | √ | √ | 124(32) (AIS-010) |
| 14 | Audible warning device | √ | √ | √ | 119(1) |
| 15 | Position for the mounting of rear registration plate | ------- | -------- | -------- | CMV Rule 50 |
| 16 | Electromagnetic compatibility | | | | AIS-004(Part 3) is under notification. Presently rule 124(20)(21)<br><br>(AIS-004(Part 1)) covering electro magnetic radiations is applicable |
| 17 | Sound level and exhaust system | √ | √ | √ | 120 (IS 3028) |
| 18 | Rear-view mirror(s) | √ | √ | √ | 125(2) (AIS-001 & AIS-002) |
| 19 | External projections | √ | √ | √ | |
| 20 | Stand (except in, case of vehicles having three or more wheels) | ------- | -------- | -------- | |
| 21 | Devices to prevent un-authorized use of the vehicle | √ | √ | √ | 124(44)(AIS-074) |

| | | | | | |
|---|---|---|---|---|---|
| 22 | Windows; windscreen wipers; windscreen washers; devices forde-icing and demisting for three-wheel mopeds, motor tricycles and quadricycles with bodywork | ------- | -------- | √ | 124(39) AIS-045 |
| 23 | Passenger hand-hold for two-wheel vehicles | √ | √ | √ | 123 (IS 14495) - 2W |
| 24 | Anchorage points for safety belts and safety belts for three-wheelmopeds, motor tricycles and quadricycles with bodywork | ------- | -------- | -------- | |
| 25 | Speedometer | √ | √ | √ | 117(1)(2) |
| 26 | Identification of controls, tell-tales and indicators | √ | √ | √ | 124(18) |
| 27 | Statutory inscriptions (content, location and method of affixing) | √ | √ | √ | 122(1) (AIS-065) |

Legend:

√ Applicable

--- Not applicable

Planned in future

**Table II**

**Comparison of Type Approval Requirements in Europe (EEC) and India (CMVR) for M and N Category Vehicles**(Ref. ANNEX IV of 2007/46/EC on Approval of Motor Vehicles and their Trailers)

| Applicability | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Subject** | **India (CMV Rule) classification** | | | | | | **Reference in Indian context** |
| | **M1** | **M2** | **M3** | **N1** | **N2** | **N3** | |
| 1. Sound levels | √ | √ | √ | √ | √ | √ | 120(2) (IS 3028) |
| 2. Emissions | √ | √ | √ | √ | √ | √ | 115 |
| 3. Fuel tanks | √ | √ | √ | √ | √ | √ | 124(7) ( IS 12056 / IS 15547) |
| Rear protective devices | - | √ | √ | - | √ | √ | 124(1-A) (IS 14812) |
| 4. Rear registration plate space | √ | √ | √ | √ | √ | √ | 50 |
| 5. Steering effort | √ | √ | √ | √ | √ | √ | 98(3) (IS 11948) |
| 6. Door latches and hinges | √ | √ | √ | √ | √ | √ | 124(16) (IS14225) |
| 7. Audible warning | √ | √ | √ | √ | √ | √ | 119(1) (IS 1884 & AIS -014) |
| 8. Indirect visiondevices | √ | √ | √ | √ | √ | √ | 125(2) (AIS-001 & AIS-002) |
| 9. Braking | √ | √ | √ | √ | √ | √ | 96(4) (IS 11852) |
| 10. Suppression(radio) | √ | √ | √ | √ | √ | √ | 124(21) (AIS-004(Part 1)) |
| 11. Diesel smoke | √ | √ | √ | √ | √ | √ | 115 |
| 12. Interior fittings | √ | | | | | | 124(38)Notification S.O.2714 for other than M1 from April 2012 (New models ) 2013(Existing models) |
| 13. Anti-theft andImmobilizer | | | | | | | AIS-075 and AIS-076 are under notification |
| 14. Protective steering | | | | | | | AIS-096 is under notification |
| 15. Seat strength | √ | √ | √ | √ | √ | √ | 125(5) M1 (IS 15546), 125(6) others (AIS-023) |
| 16. Exterior projections | √ | - | - | - | - | - | 124(11) ( IS 13942) |
| 17. Speedometer and reverse gear | √ | √ | √ | √ | √ | √ | 117(1)(2) (IS 11827) |
| 18. Plates (statutory) | √ | √ | √ | √ | √ | √ | 122(1) (AIS-065) |
| 19. Seat beltanchorages | √ | √ | √ | √ | √ | √ | 125(1A) (IS 15139) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20. Installation of lighting and light signalling devices | √ | √ | √ | √ | √ | √ | 124(20) (AIS-008) |
| 21. Retro reflectors | √ | √ | √ | √ | √ | √ | 104 (AIS-057 & AIS-090) |
| 22. End-outline, front-position (side),rear-position (side), stop, sidemarker, daytime running lamps | √ | √ | √ | √ | √ | √ | 124(20) (AIS-012) |
| 23. Direction indicators | √ | √ | √ | √ | √ | √ | 102 |
| 24. Rear registration plate lamps | √ | √ | √ | √ | √ | √ | 124(20) (AIS-012) |
| 25. Headlamps (including bulbs) | √ | √ | √ | √ | √ | √ | 124(1) &(20) (AIS-034 &AIS-012) |
| 26. Front fog lamps | √ | √ | √ | √ | √ | √ | 124(20) (AIS-012) |
| 27. Towing hooks | √ | √ | √ | √ | √ | √ | 124(22) (SS 33.1) |
| 28. Rear foglamps | √ | √ | √ | √ | √ | √ | 124(20) (AIS-012) |
| 29. Reversing lamps | √ | √ | √ | √ | √ | √ | 124(20) (AIS-012) |
| 30. Parking lamps | √ | √ | √ | √ | √ | √ | 109 &124(20) (AIS-012) |
| 31. Seat belts andrestraint systems | √ | √ | √ | √ | √ | √ | 125(1) (IS 15140) |
| 32. Forward vision | √ | - | - | - | - | - | 124(34) (AIS-021) |
| 33. Identification of Controls | √ | √ | √ | √ | √ | √ | 124(19) (SS 12.1) |
| 34. Defrost/Demist | √ | - | - | - | - | - | 124(46) Notification S.O.2714 from April 2011 (New models ) |
| 35. Wash/Wipe | √ | √ | √ | √ | √ | √ | 101(1)(2) (AIS-019 & AIS-011) |
| 36. Heating systems | - | - | - | - | - | - | Low priority in safety road map |
| 37. Wheel guards | √ | - | - | - | - | - | 124(13) (IS 13943) |
| 38. Head restraints | √ | - | - | - | - | - | 125(5) (IS 15546) |
| 39. CO2 emissions/ Fuel consumption | √ | √ | √ | √ | √ | √ | 124(31) (IS 11921) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 40. Engine power | √ | √ | √ | √ | √ | √ | 115 |
| 41. Diesel emissions | √ | √ | √ | √ | √ | √ | 115(9) |
| 42. Lateral protection | - | √ | √ | - | √ | √ | 124(1-A) (IS 14682) |
| 43. Spray-Suppression systems | - | - | - | - | √ | √ | 124 (33) (AIS-013) |
| 44. Masses and Dimensions (cars) | √ | - | - | - | - | - | 93 ( IS11825 ) |
| 45. Safety glass | √ | √ | √ | √ | √ | √ | 100 (IS 2553 (Part 2)) |
| 46. Tyres | √ | √ | √ | √ | √ | √ | 95(1) (IS 15633 & IS 15636) |
| 47. Speed limiters | √ | √ | √ | √ | √ | √ | 118 (AIS-018) |
| 48. Masses and Dimensions (other than vehicles referred to in Item 44) | - | √ | √ | √ | √ | √ | 93 ( IS11825 ) |
| 49. ExternalProjections ofcabs | - | √ | √ | √ | √ | √ | 124(11) IS 13942 |
| 50. Couplings | √ | √ | √ | √ | √ | √ | 124(22) (SS 33.1) |
| 51. Flammability | - | - | √ | - | - | - | M3 carrying more than 22 passengers 124(37) (IS 15061) |
| 52. Buses andcoaches | - | | | - | - | - | AIS-052 (Rev. 1) proposed for notification vide Draft GSR 61 |
| 53. Frontal impact | | - | - | - | - | - | AIS-098 is proposed for notification |
| 54. Side impact | | - | - | | - | - | AIS-099 is proposed for notification |
| 56. Vehicles intended for the transport of dangerous goods | - | - | - | - | | | AIS-093 proposed for notification vide Draft GSR 61 covers N2 &N3 |
| 57. Front under run protection | - | - | - | - | √ | √ | 125(1B) (AIS-069) |
| 58. Pedestrianprotection | | - | - | | - | - | AIS-100 proposed for notification |

Legend:

√ Applicable

--- Not applicable

Planned in future

**Table III**

**Comparison of Type Approval Requirements in Europe (EEC) and India (CMVR) for Agricultural Tractor**

(Ref. Chapter B of EEC directive 2003/37 on type approval of agricultural or forestry tractor)

| No | Subject | India (CMVR) (There are no separate sub-categories in CMVR) | |
|---|---|---|---|
| | | **Applicability to Category A** | **Remarks / CMVR (AIS/IS)** |
| 1.1, | Maximum laden | - | Not specifically addressed |
| 1:2. | Registration plate | √ | 50 |
| 1.3. | Fuel tank | √ | 124-A (6) (IS 12056) |
| 1.4. | Ballast masses | | AIS-105 proposed for implementation vide Draft GSR 61 |
| 1.5. | Audible warning device | √ | 119 (1)(2) (IS 1884 and AIS-014) |
| 1.6. | Sound level (external) | √ | 120(4) (IS 12180 (Part 2)) |
| 2.1. | Maximum speed | | AIS-116 is proposed for notification |
| 2.2. | Load platforms | | AIS-106 proposed for implementation vide Draft GSR 61 |
| 3.1. | Rear-view mirrors | √ | - 125(2)(AIS-001)<br>- AIS-114 proposed for implementation vide Draft GSR 61 |
| 4.1. | Field of vision and windscreen wipers | | AIS-107 proposed for implementation vide Draft GSR 61 |
| 5.1. | Steering | √ | 98 B (1) (2) & (3) (IS 11859 & AIS-042) |
| 6.1. | ElectromagneticCompatibility | | Not covered |
| 7.1. | Braking devices | √ | 96-C (IS 12056 & IS 12207) |
| | | - | |
| 8.1. | Passenger seats | | AIS-111 proposed for implementation vide Draft GSR 61 |
| 9.1. | Sound levels (internal) | √ | 120 (4) (IS 12180 (Part 1)) |
| 10.1. | ROPS (Dynamic test) | | IS 11821 (Part 1) proposed for implementation vide Draft GSR 61 |
| 12.1. | Driving seat | - | |
| 13.1. | Lighting installation | √ | 124-A (2) (AIS-030) |
| 14,1. | Lighting and light- signaling devices | √ | 124-A (1) (IS 1606)<br><br>124-A (2) (AIS-062) |
| 15,1. | Coupling and reversing devices | | Draft AIS-109 is under formulation |
| 16.1. | ROPS (Static test) | | IS 11821 (Part 2) proposed for implementation vide Draft GSR 61 |
| 17.1. | Operating space, | - | Will be taken up later date as per Tractor road map |

| | | | |
|---|---|---|---|
| 18.1. | Power take-offs | | Draft AIS-108 is under formulation |
| 19.1. | Rear-mounted ROPS (narrow-track tractors) | - | Not in tractor road map |
| 20.1. | Installation of the Controls | - | Not in tractor road map |
| 21.1. | Front-mounted ROPS (narrow-track tractors) | - | Not in tractor road map |
| 22.1. | Dimensions andtrailer mass | √ | Dimensions- 93-A (1) (2) (3) (4)<br>For mass AIS-112 is under preparation |
| 22,2. | Glazing | - | Draft AIS-118 is under formulation and will cover Agricultural tractor |
| | | - | |
| 22.3. | Speed governor | - | 118 (AIS-018) |
| 22.4. | Protection of drive Components | - | Not in tractor road map |
| 22.5. | Mechanical Couplings | | Draft AIS-091 (Part 2) is under formulation |
| 22.6. | Statutory plate | | AIS-117 is proposed for notification |
| 22.7. | Trailer-brake Coupling | | S.O. 2142 (AIS-043 will be implemented w.e.f. 31st August 2011 ) |
| 23.1. | Pollutant emissions | √ | 112 (IS 12239 (Part 1)) |
| 24.1. | Tyres | √ | 95 - A (IS 13154) |
| 25.1. | Stability | - | Not in tractor road map |
| 26.1. | Seat-beltattachment points | - | Not in tractor road map |
| 27.1. | Safety belts | - | Not in tractor road map |
| 28.1. | Reverse and Speedometer | √ | 117 (1) |
| 29.1. | Spray-suppression systems, | - | AIS-013 may be extended to Agricultural Tractor, since it is based on 91/226/EEC mentioned aside |
| 30.1. | Speed limitation devices | - | Not in tractor road map |
| 31.1. | Rear protection Structures | - | Not in tractor road map |
| 32.1. | Lateral protection | - | Not in tractor road map |

Legend:

√ Applicable

--- Not applicable

Planned in future

# Safety of in-use vehicles- Inspection & Certification

## Chapter 5

**7/20/2011**

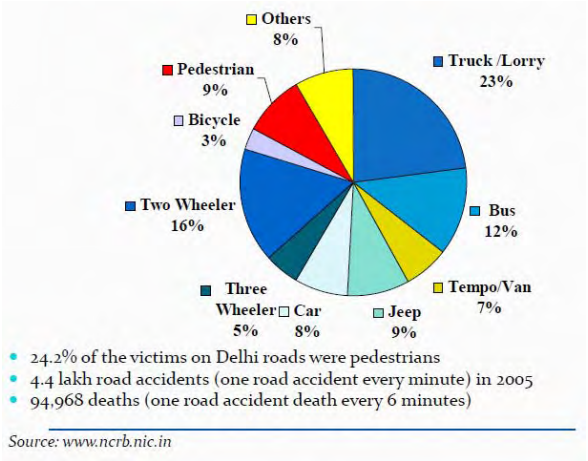
# Chapter 5
# Safety of in-use vehicles- Inspection & Certification

## 1.1 Background

With the fast growing economy, the vehicle population in India has grown rapidly. The Government of India enforced the motor vehicle emission standards in India from year 1991 and has been since updating the emission and safety norms for new vehicles. Each prototype vehicle is subjected to extensive laboratory testing for the design approval called Type approval, before these are introduced in the market. Thereafter, the vehicles produced by the vehicle manufacturer are randomly selected from the production line and subjected to emission performance test and verified against the type approval, called as 'Conformity of Production". To meet these stringent emissions standards with respect to Type approval and Conformity of Production, vehicle manufactures have upgraded the technology of the vehicles. Though the Indian safety and emission standards were introduced for the new vehicles, there is no commensurate improvement noted in ambient air quality levels and reduction of road related accidents.

Even though the new technology vehicles meeting stringent emission and safety standards are introduced in the market, there are still a lot of old vehicles operating on the roads. Various studies indicate that a small quantity of ill maintained vehicles attribute to a great extent in ambient air quality problems and thereby leading to the deterioration of urban air quality. Even new vehicles with the state of the art technologies, deteriorate in service and need to be maintained properly if they are to continue to operate at the desired emission levels. Any vehicle, which is not maintained well, would be an environmental and safety hazard to the society.

The vehicle inspection and Certification program is an effective tool to improve the condition of the in-use vehicle fleet. An increasing number of vehicles in India are not in a roadworthy state. Poor maintenance and servicing of an outdated fleet constitutes an increase in risks to persons and to environment emanating from the operation of such vehicles.




Road accident deaths in India by Vehicle Types

From the above picture it can be seen that, the segment of poorly maintained vehicles have significant impact on the road accidents in the country.

The graph below depicts the Indian Automobile Industry Growth vis-à-vis number of accidents and number of persons killed.


Source: Ministry of Road Transport & Highways and SIAM

*Note 1* : Data relating to accidents, persons killed & injured has been drawn from 'Road Accidents in India 2008' published by MoRTH and Automotive Sales data has been taken from SIAM publication.

*Note 2: Figures with respect to No. of Accidents, No. of Persons Killed and No. of Persons Injured for 2008 are provisional.*

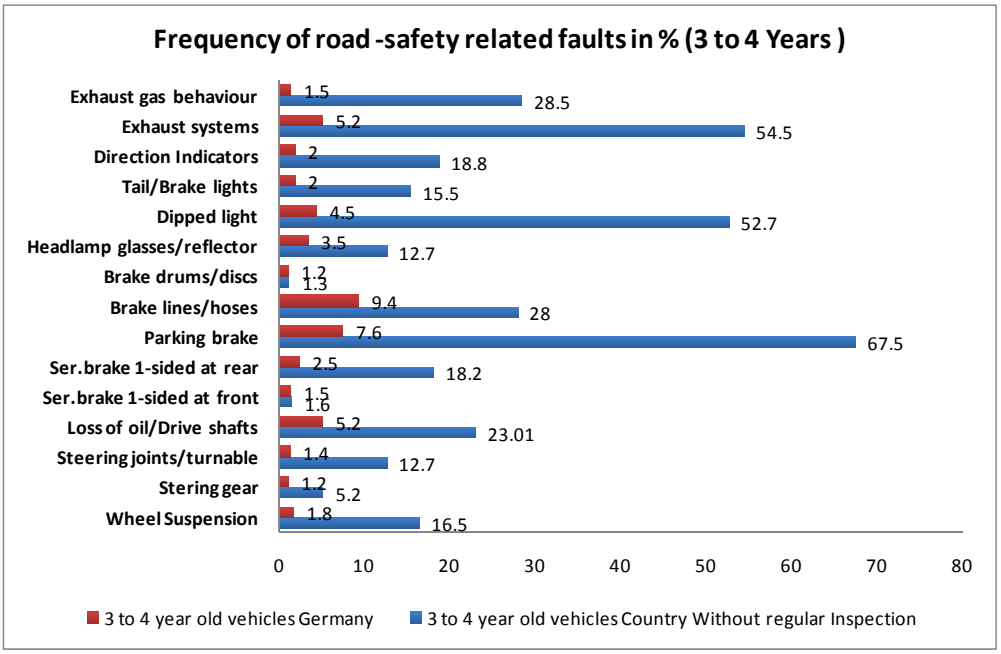
**ARAI Studies on effect of I&C on specific improvement in terms of fuel efficiency**

| ***Veh. Category*** | **Observation for Max. effect on fuel economy** |
|---|---|
| 2 W-2ST | **11 %** for 96-00 vintage |
| 2W-4ST | **14 %** for 91-96 vintage |
| 3W-Petrol | **2.25 %** for post 2005 vintage |
| 3W-LPG | **24 %** for 96-00 vintage |
| 4W-PC-Petrol | **4 %** for 91-96 vintage |
| 3W-Diesel | **0.8 %** for Post 2000 vintage |
| HCV-Trucks-Diesel | **2 %** for 91-96 vintage |
| HCV-Bus-Diesel | **1 %** for 96-00 vintage |

Effect of servicing on different categories of the vehicles was studied by ARAI. The table above gives the percentage improvement in terms of fuel economy for different categories of vehicles under the study. It is observed from the above table that, 2-4% improvement in fuel efficiency in 4 wheeler Passenger cars and about 10-14% in 2 wheelers is achieved because of the servicing.

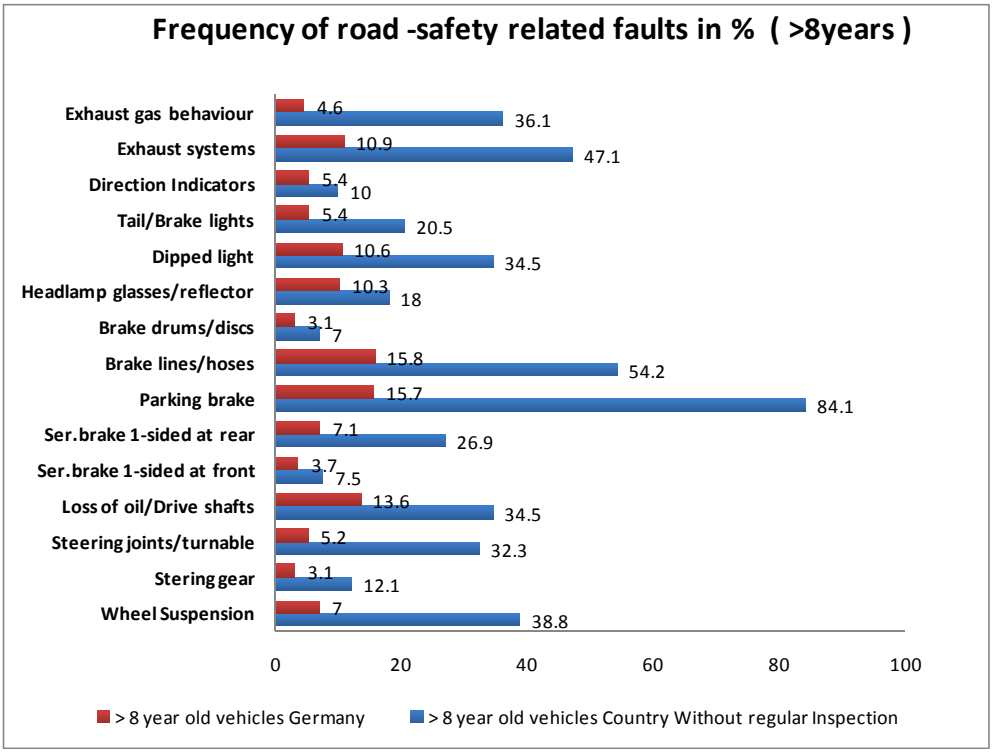
**Effect of I&C on Frequency of Safety Related Faults**
**(An International experience before and after implementation of I&M)**

## 3-4 year old vehicles




Source: TUV NORD

## >8 year old vehicles



In view of above experience and increasing vehicle population in India, it is essential to ensure that the in use vehicles, which are on road, meet the safety and emission requirements for safe and environmental friendly situation. The vehicle inspection and Certification program is an effective tool to improve the condition of the in use vehicle fleet.

