

**WORKING GROUP ON ROADS  
FOR THE  
NATIONAL TRANSPORT DEVELOPMENT POLICY  
COMMITTEE**

**FINAL REPORT**

**Transport Research Wing  
Ministry of Road Transport & Highways  
Government of India**

**May 2012**

# **Working Group on Roads for National Transport Development Policy Committee**

## **Terms of Reference**

1. Determine the role of road transport in meeting transport requirements of the economy over the next two decades, keeping in view the need to
  - a. Conserve energy and protect the environment,
  - b. Promote development of remote and inaccessible areas through universal connectivity,
  - c. Promote safety and sustain future quality of life,
  - d. Create an optimal intermodal mix.
2. Estimate the growth in road traffic, passenger and freight, by 2020 and 2030 in the context of economic, demographic and technological trends at local, national and global levels.
3. Consistent with the above, assess the current capacity and required capacity in future, of the physical road infrastructure. The requirements may be grouped into different categories:
  - a. Expressways
  - b. National Highways
  - c. State Highways and Major District Roads
  - d. Rural Roads – both PMGSY and non-PMGSY(urban road requirements would be addressed by the working group on urban transport).

The following aspects may also be kept in view while assessing the requirements:

- a. Universal rural connectivity.
  - b. Special problems of remote, difficult and border areas including the north-east region.
  - c. Road connectivity with ports, power plants, water fronts.
  - d. Road connectivity with neighbouring countries.
  - e. Development of regional and international road corridors.
4. In light of the above,
    - a. Assess the investment required to achieve the projected road traffic growth.
    - b. Identify sources of funding and assess fund requirements from budgetary, non-budgetary and private sources for different areas in road infrastructure.
    - c. Identify areas for PPP and the requirement of private and public funding in these areas.
    - d. Examine the existing PPP policy framework and policy initiatives including the regulatory and institutional framework, and suggest changes necessary to attract greater private investment.
    - e. Suggest measures for greater commercial orientation of road transport services.
  5. Assess the full costs of road transport, including the costs of externalities, and suggest appropriate pricing regimes, both direct and indirect, including institutional arrangements for rational pricing.

6. Estimate the energy requirements necessary for road infrastructure and suggest measures to put the road construction and road transport sector on a sustainable low carbon path, promoting energy efficiency, emission reduction and environment protection.
7. Review status of road quality and safety measures and ways to ameliorate road accidents and make roads more user friendly.
8. Assess the availability of human resources for the road sector and suggest measures for skill development and institutional capacity building for various stakeholders.
9. Suggest measures for promotion of research and development and technology upgradation in the road transport sector, including institutional development.
10. Indicate broad areas and investment for IT in road transport to improve customer interface/satisfaction and internal efficiency.
11. Suggest measures for speedy acquisition of land for roads, along with rehabilitation and resettlement of persons affected.
12. Identify data deficiencies in road transport and suggest measures for improving, maintaining and updating the database, including institutional measures.
13. Assess the current industry structure, including the role played by the public and private sectors and suggest policies to promote adequate competition in road transport with the objective of enhancing access and affordability.
14. Examine the barriers to free flow of road freight traffic and suggest measures to promote seamless movement of road freight across India, including in particular the use of IT.
15. Suggest measures towards consolidation and preservation of road assets.
16. Identify social disconnects arising out of construction of roads and suggest measures for their mitigation.
17. Suggest measures for upgrading and modernizing the trucking industry.

## Composition

1. Secretary (Road Transport & Highways) - Chairman
2. Shri S. Sundar, Member, NTDP
3. Shri D.P. Gupta, Member, NTDP
4. Member Secretary/Co-ordinator, NTDP
5. Chairman, National Highway Authority of India (NHAI)
6. Director General, Roads, Ministry of Road Transport & Highways
7. Principal Secretary (Transport), Government of Andhra Pradesh
8. Principal Secretary (PWD), Government of Assam
9. Joint Secretary (Road Transport), Ministry of Road Transport & Highways.
10. Joint Secretary (Rural Roads), Ministry of Rural Development
11. Professor Geetam Tiwari, Indian Institute of Technology, Delhi
12. Shri Partha Mukhopadhyay, Centre for Policy Research, New Delhi.
13. Shri Athar Shahab, Dy. MD, IDFC Projects and Chairman, CII Roads Committee
14. Shri O.B. Raju, MD, GMR Highways Pvt. Ltd., Bengaluru.
15. Shri Parvesh Minocha, MD, Transportation Division, Feedback Ventures
16. Representative of financial sector (nominated by Secretary, Department of Financial Services)
17. Representative of IT sector
18. Adviser (Transport Research), Ministry of Road Transport & Highways - Convenor

# Chapter I

## STRATEGY AND ACTION PLAN

### 1.1 Introduction

1.1.1 Improvements in road transport can be expected to have important economic effects. Lower costs or better service, or both, in road transport have a positive effect on all firms engaged in the production, distribution, trade and/or retail sale of physical goods. Reducing the per kilometre cost of goods carriage means that any production or distribution facility can serve a wider market area, with potential gains from scale efficiencies. It also means a factory can draw supplies from a wider area with potential gains in terms of the cost and/or quality of inputs coming to the factory.

1.1.2 Although improvements in road transportation have important economic ramifications, freight transportation enhancements that reduce the costs of moving goods (and services) to and from markets are critical to economic expansion. This is because the movement of goods is what economists term a factor input in the production of goods. Much like labour and capital, transportation costs affect directly the price of goods and services and the profits of products. Consequently, investments that reduce the cost of moving goods and people to and from markets (via improvements in reliability, transit times, service levels, etc.) can help to increase and sustain economic growth. In effect, the efficiency and reliability of the road transportation system affects economic productivity, and many economists would argue that productivity is the most important determinant of economic performance.

1.1.3 Improvements in the freight transportation system globally have made it possible for innovative producers to provide a high level of service to retail customers while holding inventories at low levels. One of the best examples of this is the system of on-line ordering of custom configured computers combined with just-in-time (JIT) delivery of components and tight control of inventory developed by electronic and auto sectors. The JIT system provides a high level of customer service with a dramatic reduction in inventory levels and costs. This chapter provides an overview of broad contours of policy framework to achieve an efficient road transportation system in the country to sustain an overall growth of 9 % over the medium term.

### 1.2 Projected Road Freight and Passenger Traffic

1.2.1 The growth in road freight and passenger traffic has been estimated up to 2029-30 assuming four different scenarios. The first one assumes 'Business As Usual', implying that the rates of growth of freight and passenger would remain the same, as has been observed in the past. The other three are based on elasticity of road freight and passenger traffic with respect to Gross Domestic Product (GDP), in conjunction with three variants of growth rates which have been assumed (Table 1.1).

Year	BAU		Scenario I		Scenario II		Scenario III	
	BTKM	BPKM	BTKM	BPKM	BTKM	BPKM	BTKM	BPKM
2011-12	869	8,811	1,066	10,963	1,066	10,963	1,089	11,508
2016-17	1,125	16,171	1,828	25,134	1,779	24,139	1,868	26,383
2021-22	1,457	29,679	3,053	55,341	2,972	53,150	3,205	60,485
2026-27	1,886	54,468	4,961	116,989	4,962	117,028	5,498	138,669
2029-30	2,202	78,409	6,532	178,856	6,750	187,914	7,601	228,127

Notes: Business As Usual (BAU): Freight traffic is assumed to grow at 5.3% per annum. Passenger traffic is assumed to grow at 13% per annum.  
BTKM: Billion Tonne Kilometre  
BPKM: Billion Passenger Kilometre  
Scenario I: staggered GDP growth over the horizon  
Scenario II: GDP growth of 9 per cent  
Scenario III: GDP growth of 9.5 per cent  
Elasticity of freight transport assumed at 1.2.  
Elasticity of passenger transport assumed at 1.9.

1.2.2 The expansion in the road network across various categories of roads has been worked out by keeping in view the expected growth in the different categories of vehicles and growth in road freight and passenger traffic, in particular. On the basis of the trend of growth during 2004 to 2009, it is estimated that the vehicles on the inter-city highways will witness a 4 to 22 fold growth during 2009 to 2031.