## 2.0 Present System

The Central Government lays down the law and policy guidelines under the Central Motor Vehicle Rules and the State Transport Department performs the functions of testing of the vehicle and issue of the fitness certificate. The implementation of these rules at the state level is to be done by the State Government by creating suitable and adequate infrastructure for carrying out the fitness tests. The details of the requirement of the test to be conducted for issue of the fitness certificate is given in Central Motor Vehicle Rules (CMVR) rule No. 62. As per the Rule no. 62, all transport vehicles should carry a Fitness Certificate, which is to be renewed every year. The valid Pollution Under Control (PUC) certificate issued by the state authorized test centers operated by the private operators are accepted for issue of the fitness certificate by the State Transport authorities. However all vehicles, both Transport and Non-Transport, are required to undertake mandatory idle emission test or free acceleration smoke test, as applicable, every six months or any other periodicity as notified by the state Government.

The technical and administrative committees appointed by the Ministry of Road Transport and Highways had earlier submitted a detailed report for implementing an effective Inspection and maintenance system in India. Further, Government of NCT of Delhi had established two automated vehicle inspection lanes at Burari and these lanes are currently being operated by the Transport Department, Delhi. However, for implementation of full scale Inspection and maintenance regime in India it is essential that a suitable administrative mechanism is formed with the objective of setting of a system in place and monitor the system on a continuous basis.

## 2.1 Major issues

The existing vehicle inspection system in India is inefficient and faces a lot of problems which are discussed below:

- At present, only visual inspection is carried out by the inspectors, and even that is mandatory only for commercial vehicles.
- The vehicle inspection is mandatory for the commercial vehicles only.
- Personal vehicle owners are required to pay only a “one-time” tax, at the time of initial registration of the vehicle. Therefore presently there is no mechanism by which it is made mandatory for personal vehicles to go in for a regular fitness check.
- Mostly, the vehicle inspection centres do not have any instrumentation or equipment to carry out proper inspection of the vehicle
- The inspectors and other staff are not given regular training for skill up gradation. Most of the departments are under-staffed.

- There is no set procedure for inspection and often the decision whether a vehicle is fit or not left to the discretion of the vehicle inspector.
- The number of vehicles per inspection centre is very high due to centralized nature of inspection, putting further pressure on the limited capacity of these inspection centers.
- There is no mechanism at present for auditing, monitoring performance and capability of these centers.
- Although the present PUC system is authorized by the State Governments, there is lack of control mechanisms like auditing/ inspecting for these PUC Centres. The criteria for authorising / registering a PUC Centre need to be augmented.
- The data collected in the inspection centre / PUC centre is not analysed to check the data validity and improvement in the system
- There is no organized industry for repair and maintenance of vehicles. There are number of roadside mechanics available that may or may not have adequate equipment and training for maintenance. As these mechanics are cheap and available next door, vehicle owners still use their services.

## 2.2 I&C Regime Implementation

For effective implementation of an I&C regime in India, the following various components should be developed.

- Institutional structure
- Legislative reforms
- Development of Regime
- Phasing of I/C regime
- Enforcement on road
- Auditing of the Vehicle Inspection Centres
- Human Resource Development
- Public Awareness Programs
- Data Collection and analysis and Networking of centres
- Maintenance Program
- Capacity Building - I&C centres
- Nodal agency
- Action Plan

### 2.2.1 Institutional structure

- The State Government should identify the agencies to carry out operation of I&M centers and nominate auditing agency to periodically validate the performance of centres, and should be responsible for on road enforcement. The State Government should estimate the number of test lanes required for various regions (RTO) and private sector should use it as a guide for setting up inspection centres.
- The program should be linked to registration/ insurance of vehicles to make it more effective and in making it mandatory. No vehicle should be

issued a registration or a re-registration certificate unless it possesses a valid vehicle inspection certificate.

### 2.2.2 Program Content

The I&C regime should have the tests for both safety and emission parameters. The inspection should be a combination with visual and automated test equipments. For the cities like Delhi, the CNG / LPG safety inspection should be included in the program.

For inspection of the vehicles in the automated vehicle inspection centers, detailed vehicle inspection manuals need to be developed. These manuals should prescribe the procedure for testing a vehicle, lists of tests to be conducted, methods for conducting the tests, and reasons for failures. These manuals would have to be prepared for different categories of vehicles and should be available at all test centers and others concerned with the I&C programme.

- Public service vehicle inspection manual
- Heavy goods vehicle inspection manual
- Car and light commercial vehicle testing manual
- Three wheeler and Motor cycle testing manual
- Trailers and tractors vehicle inspection manual

A handbook for administrators would also need to be prepared specifying the role, and responsibility of the inspectors in the vehicle inspection centre, the auditors and other agencies involved.

A suggested list of items that to be included in the centralized test only centres are listed below. On gaining the field experience and general public acceptance, more items can be included.

### 2.2.3 Safety Inspection

| ***Visual inspection*** |
|---|
| Inspection of legal documents, insurance and identification of the vehicle |
| Steering play |
| Chassis / frame integrity |
| CNG / LPG Safety inspections |
| Fuel tank and piping |
| Exhaust pipe |
| Catalytic converter (mounting, heat shield damages, presence) |
| Engine mountings |
| Battery (terminals, mounting, etc) |

| *Visual inspection* |
|---|
| Seatbelts (presence, integrity) |
| Condition of Tyres including spare tyre |
| Lighting and signaling devices |
| Oil leakages (engine, transmission) |
| Leaf springs integrity, shock absorbers |
| Wind screen, wipers & doors, Mirrors etc. |
| Rear Under run, side protection and front under run devices |
| Horn |
| Availability of Tool Box, First Aid kit, Fire Extinguisher and Warning Triangle |
| Registration plates |

| *Tests with Automated Equipments* | | |
|---|---|---|
| **Test Items** | **Tests** | **Equipment** |
| Service brakes | Brake test | Roller Brake tester |
| Parking brakes | | |
| Speedometer | Speedometer test | Speedometer tester |
| Headlight | Headlight test | Headlight tester |
| Side slip | Side slip test | Side slip tester |
| Suspension Test | Suspension test | Suspension Tester |
| | | |

### 2.2.4 Emission Inspection

| **Vehicles** | **Test** | **Equipment Required** |
|---|---|---|
| Diesel | Free Acceleration test | Opacity meter |
| Petrol / CNG / LPG | Idle Test | Gasoline (4 Gas Analyzer) |

While the present PUC emission testing will be continued in the vehicle inspection and certification centers with improved test procedures and audit systems, efforts should be directed to improve the testing process by studying the various international systems and its applicability to Indian conditions from time to time.

### 2.2.5 Phasing of the regime

A phased approach would be necessary to inspect all vehicles on safety and emissions performance. Significant investments, improvements in regulatory and management practices, increased capacity and capability would be prerequisites for the effectiveness for such a regime. Hence, a phased approach has been suggested for ensuring effective implementation of inspection and maintenance program. Thus, the following phasing is suggested:

- In the first phase, cities with significant transport vehicles should introduce a modern Inspection and Certification regime
- In these cities, a modern inspection regime should be first introduced for commercial vehicles, and then subsequently to private vehicles. Within private vehicles, older vehicles should be included in the regime earlier.
- Both emissions and safety tests should be introduced in parallel for both commercial and private vehicles, as and when these are included in the phased introduction.

For cities where the regime would be introduced later or for vehicle categories that are not being covered at the first instance, the current PUC and fitness testing regime should continue. Here the existing PUC regime should be strengthened by improving the efficacy of the tests carried out with improved instrumentation and test methodologies and a more effective auditing system.

### 2.2.6 Phasing of vehicles

While it would be ideal to have a large number of testing centers spread all over a city that could cater to the entire vehicle fleet so that vehicle owners are not inconvenienced, cost and investment considerations may make such an extended system unviable. The frequency of these tests should be based on the tradeoff between the cost implications for setting up the infrastructure for testing as also convenience to vehicle users. The principles on which the frequency of tests should be based are the following:

- Commercial vehicles with a higher utilization should be tested more often
- Older vehicles should be tested more frequently than newer vehicles
- Private vehicles to be included in I&M regime

Initially, the focus should be on testing of commercial vehicles only. With gradual capacity building and increased number of integrated safety and emissions testing centers, the frequency and tests can then be extended to other category of vehicles which includes private vehicles and 2 wheelers.

In the first phase, the following is suggested:

**For commercial vehicles:**

- All Commercial vehicles with a higher utilization should be tested annually (after initial 2 years of registration.)

**For private vehicles:**

- First year: Vehicles that are more than nine years old (> 9 years) to be inspected from the first year from the time the regime is introduced.
- Second year: Vehicles that are more than five years old but less than nine years old (Between 5-9 years) to be inspected from the second year from the time the regime is introduced.
- Third year: Vehicles that are more than three years old but less than five years old (Between 3-5 years) to be inspected from the third year from the time the regime is introduced.
- Fourth year: Vehicles would follow the inspection schedule as mentioned below.

| **Vehicle Types** | **Age / Frequency** | | |
|---|---|---|---|
| **Phase - I**<br>Commercial vehicles | All Vintage | | |
| Frequency | Annually -(After initial 2years) | | |
| **Phase - II** | | | |
| Private Vehicles<br>Four Wheelers | <3 Years | 3-9 Years | >9 Years |
| Frequency | NA | Biennially | Annually |
| Motorcycles & Scooters | <3 Years | 3-9 Years | >8 years |
| Frequency | NA | Biennially | Annually |

### 2.2.7 Auditing vehicle inspection centers

I&C programmes are often associated with fraud and corruption. Failure to address these issues will seriously or even totally compromise the effectiveness of an I&C system. The system of testing should itself be such that the tampering of the test results is not possible. Organizations abroad have such features built in their system. A well functioning audit and quality assurance system is crucial for the acceptance and success of any I&C regime. The State Transport Department would have to out source the auditing to any of the renowned automotive testing centers in the country like ARAI. The auditing shall be conducted at least once in a year. The auditing should at least cover the following:

- Presence of necessary equipment and other infrastructure in working condition.
- Proper calibration audits for equipment
- Proper inspection procedures being followed by the centre as detailed in the manual and verification of standard operating procedures (SOP) of each centre
- Presence of qualified/trained manpower in the inspection centre.

The audit should also cover the authenticity of the certificates given, storage, extraction, traceability and security of the data, operator's validity in terms of training, parking area, and security of the vehicles etc. This well qualified team of auditors would make random checks in the inspection centres to check for proper functioning and operation.

The State Transport Department can design an audit plan for all the fitness centres under their jurisdiction. The fitness centres will have to pay for the cost of the audit. The transport authorities will re-validate the license for the fitness checks based on these audit reports from the independent agencies.

A penalty system may be imposed for auditing the performance of the service centres based on the UK model, where, for every different type of offence committed certain penalty points are awarded and after a centre accumulates a certain number of penalty points its license is cancelled. This would enable a more transparent form of working and could include offences like:

- Issuing fake/duplicate fitness certificates
- Improper inspection procedure followed
- Inadequate infrastructure, equipment in the vehicles inspection centre
- Lack of well trained and qualified staff

### 2.2.8 Enforcement on road

The traffic police would be responsible for checking vehicles for the possession of a valid fitness certificate, mobile checking vans would have to be set up for randomly checking vehicles on the road. These mobile units would have the minimum equipment required. While the enforcement may be done by the State Transport Department, the inspection using the mobile fitness testing can be outsourced to the private contractor who operates the I&C centres in the state. Vehicles found possessing a valid fitness certificate but still not up to the prescribed standards would be sent to the vehicle inspection centre for a detailed re-examination. These vehicles could go to any inspection centre and if found unfit would have to pay the fee and go to a repair centre for further repairs before getting a valid inspection certificate. A legally enforceable sticker that is controlled by the government, difficult to falsify and that has a highly visual design enabling a police officer to identify immediately at 5 meters distance could serve this. The traffic police would have to be empowered to stop vehicles without such a valid sticker.

### 2.2.9 Data collection and analysis

To ensure that the new system responds to improvements in vehicle technology and increasingly stringent emission and safety norms, a centralized data collection and analysis function should be vested with the Nodal agency. Centralized common software is required for data transfer, storage, data analysis and uploading to the website, etc.

Overall success of an I/C program depends in part on assuring that all vehicles intended to participate in the program are actually inspected and repaired if necessary. Experience from both outside and inside Asia has demonstrated that the most effective I/C programs are those that are linked to vehicle registration, i.e., failure to present proof of passing an inspection leads to denial of registration. A well-functioning I/C system will include a data management system that ensures that all test data are transmitted on a regular basis to a central database. This will be easier if I/C stations are linked by computers that automatically transmit information on a real time basis.

Also, all the I/C centers in a state should be connected to the State registration authority and in turn all the state transport authorities are to be networked under the Central Government for data sharing and data analysis. General public also should be able to take appointment from the I/C test centers through the website for taking their vehicles for the I/C Centers.

### 2.2.10 Human resources development

For effective implementation of the I&C regime, manpower training and capacity building is necessary. The training and refresher training have to be provided for the following target groups:

- Staff, attendants and motor vehicle inspectors at the vehicle inspection centers.
- Auditors for auditing performance of inspection centers and staff of state transport departments and the staff of mobile on-road enforcement.
- Mechanics in the vehicle repair centers so that they can repair vehicles efficiently.

Training modules need to be prepared for the above target groups that specify the contents, schedule and, duration of the programme, and the period for refresher courses. In addition to the training, the manpower also should undergo refreshment courses to update their skills and knowledge. The training calendar have to be developed by the private operators for the personnel who are operating the centres and nominate them to the training courses provided by the appointed centres as designated by the State Transport Department. The state governments can pay the fees for the training programme, which can be recovered from the vehicle inspection centre in form of fees/taxes.

### 2.2.11 Public awareness campaign

Public education and information can clearly improve knowledge about the rules of the road, required condition of vehicles and necessity of periodical inspection systems and therefore increase compliance. Public perceptions regarding the effectiveness and transparency of I & C systems will heavily influence the willingness of the general public to cooperate with government-imposed I/M regimes. To ensure a positive public perception, it is important that society

understands the public safety & health need for the program and believes that it is fair and effective. A consumer awareness campaign should be launched with the help of schools, NGOs, community-based organizations, automobile associations, and research institutes. The TV / Cable network media can provide a wide coverage of the benefits of the I&C to the individual owners. This mass consumer awareness campaign to be run on a regular basis should focus on making the consumer aware of the following issues:

- Advantages of an inspection and maintenance programme for a vehicle owner
- The process followed in the inspection of a vehicle
- How a vehicle owner must maintain the vehicles
- Frequency of an inspection programme
- Location of authorized vehicle repair and maintenance centres
- Roles and duties of a vehicle inspection centre
- Locations and list of authorized vehicle testing stations and authorized garages
- Legal status of inspection programme and fines imposed for offences.

The awareness of the public is essential for the success of the program. One option of considering the participation of the general public in identifying the gross polluting vehicles which are visibly emitting higher smoke and provide information of such vehicles to the regulating authorities is through SMS, email and toll free telephone no. A website development and maintenance for the public to post the suggestions and remedial measures could be an added advantage for improving the effectiveness of the system.

### 2.2.12 Maintenance program

Though the Inspection and certification (I/C) centers would identify the grossly polluting and unsafe vehicles, it is necessary there is an efficient maintenance system in place to rectify the vehicles that have failed in the I/C centers. For ensuring effective maintenance of vehicles, the motor vehicle repair workshops must have trained mechanics, proper equipment and procedure, and quality assurance checks. Also there should be proportionate number of such workshops established in the country to serve the vehicle owners effectively. Currently, in India, the motor vehicle repair workshops are authorised by the vehicle manufactures and many small-scale motor vehicle repair workshops exist in India along the roadside. These roadside repair workshops may not have the necessary equipment, procedures or trained mechanics to carry out proper maintenance of vehicles. As a result, some vehicles continue to pose a major threat and create nuisance with respect to emission and safety even after they have been maintained by such workshops. Therefore, there is an urgent need for motor vehicle repair workshops to upgrade. The recommendation of motor vehicle repair workshops will help individual vehicle owners and vehicle fleet owners to make

informed choices in engaging respective workshops for maintenance of their vehicles to ensure vehicles working in good condition with respect to emission and safety. The above scheme will also encourage operators of motor vehicle repair workshops to develop and enhance their technical expertise in maintaining vehicles.

### 2.2.13 Legislative reforms

The following legislative provisions would need to be changed to implement the above-mentioned recommendations

**Union Government legislations**

The validity period for a fitness certificate presently for a transport vehicle is stipulated under Rule 62 of the Central Motor vehicle Rules, 1989. Rule 62 should be amended to prescribe the validity period of the fitness certificate both for transport and non-transport vehicles. The details of parameters to be checked at the time of fitness check are given in Rule 62 of the Central Motor Vehicles Rule, 1989. This list also needs to be modified to include more items concerning safety and environmental parameters requiring regular checks using the automated test equipments in a vehicle inspection center. A code of practice needs to be prescribed for management of authorized vehicle testing stations under Rule 63 of the Central Motor Vehicles Rule, 1989. Section 130 of the Motor Vehicles Act, 1988 may be amended to make it mandatory to produce all the records of the vehicle such as Registration Certificate, Insurance Certificate, Fitness certificate, (or Pollution Under Control Certificate where applicable) and permit, at the time of demand by enforcement officers.

**State Government legislations**

Personal vehicles are required to pay a one-time tax in most states given the current state government legislations. This concept of “one time tax for life” should be modified and this tax should be payable after a fixed period and synchronized with the period of validity of fitness certificate. For this, the Government of India would have to institute legislation or exert influence on the State Governments to link the payment of tax to the renewal of the registration certificate so that both these requirements are fulfilled at the same time. The State Motor Vehicle Taxation Rules would have to be amended to include these provisions. No tax should be accepted unless a fitness certificate is obtained from an authorized testing station. Non-payment of tax within the prescribed period should be made an offence with severe punishment, including a provision for impounding the vehicle. Another alternative is to link the periodicity with the vehicle insurance system. Insurance companies should not accept premium for vehicle insurance from owners unless they possess a valid vehicle fitness certificate.

### 2.2.14 Action Plan

For the implementation of effective I/C regime in India, there is an urgent need for creating an independent centralized nodal agency which can provide necessary technical and administrative assistance to the Government of India in developing a comprehensive I/C regime, assist the state government in creating necessary infrastructure and monitor the implementation at State level. This agency can be built on the basis of similar agency like Vehicle Operator Service Agency (VOSA) in UK and National Vehicle Inspection Agency in Japan. Though initially the Government may provide funds to create the nodal agency, later self-sustainability should be achieved through functioning of the agency. This agency should function with the following objective to develop an effective I&C regime for the country.

- Develop a detailed program content in consultation with State Government
- Suggest necessary changes in the legislative framework for implementing a comprehensive I&C regime in the country
- Identify the number of centres required and develop an implementation plan for creating necessary infrastructure
- Recommend the type of tests and procedures for testing vehicles on emission and safety parameters
- Prepare necessary guidelines for setting up and operation of an automated vehicle inspection centres
- Develop vehicle inspection and audit manuals
- Develop a training course content, identify resources and prepare an action plane for providing training of necessary technical manpower
- Frame specifications for a centralized software and networking of the Inspection centres
- Analyse the data and suggest further changes in the test procedures and standards
- Prepare an enforcement plan and monitor the implementation a the state level
- Setup an audit system and monitor the inspection centers periodically.

It is imperative that along with the growth in the vehicular population, the pollution level is also on the rise. The data of emission load for transport sector shows significant increase in the past decade.

Under the management control strategies, implementing I & C regime is important, assuring the emission control from in use vehicles.

However, the air quality monitoring has to be done on continuous basis to ensure the effectiveness of control strategies adopted. Especially the road side air quality monitoring is required to know the pollution load from the transport sector.

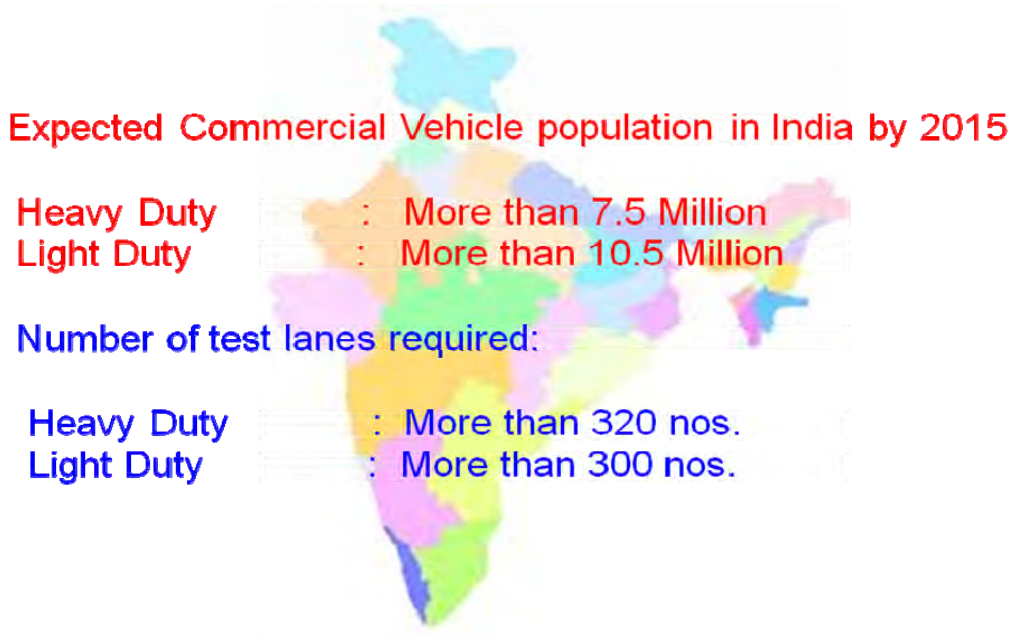
## 2.3 Conceived Picture for Entire Country for Transport/Commercial Vehicles

Based on 2006 transport vehicle data and average annual growth rate consideration with business as usual scenario, the table below shows a clear requirement of number of heavy duty & light duty lanes covering all states and union territories of India upto year 2015.

| STATES/UTS | Heavy Duty Vehicles | | Projected No. of HD lanes requirement by Year 2015 | Light Duty Vehicles | | Projected No. of LD lanes requirement by Year 2015 |
|---|---|---|---|---|---|---|
| | As on 2006 | BaU:year 2015 | II shift operation | As on 2006 | BaU:year 2015 | II shift operation |
| **STATES** | | | | | | |
| Andhra Pradesh | 200200 | 400201 | 17 | 498581 | 996666 | 28 |
| Arunachal Pradesh | 3037 | 6071 | 1 | 2393 | 4784 | 1 |
| Assam | 103179 | 206255 | 9 | 66948 | 133829 | 4 |
| Bihar | 66287 | 132508 | 6 | 68063 | 136058 | 4 |
| Chattisgarh | 76671 | 153266 | 7 | 36088 | 72140 | 2 |
| Goa | 39732 | 79424 | 3 | 19396 | 38773 | 1 |
| Gujarat | 258808 | 517358 | 22 | 637949 | 1275263 | 36 |
| Haryana | 196032 | 391869 | 17 | 136696 | 273256 | 8 |
| Himachal Pradesh | 38662 | 77286 | 3 | 37990 | 75942 | 2 |
| Jammu & Kashmir | 54609 | 109164 | 5 | 46418 | 92790 | 3 |
| Jharkhand | 79153 | 158227 | 7 | 71527 | 142983 | 4 |
| Karnataka | 251251 | 502252 | 22 | 346687 | 693029 | 20 |
| Kerala | 391836 | 783282 | 34 | 462280 | 924100 | 26 |
| MP | 111290 | 222469 | 10 | 163752 | 327341 | 9 |
| Maharashtra | 353984 | 707616 | 30 | 991665 | 1982343 | 57 |
| Manipur | 9316 | 18623 | 1 | 4952 | 9899 | 0 |
| Meghalaya | 20557 | 41094 | 2 | 14566 | 29118 | 1 |
| Mizoram | 5179 | 10353 | 1 | 6527 | 13048 | 1 |
| Nagaland | 51149 | 102247 | 4 | 26356 | 52686 | 2 |
| Orissa | 90428 | 180766 | 8 | 112629 | 225146 | 6 |
| Punjab | 89290 | 178491 | 8 | 112783 | 225454 | 6 |
| Rajasthan | 267360 | 534454 | 23 | 145221 | 290297 | 8 |
| Sikkim | 2280 | 4558 | 1 | 6541 | 13075 | 1 |
| Tamil Nadu | 405555 | 810706 | 35 | 540717 | 1080896 | 31 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Tripura** | 10099 | 20188 | 1 | 17088 | 34159 | 1 |
| **Uttarakhand** | 18041 | 36064 | 2 | 32311 | 64590 | 2 |
| **Uttar Pradesh** | 133309 | 266485 | 11 | 197457 | 394717 | 11 |
| **West Bengal** | 278868 | 557458 | 24 | 109241 | 218373 | 6 |
| **Total States** | **3606162** | **7208735** | **314** | **4912822** | **9820754** | **281** |
| **STATE STATES/UTS S/UTS** | **Heavy Duty Vehicles** | | **Projected No. of HD lanes requirement by Year 2015** | **Light Duty Vehicles** | | **Projected No. of LD lanes requirement by Year 2015** |
| | As on 2006 | BaU:year 2015 | II shift operation | As on 2006 | BaU:year 2015 | II shift operation |
| **A&N Islands** | 2374 | 4746 | 1 | 3319 | 6635 | 1 |
| **Chandigarh** | 4073 | 8142 | 1 | 11810 | 23608 | 1 |
| **D&N Haveli** | 6248 | 12490 | 1 | 2412 | 4822 | 1 |
| **Daman & Diu** | 2643 | 5283 | 1 | 3335 | 6667 | 1 |
| **Delhi** | 83645 | 167207 | 7 | 178862 | 357546 | 10 |
| **Lakshdweep** | 13 | 26 | 1 | 620 | 1239 | 1 |
| **Puducherry** | 8962 | 17915 | 1 | 11194 | 22377 | 1 |
| **UTs TOTAL** | 107958 | 215809 | 13 | 211552 | 422893 | 16 |
| | | | 314 | | | |
| **GRAND TOTAL** | **3714120** | **7424543** | **327** | **5124374** | **10243647** | **297** |

* Source MoSRTH Transport Research Wing
* UT: Union Territories




Based on BAU projections w.r.t. 2006 data

## Establishment of I&C centers in Major Cities of India for Transport Vehicles and Cost estimate:

| | Commercial Vehicle Population in Major Cities and respective test lane requirement | | | | | | | | | Considering two shift operation and 80% lane occupancy in 2015 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | City | Heavy Duty Vehicle Population in 2011 | Expected Heavy Duty Vehicle Population till 2015 | No. of Heavy Duty lanes requirement in 2015 | Heavy Duty lanes requirement in 2015 considering two shift and 80% occupancy-HD | Light Duty Vehicle Population in 2011 | Expected Light Duty Vehicle Population till 2015 | No. of Light Duty lanes requirement in 2015 | No. of Light Duty lanes requirement in 2015 considering Two shift and 80% occupancy-LD | Total Test Lane requirement in 2015 | Total Test centres requirement(Considering each test centre of 4 lane) | Estimated cost/Centre in Rs. Cr (Considering each test centre of 4 lane) |
| 1 | Chennai | 150697 | 220636 | 15 | 10 | 249317 | 365025 | 17 | 11 | 21 | 5 | 58 |
| 2 | Mumbai | 37337 | 54665 | 4 | 2 | 257720 | 377328 | 17 | 11 | 13 | 3 | 36 |
| 3 | Ahmedabad | 32288 | 47272 | 3 | 2 | 139328 | 203990 | 9 | 6 | 8 | 2 | 22 |
| 4 | Bengaluru | 130633 | 191259 | 13 | 8 | 380642 | 557298 | 26 | 16 | 24 | 6 | 66 |
| 5 | Coimbatore | 12447 | 18224 | 1 | 1 | 34495 | 50504 | 2 | 1 | 2 | 1 | 6 |
| 6 | Delhi | 151560 | 221899 | 15 | 10 | 428547 | 627436 | 29 | 18 | 28 | 7 | 77 |
| 7 | Bhopal | 10923 | 15992 | 1 | 1 | 40917 | 59907 | 3 | 2 | 3 | 1 | 8 |
| 8 | Hyderabad | 104813 | 153456 | 11 | 7 | 324783 | 475575 | 22 | 14 | 21 | 5 | 58 |
| 9 | Indore | 54836 | 80285 | 6 | 3 | 65820 | 96368 | 4 | 3 | 6 | 2 | 17 |
| 10 | Jaipur | 78049 | 114271 | 8 | 5 | 54756 | 80168 | 4 | 2 | 7 | 2 | 19 |
| 11 | Kanpur | 25130 | 36794 | 3 | 2 | 17897 | 26203 | 1 | 1 | 3 | 1 | 8 |
| 12 | Kochi | 10133 | 14835 | 1 | 1 | 83742 | 122606 | 6 | 4 | 5 | 1 | 14 |
| 13 | Kolkata | 51176 | 74926 | 5 | 3 | 59981 | 87818 | 4 | 3 | 6 | 2 | 17 |
| 14 | Lucknow | 10934 | 16008 | 1 | 1 | 33569 | 49148 | 2 | 1 | 2 | 1 | 6 |
| 15 | Madurai | 17078 | 25004 | 2 | 1 | 31813 | 46578 | 2 | 1 | 2 | 1 | 6 |
| 16 | Nagpur | 21573 | 31585 | 2 | 1 | 41324 | 60502 | 3 | 2 | 3 | 1 | 8 |
| 17 | Patna | 28816 | 42190 | 3 | 2 | 62676 | 91763 | 4 | 3 | 5 | 1 | 14 |
| 18 | Pune | 58132 | 85111 | 6 | 4 | 144234 | 211174 | 10 | 6 | 10 | 3 | 28 |
| 19 | Surat | 8406 | 12307 | 1 | 1 | 77684 | 113738 | 5 | 3 | 4 | 1 | 11 |
| 20 | Vadodara | 25122 | 36781 | 3 | 2 | 68543 | 100354 | 5 | 3 | 5 | 1 | 14 |
| 21 | Varanasi | 11110 | 16266 | 1 | 1 | 17758 | 25999 | 1 | 1 | 2 | 1 | 6 |
| 22 | Visakahapatnam | 15291 | 22385 | 2 | 1 | 42602 | 62373 | 3 | 2 | 3 | 1 | 8 |
| | | **1046484** | **1532151** | **107** | **69** | **2658148** | **3891855** | **179** | **114** | **183** | **46** | **503** |

** Assuming simultaneous establishment of I&C Test centres across the country ,above estimated cost can be reduce substantially, if we plan for bulk procurement of equipments and utilities.*

Above lane requirements and cost estimates are based on following assumptions:

- ✓ 2 shift operation and 80 % lane occupancy
- ✓ Developed Land (min. 3 acres), infrastructure (Roads) and supply of other basic amenities like electricity, water etc. is to be provided by respective State Governments and cost of same is not included in above proposal.
- ✓ The vehicle population data available from year 2009 by MoRTH- Provisional (10% vehicle growth for every year is considered.)

Source: MoRTH Transport Wing

## 2.4 Conceived Picture for Entire Country for Non Transport Vehicles

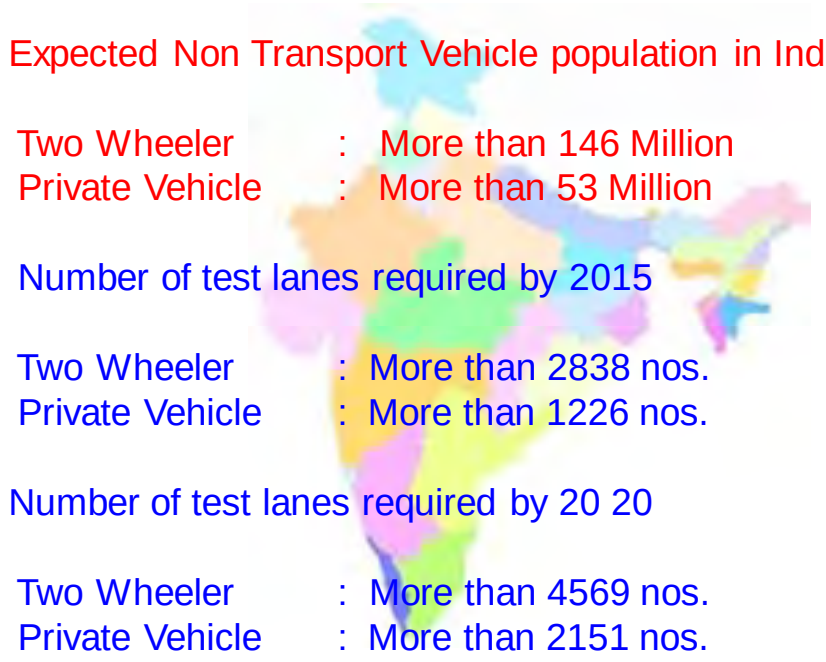
| STATES/UTS | 2wheelers | | Projected No. of 2wh lanes requirement by Year 2015 | Car jeeps and other passenger vehicles | | Projected No. of Passenger vehicles lanes requirement by Year 2015 |
|---|---|---|---|---|---|---|
| | As on 2009 | BaU:year 2015 | II shift operation and 80% lane occupancy | As on 2009 | BaU:year 2015 | II shift operation and 80% lane occupancy |
| STATES | | | | | | |
| Andhra Pradesh | 5851893 | 10366985 | 201 | 2207055 | 3909933 | 91 |
| Arunachal Pradesh | 11112 | 19686 | 1.0 | 10989 | 10989 | 0 |
| Assam | 740420 | 1311699 | 25 | 494331 | 494331 | 11 |
| Bihar | 1364757 | 2417750 | 47 | 594796 | 594796 | 14 |
| Chattisgarh | 1686424 | 2987603 | 58 | 428165 | 758520 | 18 |
| Goa | 467827 | 828784 | 16 | 206082 | 206082 | 5 |
| Gujarat | 8087416 | 14327351 | 278 | 2911235 | 2911235 | 67 |
| Haryana | 2768197 | 4904030 | 95 | 1657024 | 1657024 | 38 |
| Himachal Pradesh | 249994 | 442880 | 9 | 244404 | 244404 | 6 |
| Jammu & Kashmir | 363029 | 643128 | 12 | 305416 | 541063 | 13 |
| Jharkhand | 1570575 | 2782369 | 54 | 467445 | 828107 | 19 |
| Karnataka | 4796587 | 8497446 | 165 | 2155964 | 3819422 | 88 |
| Kerala | 2612341 | 4627921 | 90 | 2247577 | 3981720 | 92 |
| MP | 4691218 | 8310779 | 161 | 1319473 | 2337527 | 54 |
| Maharashtra | 10212360 | 18091819 | 351 | 4238548 | 7508846 | 174 |
| Manipur | 105465 | 186838 | 4 | 41929 | 74280 | 2 |
| Meghalaya | 45747 | 81044 | 2 | 96130 | 170300 | 4 |
| Mizoram | 32267 | 57163 | 1 | 37615 | 66637 | 2 |
| Nagaland | 52119 | 92332 | 2 | 187754 | 332618 | 8 |
| Orissa | 2052980 | 3636979 | 71 | 554381 | 982120 | 23 |
| Punjab | 3581837 | 6345443 | 123 | 1249694 | 2213909 | 51 |
| Rajasthan | 4715835 | 8354389 | 162 | 1773729 | 3142269 | 73 |
| Sikkim | 5956 | 10551 | 1 | 22595 | 40028 | 1 |
| Tamil Nadu | 10223233 | 18111081 | 352 | 2667764 | 4726107 | 109 |
| Tripura | 85455 | 151389 | 3 | 58368 | 103402 | 2 |
| Uttarakhand | 570359 | 1010426 | 20 | 216993 | 384416 | 9 |
| Uttar Pradesh | 8521198 | 15095822 | 293 | 2257614 | 3999501 | 93 |
| West Bengal | 2017198 | 3573589 | 69 | 1026421 | 1818367 | 42 |
| **Total States** | | **137267276** | **2668** | | **47857954** | **1108** |

| STATES/UTS | 2wheelers | | Projected No. of 2wh lanes requirement by Year 2015 | Car jeeps and other vehicles | | Projected No. of Passenger vehicles lanes requirement by Year 2015 |
|---|---|---|---|---|---|---|
| | As on 2009 | BaU:year 2015 | II shift operation and 80% lane occupancy | As on 2009 | BaU:year 2015 | II shift operation and 80% lane occupancy |
| A & N Islands | 42386 | 75089 | 1 | 17343 | 30724 | 1 |
| Chandigarh | 511568 | 906274 | 18 | 235699 | 417555 | 10 |
| D&N Haveli | 35059 | 62109 | 1 | 28300 | 50135 | 1 |
| Daman & Diu | 42861 | 75931 | 1 | 26877 | 47614 | 1 |
| Delhi | 3846721 | 6814701 | 132 | 2455446 | 4349972 | 101 |
| Lakshdweep | 5639 | 9990 | 1.0 | 1596 | 2827 | 1 |
| Puducherry | 434072 | 768985 | 15 | 104176 | 184554 | 4 |
| UTs TOTAL | | **8713079** | **170** | | **5083383** | **119** |
| | | | | | | |
| GRAND TOTAL | | **145980356** | **2838** | | **52941337** | **1226** |

* Source MoRTH
* UT: Union Territories

**Above lane requirements and cost estimates are based on following assumptions:**

- ✓ 2 shift operation and 80 % lane occupancy
- ✓ Developed Land (min. 3 acres), infrastructure (Roads) and supply of other basic amenities like electricity, water etc. is to be provided by respective State Governments and cost of same is not included in above proposal.
- ✓ The vehicle population data available from year 2009 by MoRTH- Provisional (10% vehicle growth for every year is considered.)



Expected Non Transport Vehicle population in India by 2015

Two Wheeler : More than 146 Million
Private Vehicle : More than 53 Million

Number of test lanes required by 2015

Two Wheeler : More than 2838 nos.
Private Vehicle : More than 1226 nos.

Number of test lanes required by 20 20

Two Wheeler : More than 4569 nos.
Private Vehicle : More than 2151 nos.

Based on BAU projections w.r.t. 2009 MoRTH data. (Considering 10% rise of vehicles every year)

Considering the above growth of vehicle population, large no. of I&M test centers needs to be established by year 2015. It is expected to have more than **7000 crores** investments **(without land and infrastructure)** to establish I&M centers throughout the country in HD, LD and Private Vehicles category by year 2015. Hence, the operation and establishment of I&C centre can be worked out on the basis of BOOT or PPP model and considering international experiences like UK model.

**** Assuming simultaneous establishment of I&C Test centers across the country ,above estimated cost can be reduce substantially, if we plan for bulk procurement of equipments and utilities.***

Based on experience of the I& C centers established as capacity building in each state, these centers will be replicated throughout country, depending upon state government initiatives and priorities. For the Union Territories, small states and remote locations considering the volume of the vehicles the concept of mobile test centre may be introduced. Depending upon the city fleet split of lanes in terms of Heavy Duty, Light Duty and Private vehicles in combination and shift operation may be worked out.

**Salient features of this programme:**

- Quantitative measurement of the health status of vehicles
- Number of failures, major failure areas
- Evaluation of vehicles various identified parameters in a scientific manner.
- Good maintenance practices will be proactively followed by vehicle owner/operators ensuring safer and cleaner vehicles plying on the road

- Test data will be computerized and networked so that the norms can be further improved based on the data collected.
- The gathered test data can be a critical input for important projects like "Ambient Air Quality Improvement" and "End-of-Life" of the vehicles.

**Overall Benefits of this programme:**

- Improvement in overall vehicle condition is expected to ensure
  a. Safer vehicles
  b. Cleaner vehicles
- Reduction in Accidents & fatalities.
- Identification & reduction of gross polluting vehicles.
- Improvement in fuel consumptions.
- The programme will facilitate establishment of requisite no. of garages with necessary equipments.

## 2.5 Implementation Plan

For the implementation of effective I/C regime in India, there is a need for creating an independent centralized nodal agency like ARAI, which can provide necessary technical and administrative assistance to the Government of India in developing a comprehensive I/C regime, assist the state government in creating necessary infrastructure and monitor the implementation at State level. This agency can be built on the basis of similar agency like Vehicle Operator Service Agency (VOSA) in UK and National Vehicle Inspection Agency in Japan. Though initially the Government may provide funds to create the nodal agency, later self-sustainability should be achieved through functioning of the agency. This agency should function with the following objective to develop an effective I&C regime for the country.

- Develop a detailed program content in consultation with State Government
- Suggest necessary changes in the legislative framework for implementing a comprehensive I&C regime in the country
- Identify the number of centers required and develop an implementation plan for creating necessary infrastructure
- Recommend the type of tests and procedures for testing vehicles on emission and safety parameters
- Prepare necessary guidelines for setting up and operation of an automated vehicle inspection centres
- Develop vehicle inspection and audit manuals
- Develop a training course content, identify resources and prepare an action plan for providing training of necessary technical manpower
- Frame specifications for a centralized software and networking of the Inspection centers

- Analyze the data and suggest further changes in the test procedures and standards
- Prepare an enforcement plan and monitor the implementation a the state level
- Setup an audit system and monitor the inspection centers

It is imperative that along with the growth in the vehicular population, the pollution level is also on the rise. The data of emission load for transport sector shows significant increase in the past decade.

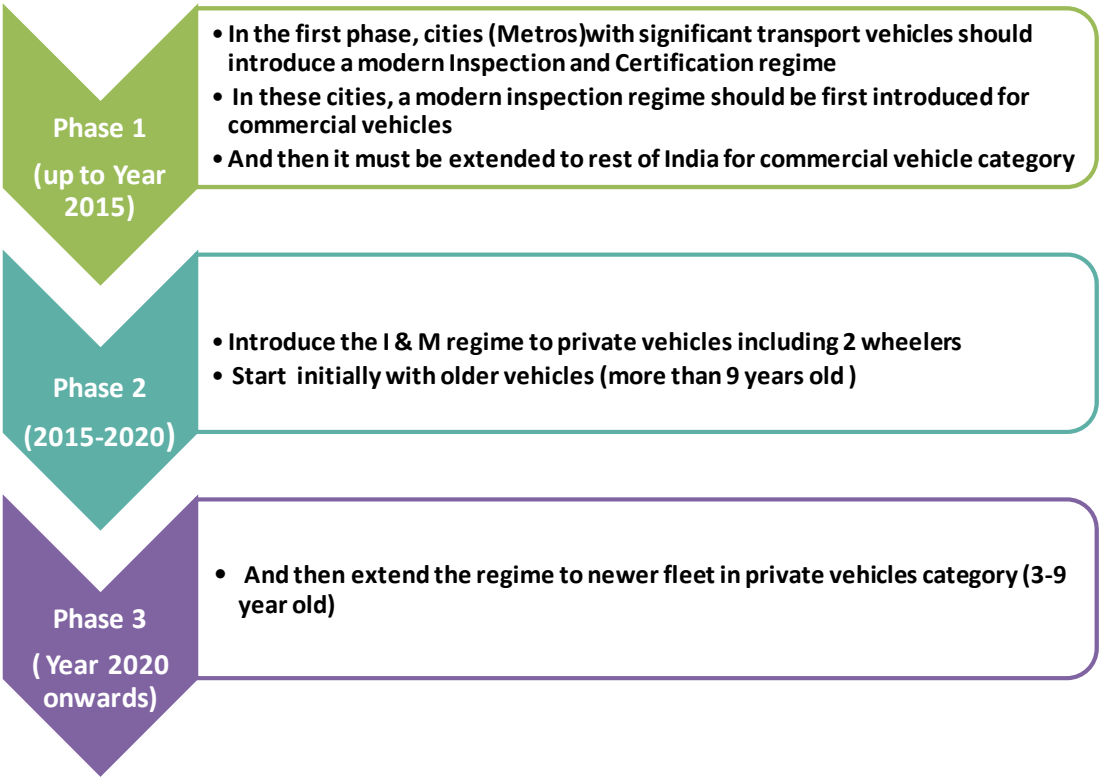
Under the management control strategies, implementing I & C regime is important, assuring the emission control from in use vehicles.