### 1.3 Strategy

#### 1.3.1 Road Network

- Primary emphasis on consolidation of existing networks rather than expanding it.
- Promote energy efficient and more environment friendly travel with enhanced safety;
- Develop Expressway Network to provide unhindered movement of traffic;
- Develop road corridors necessary for Investment Regions and Investment Areas;
- Develop multi-modal connectivity particularly road access to the airport and to ports;
- Develop State roads in Scheduled Areas;
- Improve road connectivity in Left Wing Extremism (LWE) affected areas;
- Develop fully access controlled facilities, whenever 2-lane NHs are upgraded to 4-lanes;
- Plan for bypasses in cities with population above 1 million on the NH Network;
- Setting up a Bridge Management System for formulating maintenance strategies;
- Identify a Core Network of major arterial routes, with a Corridor Concept;
- Provide urban linkages to National Expressways;
- Four-laning of existing SH on high density corridors;
- Upgradation of entire SH to at least 2-lane standards;
- Address the issue of inadequate allocation for Maintenance and Repair (M&R) of NHs;
- Make highway designs in tune with the international best practice;
- Make Road Safety Audit (RSA) an integral part of any road project.

### **1.3.2 Energy, Environment, Technology & Modernization of Trucking Industry**

- Improve operating efficiency of trucks on highways;
- Develop end of life regulations of vehicles for future implementation in India;
- Establish commercially viable recycling centres;
- Incentivize scrapping of old vehicles;
- Ensure optimum investment and operating costs for scrapping infrastructure;
- Ensure appropriate generation, storage and dissemination of data of scrapped vehicles;
- Have the provision of real-time traffic information in vehicles;
- Introduce electronic toll collection on all major highways/expressways;
- Initiate public transportation information system in major cities;
- Introduce adaptive traffic signals, congestion charging, parking guidance;
- Install weighing-in-motion of goods carriage vehicles on roads;
- Adapt electric buses in urban areas;
- Encourage use of natural gas for vehicle transportation to reduce pollutants;
- Focus on improving fuel economy of heavy commercial vehicles;
- Promote research in renewable sources;
- Introduce uniform fuel quality and uniform emission standards throughout the country;
- Follow a road map of propagation of clean diesel, alternative fuels and electric mobility
- Introduce a time lag of at least five years between successive stages of emission norms;
- Maintain an emission inventory database for facilitation of storage and retrieval of data;
- Make inspection and certification mandatory for all motor vehicles;
- Make retirement compulsory for vehicles which do not obtain road worthiness certificate;
- Curb fuel adulteration;
- Strengthen fuel delivery infrastructure;
- Establish traffic injury surveillance systems at hospitals and medical;
- Develop a highway crash data system to monitor the details of vehicle and road design;
- Develop three or four multidisciplinary crash investigation centres and personnel trained;
- Implement uniform bus body and truck codes throughout the country;
- Encourage bus and truck body manufacturers for technology upgradation;
- Develop institutional structure of I&M regime;
- Phase I/C regime through a nodal agency;
- Audit Vehicle Inspection Centres.

### **1.3.3 Road Safety and HRD**

- Initiate a systems approach;
- Coordinate with health, law, transport, police, insurance agencies, NGOs and road agencies;
- Main thrust of accident prevention and control on 4 E's.

### **1.3.4 IT and Data Issues**

- Apply IT to roads and road transport sector.

### **1.3.5 Public transportation and Seamless Freight and Passenger Movement**

- Rationalise tax structure in passenger transport;

- Inter-modal integration;
- Give primacy to mobility to ensure access of people to socio economic services;
- Facilitate speedy finalization of the inter-State agreements;
- Free movement of personalized vehicles;
- Adopt a single window clearance system for all authorized charges;
- Revive SRTUs.

### **1.3.6 Rural Roads**

- Follow a need-based approach
- Strengthen institutional arrangement and contracting capacity
- Explore the possibility of PPP

## **1.4 ACTION PLAN**

### **1.4.1 Expansion of Road Network**

- It is proposed to develop a total Expressway Network of about 18,637 km by 2031.
- Keeping in view the targeted economic growth of 9% or more, it is desirable to aim at achieving an average grid length of about 60 km for NH Network in the country by 2031. This would require the total NH network length of about 100,000 km by 2031.
- Investment approval of Rs. 10,700 crore for development of 8,014 km road stretches under Road Requirement Plan (RRP) phase II spread over 34 districts in 8 states is proposed to be obtained. The development of roads under Phase II of RRP is likely to be completed by March, 2017.
- Complete all the works under Vijayawada-Ranchi route by March, 2015.
- Upgrade about 4,958 km length of stretches of NHs which are less than 2-lane standards to 2-lane standards following Corridor Development Approach by December 2014 through budgetary resources and also through possible Loan Assistance from the World Bank.
- While identifying the specific linkages, emphasis is required to be given to the following:
  - Providing linkages with minor ports, industrial towns, pilgrimage and tourist centres;
  - Connecting the remaining towns with population 5000 and above;
  - Connecting the capitals of the newly carved out States with the district headquarters.
- Develop the balance length of about 9,129 km under SARDP-NE and Arunachal Package on priority.
- Develop 4-lane road connectivity for 3 Investment Regions (IRs) (minimum area of over 200 sq. km) and Investment Areas (IAs) (minimum of 100 sq. km) on pilot basis, viz. Dighi Port connectivity and Shendra - Bidkin Mega Industrial Park connectivity in Maharashtra and Neemrana-Khushkhera-Bhiwadi Investment Region in Rajasthan.
- Develop road connectivity for the remaining 11 IRs / IAs.
- Develop roads in Jammu & Kashmir under a Special Package.
- Provide road connectivity to non-major ports.
- Develop road connectivity to 24 airports which need creation of new approach roads, widening of existing approach road, provision of flyovers with clover leaves and grade separators to de-congest and streamline the moving traffic at road junctions etc.
- Develop about 4,000 km length of roads to 2-lane standards in Scheduled Areas in the States of Andhra Pradesh, Himachal Pradesh, Gujarat, Odisha, Rajasthan, Maharashtra, Chhattisgarh, Madhya Pradesh and Jharkhand.

- Initiate detailed investigations on the promising corridors of expressways to fix up alignment and start the process of freezing land.
- Explore the possibility to take up the development to proper 2-lane NH standards of at least 40 % of the total stretches on BOT basis.
- Develop an institutionalized system of database which would be capable of maintaining and updating the details of investments made historically for developing and maintaining a road.
- Apart from the ongoing phases of NHDP (viz. NHDP-Phases-I to VI and NHDP-Phase-VII), upgrade about another 25,000 km length of NHs to 4-lane divided carriageway facilities or more.
- Improve the riding quality of about 30,000 km of NH during 20 year horizon.
- Provide urban linkages at every toll plaza (having closed system of tolling) located at about 50 km apart along National Expressways Network, and an average length of about 10 km for each such urban linkages.
- Achieve a target of 50 per cent of MDR roads (i.e. 119,025 km) to be widened to two-lane standards in the next 20 years.

#### **1.4.2 Energy, Environment, Technology and Modernization of trucking industry**

- The purpose of the national transportation policy should be to provide emphasis on improving efficiency, safety, reduction of emissions and promoting sustainability.
- Consider and adopt various measures for greenhouse gas mitigation such as promotion of green vehicles like hybrid electric through incentivization.
- Introduce commercially viable Inspection and Maintenance centres.
- In order to mitigate congestion problem in cities, develop transport hubs or nagars on outskirts of the cities across the country. Fix suitable restrictions on the commercial vehicles entering the city on the basis of size and tonnage.
- Mandate freight vehicles in the city to use CNG as this will improve the fuel mix of the overall freight fleet.
- Make driving license test stringent by following Sundar Committee's recommendation on making the minimum education qualification for driving license as 10th standard with effect from 2015. Further, the applicant should hold a learner's license for a period of four months and obtain a competency certificate from a government recognized school.
- Introduce statutory regulations for the bus/truck drivers' working conditions. Tachographs or similar devices can be used to track their working hours.
- Establish driving schools with sophisticated simulators for driver training.
- Introduce traffic management system on highways through automatic tolling system (ITS/RFID/Smart Card) which would ensure smooth movement of trucks and maximize returns.
- Adopt end-of-life norms for vehicles.
- Rationalise toll rate structure for the highways for promoting multi-axle vehicles which, have lower cost of carriage and cause less pavement damage.
- Encourage financial institutions like NBFC to enhance their level of financing.
- Encourage rail transport in order to offset the increasing shift towards road freight.
- Creation of the National integrated logistics policy and Investment of USD 700 Billion in India for road logistics infrastructure till 2030
- To have in place 318 I&C centres by 2015