However, the air quality monitoring has to be done on continuous basis to ensure the effectiveness of control strategies adopted. Especially the road side air quality monitoring is required to know the pollution load from the transport sector.

### 2.6 Key recommendations/Suggestion for Implementation for I&C Regime

A phased approach would be necessary to inspect all vehicles on safety and emissions performance. Significant investments, improvements in regulatory and management practices, increased capacity and capability would be prerequisites for the effectiveness for such a regime. Hence, a phased approach has been suggested for ensuring effective implementation of inspection and maintenance program. Thus, the following phasing is suggested:

- In the first phase, cities with significant transport vehicles(Metros) should introduce a modern Inspection and Certification regime
- In these cities, a modern inspection regime should be first introduced for commercial vehicles, and then subsequently to private vehicles.
- Within private vehicles, older vehicles (more than 9 years old) should be included in the regime earlier. And then it must be extended to newer fleet (3-9 year old)
- Both emissions and safety tests should be introduced simultaneously for commercial vehicles.




**Please find below the table indicating vehicle category and age wise suggested inspection frequency:**

| Vehicle Types | Age / Frequency | | |
|---|---|---|---|
| **Phase - I**<br>Commercial vehicles | All Vintage | | |
| Frequency | Annually -(After initial 2 years) | | |
| **Phase - II** | | | |
| Private Vehicles<br>Four Wheelers | <3 Years | 3-9 Years | >9 Years |
| Frequency | NA | Biennially | Annually |
| Motorcycles & Scooters | <3 years | 3-9 Years | >9 years |
| Frequency | NA | Biennially | Annually |

For cities where the regime would be introduced later or for vehicle categories that are not being covered at the first instance, the current PUC and fitness testing regime should continue. Here the existing PUC regime should be strengthened by improving the efficacy of the tests carried out with improved instrumentation and test methodologies and a more effective auditing system.

While it would be ideal to have a large number of testing centers spread all over a city that could cater to the entire vehicle fleet so that vehicle owners are not inconvenienced, cost and investment considerations may make such an extended system unviable. The frequency of these tests should be based on the tradeoff

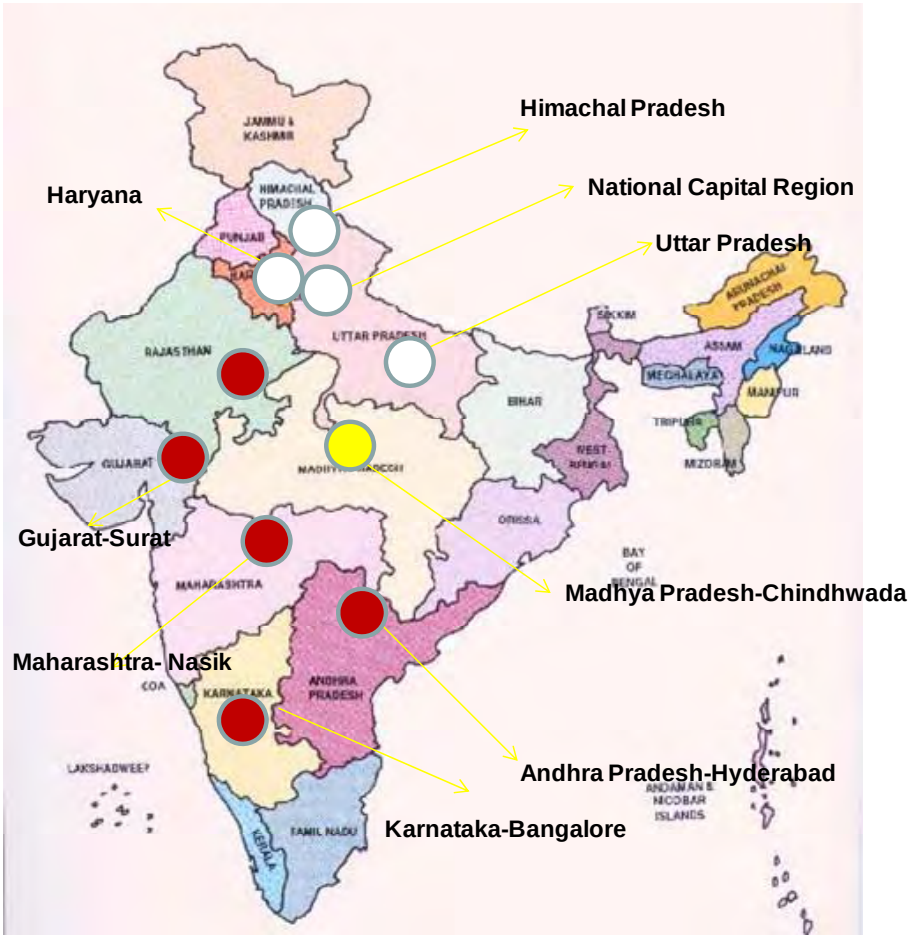
between the cost implications for setting up the infrastructure for testing as also convenience to vehicle users. The principles on which the frequency of tests should be based are the following:

- Commercial vehicles with a higher utilization should be tested more often
- Older vehicles should be tested more frequently than newer vehicles
- Private vehicles including 2 wheelers to be included in I&M regime

Initially, the focus should be on testing of commercial vehicles only. With gradual capacity building and increased number of integrated safety and emissions testing centers, the frequency and tests can then be extended to private vehicles and other category of vehicles including 2 wheelers.

Considering the international fee structure and planning of additional safety tests in automated test centers, in future 20% fee increase over the existing fees is suggested for instrumented tests in I&C centre.

## 3.0 Recent Initiative by MoRTH



It is pertinent to note that **MoRTH** has taken the initiative to establish 10 model I&C centers in India with the help of **ARAI** and other executing agencies (Please refer above Fig). In this scheme, I&C center Primary focus is to inspect commercial vehicles and it is expected that I &C will work in two shifts with 80% lane occupancy. With above assumptions and with existing test fee structure the I&C centre will be financially viable.

Considering the huge requirement of I&M test centres in future ,the operation and establishment of I&C centre can be worked out on the basis of BOOT or PPP model.

Based on experience of the I& C centers established as capacity building in each state, these centers will be replicated throughout country, depending upon state government initiatives and priorities. For the Union Territories considering the volume of the vehicles the concept of mobile test centre may be introduced. Depending upon the city fleet split of lanes in terms of Heavy Duty, Light Duty and Private Vehicles, combination and shift operation may be worked out. These centers will also be useful in collecting data of in use vehicles in terms of

- Quantitative measurement of the health status of vehicles,
- Number of failures, major failure areas
- need of maintenance garage and auditing system

As such I&C regime becomes mature in the country, the same may be extended to non transport (Private Vehicles) by year 2020. As a long term goal we can also explore the possibility of bringing end of life Vehicles concept to India.

## 4.0 End of Life Vehicle (ELV)

The ultimate fate of vehicles depends on one or more following actions:

1. Recycled via the existing end of life vehicle management infrastructure.
2. Abandoned, typically in remote or hard-to-reach locations
3. Stored indefinitely in inactive condition by owners on private property
4. Maintained indefinitely in working condition by owners as collector items (i.e. classic/ antique cars).

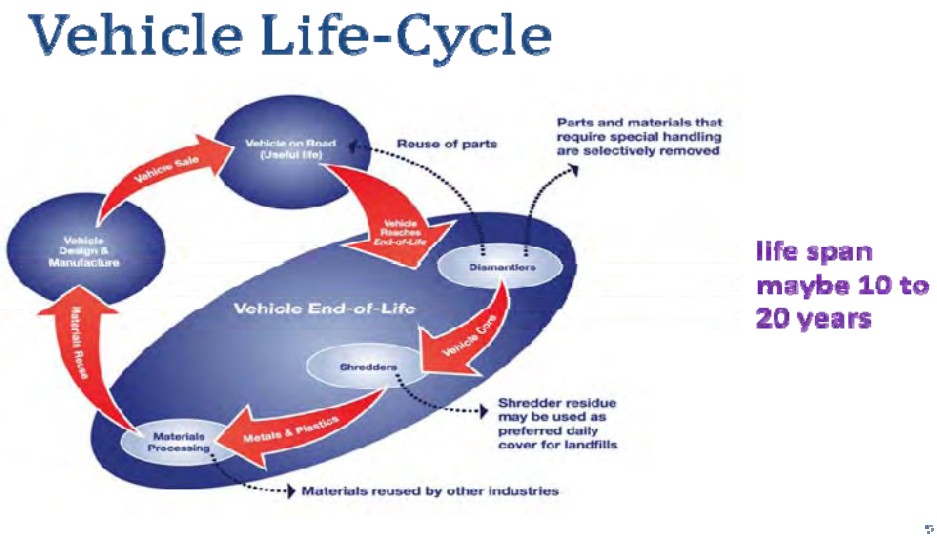
It is clear that (1) and (2) above are categories as “permanently retired” vehicles or ELVs and (3) and (4) as “retired” vehicles. Automobile owners permanently retire their vehicles for a variety of reasons such as:

- Loss of structural/mechanical integrity from corrosion or an accident
- Poor reliability of parts and components
- Degraded performance

The decision to permanently retire a vehicle poses a challenging resource optimization problem from both an environmental and economic perspective. Investment of additional resources in the form of parts and components can potentially extend the life of the vehicle, but the environmental performance of

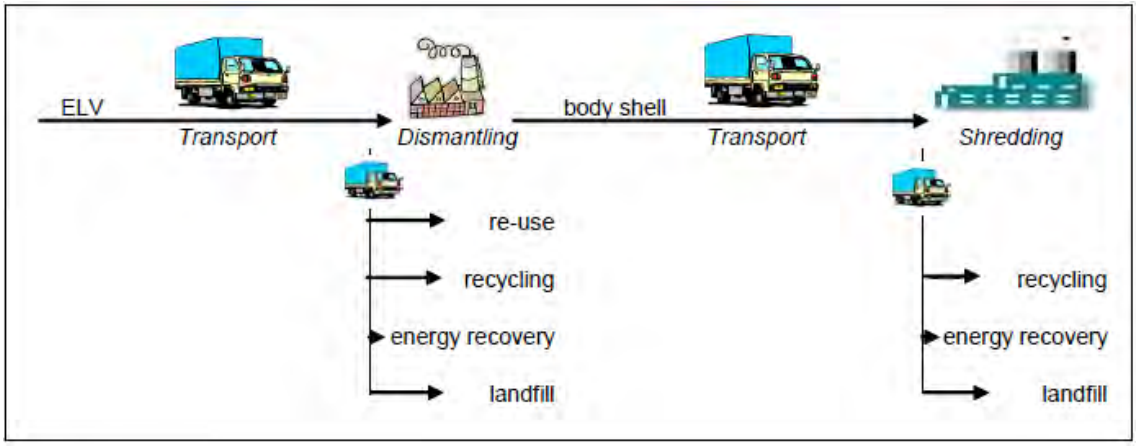
an older vehicle in terms of fuel economy and emissions is worse than a newer vehicle. The depreciated value of the vehicle and the owner's opportunity cost for making repairs are economic factors influencing this decision. It is difficult to develop guidelines to assist users in calculating precise environmental tradeoffs. The first product of this effort is a life cycle optimization model for minimizing the total energy consumed over a specified time horizon

**Vehicle life cycle** is depicted as under:




### 4.1 ELV Management Process

A generalized flow diagram indicating the overall ELV processing structure and associated materials streams is provided in Figure below.




Major activities in the process are:

**1. Dismantling:** Occurring at either a dismantler facility or a salvage/scrap yard, a variety of parts and all vehicle fluids and tires are removed for either:

- Direct reuse (e.g., body panels used to repair collision-damaged vehicles)
- Remanufacture (e.g., clutches, starters, engines)

- Recycle (e.g., fluids, batteries, catalytic converters, steel fuel tanks)
- Energy Recovery (e.g., tires)
- Disposal (e.g., plastic fuel tanks)

After removal, the remaining gutted vehicle ("hulk") is typically flattened prior to shipment to the shredding facility.

**2. Shredding:** Occurring at a shredding facility, the vehicle hulks are placed in a shredder, which tears the hulks into fist-sized pieces.

**3. Post-shredder material separation and processing:** Initially, the post-shredder material stream is separated at the shredding facility into two basic streams: as Ferrous metal (all iron and steel, except stainless steel) and Non-ferrous materials (both metals and non-metals)

### 4.2 Environmental and Energy burdens of ELVs

The environmental and energy burdens associated with ELV management are strongly dependent on the material composition of vehicles processed and the infrastructure in place to process those vehicles. These factors also influence the potential for material and energy recovery, which reduces burdens experienced both at end-of-life and upstream in the life cycle such as during materials production and vehicle manufacturing/assembly activities

#### 4.2.1 Environmental Burdens

Overall, there are a number of environmental burdens associated with ELV management, including:

- Wastes produced as an immediate and direct end result of normal ELV processing
- Waste/emissions produced in ancillary activities associated with ELV processing. Such ancillary activities include: Recycling of removed vehicle fluids, batteries, catalytic converters, and, when used for energy recovery, Remanufacturing of removed electro-mechanical parts (engines, alternators, etc.), Smelting of recovered scrap iron and steel, Production of ingots from recovered non-ferrous metals, etc.
- Burdens associated with abandoned ELVs (approximately 6% all ELVs), principally Leaking of vehicle fluids and air conditioning refrigerant into the environment.
- Burdens associated with traditional scrap/salvage yards, due to the historic low-tech nature of operations that often operate with little regard for environmental protection- the principal concern being releases of ELV fluids and air conditioning refrigerant into the environment.
- The potential release to the environment of mercury (a toxic chemical) from mercury containing switches potentially present in ELVs during hulk shredding and subsequent ferrous metal recovery activities

#### 4.2.2 Energy burdens

For purposes of this report, evaluation of energy burdens will focus on those burdens associated with immediate and direct management of ELVs, namely

- Traditional ELV management processes
- Three key transportation-derived burdens

- Other sources of energy burdens include: Initial transportation of permanently retired vehicles to dismantlers and Ancillary activities associated with ELV processing.

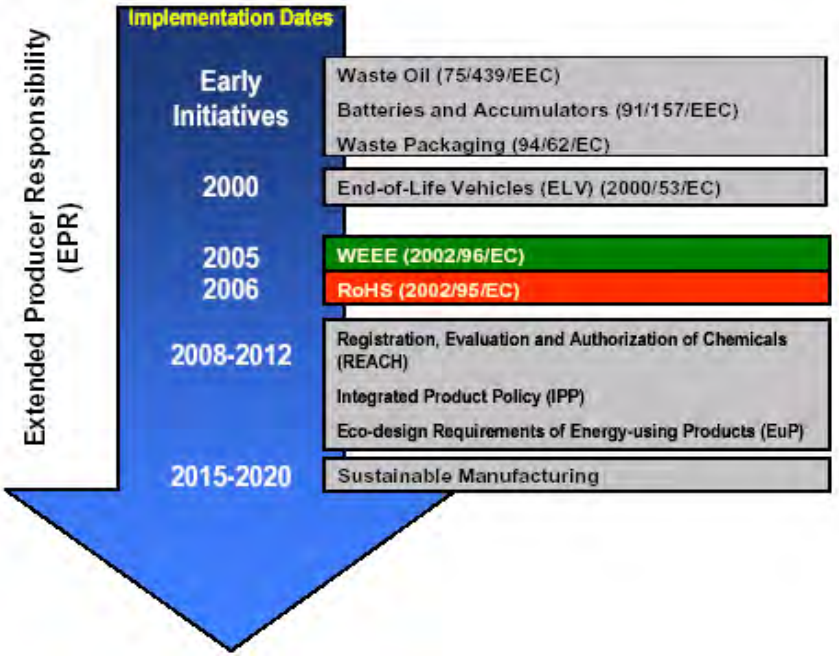
### 4.3 Economic assessment

The economics of the ELV management process depend principally on the following factors:

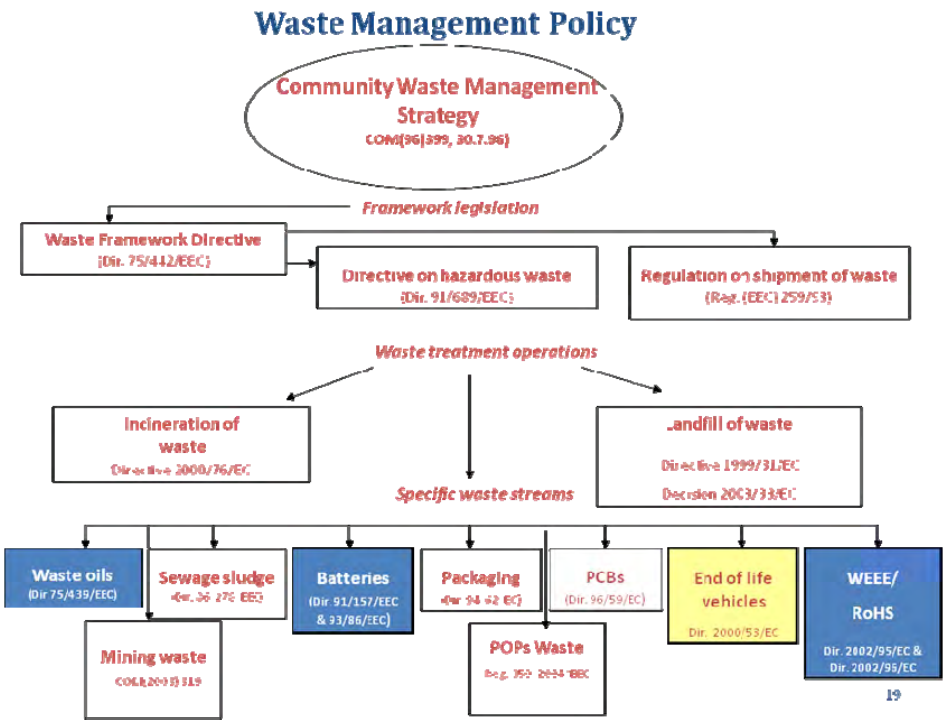
- Value of ELVs ("as is" value)
- Processing costs incurred by ELV processors
- Recovered scrap metal value
- ASR disposal costs (i.e., landfill disposal costs)
- Regional/local conditions/factors (potentially affecting all of the above)

Specific economic data or analyses on ELV activities are relatively unavailable and/or difficult to obtain but world-wide overall economics are obviously favorable.

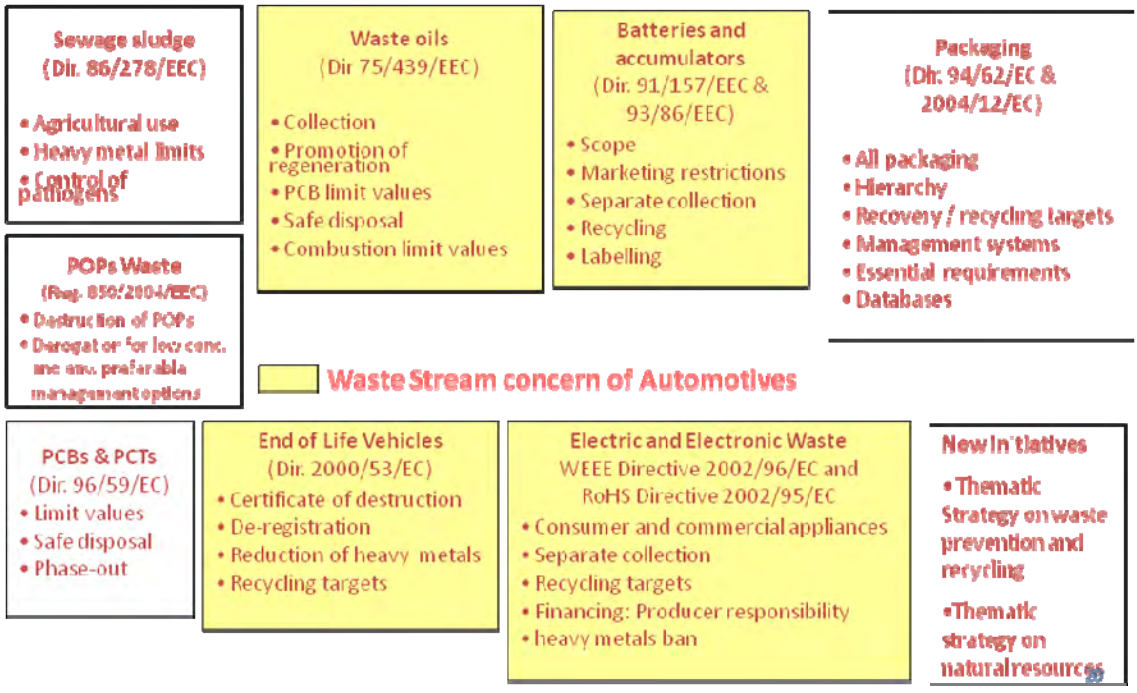
### 4.4 ELV Regulations Overview on international scenario




#### 4.4.1 Development of Directives on ELV



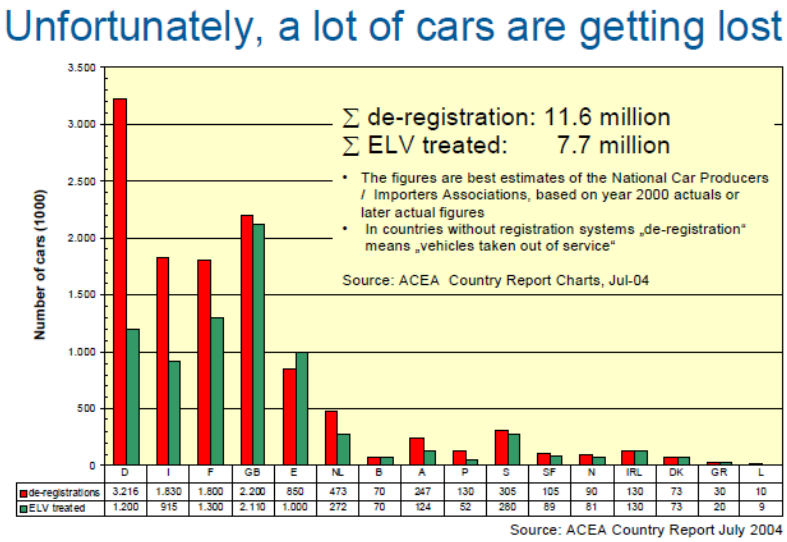

### 4.4.2 **Waste Stream concern of Automotives**



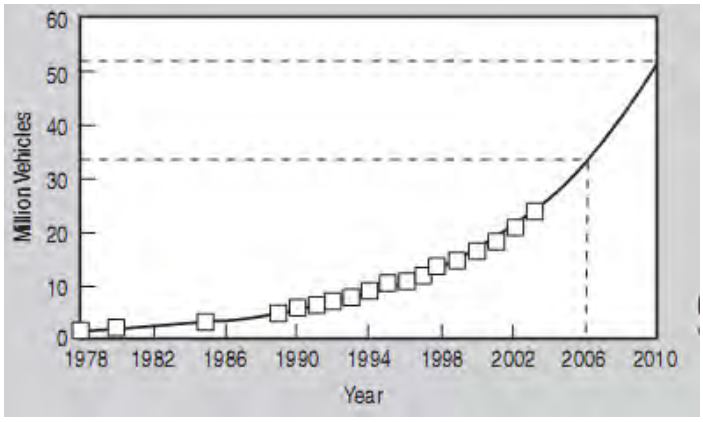

### 4.4.3 ELV Regulation International Scenario

- European Union promulgated the "**E.U. ELV Directive**" in 2000
- Japan's "**Automobile Recycling Law**" was promulgated in 2002
- China "**Statute 307- ELV Standard**" was issued in 2001

- US: **Automobile Recycling Study Act of 1991** was put up in the house of representative but did not pass




ELV Regulations: EU Status




**Over 50 million vehicles on road in China, out of which ~3.5 million are ELV***

## 4.5 ELV Regulation Indian Perspective

ELV Regulations in India are expected to bring following benefits

- **Environmental**
  - Reduction in emissions due to decrease in number of old polluting vehicles
  - Maximum recycling or re-use of materials and reducing the amount of non-degradable products
  - Efficient utilization of natural resources
- **Industrial**
  - Improvement in efficiency through recycling and energy generation

- Reduction in cost of materials due to recycling

- **Technological**
  - Thought to recyclability issue given right from the beginning of developing a new technology
  - Development of environmental friendly technologies
- **Administrative/ Societal**
  - Possible to keep track of a vehicle right up to its scrapping
  - One always cautious to check emission levels in order that his/her vehicle does not become ELV sooner than expected life of the vehicle

**4.6 Lessons from Timelines for International Regulations**

- 3 years for EU Directive from acceptance of proposal to formulation of the directive
- 10 years for UK to get the law into practice from EU Directive
- 15 years for Japan from EVL consciousness to getting law into effect
- China: law in 2001, Only 10% ELV dismantled by 2004

India should therefore plan vigorously for rapid implementation and impact of ELV regulation

**4.7 Suggested ELV Program**

- Prepare Indian standards based on EU Directives and define targets for material Recovery or re-use rates.
- Define ELV in Indian context including 2, 3 and 4 wheelers
- To define recycling mechanism, identify present usage of various materials for construction of vehicle.
  - Non-recyclable, hazardous, flammable, and toxic materials that go in vehicle construction.
  - Prepare national guideline standard on Substances of Concern (SoC) and Restriction on Hazardous Substances (RoHS).
- Enforce mandatory regulations on ELV and RoHS
- Define Players, Responsibilities and Authorization in Waste Management Disposal/Recycling Mechanism
  - Identify organization which will provide Certificate of Destruction (COD)
  - Prepare Procedure for deregistration of vehicle from the market.
  - Identify the authority (License holders) who will perform the activities such as collection, dismantling, recycling or recovery, and destruction (CDR&D) of ELV.
  - Define cost bearing system, fiscal incentives to promote recyclability in the country.

WORKING GROUP ON 4 'E' OF ROAD SAFETY- ENGINEERING (VEHICLES)

# Accident Investigation

## Chapter 6

**7/20/2011**

## Chapter 6

## Accident Investigation

Road Safety is of growing concern in the present day world. The statistics of accidents, their collection, assimilation and analysis is an important area in Road Safety as this leads to the understanding of the root causes of accidents and evolve methodologies to reduce them. The objective of the accident data collection, analysis and re-construction is to provide information to the designer, the causes of the accidents and possible remedies to prevent and soften them.

### 1. Need for Accident Investigation

Road Safety is directly quantifiable with accident data. However, mere data is not adequate arriving at technically sound conclusions and action plans. In India, the need for accident investigation is fast arising on account of following facts:

- The increasing trend of fatalities in our country is a challenge for all involved parties.
- The pattern of accidents in India is much different as compared to developed countries. The number of pedestrians, cyclists and 2-wheelers involved in the accidents in India is much higher in India. Hence, it is necessary to develop different techniques in this area for India. The priorities of safety measures with regard to life saving potential, as they can be found in Europe or other countries, cannot be transferred to India as they are.
- So National level accident research is needed to derive an adequate safety strategy.
- This is a challenge for industry, but also for the governments and researchers of the emerging countries where mobility penetration is on the rise.

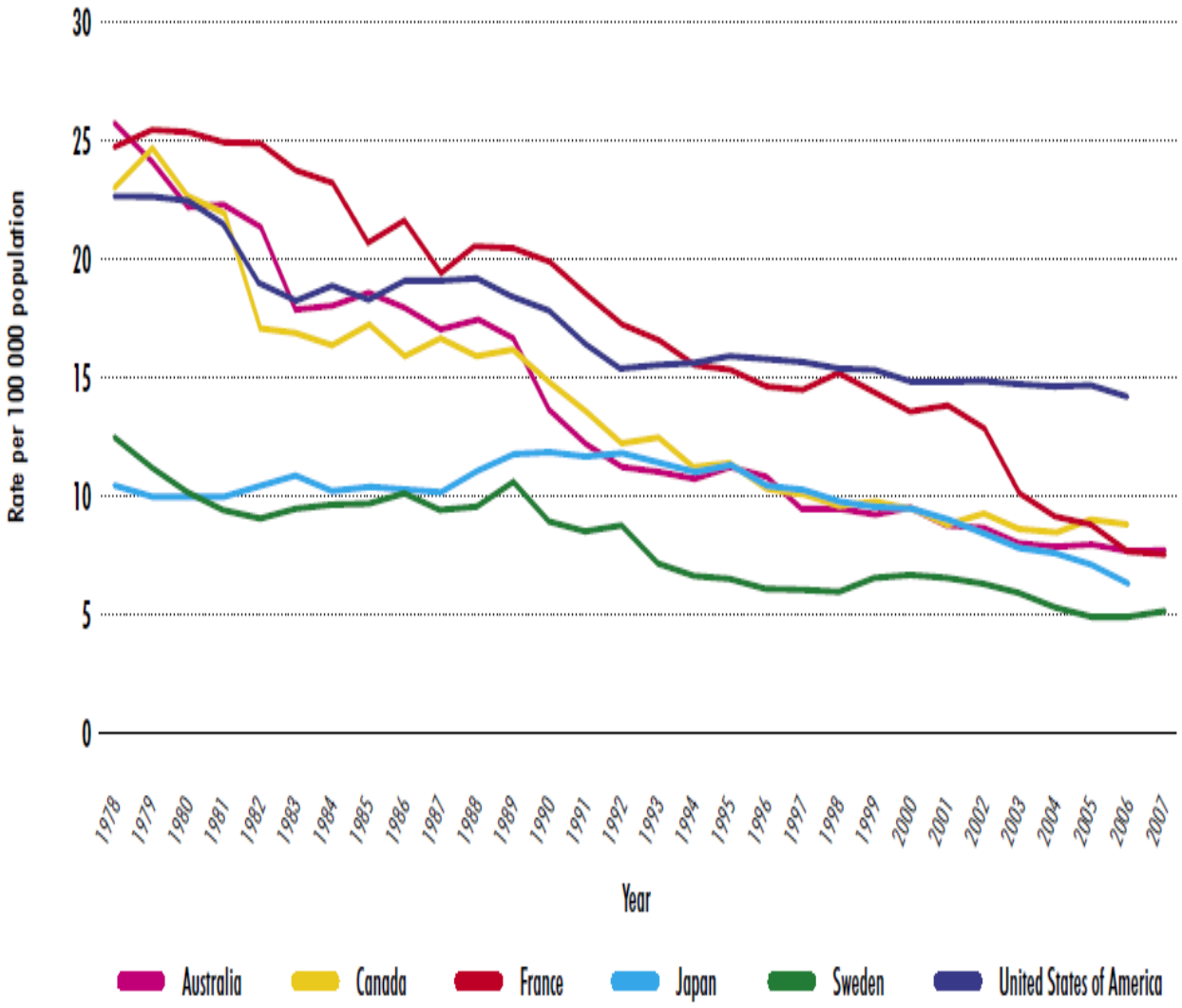
### 2. World Status

In developed countries, this activity has become a well-established science which is carried out jointly by the specialized agencies of accident investigators, police departments, hospitals, vehicle manufactures, Non-Government Organizations, etc. Specialized formats have been developed by the agencies to be used by the Police, so that no essential data is missed. Computer Programmes have been developed to analyze the results. Based on the database and analysis, a number of techniques have been developed for accident reconstruction – both computer based and experimental for validation. In USA the national accident data base called FARS (Fatality Accident Reporting System) and NASS (National Accident Sampling System) is maintained and it is obligatory to add every fatality report in uniform format. (standard format attached) In Germany data base called GIDAC (German in depth accident collection) is available for researchers, designers and regulators. In Japan, Institute for Traffic Accident Research and Data Analysis (ITARDA) is responsible for

publishing extensive Accident Statistics. Thailand Accident Research Center (TARC) is the national center for collecting scientific information regarding road accidents in Thailand.

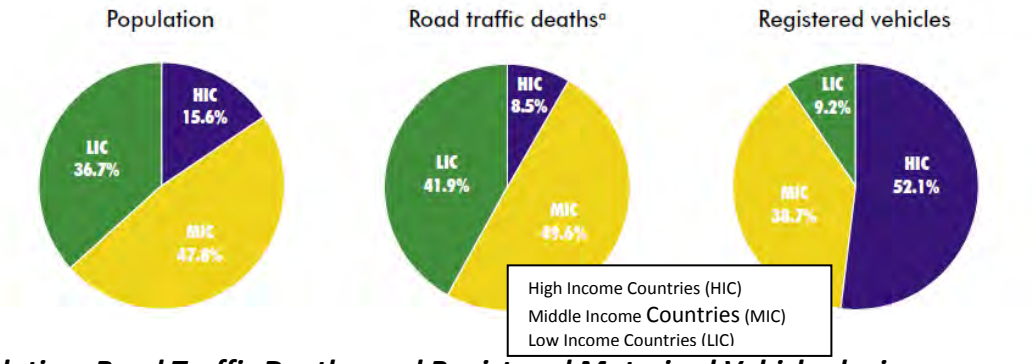
The road accident data is always referred for any improvement in vehicle regulation. Apart from this many OEs have their full-fledge teams for accident investigation and analysis.

There are national targets both short term and long term to reduce fatality. There have been many collaborative accident research teams consisting of various manufactures and research institutes in Europe. With focus efforts, the advanced countries have reducing trend of number of fatalities. *(as seen in the Graph below extracted from WHO report on Global Status Report on Road Safety – Time for Action)*




***Trends in Road traffic fatality rates in selected high-income countries***

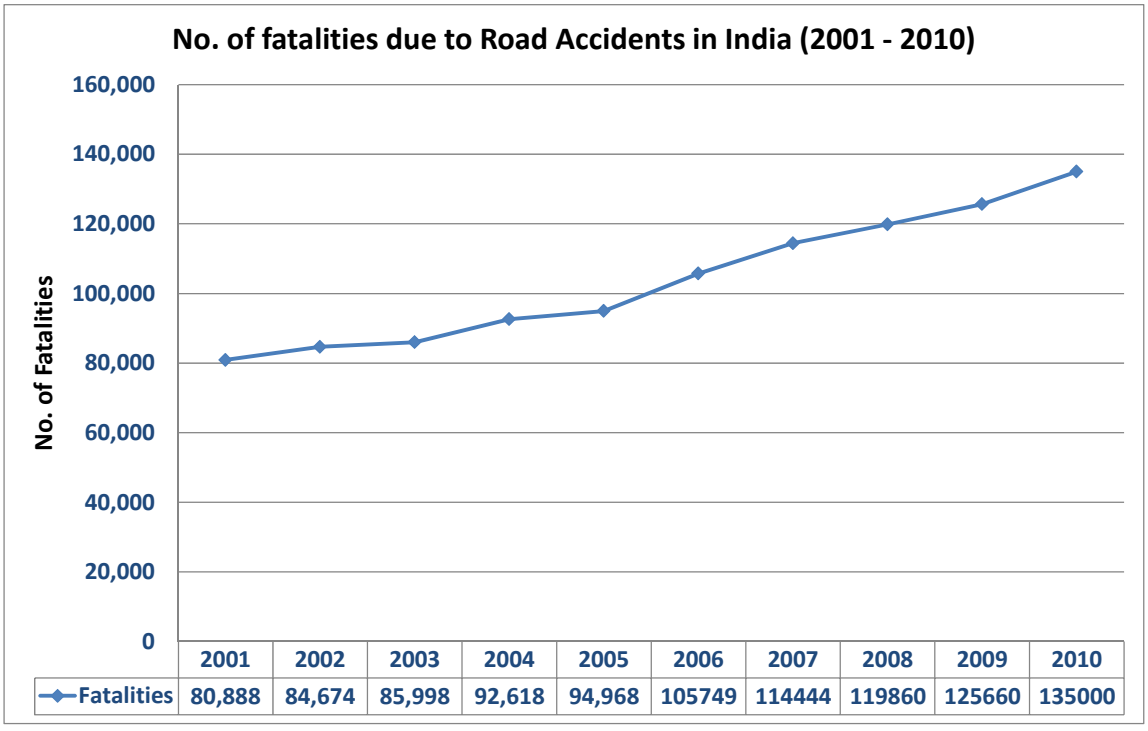
In spite of low motorization in Low Income and Medium Income countries road traffic deaths are more.




***Population, Road Traffic Deaths, and Registered Motorized Vehicles by income group***

## 3. Indian Scenario

- Collection of accident data is very poor in India as this is based on the police records only. India's vehicle population is just 1% of the world while 8% of world's accidents occur in India. The national highways comprising 2% of the entire road network in the country accounts for 20% of the total road accidents.
- There has been no scientific comprehensive study. Accident Research centre has been identified under NATRiP.




***Trends in Road Traffic Deaths in India***

- India contributes 8% fatalities with only 1% vehicle population contribution
- 75% of victims are pedestrians and two wheeler users.

- 85% of accidents happening worldwide occur in developing countries.
- Three major causes of human casualties in 2020 would be ** –
    1. Heart disease
    2. Major depression
    3. *Road traffic accidents*

**According to an independent study by *WHO*

**4. Indian Roadmap**

Resources required for conducting accident data collection is also included in the report. Detailed accident investigation and analysis will help in the following;

- Giving inputs to formulate / amend various safety standards
- Decide the priorities in implementation of regulations.
- Improving vehicle design.
- Up gradation of road infrastructure.

▪ **NATIONAL LEVEL ACCIDENT RESEARCH CENTRES IN INDIA**

Considering the vast spread of the country at least 4-5 parallel teams will have to work in various regions of India and consolidate the national data. In this area contributions from companies willing to volunteer should be encouraged.


*Schematic of Accident Research Centre working with the Sub centre*

▪ **FUNCTIONS OF NATIONAL ACCIDENT RESEARCH CENTRE**

- This center will work as a Center of Excellence for in-depth data Analysis.
- Contribute significantly for inputs for policy making at national level.
- Sharing of experiences between various sub-centers and promotes synergy.

- To create a National Archive for ready reference.
  - **FUNCTIONS OF ACCIDENT DATA AQUISATION SUB CENTERS**
- Responsible for collecting Accident Data in identified sub region.
- Reporting it uniformly into the national archives. One of the illustrative forms used in National Accident Sampling System (NASS), USA is attached.

A typical example of recently conducted Accident Data Investigation is available from Tamil Nadu state. It was carried out by organization called JP Research with the support and cooperation of the Kanchipuram district police and Tamil Nadu police from 1 September 2008 to 15 October 2008. It conducted detailed investigations of accidents occurring on the National Highway 45 over a 60 km stretch. The primary objective was to collect and analyze India-based traffic crash data to begin to create a sound basis for decision making for improving safety on India's roadways. Detailed information on the work is available at the following links:

- *http://www.tnpolice.gov.in/trafficimprove/e-TrafficMag.pdf*
- *http://internationaltransportforum.org/irtad/pdf/seoul/P02_Rajaraman.pdf*

- **TYPICAL STEPS THAT CAN BE FOLLOWED BY SUB CENTERS FOR UNDERSTANDING AN ACCIDENT**

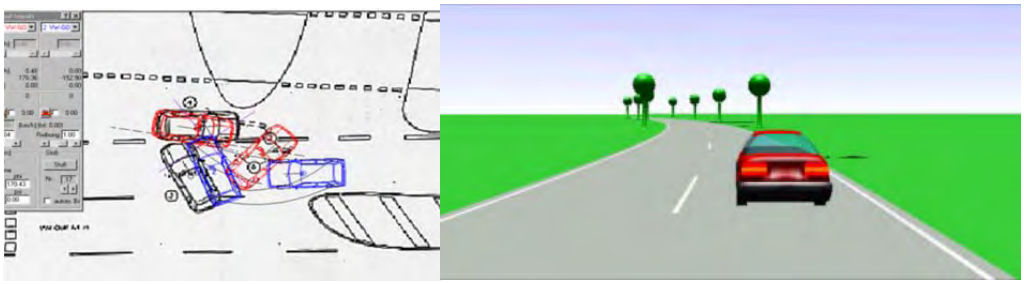
Step 1: On-the-scene documentation


Step 2: Inspection of the vehicle(s)

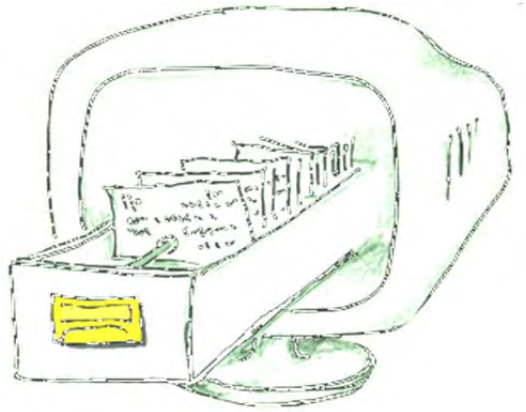
Step 3: Gathering injury information


Step 4: Road user Interview

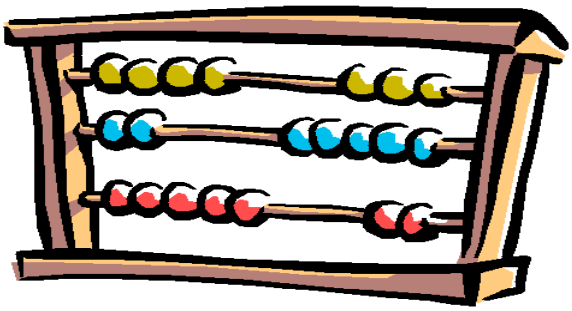
Step 5: Reconstruction



Step 6: Storage in accident database



Step 7: Statistical analysis



- **COMPOSITION OF THE ACCIDENT DATA ANALYSIS TEAM**
  - Mechanical / Automotive Engineering
  - Civil engineering or land survey
  - Biomechanics, Legal medicine or Trauma Surgery
  - Psychology
  - Statistical analysis
  - Computer Science and Database Management
  - Communications.
- **ACCIDENT DATA ANALYSIS STAKE HOLDERS**


## 5. Actionable Points

Following actions emerge out at the national level to address the need for accident investigation system:

- The development of a comprehensive road accident data system should be fully integrated into national road safety plans.
- It is essential to have strategic alliance with one or more of the International organizations / Government Bodies who have successfully implemented accident investigation exercises in their countries. Annexure I gives the various International organizations / government bodies with their website details for further references.
- With the help of above mentioned cooperation a comprehensive plan needs to be formulated. This plan should also indicate all resource requirement, financial impact along with modalities to train Road Transport personnel for establishing Accident Data Investigation teams.
- A National Accident Research Centre needs to be established at an early date.
- The Accident Data should be made available to all stake holders for collective efforts to reverse the trend of fatality in the years to come.
- Some of the MNC OEs are keen doing accident data measurement. We should take the opportunity by supporting them suitably.

- A Project proposal on "Automotive Accident Data Collection, Analysis and Re-Construction" prepared by The Automotive Research Association of India (ARAI), Pune has been attached for ready reference.
- Accident data is collected for various purposes and various levels for addressing specific functions. Table summarizes these levels that can be achieved over a period of time:

| Timeline | Level | Source of Data | Functions / Level of Data Collection |
|---|---|---|---|
| SHORT TERM (3-5yrs) | Base | o National Accident Data | o Priorities<br>o Trends<br>o Progress of targets |
| INTERMEDIATE (5-10yrs) | Intermediate | o Specialist police<br>o Reports<br>o Insurance Reports | o Identification of Blame<br>o Reconstruction of pre-crash events |
| LONG TERM (>10yrs) | In-depth | o Special Investigations | o Accident Causation & Injury Causation<br>o Basic Research<br>o Engineering feedback<br>o Technical Standards |
| | Specialist | o Research Studies | o Specific Research Questions |

## ANNEXURE I

| COUNTRY & ORGANIZATION | CONTACT DETAILS / WEBSITE: |
|---|---|
| **USA**<br>1. Fatality Analysis Reporting System (FARS)<br>2. National Accident Sampling System (NASS) | http://www-fars.nhtsa.dot.gov |
| **Great Britain**<br>1. Department for Transport (DFT) | www.dft.gov.uk |
| **Sweden**<br>STRADA – Swedish Traffic Accident Data Acquisition | http://www.transportstyrelsen.se/en/road/STRADA/ |
| **Germany**<br>1. German In-Depth Accident Study (GIDAS)<br>2. Federal Highway Research Institute (BASt) | http://www.gidas.org/<br>http://www.bast.de |
| **Japan**<br>Ministry of Land, Infrastructure and Transport (MLIT) | http://www.mlit.go.jp/en/index.html |
| **Australia**<br>Department of Infrastructure and Transport | http://www.infrastructure.gov.au/roads/safety/ |
| **Netherlands**<br>Institute for Road Safety Research (SWOV) | http://www.swov.nl |
| **New Zealand**<br>Crash analysis system (CAS) | http://www.nzta.govt.nz/resources/ |
| **OTHER INTERNATIONAL ORGANIZATIONS** | |
| International Traffic Safety Data and Analysis Group (**IRTAD**) | http://internationaltransportforum.org/irtad/index.html |
| Asia-Pacific Road Accident Database (**APRAD**) | http://www.unescap.org/ttdw/data/aprad.aspx |
| Community database on Accidents on the Roads in Europe (**CARE**) | https://webgate.ec.europa.eu/care_bo/ |

U.S. Department of Transportation
National Highway Traffic Safety
Administration

# GENERAL CRASH FORM



1. Primary Sampling Unit Number _____ _____

2. Case Number - Stratum _____ _____ _____ _____

## CRASH DESCRIPTION

Describe the crash sequence in detail including events/driver actions which resulted in crash occurrence.