#### **1.4.3 Road Safety and HRD**

- Adopt Millennium Development Goals-like activities for road safety;
- Create a separate Road Safety Education and Awareness Fund;
- Introduce a road safety policy for all large fleet owners;
- Promote road safety issues on social networking sites, FM radio, TV and printed media;
- Have Brand Ambassadors to spread the message of road safety;
- Include road safety as a part of Value/Life Education Programme in schools and colleges;
- Set up Model Driving Training Schools on PPP mode.
- Develop and implement *Safe System* road design principles and standards;
- Set and manage speed limits in accordance with the protective quality of the road;
- Develop pilot fully access controlled freeway system;
- Provide service roads along all 4 and 6-lane highways;
- Introduce traffic calming measures where necessary;
- Earmark 1% of cess money for engineering aspects of road ;
- Abandon cost cutting approach in road development and provide forgiving highways;
- Plan more Expressways rather than upgrading existing 4- lane highways;
- Focus on VRUs;
- Incorporate RSA in the planning, design, construction and operation of the highways;
- Encourage institutionalization of conducting RSAs by certified Road Safety Auditors;
- Create an accreditation body for Road Safety Auditors;
- Enhance the capacity for RSA works in the country;
- Subject the network of NH and SH to RSA in a planned manner over the next three years;
- Implement improvements recommended by RSA;
- Priority roads with high accident records are to be taken up first;
- Train qualified engineers to carry out RSA for the entire primary network;
- Adopt across all States/UTs a uniform accident data recording system;
- Collect accident data through hand-held GPS.
- Have a standard accident analysis module for accident investigation and adjudication;
- Study selected accidents, using the accident reconstruction technique;
- Establish Centres of Excellence for Road Safety Research and Accident;
- Establish a large number of Inspection and Maintenance (I&M) test centres.
- Create an independent centralized nodal agency for the implementation of effective I&C regime in India.
  - Follow a phased approach to inspect all vehicles on safety and emissions performance.
    - In the first phase (up to 2015), cities with significant transport vehicles (Metros) should introduce a modern I&C regime. In these cities, a modern inspection regime should be first introduced for commercial vehicles, and then subsequently to private vehicles. Thereafter, it must be extended to the rest of India for commercial vehicle category.
    - In the second phase (2015 to 2020), the I&M regime of private vehicles including two wheelers must be introduced. Initially the older vehicles (more than 9 years old) should be covered.
    - In the third phase, beginning from 2020 onwards, the regime should be extended to newer fleet in private vehicles category, i.e. 3 to 9 years old.
  - Enhance the amount of compensation for road accident victims and revise it every three years;

- Introduce compulsory provision of basic additional security requirements such as steering locks/clutch locks and ignition cut off lock systems by automobile manufacturing companies;
- Vehicles costing more than Rs. 5 lakhs to be provided with GPS based vehicle tracking system;
- It should be mandatory for all driving license holders to possess training in First Aid and a Medical Insurance Policy and the same should be ensured at the time of issue/renewal of the driving license;
- There should be one-time insurance for third party on the lines of road tax;
- Review and Audit of existing National Highway Trauma Care Project and National Highways Relief Services Scheme
- Periodic audit of medical equipment, ambulances, cranes with respect to their utilization, availability, location, etc.
- All Crash Rescue Vehicles (CRVs) and Ambulances should be accessible through National Medical Toll Free Number integrated under National Highways Relief Network and closely linked with State EMS;
- The specifications for the Ambulances, Patrol Cars, CRVs should be revised and updated;
- Enunciate a National Accident Relief Policy and a National Trauma System Plan
- Deployment of a Pan-India Pre-Hospital Emergency Medical Care Network to ensure a primary crash response time of 8–10 mins. This network should be adequately supported by a unified toll free number, seamless communication, centralized dispatch, medical direction, triage protocols and crash rescue units.
- To verify and designate the existing healthcare facilities along the Highways and upgrade those found deficient to minimum defined levels and to plan for new facilities where there is a deficit so as to ensure the availability of one emergency care facility at every 50km along NH.
- Short term Emergency Medical Services (EMS) programmes to train paramedics working in trauma centres
- Plan for seamless networking amongst health facilities, rescue services, existing fleet of ambulances, etc.
- Capacity building and regular training in EMS to all involved in trauma care supplemented by training in First Aid to the public
- Encourage research and development into post-crash response.
- Establish minimum standards, guidelines and protocols for various components of EMS, viz, Ambulances, Trauma Centres, Emergency Medical Technicians, Communications, Command and Control.
- All district hospitals /community health centres across the country to be developed as integrated trauma care centres with appropriate manpower and facilities
- Augmentation in capacity and resources of available Medical establishments
- Setting up of Regional Referral Trauma Centres in tertiary hospitals across the country.
- Plan for rehabilitation centres for the trauma care victims
- Standardize minimum national specifications for various types of Emergency Response Vehicles viz. First Responders, Patient Transport Ambulances, BLS Ambulances and ALS Ambulances, Crash Rescue Vehicles, Dispatch Centres, Command & Control Centres, etc. so as to bring homogeneity in the system across the country.
- State Road Safety Councils need to be constituted/activated at the State level. These Councils would have representatives from all stake-holders.

- For Roads and Highways Sector, focus on training of supervisors and junior engineers who have so far largely been bypassed from skill enhancement.
- Road agencies of the government may consider making a provision of 0.25% of the project cost in each estimate towards training of staff. For workers, there could be a dialogue with the DG (Labour Welfare) and DG (Employment & Training). Ministry of Labour and Employer for earmarking 0.25% of the cess collected under the Workers Welfare Cess Act, 1996 for training of Construction workers as this is also a welfare measure.
- Set up one Construction Training Centre in each State through the joint efforts of the government and the contracting industry. National Institute for Training Highway Engineers (NITHE) can be mandated to organize training programmes for Central and State Government officials engaged in road construction.
- Ministry of Road Transport & Highways (MORTH) in consultation with the Ministry of Rural Development and State Governments may take the lead in formulating a training strategy for the road sector in India, covering all stakeholders.
- Upgrade motor vehicle repair workshops.
- Establish a centralized accreditation and quality assurance system for training institutions for driving
- Put in place a three-tier structure to integrate driving training at local level to a standards monitoring body. The components would be (i) Local Driving Training Schools and Regional Driving Training Schools; (ii) IDTR (Institute of Driving & Traffic Research) and DTI (Driving Training Institute); (iii) Forum comprising IDTR and DTI.
- Encourage driver training schools to come up in PPP mode.

#### **1.4.4 IT and Data issues**

- Electronic payments for toll collection
- Replicate in all States/UTs Road Accident Data Management System in operation in Tamil Nadu
- Adapt IT applications to suit road transport needs
- Detailed surveys to be carried out by NSSO, supplemented by professional organizations and Directorate of Economics and Statistics at the State level.
- Computerize and electronically transfer data
- Computerize all Regional Transport Offices/State Transport Authorities and link them to the National and State Registers.

#### **1.4.5 Public transportation and Seamless Freight and Passenger Movement**

- Achieve uniformity in taxation rates.
- Establish linkages between different transportation systems.
- Re-look at the regulatory framework, keeping in view the overall requirement of passenger transport for an area / region.
- Frame basic guidelines for uniformity in the inter-State agreements on stage carriages including delegation of powers to Transport Commissioners of States for entering into inter-State agreements.
- Establish benchmarks for bus operations
- Facilitate seamless movement of passenger transport vehicles in line with New National Permit Scheme for goods vehicles.

- Evolve norms regarding minimum requirement of buses for different category of operations including hilly areas, mofussil and city operations.
- Assess scientifically travel demand for both passengers and goods for the present and over medium term.
- Exempt personalized vehicles covered by “Life Time Tax” in one State from payment of tax to other States if the stay of vehicles concerned does not exceed six months in the other State.
- Introduce single window integrated border check posts
- Evolve a framework to provide flexibility and freedom to SRTUs for automatic fare revision, depending on the increase of fuel and wage costs.

#### **1.4.6 Rural Roads**

- Classify rural roads with reference to road utility, terrain/topography, climatic conditions, traffic intensity, population coverage, prevailing socio-economic status, etc.
- Focus on interfacing roads like MDRs to improve mobility patronages, road safety, environment sustenance and economic interactions.
- Develop road user preferred paths and evolve link/ node overlap size to facilitate the identification of roads for PPP mode of operation and for identification of through routes which are dynamically changing over a time and space in the planed period.
- Carry out Geographic Integrated System (GIS) supported and Global Positioning System (GPS) enabled transect walk mapping to address many obligatory issues in planning, construction, quality assurance and maintenance aspects of Rural Roads.
- Accommodate GIS interventions with specific modules/ layers additions at Graphical and Non Graphical data like naturally formed drains, socio- economic profiles, changes in land use pattern, etc. at the main server for constructive use in the Central and the State Governments. These modules will be in addition to the usually digitized data/ base map.
- Make the cess on High Speed Diesel (HSD) ‘*ad valorem*’ by linking it to the price of HSD, instead of being a specific amount per litre as at present.
- Design rural roads on which heavy mining to bear heavy traffic.
- Evolve maintenance policy using audits of different indicators such as surface condition, structural condition, material characterization, traffic intensity, etc.
- Put in place an effective HRD Policy for Rural Road Sector.
- Carry out a proper evaluation of performance after training through examination or other means to obtain feed backs for further improvement in the training system.
- Impart training on Detailed Project Report (DPR) preparations.
- Carry out research on the construction of bridges and other hydraulic structures for improving the life of the pavement and facilitating All Weather Connectivity to the rural people.
- Accord priority to road safety right from the planning to the construction and the maintenance of Rural Roads.

## Chapter 2

### Projected Road Freight and Passenger Traffic

The demand for transport is dependent on GDP, location and pattern of industries, consumption pattern of goods and services and travel freight lead distances. The main determinant of road transport is the growth and composition of GDP, viz. those sectors which generate the volume of transport output along with backward and forward linkages. Elasticity of road freight transport depends on structure of the economy and its level of development. As economies develop, the composition of GDP shifts from primary and secondary sectors to tertiary sectors. As tertiary sectors are not material intensive, increasing share of tertiary sectors reduces freight intensity of the economy. Thus, typically for developed countries the road freight elasticity is as low as 0.6 to 0.7, while for developing countries it varies from 1.3 to 1.5. Rapidly developing country like India exhibit a transport elasticity exceeding unity and historical elasticity of road transport has ranged from 1.0 to 1.3 with respect to GDP.

#### 2.1 Methodology for Inter-regional Freight Traffic Projection

2.1.1 The year 2007-08 has been considered as the base year for the projection of freight traffic. The total loading and freight output of road were 1,558 million tonnes and 707 Billion Tonne Kilometres (BTKMs), respectively, in the base year 2007-08 (based on Total Transport System Study conducted by RITES for Planning Commission). For projecting road freight traffic, two methods have been adopted:

- (a) Business As Usual (BAU) – In this method, the growth in freight traffic over the time horizon is based on observed growth in road freight traffic during 1999 to 2008.
- (b) Road freight transport elasticity with respect to GDP has been used in conjunction with different GDP growth rates over the horizon.

#### (a) Business as Usual (BAU)

2.1.2 In this method, it is assumed that the future growth of road freight movement will follow the existing road freight flow pattern. The growth rate of road freight traffic during 1999-2000 and 2007-08 has been considered and estimated at 5.3 per cent per annum. In case of road originating tonnage, the growth rate during the period 1986-87 and 2007-08 was considered and estimated at 9.2 per cent per annum. Based on the above mentioned growth rates, road freight traffic, both in terms of Originating Tonnage and BTKM, was projected for the horizon years of 2011-12, 2016-17, 2021-22 and 2026-27, which conform to the terminal years of the future five year plans, and 2029-30 (Table 2.1).

<b>Year</b>	<b>BTKM</b>
2011-12	869
2016-17	1,125
2021-22	1,457
2026-27	1,886
2029-30	2,202

**(b) Road Freight Transport Elasticity with Respect of GDP**

2.1.3.1 In this method, the road transport elasticity has been calculated based on the past data of the contribution of road transport sector to GDP and total GDP through regression method. Taking the data of the last 18 years, road transport elasticity was estimated at 1.2. For the projection of GDP growth rates, three scenarios have been adopted by taking different growth rates for horizon years:

Scenario I: Staggered GDP growth rate

Scenario II: GDP growth rate of 9 per cent over the time horizon

Scenario III: GDP growth rate of 9.5 per cent over the time horizon

**(i) GDP Growth Projection Scenario – I**

2.1.3.2 Based on various factors like current economic scenario, future FDI, agricultural and industrial expansion and above mentioned estimates, road transport elasticity, GDP growth and road freight growth rates for horizon years have been calculated (Table 2.2).

<b>Year</b>	<b>Elasticity</b>	<b>Projected GDP Growth* (%)</b>	<b>Freight Growth (%)</b>	<b>Freight Traffic (BTKM)</b>
2011-12	1.2	9.0	10.8	1,066
2016-17	1.2	9.5	11.4	1,828
2021-22	1.2	9.0	10.8	3,053
2026-27	1.2	8.5	10.2	4,961
2029-30	1.2	8.0	9.6	6,532

\* The rate of growth has been assumed for the five year plan periods. E.g. 9.0 per cent growth rate for 2011-12 indicates that for the block years of 2006-07 to 2011-12, a growth rate of 9.0 per cent per annum was assumed. Similarly, for the other periods.

2.1.3.3 The transport output (TKMs) estimated for horizon years on the basis of commodity-wise projected tonnage and average lead, has been derived by dividing BTKM by million tonnes (MT) in the base year 2007-08 and the same has been assumed for the horizon years.

**(ii) GDP Growth Projection Scenario – II**

2.1.3.4 In this scenario, 9% GDP growth rate has been considered for different time horizons. In conjunction with the road transport elasticity with respect to GDP of 1.2, road freight growth has been projected over the time horizon, as indicated in Table 2.3. The transport output (TKMs) has been estimated for the years on the basis of commodity-wise projected tonnage and base year average lead.

<b>Year</b>	<b>Elasticity</b>	<b>Projected GDP Growth (%)</b>	<b>Freight Growth (%)</b>	<b>BTKM</b>
2011-12	1.2	9	10.8	1,066
2016-17	1.2	9	10.8	1,779
2021-22	1.2	9	10.8	2,972
2026-27	1.2	9	10.8	4,962
2029-30	1.2	9	10.8	6,750

### (iii) GDP Growth Projection Scenario – III

2.1.3.5 In this scenario, 9.5 % GDP growth rate has been assumed for the years considered. In conjunction with road transport elasticity with respect to GDP of 1.2, the road freight growth has been projected over the time horizons as indicated in Table 2.4. The transport output (TKMs) has been estimated for horizon years on the basis of commodity-wise projected tonnage and base year average lead.

<b>Year</b>	<b>Elasticity</b>	<b>Projected GDP Growth (%)</b>	<b>Freight Growth (%)</b>	<b>BTKM</b>
2011-12	1.2	9.5	11.4	1,089
2016-17	1.2	9.5	11.4	1,868
2021-22	1.2	9.5	11.4	3,205
2026-27	1.2	9.5	11.4	5,498
2029-30	1.2	9.5	11.4	7,601

## 2.2 Intra-Regional Freight Traffic (RITES' ESTIMATES)

2.2.1 The methodology adopted for assessment of intra-regional traffic by roads by RITES entailed a sampling approach envisaging conduct of surveys at select representative regions, which would be replicable in the case of other districts/regions with similar demographic, agricultural, mineral, commercial and industrial texture. All-India intra-regional traffic arrived at on the basis of allocation of sample results to other districts/regions has been estimated at 4,640.68 million tonnes.

## 2.3 Approach for Road Passenger Traffic Projection

2.3.1 Passenger growth projection is a difficult exercise for a variety of reasons. One is the absence of base year estimates of passenger kilometres (PKMs) travelled. Second, road passenger mode consists of a large array of choices consisting of two-wheelers, three-wheelers, passenger cars, mini-vans, buses, etc. in the personalized mode (two-wheelers and passenger cars). It is difficult to estimate the two most important parameters needed for any projection of passenger growth, viz. average occupancy and lead distances. There does not exist a system of passenger surveys in India, as it exists in developed countries. As economies grow, passenger travel is expected to grow faster owing to increased mobility. Mobility increases due to higher disposable income and improved vehicular access. Further, as technologies improve travel leads also increase.

### 2.3.2 Methodology for Road Passenger Traffic Projection

For projecting the growth of passenger traffic, two methods have been adopted, viz.

- (a) Business as Usual - In this method, the future growth of passenger traffic is assumed to follow the existing flow pattern.
- (b) Road Passenger Traffic Elasticity with respect to GDP – In this method, the elasticity of road passenger traffic, with respect to GDP in conjunction with GDP growth has been used. Based on this, three scenarios have been worked out.

#### (a) Business as Usual

2.3.3 In this method, the projection of passenger traffic is based on the growth rate of passenger traffic recorded during 1995-96 and 2005-06 which was estimated at 13 % per annum.