U.S. Department of Transportation
National Highway Traffic Safety Administration

# GENERAL CRASH FORM

National Automotive Sampling System
Crash Causation Special Study

1. Primary Sampling Unit Number _____ _____

Case Number - Stratum _____ _____ _____ _____

## IDENTIFICATION

3. Number of General Vehicle Forms Submitted _____ _____

4. Date of Accident (Month/Day/Year) ___ ___/___ ___/___ ___ ___ ___

5. Time of Accident _____ _____ _____ _____

Code reported military time of accident.

NOTE: Midnight = 2400
Unknown = 9999

## SPECIAL STUDIES SPECIAL

Check (√) each special study that has been completed; code 1 for the checked special studies and 0 for the special studies not checked.

6. _____ Heavy Truck Causation _____

## NUMBER OF EVENTS

11. Number of Recorded Events in This Crash _____ _____
Code the number of events which occurred in this crash.

## CRASH EVENTS

For each event that occurred in the crash, code the lowest numbered vehicle in the left columns and the other involved vehicle or object in the right columns.

| Accident Event Sequence Number | Vehicle Number | Class Of Vehicle | General Area Of Damage | Vehicle Number Or Object Contacted | Class Of Vehicle | General Area Of Damage |
|---|---|---|---|---|---|---|
| 12. 0 1 | 13. ___ ___ | 14. ___ ___ | 15. ___ ___ | 16. ___ ___ | 17. ___ ___ | 18. _____ |
| 19. 0 2 | 20. ___ ___ | 21. ___ ___ | 22. ___ ___ | 23. ___ ___ | 24. ___ ___ | 25. _____ |
| 26. 0 3 | 27.___ ___ | 28.___ ___ | 29.___ ___ | 30.__ ___ | 31.__ ___ | 32. _____ |
| 33. 0 4 | 34___ ___ | 35___ ___ | 36___ ___ | 37___ ___ | 38___ ___ | 39. _____ |
| 40. 0 5 | 41___ ___ | 42___ ___ | 43___ ___ | 44___ ___ | 45___ ___ | 46. _____ |

IF GREATER THAN FIVE EVENTS, CONTINUE CODING ON THE CRASH EVENT SUPPLEMENT.

## CODES FOR CLASS OF VEHICLE

(00) Not a motor vehicle
(01) Subcompact/mini (wheelbase < 254 cm)
(02) Compact (wheelbase ≥ 254 but< 265 cm)
(03) Intermediate (wheelbase ≥ 265 but < 278 cm)
(04) Full size (wheelbase ≥ 278 but< 291 cm)
(05) Largest (wheelbase ≥ 291 cm)
(09) Unknown passenger car size
(14) Compact utility vehicle
(15) Large utility vehicle (≤ 4,536 kgs GVWR)
(16) Utility station wagon (≤ 4,536 kgs GVWR)
(19) Unknown utility type
(20) Minivan (≤ 4,536 kgs GVWR)
(21) Large van (≤ 4,536 kgs GVWR)
(24) Van based school bus (≤ 4,536 kgs GVWR)
(28) Other van type (≤ 4,536 kgs GVWR)
(29) Unknown van type (≤ 4,536 kgs GVWR)
(30) Compact pickup truck (≤ 4,536 kgs GVWR)
(31) Large pickup truck (≤ 4,536 kgs GVWR)
(38) Other pickup truck (≤ 4,536 kgs GVWR)
(39) Unknown pickup truck type (≤ 4,536 kgs GVWR)
(45) Other light truck (≤ 4,536 kgs GVWR)
(48) Unknown light truck type (≤ 4,536 kgs GVWR)
(49) Unknown light vehicle type
(50) School bus (excludes van based) (> 4,536 kgs GVWR)
(58) Other bus (> 4,536 kgs GVWR)
(59) Unknown bus type
(60) Truck (> 4,536 kgs GVWR)
(67) Tractor without trailer
(68) Tractor-trailer(s)
(78) Unknown medium/heavy truck type
(79) Unknown light/medium/heavy truck type
(80) Motored cycle
(90) Other vehicle
(99) Unknown

## CODES FOR GENERAL AREA OF DAMAGE (GAD)

| | | | | | | |
|---|---|---|---|---|---|---|
| CDS APPLICABLE AND OTHER VEHICLES | (0) | Not a motor vehicle | (R) | Right side | (T) | Top |
| | (N) | Noncollision | (L) | Left side | (U) | Undercarriage |
| | (F) | Front | (B) | Back | (9) | Unknown |

| | | | | | | |
|---|---|---|---|---|---|---|
| TDC APPLICABLE VEHICLES | (0) | Not a motor vehicle | (L) | Left side | (C) | Rear of cab |
| | (N) | Noncollision | (B) | Back of unit with cargo area (rear of trailer or straight truck) | (V) | Front of cargo area |
| | (F) | Front | | | (T) | Top |
| | (R) | Right size | (D) | Back (rear of tractor) | (U) | Undercarriage |
| | | | | | (9) | Unknown |

## CODES FOR VEHICLE NUMBER OR OBJECT CONTACTED

(01-30) - Vehicle Number

Noncollision
(31) Overturn - rollover (excludes end-over-end)
(32) Rollover - end-over-end
(33) Fire or explosion
(34) Jackknife
(35) Other intraunit damage (specify):
_____
(36) Noncollision injury
(38) Other noncollision (specify):
_____
(39) Noncollision - details unknown

Collision With Fixed Object
(41) Tree (≤ 10 cm in diameter)
(42) Tree (> 10 cm in diameter)
(43) Shrubbery or bush
(44) Embankment
(45) Breakaway pole or post (any diameter)

Nonbreakaway Pole or Post
(50) Pole or post (≤ 10 cm in diameter)
(51) Pole or post (>10 cm but ≤ 30 cm in diameter)
(52) Pole or post (>30 cm in diameter)
(53) Pole or post (diameter unknown)

(54) Concrete traffic barrier
(55) Impact attenuator
(56) Other traffic barrier (includes guardrail)
(specify):_____
(57) Fence
(58) Wall
(59) Building
(60) Ditch or culvert
(61) Ground
(62) Fire hydrant
(63) Curb
(64) Bridge
(68) Other fixed object (specify):
_____
(69) Unknown fixed object

Collision With Nonfixed Object
(70) Passenger car, light truck, van, or other vehicle not in-transport
(71) Medium/heavy truck or bus not in-transport
(72) Pedestrian
(73) Cyclist or cycle
(74) Other nonmotorist or conveyance
_____
(75) Vehicle occupant
(76) Animal
(77) Train
(78) Trailer, disconnected in-transport
(79) Object fell from vehicle in-transport
(88) Other nonfixed object (specify):
_____
(89) Unknown nonfixed object

(98) Other event (specify):
_____
(99) Other event (specify):
_____

**U. S. Department of Transportation National Highway Traffic Safety Administration**

# OCCUPANT ASSESSMENT FORM

**National Automotive Sampling System Crash Causation Special Study**

1. Primary Sampling Unit Number _____ _____

2. Case Number - Stratum _____ _____ _____ _____

3. Vehicle Number _____ _____

4. Occupant Number _____ _____

## OCCUPANT'S CHARACTERISTICS

5. Occupant's Age _____ _____
   Code actual age at time of crash.
   (00) Less than one year old (specify by month):
   _____
   (97) 97 years and older
   (99) Unknown

6. Occupant's Sex _____
   (1) Male
   (2) Female - not reported pregnant
   (3) Female - pregnant - 1st trimester (1st-3rd month)
   (4) Female - pregnant 2nd trimester (4th-6th month)
   (5) Female - pregnant - 3rd trimester (7th-9th month)
   (6) Female - pregnant term unknown
   (9) Unknown

7. Occupant's Height _____ _____ _____
   Code actual height to the nearest centimeter.
   (999) Unknown

   ___ ___inches x 2.54 = ___ ___ ___centimeters

8. Occupant's Weight _____ _____ _____
   Code actual weight to the nearest kilogram.
   (999) Unknown

   ___ ___ ___pounds x .4536 = ___ ___ ___kilograms

9. Occupant's Role _____
   (1) Driver
   (2) Passenger
   (9) Unknown

## OCCUPANT'S SEATING

10. Occupant's Seat Position _____ _____
    *Front Seat*
    (11) Left side
    (12) Middle
    (13) Right side
    (14) Other (specify): _____
    (15) On or in the lap of another occupant

    *Second Seat*
    (21) Left side
    (22) Middle
    (23) Right side
    (24) Other (specify): _____
    (25) On or in the lap of another occupant

    *Third Seat*
    (31) Left side
    (32) Middle
    (33) Right side
    (34) Other (specify): _____
    (35) On or in the lap of another occupant

    *Fourth Seat*
    (41) Left side
    (42) Middle
    (43) Right side
    (44) Other (specify): _____
    (45) On or in the lap of another occupant

    (96) In sleeper berth
    (98) Other seat (specify): _____
    (99) Unknown

11. Occupant's Posture _____
    (0) Normal posture

    *Abnormal posture*
    (1) Kneeling or standing on seat
    (2) Lying on or across seat/sleeper mattress
    (3) Kneeling, standing or sitting in front of seat
    (4) Sitting sideways or turned to talk with another occupant or to look out a rear window
    (5) Sitting on a console
    (6) Lying back in a reclined seat position
    (7) Bracing with feet or hands on a surface in front of seat
    (8) Other abnormal posture (specify): _____
    (9) Unknown

## EJECTION/ENTRAPMENT

12. Ejection _____
    - (0) No ejection
    - (1) Complete ejection
    - (2) Partial ejection
    - (3) Ejection, unknown degree
    - (9) Unknown

13. Ejection Area _____
    - (0) No ejection
    - (1) Windshield
    - (2) Left front
    - (3) Right front
    - (4) Left rear
    - (5) Right rear
    - (6) Rear
    - (7) Roof
    - (8) Other area (e.g., back of pickup, etc.)
      (specify): _____
    - (9) Unknown

14. Ejection Medium _____
    - (0) No ejection
    - (1) Door/hatch//tailgate
    - (2) Nonfixed roof structure
    - (3) Fixed glazing
    - (4) Nonfixed glazing
      (specify): _____
    - (5) Integral structure
    - (8) Other medium
      (specify): _____
    - (9) Unknown

15. Medium Status (Immediately Prior To Impact) _____
    - (0) No ejection
    - (1) Open
    - (2) Closed
    - (3) Integral structure
    - (9) Unknown

16. Entrapment _____
    - (0) Not entrapped/exit not inhibited
    - (1) Entrapped/pinned - mechanically restrained
    - (2) Could not exit vehicle due to jammed doors, fire, etc.
      (specify): _____
      _____
    - (9) Unknown

17. Occupant Mobility _____
    - (0) Occupant fatal before removed from vehicle
    - (1) Removed from vehicle while unconscious or not oriented to time or place
    - (2) Removed from vehicle due to perceived serious injuries
    - (3) Exited vehicle with some assistance
    - (4) Exited vehicle under own power
    - (5) Occupant fully ejected
    - (8) Removed from vehicle for other reasons
      (specify): _____
    - (9) Unknown

## BELT SYSTEM FUNCTION

18. Manual (Active Belt System Availability) _____
- (0) None available
- (1) Belt removed/destroyed
- (2) Shoulder belt
- (3) Lap belt
- (4) Lap and shoulder belt
- (5) Belt available - type unknown

*Integral Belt Partially Destroyed*
- (6) Shoulder belt (lap belt destroyed/removed)
- (7) Lap belt (shoulder belt destroyed/removed)
- (8) Other belt (specify): _____
- (9) Unknown

19. Manual (Active Belt System Use) _____ _____
- (00) Not used, not available, or belt removed/destroyed
- (01) Inoperative (specify): _____
- (02) Shoulder belt
- (03) Lap belt
- (04) Lap and shoulder belt
- (05) Belt used - type unknown
- (08) Other belt used (specify): _____
- (12) Shoulder belt used with child safety seat
- (13) Lap belt used with child safety seat
- (14) Lap and shoulder belt used with child safety seat
- (15) Belt used with child safety seat - type unknown
- (18) Other belt used with child safety seat (specify): _____
- (99) Unknown if belt used

20. Proper Use of Manual (Active) Belts _____
- (0) None used or available
- (1) Belt used properly
- (2) Belt used properly with child safety seat

*Belt Used Improperly*
- (3) Shoulder belt worn under arm
- (4) Shoulder belt worn behind back or seat
- (5) Belt worn around more than one person
- (6) Lap belt worn on abdomen
- (7) Lap belt or lap and shoulder belt used improperly with child safety seat (specify): _____
- (8) Other improper use of manual belt system (specify): _____
- (9) Unknown

21. Manual (Active Belt Failure Modes During Crashes) _____
- (0) No manual belt used or not available
- (1) No manual belt failure(s)
- (2) Torn webbing (stretched webbing not included)
- (3) Broken buckle or latch plate
- (4) Upper anchorage separated
- (5) Other anchorage separated (specify): _____
- (6) Broken retractor
- (7) Combination of above (specify): _____
- (8) Other manual belt failure (specify): _____
- (9) Unknown

22. Manual Shoulder Belt Upper Anchorage Adjustment _____
- (0) No manual shoulder belt
- (1) No upper anchorage adjustment for manual shoulder belt

*Adjustable shoulder Belt Upper Anchorage*
- (2) In full up position
- (3) In mid position
- (4) In full down position
- (6) Lap belt worn on abdomen
- (5) Position unknown
- (9) Unknown if position has adjustable upper anchorage adjustment

23. Automatic (Passive) Belt System Availability/Function _____
- (0) Not equipped/not available
- (1) 2-point automatic belts
- (2) 3-point automatic belts
- (3) Automatic belts - type unknown

*Non-functional*
- (4) Automatic belts destroyed or rendered inoperative
- (9) Unknown

24. Automatic (Passive) Belt System Use _____
- (0) Not equipped/not available/destroyed or rendered inoperative
- (1) Automatic belt in use
- (2) Automatic belt not in use (manually disconnected, motorized track inoperative) (specify): _____
- (9) Unknown

25. Automatic (Passive) Belt System Type _____
- (0) Not equipped/not available
- (1) Non-motorized system
- (2) Motorized system
- (9) Unknown

26. Proper Use of Automatic (Passive) Belt System _____
- (0) Not equipped/not available/not used
- (1) Automatic belt used properly
- (2) Automatic belt used properly with child safety seat

*Automatic Belt Used Improperly*
- (3) Automatic shoulder belt worn under arm
- (4) Automatic shoulder belt worn behind back
- (5) Automatic belt worn around more than one person
- (6) Lap portion of automatic belt worn on abdomen
- (7) Automatic lap and shoulder belt or automatic shoulder belt used improperly with child safety seat (specify): _____
- (8) Other improper use of automatic belt system (specify): _____
- (9) Unknown

27. Automatic (Passive) Belt Failure Modes During Crash _____
- (0) Not equipped/not available/not in use
- (1) No automatic belt failures
- (2) Torn webbing (stretched webbing not included)
- (3) Broken buckle or latch plate
- (4) Upper anchorage separated
- (5) Other anchorage separated (specify): _____
- (6) Broken retractor
- (7) Combination of above (specify): _____
- (8) Other automatic belt failure (specify): _____
- (9) Unknown

## POLICE REPORTED RESTRAINT USE

28. Police Reported Belt Use _____
    (0) None used
    (1) Police did not indicate belt use
    (2) Shoulder belt
    (3) Lap belt
    (4) Lap and shoulder belt
    (5) Belt used, type not specified
    (6) Child safety seat
    (7) Automatic belt
    (8) Other type belt, (specify):
    _____
    (9) Police indicated "unknown"

29. Police Reported Air Bag Availability/Function _____
    (0) No air bag available
    (1) Police did not indicate air bag
    (2) Deployed
    (3) Not deployed
    (4) Unknown if deployed
    (9) Police indicated "unknown"

Check the Primary Source Used In Determining Belt Use.

[ ] Vehicle inspection
[ ] Official injury data
[ ] Driver/occupant interview
[ ] Other (specify):
_____
[ ] Unknown if belt used

_____

_____

_____

_____

## AIR BAG SYSTEM FUNCTION

30. Frontal Air Bag System Availability/Function _____
    (This Occupant Position)
    (0) Not equipped/not available
    (1) Air bag

*Non-functional*
    (2) Air bag disconnected (specify):
    _____
    (3) Air bag not reinstalled
    (9) Unknown

31. Frontal Air Bag System Deployment _____
    (This Occupant Position)
    (0) Not equipped/not available
    (1) Deployed during crash (as a result of impact)
    (2) Deployed inadvertently just prior to crash
    (3) Deployed, details unknown
    (4) Deployed as a result of a noncollision event during crash sequence (e.g., fire, explosion, electrical)
    (5) Unknown if deployed
    (7) Non-deployed
    (9) Unknown

32. Other Than First Seat Frontal Air Bag Availability/Function _____
    (This Occupant Position)
    (0) Not equipped/not available
    (1) Air bag
*Non-functional*
    (2) Air bag disconnected (specify):
    _____
    (3) Air bag not installed
    (9) Unknown
    *Specify type of "other" air bag present:*
    _____

33. Air Bag(s) Deployment, Other Than First Seat Frontal (This Occupant Position) _____
    (0) Not equipped with an "other" air bag
    (1) Deployed during crash (as a result of impact)
    (2) Deployed inadvertently just prior to crash
    (3) Deployed, details unknown
    (4) Deployed as a result of a noncollision event during crash sequence (e.g., fire, explosion, electrical)
    (5) Unknown if deployed
    (7) Non-deployed
    (9) Unknown

34. Are There Indications of Air Bag System Failure? _____
    (This Occupant Position)
    (0) Not equipped/not available
    (1) No
    (2) Yes (specify):
    _____

## INJURY CONSEQUENCES

35. Injury Severity (Police Rating) _____
    - (0) O - No injury
    - (1) C - Possible injury
    - (2) B - Non-incapacitating injury
    - (3) A - Incapacitating injury
    - (4) K - Killed
    - (5) U - Injury, severity unknown
    - (6) Died prior to crash
    - (9) Unknown

36. Treatment - Mortality _____
    - (0) No treatment
    - (1) Fatal
    - (2) Fatal - ruled disease (specify):
      _____

*Nonfatal*
    - (3) Hospitalization
    - (4) Transported and released
    - (5) Treatment at scene - non-transported
    - (6) Treatment later
    - (7) Treatment - other (specify):
      _____
    - (8) Transported to a medical facility-unknown if treated
    - (9) Unknown

37. Type Of Medical Facility (For Initial Treatment) _____
    - (0) Not treated at a medical facility
    - (1) Trauma center
    - (2) Hospital
    - (3) Medical clinic
    - (4) Physician's office
    - (5) Treatment later at medical facility
    - (8) Other (specify):
      _____
    - (9) Unknown

38. Hospital Stay _____ _____
    - (00) Not Hospitalized
      Code the number of days (up through 60) that the occupant stayed in hospital
    - (61) 61 days or more
    - (99) Unknown

39. Working Days Lost _____ _____
    Code the number of days (up through 60) that the occupant lost from work due to the crash
    - (00) No working days lost
    - (61) 61 days or more
    - (97) Not working prior to crash
    - (99) Unknown

## *TO BE CODED BY THE ZONE CENTER*

## INJURY CONSEQUENCES

40. Time To Death _____ _____
____ Code the number of hours from time of crash to time of death up through **24** hours. If time of death is greater than 24 hours, code number of days = 32, …n days = 30 + n up through 30 days = 60)
(00) Not fatal
(96) Fatal - ruled disease
(99) Unknown

41. 1st Medically Reported Cause of Death _____ _____

42. 2nd Medically Reported Cause of Death _____ _____

43. 3rd Medically Reported Cause of Death _____ _____
____ Code the Occupant Injury from line number(s) for the medically reported injury(s) which reportedly contributed to this occupant's death.
(00) Not fatal or no additional causes
(96) Mode of death given but specific injuries are not linked to cause of death. (specify):
_____
(97) Other result (includes fatal ruled disease) (specify):
_____
(99) Unknown

44. Number of Recorded Injuries For This Occupant _____ _____
____ Code the actual number of injuries recorded for this occupant.
(00) No recorded injuries
(97) Injured, details unknown
(99) Unknown if injured

45. Highest AIS Severity Level Sustained _____
(0) Not injured
(1) AIS - 1
(2) AIS - 2
(3) AIS - 3
(4) AIS - 4
(5) AIS - 5
(6) AIS - 6
(7) AIS - 7
(9) Unknown

## TRAUMA DATA

46. Glasgow Coma Scale (GCS) Score _____ _____
(At Medical Facility)
(00) Not injured
(01) Injured - not treated at medical facility
(02) No GCS Score at medical facility
(03-15) Code the actual value of the initial GCS Score recorded at medical facility.
(97) Injured, details unknown
(99) Unknown if injured

47. Was the Occupant Given Blood? _____
(1) No - blood not given
(2) Yes - blood given (specify units):
_____
(9) Unknown if blood given

48. Arterial Blood Gases (ABG) - $HC_3$ _____ _____
(00) Not injured
(01) Injured - ABGs not measured or reported
(02-50) Code the actual value of the $HCO_3$
(96) ABGs reported, $HCO_3$ unknown
(97) Injured, details unknown
(99) Unknown if injured

## BELT USE DETERMINATION

49. Primary Source of Belt Use Determination _____
(0) Not equipped/not available/destroyed or rendered inoperative
(1) Vehicle inspection
(2) Official injury data
(3) Driver/occupant interview
(4) Police accident report
(8) Other ( specify):
_____
(9) Unknown if belt used

WORKING GROUP ON 4'E' OF ROAD SAFETY- ENGINEERING (VEHICLES)

# Intelligent Transportation System (ITS)

## Chapter 7

**7/20/2011**

# Chapter 7

# Intelligent Transportation Systems (ITS)

**Background**

Information technology (IT) has transformed many industries, from education to health care to government and is now in the early stages of transforming transportation systems. IT enables elements within the transportation system—vehicles, roads, traffic lights, message signs, etc.—to become intelligent by embedding them with microchips and sensors and empowering them to communicate with each other through wireless technologies. In the leading nations in the world, ITS brings in significant improvement in transportation system performance, including reduced congestion and increased safety and traveler convenience.