Based on this growth rate, road passenger traffic, in terms of PKMs, has been projected for horizon years 2011-12, 2016-17, 2021-22, 2026-27 and 2029-30 (Table 2.5):

<b>Year</b>	<b>Passenger Traffic (BPKM)</b>
2011-12	8,811
2016-17	16,171
2021-22	29,679
2026-27	54,468
2029-30	78,409

**(b) Road Passenger Traffic Elasticity**

2.3.4 The elasticity of passenger traffic with respect to GDP has been calculated based on past data of road passenger traffic<sup>1</sup> in terms of PKMs and total GDP through regression method. The road passenger traffic elasticity was observed to be 1.9 (taking the data of last 16 years). For the projection of passenger traffic growth rates, three scenarios have been adopted by taking different GDP growth rates for different horizon year.

**(i) GDP Growth Projection Scenario – I**

2.3.5 Using road passenger elasticity of 1.9 in conjunction with staggered GDP growth over the time horizon, as indicated in Table 2.6, passenger traffic has been estimated.

<b>Year</b>	<b>Elasticity</b>	<b>Assumed GDP Growth (%)</b>	<b>Passenger Traffic Growth Rate (%)</b>	<b>Passenger Traffic (BPKMs)</b>
2005-06				4252
2011-12	1.9	9	17.1	10963
2016-17	1.9	9.5	18.1	25134
2021-22	1.9	9	17.1	55341
2026-27	1.9	8.5	16.2	116989
2029-30	1.9	8	15.2	178856

\* The rate of growth has been assumed for the five year plan periods. E.g. 9.0 per cent growth rate for 2011-12 indicates that for the block years of 2006-07 to 2011-12, a growth rate of 9.0 per cent per annum was assumed. Similarly, for the other periods.

**(ii) GDP Growth Projection Scenario – II**

2.3.6 In this scenario, 9% GDP growth rates for all horizon years have been considered. In conjunction with road passenger traffic elasticity with respect to GDP of 1.9, passenger traffic has been projected over the time horizon, as indicated in Table 2.7.

<sup>1</sup> [Passenger transport services are provided both by State Road Transport Undertakings (SRTUs) and private operators. The actual BPKMs of SRTUs is available from Transport Research Wing’s publications ‘Review of Physical Performance of State Road Transport Undertakings’ compiled on the basis of information provided by the respective SRTUs. Private sector buses were assumed to perform at par with the best performing SRTUs]

<b>Table 2.7: Projected Road Passenger Traffic (Scenario II)</b>				
<b>Year</b>	<b>Elasticity</b>	<b>Assumed GDP Growth (%)</b>	<b>Passenger Traffic Growth Rate (%)</b>	<b>Passenger Traffic (BPKMs)</b>
2005-06				4252
2011-12	1.9	9	17.1	10963
2016-17	1.9	9	17.1	24139
2021-22	1.9	9	17.1	53150
2026-27	1.9	9	17.1	117028
2029-30	1.9	9	17.1	187914

**(iii) GDP Growth Projection Scenario – III**

2.3.7 In this scenario, 9.5% GDP growth rates for all horizon years have been considered. In conjunction with road passenger traffic elasticity with respect to GDP of 1.9, passenger traffic growth rate has been projected over the different time horizons, as indicated in Table 2.8.

<b>Table 2.8: Projected Road Passenger Traffic (Scenario III)</b>				
<b>Year</b>	<b>Elasticity</b>	<b>Assumed GDP Growth (%)</b>	<b>Passenger Traffic Growth Rate (%)</b>	<b>Passenger Traffic (BPKMs)</b>
2011-12	1.9	9.5	18.1	11,508
2016-17	1.9	9.5	18.1	26,383
2021-22	1.9	9.5	18.1	60,485
2026-27	1.9	9.5	18.1	138,669
2029-30	1.9	9.5	18.1	228,127

## Chapter III Road Issues

### 3.1 Present Status of Road Network in India

3.1.1 India has a large network of roads, totalling about 41.09 lakh km. The road density in India is now nearly 1.3 km per sq. km of area which compares favourably with many countries. The classification of the road system is given in Annexure 3.1. The length of various categories of roads is as under:

<b>Table 3.1: Category-wise Length of Roads</b>	
<b>Category of Road</b>	<b>Length (in km)</b>
National Highways	76,818
State Highways	154,522
Major District Roads, Other District Roads and Rural Roads	38,78,250

### 3.2 National Highways

#### 3.2.1 Importance

3.2.1.1 The National Highways Authority of India (NHAI) was constituted for execution of works on National Highways (NHs). NHs constitute the primary system of road transportation in the country. Their length stands at 76,818 km at present (growing from a length of about 21,000 km in 1947). These roads play a vital role in the national transportation endeavour in as much as they carry about 40 per cent of the total road traffic, although their length is only about 1.9 per cent of the road network. They are major carriers of road traffic across the length and breadth of the country.

#### 3.2.2 Achievements

3.2.2.1 Broad achievements made on the NH system since its inception in 1947 are reflected in Tables 3.2 and 3.3.

<b>Table 3.2: Achievements - National Highway Network</b>					
Period	Total Length*	Widening to two-lanes	Widening to four-lanes	Strengthening of Pavement	Major Bridges
	(km)				(Nos.)
1947-1969	24,000	14,000**	Nil	Nil	169
1969-1990	33,612	16,000	267	9,000	302
1990-2002	58,112	3,457	1,276	7,000	87
Tenth Plan (2002-2007)	66,590	4,177	6,769 <sup>@</sup>	8,377	611***
Eleventh Plan (2007-12)	76,818	5,107	10,949	4,621	121***
*length end of period; ** includes length of 6,000 Km already 2 Lane at the time of declaration as NH <sup>@</sup> includes 216.62 km 6 / 8-laned upto 10 <sup>th</sup> Plan *** Does not include bridge constructed / rehabilitated under NHDP					

3.2.2.2 The Central Government is responsible for the development and maintenance of NHs. The development and maintenance works are being implemented on the agency basis. The State

Governments (State PWDs), Border Roads Organisation (BRO) and NHAI are implementing the development and maintenance works on NH.

- Total Length 76,818 km
- Maintained by
  - State PWD 42,483 km
  - NHAI 30,537 km
  - BRO 3,798 km

<b>Table 3.3: Plan Wise Expansion of National Highway Network</b>		
<b>Period</b>	<b>Length added in km</b>	<b>Total length in km</b>
As on 01.04.1947		21,440
Pre-First Plan (1947-1951)	815	22,255
First Plan (1951-1956)		22,255
Second Plan (1956-1961)	1,514	23,769
Third Plan (1961-1966)	179	23,948
Interregnum Period (1966-1969)	52	24,000
Fourth Plan (1969-1974)	4,819	28,819
Fifth Plan (1974-1978)	158	28,977
Interregnum Period (1978-1980)	46	29,023
Sixth Plan (1980-1985)	2,687	31,710
Seventh Plan (1985-1990)	1,902	33,612
Interregnum Period (1990-1992)	77	33,689
Eight Plan (1992-1997)	609	34,298
Ninth Plan (1997-2002)	23,814	58,112
Tenth Plan (2002-2006)	9,008	66,590*
Eleventh Plan (2007-12)	10,228	76,818
* 530 km length of NH was de-notified in Madhya Pradesh at the behest of the State Government as the State Government insisted to develop these stretches at their own cost.		

3.2.2.3 NHs comprise only 1.9% of total road network, but carry about 40% of the road traffic. Distribution of lane wise NHs: 4-or more lanes - 23 per cent ( 17,774 km); 2-lanes - 54 per cent ( 41,518 km); and Intermediate/Single Lane - 23 per cent (17,526 km). Nearly one-fourth of the NH network is still less than 2 lane standard. Two lane roads is a minimum requirement for both safety and mobility considerations.

### **3.3 Status of State Highways and Major District Roads**

3.3.1 State Highways (SHs) and Major District Roads (MDRs) constitute the secondary system of road transportation in the country. The SHs provide linkages with NHs, district headquarters of the States and important towns, tourist centres and minor ports. The total length of SHs at present is about 154,522 km. About 101,049 km (65 per cent) of SHs have carriageways less than 2-lane standards. The position is further aggravated with movement of overloaded vehicles and presence of railway level crossings, weak and narrow bridges and culverts, congested sections passing through towns and villages. These roads also carry medium to heavy traffic. MDRs run within the districts, connecting areas of production with markets, connecting the rural areas to the district headquarters and to SHs and NHs. The total length of MDRs is at present

about 266,058 km. The position in respect of MDRs is still worse; for which about 238,049 km (90 per cent) have carriageways less than 2-lane standards.