Intelligent transportation systems include a wide and growing suite of technologies and applications such as real-time traffic information systems, in-car navigation (telematics) systems, vehicle-to-infrastructure integration (VII), vehicle-to-vehicle integration (V2V), adaptive traffic signal control, ramp metering, electronic toll collection, congestion pricing, fee-based express (HOT) lanes, vehicle usage-based mileage fees, and vehicle collision avoidance technologies.

1. **Why Is ITS Important?**
   Many think improving a country's transportation system solely means building new roads or repairing aging infrastructure. But the future of transportation lies not only in concrete and steel, but also in the implementation of technology, specifically a network of sensors, microchips, and communication devices that collect and disseminate information about the functioning of the transportation system. What intelligent transportation systems do is empower elements in the transportation system—from commuters, to highway and transit network operators, even down to the actual traffic lights themselves—with actionable information (or, intelligence) to make better-informed decisions. The big opportunity at hand is to bring information to bear on transportation networks, transforming them into truly intelligent transportation systems.

2. **Understanding Intelligent Transportation Systems**
   ITS applications can be grouped within five primary categories: Advanced Traveler Information Systems (ATIS), Advanced Transportation Management Systems (ATMS), ITS-Enabled Transportation Pricing Systems, Advanced Public Transportation Systems (APTS), and Fully Integrated ITS Systems (VII and V2V Systems). Table 1 below indicates typical applications that are covered in each of these 5 categories:

| Category | Application |
|---|---|
| Advanced Traveler Information Systems (ATIS) | Real-time Traffic Information Provision<br>Route Guidance/Navigation Systems<br>Parking Information<br>Roadside Weather Information Systems |
| Advanced Transportation Management Systems (ATMS) | Traffic Operations Centers (TOCs)<br>Adaptive Traffic Signal Control<br>Dynamic Message Signs (or "Variable" Message Signs)<br>Ramp Metering |
| ITS-Enabled Transportation Pricing Systems | Electronic Toll Collection (ETC)<br>Congestion Pricing/Electronic Road Pricing (ERP)<br>Fee-Based Express (HOT) Lanes<br>Vehicle-Miles Traveled (VMT) Usage Fees<br>Variable Parking Fees |
| Advanced Public Transportation Systems (APTS) | Real-time Status Information for Public Transit System (e.g. Bus, Subway, Rail)<br>Automatic Vehicle Location (AVL)<br>Electronic Fare Payment (for example Smart Cards) |
| Vehicle-to-Infrastructure Integration (VII) and Vehicle-to-Vehicle Integration (V2V) | Cooperative Intersection Collision Avoidance System (CICAS)<br>Intelligent Speed Adaptation (ISA) |

**Table 1**

## 3. Key Underlying Technologies for ITS

There are several technologies, which are used world-wide to meet the exploding challenges related to traffic management. Some of the most promising technologies available and are already implemented are described below:

### 3.1 Global Positioning System (GPS):

Embedded GPS receivers in vehicles' on-board units (OBUs, a common term for telematics devices) receive signals from several different satellites to calculate the device's (and thus the vehicle's) position. Location can usually be determined to within ten meters. GPS is the core technology behind many in-vehicle navigation and route guidance systems. Several countries, notably Holland and Germany, are using or will use OBUs equipped with satellite-based GPS devices to record miles travelled by automobiles and/or trucks in order to implement user fees based on vehicle miles travelled to finance their transportation systems.

**3.2 Dedicated-Short Range Communications (DSRC):**

DSRC is a short- to medium-range wireless communication channel, operating in the 5.8 or 5.9 GHz wireless spectrum, specifically designed for automotive uses. Critically, DSRC enables two-way wireless communications between the vehicle (through embedded tags or sensors) and roadside equipment (RSE). DSRC is a key enabling technology for many intelligent transportation systems, including vehicle-to-infrastructure integration, vehicle-to-vehicle communication, adaptive traffic signal timing, electronic toll collection, congestion charging, electronic road pricing, information provision, etc. DSRC is a subset of radio frequency identification (RFID) technology. The technology for ITS applications works on the 5.9 GHz band (United States) or the 5.8GHz band (in Japan and Europe).

**3.3 Wireless Networks:**

Similar to technology commonly used for wireless Internet access, wireless networks allow rapid communications between vehicles and the roadside, but have a range of only a few hundred meters. However, this range can be extended by each successive vehicle or roadside node passing information onto the next vehicle or node. South Korea is increasingly using WiBro, based on WiMAX technology, as the wireless communications infrastructure to transmit traffic and public transit information throughout its transportation network.

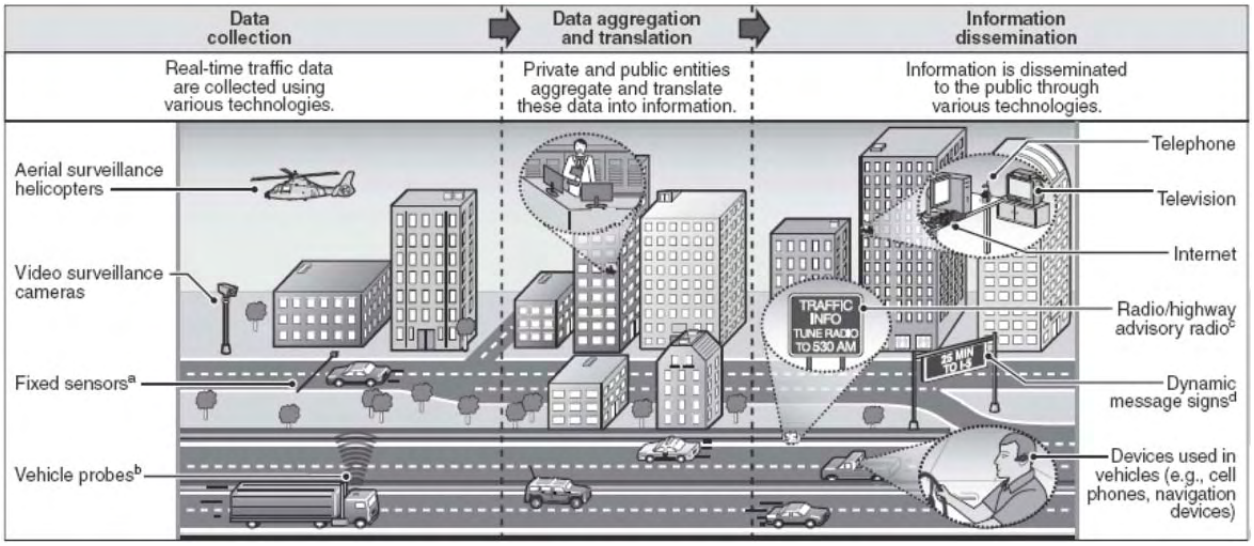
**3.4 Mobile Telephony:** ITS applications can transmit information over standard third or fourth generation (3G or 4G) mobile telephone networks. Advantages of mobile networks include wide availability in towns and along major roads. However, additional network capacity may be required if vehicles are fitted with this technology, and network operators might need to cover these costs. Mobile telephony may not be suitable for some safety-critical ITS applications since it may be too slow.

**3.5 Radio-wave or Infrared Beacons:** Japan's Vehicle Information Communications System (VICS) uses radio wave beacons on expressways and infrared beacons on trunk and arterial roadways to communicate real-time traffic information. VICS uses 5.8GHz DSRC wireless technology.

**3.6 Roadside Camera Recognition:** Camera- or tag-based schemes can be used for zone-based congestion charging systems (as in London), or for charging on specific roads. Such systems use cameras placed on roadways where drivers enter and exit congestion zones. The cameras use Automatic License Plate Recognition (ALPR), based on Optical Character Recognition (OCR) technology, to identify vehicle license plates; this information is passed digitally to back-office servers, which assess and post charges to drivers for their use of roadways within the congestion zone.

**3.7 Probe Vehicles or Devices:** Several countries deploy so-called "probe vehicles" (often taxis or government-owned vehicles equipped with DSRC or other wireless technology) that report their speed and location to a central traffic operations management center, where probe data is aggregated to generate an area-wide picture of traffic flow and to identify congested locations. Extensive research has also been performed into using mobile phones that drivers often carry as a mechanism to generate real-time traffic information, using the GPS-derived location of the phone as it moves along with the vehicle. As a related example, in Beijing, more than 10,000 taxis and commercial vehicles have been outfitted with GPS chips that send travel speed information to a satellite, which then sends the information down to the Beijing Transportation Information Center, which then translates the data into average travel speeds on every road in the city.

**Figure 1: Technologies Associated with Real-Time Traffic Information Systems**




## 4. ITS Applications: Definitions and Technologies

### 4.1 Advanced Traveler Information Systems

Perhaps the most-recognized ITS applications, Advanced Traveler Information Systems (ATIS) provide drivers with real-time travel and traffic information, such as transit routes and schedules; navigation directions; and information about delays due to congestion, accidents, weather conditions, or road repair work. As Figure 1 illustrates, there are three key facets to the provision of real-time traffic information: collection, processing, and dissemination, with each step entailing a distinct set of technology devices, platforms, and actors, both public and private.

### 4.2 Advanced Transportation Management Systems

Advanced Transportation Management Systems (ATMS) include ITS applications that focus on traffic control devices, such as traffic signals, ramp metering, and the dynamic (or "variable") message signs on highways that provide drivers real-time messaging about traffic or highway status. Traffic Operations Centers (TOCs), centralized traffic management centers run by cities and states worldwide, rely on information technologies to connect sensors and roadside equipment, vehicle probes, cameras, message signs, and other devices together to create an integrated view of traffic flow and to detect accidents, dangerous weather events, or other roadway hazards.

### 4.3 ITS-Enabled Transportation Pricing Systems

ITS have a central role to play in funding countries' transportation systems. The most common application is electronic toll collection (ETC), also commonly known internationally as "road user charging," through which drivers can pay tolls automatically via a DSRC-enabled on-board device or tag placed on the windshield. The most sophisticated countries, including Australia and Japan, have implemented a single national ETC standard, obviating the need to carry multiple toll collection tags on cross-country trips because various highway operators' ETC systems lack interoperability. This particularly has been a problem for the European Union, although the European Committee for Standardization is working to resolve this challenge.

### 4.4 Advanced Public Transportation Systems

Advanced Public Transportation Systems (APTS) include applications such as automatic vehicle location (AVL), which enable transit vehicles, whether bus or rail, to report their current location, making it possible for traffic operations managers to construct a real-time view of the status of all assets in the public transportation system. APTS help to make public transport a more attractive option for commuters by giving them enhanced visibility into the arrival and departure status (and overall timeliness) of buses and trains. This category also includes electronic fare payment systems for public transportation systems, such as Suica in Japan or T-Money in South Korea, which enable transit users to pay fares contactless from their smart cards or mobile phones using near field communications technology.

### 4.5 Vehicle-to-infrastructure Integration (VII) and Vehicle-to-vehicle (V2V) Integration

Vehicle-to-infrastructure integration is the archetype for a comprehensively integrated intelligent transportation system. In the United States, the objective of the VII Initiative—rebranded as IntelliDrive$^{SM}$—has been to deploy and enable a communications infrastructure that supports vehicle-to-infrastructure, as well as vehicle-to-vehicle, communications for a variety of vehicle safety applications and transportation operations. IntelliDrive envisions that DSRC-enabled tags or sensors, if widely deployed in vehicles, highways, and in roadside or intersection equipment, would enable the core elements of the transportation system to intelligently communicate with one another, delivering a wide range of benefits.

## 5. Benefits of Intelligent Transportation Systems

Applying ITS to a country's transportation network delivers five key classes of benefits by: 1) increasing driver and pedestrian safety, 2) improving the operational performance of the transportation network, particularly by reducing congestion, 3) enhancing personal mobility and convenience, 4) delivering environmental benefits, and 5) boosting productivity and expanding economic and employment growth.

## 6. Benefit-Cost Ratio and Economic Assessments of Intelligent Transportation Systems

Overall, the benefit-cost ratio of systems-operations measures (enabled by intelligent transportation systems) has been estimated at about 9 to 1, far above the addition of conventional highway capacity, which has a benefit-cost ratio of 2.7 to 1. In one study, researchers at Florida International University found that the $9.9 million annual cost of a traffic operations management system in Broward County, Florida, yielded a benefit of $142 million in reduced travel time, fuel consumption, emissions, and secondary accidents involving rubbernecks (a 14 to 1 ratio). With regard to implementation of specific ITS systems, a study of 26 traffic signal optimization projects in Texas found that signal optimization benefits outweighed costs by 38 to 1.

A 2005 study of a model ITS deployment in Tucson, Arizona, consisting of 35 technologies including Highway Advisory Radio, dynamic message signs, a telephone and Web-based traveler information system, and kiosks found the implementation would deliver an expected 6 percent decrease in congestion, a 70 percent decrease in incident-related delay on freeways, and would decrease annual travel time by 7 hours per resident. The environmental impact of the implementation anticipated reduction in annual fuel use by 11 percent and reduction in annual carbon monoxide, hydrocarbon, and nitrous oxide emissions between 10 and 16 percent. The expected average annual cost for implementing, operating, and maintaining all 35 ITS technologies was estimated at $72 million, while the expected average benefit from the ITS deployments to mobility, the environment, safety, and other areas was estimated at $455 million annually. In total, the study estimated that the benefits of deploying ITS outweighed the cost by 6.3 to 1.

South Korea's implementation of intelligent transportation systems has generated concrete benefits for its citizens. South Korea estimates that that the economic benefit of the country's Traffic Management System due to reduced transportation time, accidents, and environmental pollution has been 146.2 billion won ($109 million) annually. It estimates the impact of its Hi-Pass electronic toll collection system due to reduced transportation time, expense, environmental pollution, and operating expense, including labor costs, as 1,757 billion won ($1.3 billion), an 11.9 to 1 benefit-cost ratio. Lastly, it estimates the economic benefits of providing real-time traffic information (through in-vehicle radio broadcasts) as 181.1 billion won ($136 million) annually.

## 7. Challenges in Implementing ITS

There are a number of challenges involved in developing and deploying intelligent transportation systems. ITS face a range of challenges, including system interdependency, network effect, scale, funding, political, institutional and other challenges. To estimate ITS challenges, it is apt to distinguish between two classes of ITS applications: 1) Those that can be deployed locally on an independent basis and deliver value, and 2) Those that must be deployed as part of a scalable interrelated system to deliver meaningful value.

The first class includes ITS applications such as ramp meters, computerized smart signals, roadside cameras, and even local traffic operations centers. Communities or regions can make independent decisions about whether to fund and deploy ramp meters or adaptive traffic signal lights, and these applications will deliver local benefits to motorists without having to be connected to a scaled system or without travelers having to adopt these technologies at the same time.

But the vast majority of ITS applications—and certainly the ones primed to deliver the most extensive benefits to the transportation network—must operate at scale, often must operate at a national level, and must involve adoption by the overall system and by individual users at the same time to be effective, raising a set of system interdependency, network effect, and system coordination challenges. ITS applications that must operate at scale include VII and V2V systems, real-time traffic information systems, electronic toll collection systems, and vehicle miles traveled systems.

## 8. Worldwide Scenario

Most advanced countries are in some way, shape, or form deploying intelligent transportation systems. Approximately ten countries are taking moderate to significant steps to deploy ITS applications, including: **Australia, France, Germany, Japan, the Netherlands, New Zealand, Sweden, Singapore, South Korea, the United Kingdom, and the United States**. (A number of developing countries, notably **Brazil, Taiwan, and Thailand** are also deploying increasingly sophisticated intelligent transportation systems. **China** has also committed to making rapid leaps in ITS, and endeavors to become a world leader in the not-too-distant future.) Many of these countries have particular strengths in ITS, notably: real-time traffic information provision in Japan and South Korea; congestion pricing in Sweden, the United Kingdom, and Singapore; vehicle-miles traveled systems in The Netherlands and Germany; electronic toll collection in Japan, Australia, and South Korea; APTS in South Korea, Singapore, and France. **Japan, South Korea and Singapore in particular stand out as world leaders in ITS**.

### 8.1 Japan

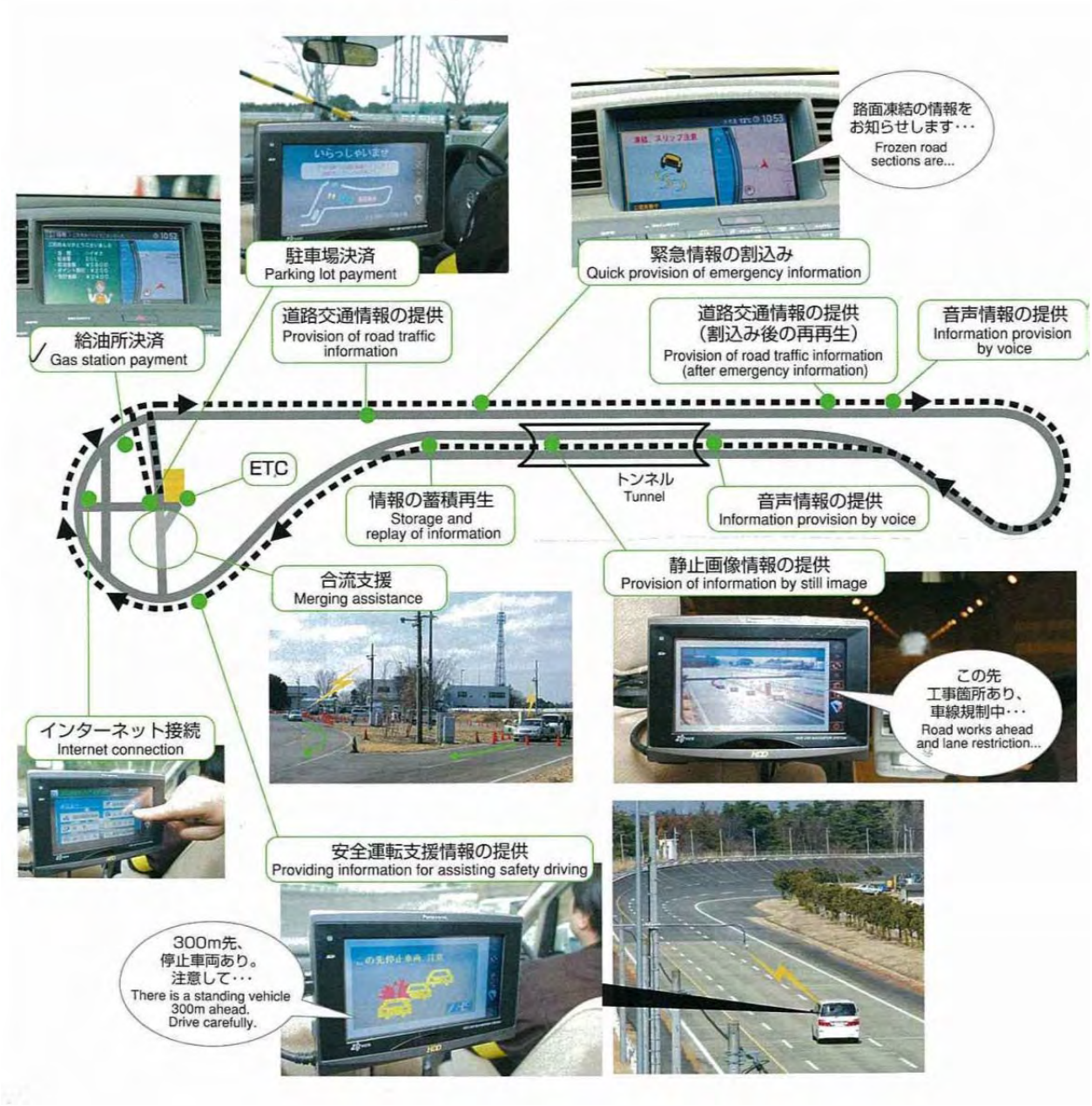
Japan leads the world in intelligent transportation systems based on the importance ascribed to ITS at the highest levels of government, the number of citizens benefitting from

use of an impressive range of operationally deployed ITS applications, and the maturity of those applications.

One of Japan's central goals for ITS has been to provide real-time information on traffic conditions on most expressway and arterial roads in Japan. In collecting and disseminating real-time traffic information, Japan started with a fixed system with its Vehicle Information and Communications System (VICS) launched in 1996. Starting in 2003, Japan began to make extensive use of probes to capture real-time traffic information.


Japan's VICS was based on in-car navigation systems. Japan is now developing Smartway, which might be called "Version 2.0" of the country's state-of-the-art ITS service. Through an on-board unit, Smartway will provide users three classes of services: 1) information and direct driving assistance, including safety aspects, 2) Internet connection services, and 3) cashless payment services at toll booths, parking lots, gas stations, convenience stores, etc. Smartway will also implement advanced technologies such as AHS (Advanced Cruise-Assist Highway System) to eliminate the potential causes of accidents in high-speed environments, and ASV (Advanced Safety Vehicle) to offer safer "smart driving" via vehicle-to-vehicle communications.

### Japan's Smartway




Japan is also a leader in electronic toll collection, with 25 million vehicles (about 68 percent of all vehicles regularly using Japan's toll expressways) equipped with ETC on-board units. Japan operates a single national standard for electronic tolling to make the system compatible nationwide for transactions across all the country's toll roads.