3.3.2 By acting as linkages between rural and urban areas, SHs and MDRs contribute significantly to the rural economy as also to the industrial development of the country by enabling movement of industrial raw materials and products from and to the interiors of the country. The development and maintenance of SHs and MDRs are the responsibility of the State Governments. Because of financial constraints and an overwhelming need for provision of road links to villages, States find it very difficult to allocate the needed funds for the secondary roads.

3.3.3 As far as development of National Expressways in the Country is concerned, at present, there are only two National Expressways in the Country, viz. National Expressway No.-I (Ahmedabad-Vadodara Expressway) having 93 km length which is under operation and National Expressway No.-II (From near NH-1 near Kundli –crossing river Yamuna near Toki Manauli, crossing SH-57 near Mawi kalan-crossing river Hindon near Safiabab, NH-58 at km 27, NH-24 at km 30 and NH-91 at km 43, again crossing river Yamuna near Arwa and terminates near Palwal at NH-2 at km 64.33) having about 134 km length. NE-II has been identified for development and construction and land acquisition process and bidding process for construction of expressways have been initiated.

3.3.4 The Government approved NHDP Phase VI in November, 2006 involving the construction of 1,000 km of Expressways at an estimated cost of Rs. 16,680 crore on Design-Build-Finance-Operate (DBFO) basis. NHDP Phase-VI is targeted for completion by December, 2015. Four stretches, viz. Vadodara-Mumbai (400 km), Bangalore-Chennai (334 km), Delhi-Meerut (66 km) and Kolkata-Dhanbad (277 km), have been identified under NHDP-VI. Their alignment studies have been completed and the feasibility studies are in progress, which are expected to be completed in phases by June, 2012. It is proposed to develop a total Expressway Network of about 18,637 km, which has been accepted by the Government in December, 2009. The detailed programme of implementation, funding arrangements, investments decisions, etc. is yet to be finalized.

3.3.5 The expansion in the road network across various categories of roads has been worked out by keeping in view the expected growth in the different categories of vehicles and growth in road freight and passenger traffic, in particular. On the basis of the trend of growth during 2004 to 2009, it is tentatively estimated that the vehicles on the inter-city highways will witness a 4 to 22 fold growth during 2009 to 2031.

### **3.4 Major Arterial Road Network for 2031**

It is recommended that the Expressways, National Highways (NHs) and State Highways (SHs) should constitute the Primary Road Network in the Country (**as compared to the previous categorization of SH under Secondary Road Network along with MDR; Rural Roads (comprising of ODR and VR) are categorized as Tertiary System**). These should be supplemented by other road networks such as Major District Roads (MDRs), Other District roads (ODRs), Village Roads (VRs), etc.

**Further, the NHs and SHs should have minimum 2-lane standards carriageways.**

The necessity for augmentation of Road Network has been viewed integrally. It is presumed that the Expressways would have to essentially come up as Green Field Projects as High Speed corridors mainly to cater for fast moving vehicles. While recommending network of highways, their complementarities with other road networks have been considered.

### **3.4.1 Augmentation of National Highways Network by 2031**

3.4.1.1 Inadequate road network is a major challenge to our economic reform programme. The 20 year Road Development Plan 2001—2021 (“The Road Development Plan Vision: 2021”) prepared by the Ministry of Road Transport & Highways (MORTH) envisaged a total NH Network of about 80,000 km by the year 2021, inter-alia considering that the country had ambitious plan for GDP growth of 6-8% annually in the ‘coming years’ and improvement of transport infrastructure including its extension should be in tune with the economic growth. MORTH has received proposals for declaration of various State roads as new NHs from various State Governments / Union Territories (UTs) for a total length of more than about 64,000 km. Keeping the targeted economic growth of 9% or more, it is desirable to aim at achieving an average grid length of about 60 km for the NH Network in the country by the year 2031. This would require the total NH network length of about 100,000 km in next 20 years (i.e. by 2031). As a consequence, average length of square grid for NH Network would be around 65 km.

### **3.4.2 Establishing National Expressways Network by 2031**

3.4.2.1 The 20 year Road Development Plan 2001-2021 (“The Road Development Plan Vision: 2021”) prepared by MORTH envisaged a modest, target of development of 10,000 km length of Expressways in the Country by 2021, against a need of Expressway Network of 15,766 km by 2020. Keeping this in view, Expressway Network of about 18,637 km is envisaged by 2031.

### **3.4.3 State Highways by 2031**

3.4.3.1 The 1981-2001 Plan envisaged that NHs and SHs taken together should link all towns with population of 5,000 and above. For SHs, a target of 145,000 km was recommended. The total length of SH network at present is around 154,522 km. In respect of State level, the focus should be on consolidating the network of existing highways and go in for expansion in a limited way.

### **3.4.4 Principle/criteria for proposing Expressways, NHs/SHs**

3.4.4.1 Assuming that Expressways, NHs and SHs must pass through each of these towns, the size of the square grid to achieve this will be  $= \sqrt{(3291080/7935)} \text{ km} = 20 \text{ km}$ . Thus, the length of Expressways, NHs and SHs will be  $= 2 \times 20 \times 7935 = 317,400 \text{ km}$ .

3.4.4.2 Detailed justifications for proposing NH network of about 1,00,000 km are given at Annexure 3.2. Since, the target length of NHs for the 2031 horizon is 100,000 km, and the length of Expressways is about 18,637 km, the length of SHs will say about 200,000 km. Accordingly, this would result in about 33 km square grid. While identifying the specific linkages, emphasis is required to be given to the following aspects:

- Providing linkages with minor ports, industrial towns, pilgrimage and tourist centres
- Connecting the remaining towns with a population of 5,000 and above
- Connecting the capitals of the newly carved out States with the district headquarters.

3.4.4.3 Keeping in view the current status of development of the existing network and their overall efficiency in handling of traffic demands, it is suggested that the primary emphasis should be given on consolidation of the existing Networks rather than expanding it. It is, further, recommended that the total network of roads recommended above should be frozen even beyond 20 year horizon as it is perceived that it should be adequate to cater for future needs when adequately supplemented by development of other lower categories of roads.

3.4.4.4 The justification of declaration of State roads as NHs:-

- (i) At present MORTH has received proposals from various State Governments and UTs for declaration of about more than 64,000 km State roads as new NHs.
- (ii) The above shows that the initiative to declare new NHs is not only on part of the Central Government but the State Governments are also keen to have the State roads as new NHs.
- (iii) Further, generally there is a lack of availability of adequate funds for development and maintenance of the State roads including SHs in the States. However, at the same time there is a requirement to keep these roads in traffic worthy conditions for ensuring mobility and safety.
- (iv) When a State road is declared as new NH, in most of the cases the Central Government has to take up major development works on these roads.
- (v) In many of the cases when the State roads are being developed by State Governments in a significant way either through budgetary allocation or through public private partnership, generally such corridors or roads are not declared as new NHs as State Governments are not proposing such roads to be declared as new NHs. It is pertinent to mention in this context that one of the pre-requisites for declaring a State road as new NH is that the proposal should come from the concerned State Government.
- (vi) The philosophy behind proposing network of NH and SHs is providing connectivity to all the towns as per provisional census 2011 having a population of 5,000 and above.

### **3.4.5 Major District Roads (MDR) by 2031**

3.4.5.1 The total length of MDR network at present is around 266,058 km. Length of MDRs may be obtained by adopting about half the size of square grid for SH. Accordingly, a length of 400,000 km of MDRs (twice that of the length of SHs) could be considered a reasonable target for the year 2031. The total length of MDR network at present is around 266,058 km. Length of MDRs may be obtained by adopting about half the size of square grid for State Highways. Accordingly, a length of 400,000 km of MDRs (twice that of the length of SHs) could be considered a reasonable target for the year 2031.

### **3.4.6 National Highways and National Expressways – Initiatives taken so far**

**3.4.6.1 National Highways Development Project (NHDP):** - The Government has taken up major development works on NHs. Various phases of National Highways Development Project (NHDP) envisage improvement of about 53,500 km length (net length of about 47,050 km excluding overlapping reaches) of NHs. Apart from this, NHDP Phase-VI envisages the development of about 1,000 km length of Expressways. The details are as indicated in Tables 3.4 and 3.5.

<b>Table 3.4: Various Phases of National Highways Development Programme</b>			
<b>Phase</b>	<b>Name of Project</b>	<b>Length (km)</b>	<b>Estimated Cost (Rs. Crore)</b>
NHDP Phase-I	4-laning of 5,846 km of Golden Quadrilateral, 981 km of NS-EW corridors, 356 km Port connectivity, 315 km other	7,522	30,300
NHDP Phase-II	4-laning of 6,161 km of NS-EW corridors, 486 km other NHs	6,647	34,339
NHDP Phase-III	4-laning of 12,109 km of NHs	12,109	80,626
NHDP Phase-IV	2-laning with paved shoulders of 20,000 km of NHs	20,000	27,800
NHDP Phase-V	6-laning of 6,500 km of selected stretches of NHs	6,500	41,210
NHDP Phase-VI	Development of 1,000 km of Expressways	1,000	16,680
NHDP Phase-VII	Construction of ring roads, flyovers and bypasses on selected stretches in cities/towns	-	16,680
<b>Total</b>		<b>53,778</b> *	<b>247,635</b>
* includes about 47,078 km of total NHs other than overlapping lengths of NHs (about 5,700 km common under NHDP-I and NHDP-V)			

**Table 3.5: Status of NHDP as on 31.3.2012 (Provisional)**

<b>Phases</b>	<b>Total Length (km)</b>	<b>Length Completed upto 11<sup>th</sup> Plan (prov.) (km)</b>	<b>Length under Implementation (km)</b>	<b>To be awarded (km)</b>	<b>Balance Length to be completed in 12th Plan (km)</b>
I – GQ,EW-NS corridors, Port connectivity & others	7,522	7,484	38	0	38
II – 4/6-laning North South- East West Corridor, Others	6,647	5,499	704	444	1,148
Upgradation, 4/6-laning Phase III	12,109	3,643	6,626	1,849	8,475
IV – 2 - laning with paved shoulders	20,000	0	3,318	16,682	20,000
V – 6-laning of GQ and High density corridor	6,500	913	3,068	2,519	5,587
VI – Expressways	1000	0	0	1,000	1,000
VII – Ring Roads, Bypasses and flyovers and other structures	700 km of ring roads/ bypass + flyovers	11	30	659	689
<b>Total</b>		<b>17,550</b>	<b>13,784</b>	<b>23,153</b>	<b>36,937</b>

**Table 3.5.1: Mode of delivery wise physical completion of NHDP (in km) during 10<sup>th</sup> Five Year Plan (2002-07) and 11<sup>th</sup> Five Year Plan (2007-12)**

<b>Total Length completed (in km) under NHDP during 2002-07(Tenth Five Year Plan)</b>	
<b>BOT(Annuity)</b>	<b>475.56</b>
<b>BOT(Toll)</b>	<b>401.38</b>
<b>EPC</b>	<b>4365.03</b>
<b>SPV</b>	<b>203.74</b>
<b>Total</b>	<b>5445.71</b>
<b>Total Length completed (in km) under NHDP during 2007-2012 ( Eleventh Five year Plan)</b>	
<b>BOT(Annuity)</b>	<b>1074.05</b>
<b>BOT(Toll)</b>	<b>5214.44</b>
<b>EPC</b>	<b>4121.37</b>
<b>SPV</b>	<b>204.63</b>
<b>Total</b>	<b>10614.49</b>
<b>Grand Total</b>	<b>16060.2</b>

### **3.4.6.2 Special Accelerated Road Development Programme for North-East region (SARDP-NE) including Arunachal Pradesh Package:**

MORTH has also taken development initiatives in the North-East States under the SARDP-NE programme. Phase 'A' of SARDP-NE approved by the Government envisages improvement of about 4,099 km length of roads (NH-2,041 km + State roads & other roads – 2,058 km) and it is expected to be completed by March, 2017. So far, about 892 km length has been completed under SARDP-NE Phase-A till March, 2012. Phase 'B' of SARDP-NE, covering 3,723 km has been approved for DPR preparation only and so far DPRs for about 450 km has been completed. The Department of Expenditure suggested that the implementation of Phase 'B' of SARDP-NE may be taken up during the 12th plan due to constraint of funds. The target for completion of sanctioned works is March 2015.

The Arunachal Pradesh Package for Road and Highways involving development of about 2,319 km length of road (1,472 km is NHs and 847 km is State/General Staff/Strategic roads) has also been approved by the Government, which is targeted for completion by June 2016. Projects on 776 km are to be taken up on BOT (Annuity) mode and the balance 1,543 km is to be developed on EPC basis. The target for completion of sanctioned works is June 2016. The status of Projects under this Programme is as follows: -

BOT (Annuity) Projects – 2 Projects awarded in 58 km costing Rs. 1,553 crore; tendering for third time completed for remaining 2 projects for balance 718 km and projects are on the verge of award.

EPC Projects –sanctioned 359 km; under tendering 25 km; under process for sanction 118 km; DPRs under preparation for balance 900 km;

### **3.4.6.3 Improvement of Road Connectivity in Left Wing Extremism (LWE) affected areas:**

The Government has also taken up a programme for the development of about 5,477 km (1,126 km of NH and 4,351 km of State Roads) in Left Wing Extremism (LWE) affected areas as a special project estimated to cost about Rs. 7,300 crore in 34 districts in eight states namely in Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh. Development of 1,084 km length has been completed by March, 2012. It has been targeted to complete all the works by March, 2015.

### **3.4.6.4 Additional proposals for inclusion in Road Requirement Plan (Phase II):**

Investment approval of Rs. 10,700 crore for development of 8,014 km road stretches under RRP phase II spread over 34 districts in 8 States is also proposed to be obtained. CCI Note for the same is under consideration in MORTH. The development of roads under Phase II of RRP is likely to be completed by March, 2017.

### **3.4.6.5 Development of Vijayawada Ranchi route**

Development of 600 km of State Roads in Odisha to 2-lane, not covered in any Central or State Schemes (out of 1,632 km long LWE affected Vijayawada Ranchi route) at a cost of Rs. 1200 crore has been approved by CCI on 4th November, 2010.

The works are likely to be completed by March, 2016.

### **3.4.6.6 Special Programme for 2-laning of entire balance NH network not covered under any approved programmes: -**

Out of the total NH length of 76,818 km, the total balance length of NHs not covered under any programme is about 23,500 km. Out of this, about 10,000 km are less than 2-lane standards, i.e.

less than the minimum stipulated standards for NHs. MORTH has taken initiatives to develop/upgrade about 4,614 km length of such stretches of NHs to 2-lane standards following Corridor Development Approach by December 2014 through budgetary resources [1,564 km of less than 2-lane NHs] and also through possible Loan Assistance from the World Bank [3,770 km having 3,050 km length of less than 2-lane NHs]. The balance length of about 5,400 km length of NHs having less than 2-lane NH standards are required to be upgraded to minimum acceptable 2-lane NH standards also. Total length proposed to be taken up through World Bank funding is about 3,770 km. The DPRs are under preparation for these projects proposed to be funded through World Bank loan assistance.

### **3.4.6.7 Development of NHs entrusted with State PWDs which are not covered under any approved programmes such as NHDP, SARDP-NE, etc.:**

The development works on NH entrusted with State PWDs (which are not covered under any approved programmes) are taken up through the Annual Plan of works during every financial year. Various types of development works on NHs, such as widening, strengthening of weak pavements, construction of missing links, construction/rehabilitation/reconstruction of bridges, culverts, bypasses and improvement of riding qualities, etc., are identified and included in the list of Annual Plan of National Highways (Original) {NH(O)} works well in advance of the beginning of a particular financial year (e.g. By February of preceding financial year) in order of priority.

## **3.5 Assessment of Investment Needs (upto 2031)**

### **3.5.1 National Highway Development Programme**

3.5.1.1 Under NHDP a balance length (expansion and improvement) of 39,095 Km spread across various phases is to be completed during the 12<sup>th</sup> Plan Period and beyond. The status of progress under NHDP is given in Table 3.6.

<b>Phases</b>	<b>Total Length (km)</b>	<b>Length Completed (km) end March 2012</b>	<b>Length to be completed (km) Beyond March 2012</b>
NHDP-I GQ,EW-NS corridors, Port connectivity, etc.	7,522	7,484	38
NHDP-II 4/6-laning N-S,E-W corridors etc	6,647	5,499	1,148
NHDP-III Upgradation, 4/6-laning	12,109	3,643	8,466
NHDP-IV 2 - laning with paved shoulders	20,000	0	20,000
NHDP-V 6-laning of GQ and High density corridor	6,500	913	5,587
NHDP-VI Expressways	1,000	0	1,000
NHDP-VII Ring roads, bypasses, flyovers, etc.	700 km of ring roads / bypass + flyovers	11	689

The estimated fund requirement for NHDP for 2012-31 and its sources are given in Table 3.7.