Japan uses probe vehicles not only to support provision of real-time traffic information, but also to enable sophisticated administration of road services by monitoring and evaluating the state of transportation system performance and making the results public. Using information technology, Japan enhances the accountability of its road administrators by illustrating the effect of road construction and improvement projects in addressing traffic

congestion with three-dimensional maps of traffic congestion using data on traffic volume and travel time collected from probe cars.

**8.2 South Korea**

South Korea's strengths in several ITS application areas make it a world leader in intelligent transportation systems. These strengths include: 1) real-time traffic information provision, 2) advanced public transportation information systems, and 3) electronic fare payment and electronic toll collection.

ITS has been a national priority of South Korea since the late-1990s. In December 2000, South Korea unveiled its National ITS Master Plan for the 21st century, a 20-year blueprint for ITS development in South Korea that provided a strategic guideline for development of seven specific ITS application areas as part of a National ITS Service. The National ITS Service addresses: traffic operations and management, electronic payments, information integration and dissemination, public transport quality enhancement, enhanced safety and automated driving, efficient commercial vehicles, and pollution control. A central mission of the National ITS Service is to create a network of traffic systems that facilitate interactions and interconnection between South Korea's large cities.

South Korea built its ITS infrastructure on a city-by-city basis, establishing “ITS Model Cities” starting in 1998. With these initial pilots validating ITS benefits, the South Korean government provided national budget support to introduce ITS systems in 25 more South Korean cities by 2007.

South Korea’s Expressway Traffic Management System (ETMS) collects real-time traffic information. This data is communicated to South Korea’s National Transport Information Center (NTIC) to support the country’s ITS applications (including also South Korea’s Hi-Pass electronic toll collection and electronic fare payment systems.) The NTIC, South Korea’s integrated traffic information service, aggregates data from 79 different transport authorities.

Public transportation information systems, particularly for buses, are also highly deployed in South Korea. South Koreans regularly use the location-based tracking feature in their GPS-enabled phones to access a Web site that automatically presents the nearest public transportation option.


South Korea has introduced a unified fare smart card system for public transportation called T-money (initially available only in Seoul but now being expanded nationally). Customers use T-money to pay for transportation, including bus, train, and taxi service, as e-money to make purchases at vending machines, convenience stores, and museums, to pay fines or taxes, and even as a mileage or membership card.

South Korea’s Hi-Pass electronic toll collection system, covers 260 toll plazas and over 3,200 km of highway in South Korea. Five million South Korean vehicles use Hi-Pass, which has a highway utilization rate over 30 percent. South Koreans can also use their Hi-Pass card for other purchases beyond highway tolls, including at parking lots, gas stations, and convenience stores.

**South Korea Hi-Pass Card and OBU Device**

### 8.3 Singapore

Singapore is a world leader in intelligent transportation systems based on its: 1) use of probes vehicles to collect traffic information, 2) use of electronic road pricing (that is, congestion charging), 3) nationwide deployment of adaptive computerized traffic signals, 4) and use of traffic management ITS applications.

Singapore collects real-time traffic information through a fleet of 5,000 taxis which act as vehicle probes, feeding their speed and location information back to Singapore's Traffic Operations Management Center, enabling it to generate an accurate picture of traffic flow and congestion on Singapore's roadways from this critical mass of probe data. Singapore disseminates traffic information via its Expressway Monitoring and Advisory System (EMAS).

**Singapore's Traffic Operations Management Center**

In 1998, Singapore implemented a fully automated electronic road pricing (ERP) system that accepts a prepaid stored-value smart card called the "Cashcard." The cost of using a particular road is automatically deducted from the Cashcard when the vehicle passes an ERP gantry.

Singapore has made public transportation a more attractive option for commuters by installing real-time bus arrival panels at almost all bus stops throughout the country. A Public Transport Journey planner is provided with basic map features that advises commuters on optimal public transport travel routes from origin to destination. This is supported by an Integrated Multi-Modal Travel Information System (IMTI), which provides commuters with comprehensive travel information on different platforms such as the mobile phone and the Internet (via GRPS, WAP, and WIFI.)

In April 2008, Singapore launched a Parking Guidance System, consisting of roadside variable messaging signs, which alerts drivers to the location of public parking locations throughout the city and how many spots are available at each location. Singapore is now expanding this service country-wide.

Singapore's long-term ITS plans include advanced telematics that will bring location-based services and traffic information to commuters through in-vehicle devices, and advanced congestion management systems that will include both targeted and variable user road-charging schemes. Singapore is at the cutting edge of predictive traffic flow modeling based on using historic and real-time traffic data.

**Real-Time Public Transport Status Information at Singapore Bus Stop**


**Singapore Parking Guidance System**


### 8.4 United States of America

USA has pockets of strengths with regard to ITS in particular regions and applications, including use of variable rate highway tolling, electronic toll collection, certain advanced traffic management systems such as ramp metering, and an active private sector market in telematics and travel information provision. Implementation of intelligent transportation systems in the United States varies immensely by state and region, thus tending to be sporadic, isolated, incremental, and, unlike Japan's Smartway, not connected into a nationally integrated intelligent transportation system.

## 9. Governments' Explicit Recognition of the Importance of and Vision for ITS

One reason why Japan, South Korea, and Singapore lead in ITS is because these countries view ITS as one of a suite of IT applications or infrastructures that will transform their societies and drive economic growth. As such, they have focused on establishing policies for digital transformation generally and ITS transformation specifically, and have made both a national priority.

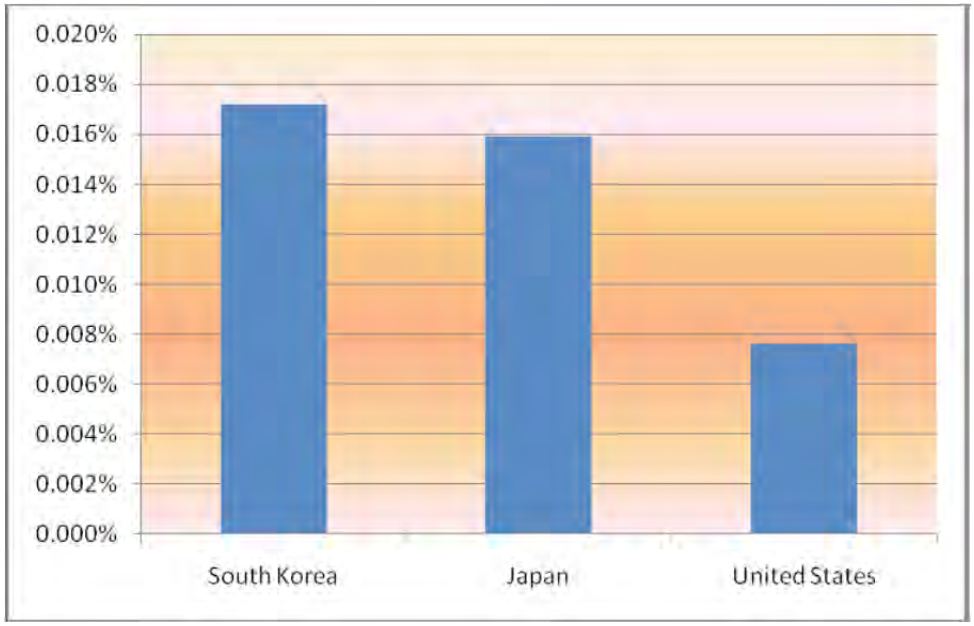
In June 2007, the Japanese Cabinet announced a long-term strategic vision for the country, "Innovation 25," which articulated short- and medium-term policies on research and development, changes to social systems, training, etc. to create a more convenient, vibrant future for Japanese citizens by 2025. ITS has been its government's explicit recognition of the importance of ITS.

## 10. Government Funding for Intelligent Transportation Systems Development

The leading countries in intelligent transportation systems have not only developed an explicit national strategy for ITS, they have also invested heavily in it. South Korea's National ITS Master Plan 21 commits to investing a total of $3.2 billion from 2007 to 2020 in intelligent transportation systems, an average of $230 million annually over the fourteen-year period. Japan invested ¥64 billion in ITS from April 2007 to March 2008 and ¥63.1 billion in ITS from April 2008 to March, 2009 on average about $690 million annually. Aggregate investment in ITS at all government levels in the United States in 2006 was

approximately $1 billion (including $110 million in federal funding and over $850 million in funding from the U.S. states). As a percentage of GDP, South Korea and Japan each invest more than twice as much in intelligent transportation systems than the United States.

**Investment in ITS as a Share of GDP Amongst Selected Countries**




**11. Viewing ITS as a Multi-Purpose Platform and Partnering with the Private Sector**

An important lesson from the success of Japan's VICS and Smartway travel information systems is the need to view intelligent transportation systems platforms as "multi-use infrastructure." VICS and Smartway were designed and built using a strategic roadmap that envisioned multiple use cases for the intelligent transportation systems infrastructure, including of course safety applications and the public provision of real-time traffic information, but also viewing the infrastructure as a platform for the private sector to introduce value-added ITS applications. The essential point is that in designing the VICS system, Japan's government partnered with its private sector to understand how commercially viable business models for value-added ITS services could be built off the VICS platform.

**12. Present Status of ITS in India**

ITS applications in India can be broadly classified into 6 sectors – location technologies, fare collection technologies, toll collection technologies, intelligent signaling, telematics and highway traffic technologies.

- **Location technologies**: Location based services have made significant headway in India over last five years. Many small firms have emerged to provide tracking

services to fleet managers. There are some big firms in this space that are developing platforms that can integrate multiple types of devices and multiple types of maps. Some big public transport fleets have adopted GPS based location solutions for fleet management. The biggest implementation so far is in Delhi Transport Corporation, where more than 3000 buses are daily tracked for managing a variety of performance parameters. Govt. of National Capital Territory of Delhi has formed a joint venture company Delhi Integrated Multi-modal Transit System (DIMTS) to develop multi-modal transit centres in Delhi metro city. Bangalore Metropolitan Transport Corporation, Indore City Transport, and a few other public transport operators have also implemented systems on a smaller scale. Some large trucking companies like Transport Corporation of India, have adopted GPS based solutions for operational efficiency. To sum up, location based technologies are still in a growth phase. In the coming years, there will a lot of integration between GPS devices and mobile phones. The standards that will evolve out of this integration will likely last for a longer period.

- **Fare Collection technologies:** Delhi Metro is the pioneer in Automatic Fare Collection System in India. Delhi Transport Corporation, BEST, BMTC and APSRTC are other innovators in fare collection sector. The traditional fare collection systems used in the West are being challenged on many grounds. Innovations are coming up with changes in mobile technology, card technology and cheaper cost of communications. There is a move for IndiaOne transit card, though it is still in a design and concept stage. This sector will see a lot of action in the coming five years, as transit operators try to reduce the cost of collection and hassles of cash handling.

- **Toll collection:** Presently, in India Electronic Toll Collection is in place on certain highways e.g. Delhi-Noida Highway, Bangalore-Electronic City Highway. Govt. had constituted high level committee to recommend unified ETC technology and the committee has submitted the report to the Govt. with a comprehensive proposal for toll collection using passive RFID tags. This new technology, yet to be conclusively proven in Indian conditions, will likely change the scenario in toll collection sector.

- **Intelligent Signaling:** Two major implementations have taken place, one in Mumbai and other in Delhi. These systems are new and would be evaluated over the next two years by actual usage.

- **Telematics:** Govt. of India has initiated pilot project on public transportation management using telematics at Koyambedu, Chennai bus terminal. Under World Bank sponsored project, ITS project is underway for public transport management in Mysore city.

- **Highway traffic management:** This field is very fragmented. Some experiments in vehicle counting, number plate recognition, incident management and lane control are happening at various places, but there is no concerted move towards having a comprehensive set of standards or devices.

## 13. Proposed Strategy for Government

1. It is clear from the current situation that the government needs to establish a long term strategy on ITS with a view to road safety.
2. Priority should be given to the development of ITS that address identified road safety problems
3. The Government should encourage the early nation-wide implementation of those ITS which have proven safety benefits.
4. It should give priority in long-term development to systems that have a significant potential to improve safety.
5. The Government should ensure that ITS introduced on the market is monitored and evaluated from a safety point of view.

## 14. ITS & Road Safety

Road safety has, until lately, been a mere spin-off in ITS development and certainly not a central aspect of design. Today, there is sufficient evidence to suggest that the development and application of ITS should not be left entirely to market forces, as the market does not necessarily select the alternative most contributor to safety. Manufacturers should be helped with design, development, and implementation issues, in order to reestablish the correct balance between safety and other ITS objectives, and to prevent further uncontrolled development.

There are two ways to improve road safety by means of ITS: systems that influence safety in a direct way and systems that influence safety in an indirect way. Examples of promising direct systems are, for example, incident detection and warning systems using variable message signs, violation detection and enforcement systems, electronic licenses, in-vehicle black boxes (crash recorders), variable speed limits, intelligent speed adaptation. Examples of indirect systems are those that change the exposure or mode of traffic, debiting systems, systems giving priority to public transport.

Another way of analysing the potential safety effects of ITS applications is to distinguish between three main variables that determine road safety levels in terms of health consequences: exposure in traffic, risk of a crash given the exposure, consequence of the crash. ITS has the potential to improve safety along each one of these three dimensions:

- It is possible and feasible to influence or even control traffic exposure by means of ITS.
- It will be possible to reduce the probability of crashes, to prevent crashes by means of ITS.
- It will be possible to reduce the injury consequences of crashes by means of ITS.

**Prioritization of ITS Applications Based on Safety for Implementation**

| ITS Application | Safety Rating | Cost Rating | Priority |
|---|---|---|---|
| Real-time Traffic Information Provision | **** | * | I |
| Roadside Weather Information Systems | **** | ***** | I |
| Electronic Toll Collection (ETC) | *** | *** | I |
| Real-time Status Information for Public Transit System (e.g. Bus, Subway, Rail) | **** | **** | I |
| Dynamic Message Signs (or "Variable" Message Signs) | **** | ***** | I |
| Adaptive Traffic Signal Control | **** | ** | I |
| Ramp Metering | *** | *** | I |
| Congestion Pricing/Electronic Road Pricing (ERP) | *** | *** | I |
| Parking Information | *** | ***** | I |
| Automatic Vehicle Location (AVL) | *** | *** | I |
| Incidence Management | **** | ** | I |
| Route Guidance/Navigation Systems | ** | ** | II |
| Traffic Operations Centers (TOCs) | *** | * | II |
| Vehicle-Miles Traveled (VMT) Usage Fees | ** | * | II |
| Variable Parking Fees | * | **** | II |
| Electronic Fare Payment (for example Smart Cards) | * | *** | II |
| Intersection Collision Avoidance System | **** | * | III |
| Intelligent Speed Adaptation (ISA) | **** | * | III |
| Automated Speed Enforcement | **** | * | III |
| Freight and Fleet Management e.g. Tow-Bar System | * | ** | III |
| Lane Keeping | ** | ** | III |

**Priority I: Within next 3-5 years**

**Priority II: Within next 5-10 years**

**Priority III: After 10 years**

## 15. Overall Recommendations

Considering present ITS infrastructure, traffic scenario in India following applications can be considered for implementation in the country on pilot city basis:

1. Provision of real time traffic information to vehicle users
2. Electronic toll collection on all major highways
3. Public transportation information system
4. Adaptive traffic signals at major traffic junctions in the cities
5. Congestion charging in crowded city areas
6. Parking guidance system in cities
7. Weighing in motion (WIM) for goods carrier vehicle to avoid overloading of such vehicles on the highways
8. Incidence Management

### 15.1 Sector wise Recommendations

| ITS Application | Engineering (Vehicle) | Engineering (Roads) | Enforcement | Education | Emergency Care |
|---|---|---|---|---|---|
| Real time traffic information | Standardisation of GPS based OBU (On Board Unit) device in vehicle | Infrastructure | Implementation | Post graduate course on Transport Management / ITS<br><br>Organisation of workshops, conferences on ITS | |
| Electronic toll collection | Standardisation of RFID/DSRC device | Infrastructure | Implementation | | |
| Public transportation information system | Standardisation of destination displays in buses | | Implementation through transport undertakings | | |
| Adaptive traffic signals | | Infrastructure | Real time traffic analysis | | |
| Congestion charging | RFID/DSRC device with smartcard | | Implementation | | |
| Parking guidance system | | Infrastructure | | | |
| Weighing in motion | | Infrastructure | | | |
| Incidence | Telematics | Infrastructure | Traffic | | Integration |

| | | | | | |
|---|---|---|---|---|---|
| Management | device | | diversion, clearing of highway, Information to Traffic Management Centre | | of emergency care organisations |

# Summary and Recommendations

## Chapter 8

**7/20/2011**

## Chapter 8

## Summary and recommendations

The Working Group has identified specific action areas and summarizes its recommendations at the macro level as under. It would be necessary to develop detailed action plan further and also estimate funding requirements for necessary allocation. Details and technical inputs are given in respective chapters, which would be useful in developing detailed action plans. Recommendations suggest that vision and goals for next 20 years need to be adopted and established for further drawing up definite action plan.

1. **Establishing Safety Vision and Goals**
    a. India contributes to 8% of fatalities with only 1 % contribution of vehicle population. Vision and Goals for Road Safety should be therefore established and action plan should be drawn to achieve the same in next 20 years. Many countries like Sweden, Japan, Korea and Australia have very well defined goals for road safety.
    b. Proposed Vision and Goals for road safety are:

    **Vision-** To reduce the fatalities and injuries due to road traffic accidents by 4 Es (Engineering, Enforcement, Education and Emergency Medical Services)

    **Goals- Stage 1 (2011-2020):** Reduce the increasing rate of fatalities
    Current situation shows that the rate of road fatalities is increasing annually. The first immediate objective should be to reduce this rate
    **Stage 2 (2020-30):** Reverse the trend of fatalities and injuries
    Reversing the trend would require comprehensive action plan.
    **Stage 3 (2030 and beyond):** "Vision zero" to pursue no road injuries or fatalities
    Sweden adopted "Vision Zero" in year 1997 and they have taken several steps to work towards the goal.

    Accordingly specific targets should be given to each of the 4 'E's

2. **Implementing vehicle engineering solutions through mandatory safety rules**
    Safety Roadmap is already drawn by Government of India. This Roadmap should be now updated and new safety standards should be mandated step-by-step.
    a. Requirements related to passive safety, active safety and general safety (as given in Chapter 3-Table 1) to be introduced in a planned manner
        - **Short term (3-5 years)** actions are already planned as per Chapter 4- Para 4. These standards should be implemented. Major improvements in

vehicle designs are expected with introduction of full vehicle crash tests, EMC and high technology solutions for better visibility. Enhancement of standards related to vehicle stability and braking should be implemented. Standardization of bus bodies, truck bodies and trailers would greatly enhance road safety.

- **Intermediate (5-10 years)-** Discussions should be initiated in CMVR-Technical Standing Committee on the new subjects like pedestrian safety, crash avoidance systems, Electronic Stability Control. Safety standards for vehicle categories like Construction Equipments should be upgraded.
- **Long term (beyond 10 years)-** Work should be initiated in next 1-2 years. Vehicle to vehicle crash compatibility, advanced restraint systems, vehicle to road furniture interaction are some of the future areas of work. Additional safety enhancement would be possible through advanced technologies for driver assistance systems

b. Take up formulation of new safety standards for Intermediate and Long Term phases as above. Also existing standards should be upgraded from time to time to address new technology and stringency requirements.

c. Also address other areas like construction equipment vehicles, hydraulic trailers, ITS, inspection and testing rules for in-use vehicles, End of Life Vehicle, etc. Standards should be developed for mandating these requirements in future.

**3. Establishing effective mechanism for control of in-use vehicle**

a. Introduce mandatory Inspection and Certification (I&C) requirements for all categories of vehicle (Transport vehicles as well as non-transport vehicles, including 2 wheelers). This should be done in phased manner.

b. Establish computerized I&C Centers all across the country. Proposed action plan is given in Chapter 7. These centers should diligently work independently but should be under the guidance and supervision of government authorities.

c. Define policies and procedures for End of Life and scrapping of un-usable vehicles. Encourage investments by private sector in order to develop sustainable centers.

d. Establish control mechanism for use of spurious parts in the aftermarket by covering more and more components under mandatory marking scheme. Independent/ 3$^{rd}$ party testing agencies should be involved in auditing and testing of samples collected from market.

**4. Establish comprehensive Road Accident Data Analysis**

a. Develop strategic alliances with international organizations/ experts

b. For effective planning and execution, there should be National Accident Research Center (mother organization) and data collection at State Accident

Research Centers (daughter organizations). Department of Heavy Industry has already planned Accident Research Center under NATRiP. Center under NAIRiP needs to be considered while making future plans.

c. Develop human resources and formulate Accident Investigation Teams and empower them for scientific data collection. Involve other stake holders for accident data collection and dissemination.

**5. Effective use of IT & Electronics for vehicle-road interfaces and transport management**

a. Establish long term strategy for use of ITS in India.

b. ITS solutions are expected to lead to better road safety. **One should not wait for the market forces to usher-in the technology and ITS needs to be driven by the Government efforts**. Government should review globally available options and announce action plan for India.

c. ITS being an inter-disciplinary subject, a task force should be appointed to establish a comprehensive action plan based on the government policy. To begin with, this Working Group has identified the sector-wise recommendations as per Para 15.1 of Chapter 7. The details should be shared with other Working Groups.

d. Identify priority areas where immediate penetration would be easy. Some such areas would be Real Time Traffic Information System, Electronic Toll Collection, Automatic Vehicle Tracking and fleet management, incidence Management, etc.

**6. Support research activity in vehicle engineering and regulations**

a. Undertake or support projects such as standardization of bus designs, truck bodies, trailer designs, Under-run protection Devices, etc. This will help the un-organized sector of the industry to bump-less transition to new safety regulations.

b. Evolve India specific vehicle and laboratory test data to support our endeavor of harmonization of standards with international regulations

c. Undertake feasibility studies for advance technology safety requirements (like Electronic Stability Control, rear collision, frontal impact for buses, etc. Also undertake benefit to cost analysis studies in order to mandate specific standards for approval of vehicles.

All these studies require funding by the government. Necessary allocation for all such activities need to be worked out.

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