**Table 3.6: Sources of Funds for NHDP (2012-31) at 2011-12 prices Rs Crore**

Sl No.	Scheme	Likely sources of Funds				
		2012-17	2017-22	2022-27	2027-31	Total (2012-31)
1	NHAI (Investment) (Cess)	52,881	70,667	90,967	91,256	2,14,515
2	External Assistance	225	0	0	0	225
3	Remittance of toll receipts	27,200	41,166	49,980	50,588	1,18,346
4	NHAI (ABS for J&K package, etc.)	8,342	16,205	16,155	9,836	40,702
5	IEBR / Borrowings by NHAI	64,834	685	0	0	65,519
	<b>Sub Total</b>	<b>1,53,482</b>	<b>1,28,723</b>	<b>1,57,102</b>	<b>1,51,680</b>	<b>4,39,307</b>
6	Private sector Investments (NHDP)	1,82,230	7,287	0	0	1,89,517
	<b>Total</b>	<b>3,35,712</b>	<b>1,36,010</b>	<b>1,57,102</b>	<b>1,51,680</b>	<b>6,28,824</b>

### 3.5.2 SARDP-NE including Arunachal Pradesh Package

3.5.2.1 Out of the total length of about 10,141 km length of roads (4,798 km NH and 5,343 km State roads) under SARDP-NE and Arunachal Package, about 892 km length of NHs have been developed upto 31.3.2012. Therefore, balance length of about 9,249 km has to be developed on priority.

3.5.2.2 The estimated fund requirements for the above programme from GBS (including estimated Annuity payments to be made to the Concessionaires) are as follows: -

- (i) Fund requirement from GBS for Phase A including Arunachal Package (including Annuity payments to be made from GBS) – Rs. 34,283 crore
- (ii) Fund requirement from GBS for Phase B – Rs. 26,926 crore
- (A) Total fund requirements from GBS [(i) + (ii)] – Rs. 61,209 crore

### 3.5.3 Special Programme for development of Roads in the LWE affected areas (phases-I and II)

**Phase-I (approved):-** Out of total length of about 5,477 km, about 4,393 km would remain to be completed during 12 Plan requiring an investment of about Rs. 5,409 crore from GBS.

**Vijayawada – Ranchi corridor (State road portion):-** Total length of 600 km is targeted to be completed during 12<sup>th</sup> plan for a total estimated investment of Rs. 1,100 crore from GBS.

**Phase-II (yet to be approved):-**

Total length of about 8,014 km to be completed in 12<sup>th</sup> Plan for a total estimated investment of about Rs. 10,700 crore from GBS.

### **3.5.4 Special Package for the Development of Road Corridors for Delhi-Mumbai Industrial Corridor (DMIC) Project for Maharashtra and Rajasthan region on pilot basis**

3.5.4.1 The Government has approved the proposal for Development of various Investment Regions (Irs) (minimum area of over 200 sq. km) and Investment Areas (minimum of 100 sq. km) under Delhi-Mumbai Industrial Corridor (DMIC) project. For development of these identified Irs and Ias in phased manner, Delhi Mumbai Industrial Corridor Development Corporation (DMICDC) has been set up. A Dedicated Freight Corridor (DFC) of about 1,483 km length connecting Delhi-Mumbai is also being developed by Ministry of Railways to support these Irs and Ias. For efficient hinterland dispersal traffic generated on account of the DFC and anticipated future demands on account of proposed development of Irs/Ias, DMICDC has been persistently making requests to MORTH to give special emphasis for development of road corridors necessary for these Irs and Ias.

3.5.4.2 However, since most of these road infrastructure are required to be developed ahead of their demand in order to catalyze and accelerate the development of these Irs and Ias, MORTH is proposing the development of primarily 4-lane road connectivity for 3 Irs /Ias on pilot basis (viz. (i) Dighi Port connectivity and (ii) Shendra – Bidkin Mega Industrial Park connectivity in Maharashtra and Neemrana-Khushkhera-Bhiwadi Investment Region in Rajasthan) under a Special Programme on the same analogy as that of SARDP-NE or Special Programme for Development of Roads in LWE affected areas. The total length of roads of about 821 km is proposed to be developed during 12<sup>th</sup> Plan for these Irs / Ias. The total budgetary allocation required for the above mentioned projects during the 12<sup>th</sup> Five Year Plan is Rs. 14,425 crore.

3.5.4.3 It is proposed to develop road connectivity for the remaining 11 (eleven) Irs / Ias. Tentatively, the total road length (primarily 4-lane) required to be additionally developed @ about 150 km per IA / IR is estimated to be about 1,650 km. The estimated budgetary allocation required for developing these road connectivity @ about Rs. 15.75 crore per km (including LA cost @ Rs. 1 crore per Ha) is about Rs. 26,000 crore. Therefore, the total estimated fund requirement for developing about 2,471 km length of primarily 4-lane roads for these Irs / Ias is about Rs. 40,425 crore. However, it is proposed that the budget for these projects may be provided over and above the other schemes under Central Sector Roads.

### **3.5.5 Special Package for Development of State Roads in the State of Jammu & Kashmir from strategic considerations**

3.5.5.1 The State Government of Jammu & Kashmir had submitted a proposal for development of some identified State roads for providing better connectivity to the militancy affected areas in the State on the analogy of Special Programme for Development of Roads in LWE affected areas. The Ministry requested the State Government of Jammu & Kashmir in June 2011 to take up the matter with the Ministry of Home Affairs for identification and allocation of funds for development of these roads as a Special Package on the same analogy for roads in LWE affected areas.

3.5.5.2 Accordingly, the State Government of Jammu & Kashmir submitted the revised proposal for developing the identified roads (103 nos. of projects involving about 1,000 km length) in August 2011 to the Ministry of Home Affairs for a total estimated cost of Rs. 932 crore. Ministry of Home Affairs vide their letter dated 15.9.2011, requested this Ministry to take up further necessary action in this matter. Considering the necessity of developing these roads from

strategic considerations, it is proposed to take up their development under a Special Package for a total estimated cost of Rs. 932 crore. However, it is proposed that the funding for these projects may also be additionally allocated over and above the other schemes under Central Sector Roads.

### **3.5.6 Road Connectivity to Minor Ports: -**

3.5.6.1 The programme to provide road connectivity to Major Ports (primarily by 4-lane NHs / road) was taken up under NHDP-Phase-I through SPV mode. The total length of NHs / roads identified for upgradation/development under this programme was about 380 km. Out of this, works have been completed in about 324 km length. Works in balance length of about 56 km are in progress.

3.5.6.2 The equity partners for these projects were NHAI, Port Authorities and the concerned State Governments. Due to exorbitant borrowing rates quoted by financial institutions as projects were not found viable, NHAI arranged sub-debt also for these shelf of projects. The equity participation of ports were inadequate for these projects. Therefore, NHAI had to provide debt to SPVs by leveraging cess fund.

3.5.6.3 Apart from this, Land Acquisition, Utility shifting and Rehabilitation & Resettlement matters for the port connectivity projects caused lots of difficulties leading to time and cost overruns. There is a great need for active participation and cooperation from Port Trust and State Governments.

3.5.6.4 Government of India constituted a Committee of Secretaries in March, 2005 to establish policies and priorities for improving port connectivity. The key recommendations of this Committee relevant to improvement of road connectivity were: -

- (a) Each Major Port to have at least 4-lane road connectivity;
- (b) For those connectivity projects having a lower than prescribed rate of return, budgetary assistance, or VGF in the case of PPP projects, may be considered;
- (c) NHAI shall undertake port connectivity (less than 50 km) projects on a BOT basis, and hinterland connectivity highway projects on a BOT basis where possible;
- (d) Toll rates for highway port connectivity projects to be established jointly by NHAI and Department of Shipping;
- (e) Ongoing 10 port connectivity projects are to be monitored on a quarterly basis and pending approvals to be expedited.

3.5.6.5 The balance works under Port connectivity programme under NHDP-I would be completed within the first half of the 12<sup>th</sup> Plan. Whereas the Committee's recommendations helped focus attention on the connectivity issues faced by Major Ports, it is also important to give attention for developing road connectivity to minor ports. In recognition to the above aspect, the criteria for declaration of a road as new NH have been amended by MORTH in consultation with the Planning Commission in the year 2011 to also include connectivity to non-major ports as one of the criteria.

3.5.6.6 NHAI has taken some initiatives to develop NH / road connectivity to the minor ports at Mundra, Hazira, Machilipatnam, Dighi and Jaygad. The brief status is as follows: -

- (i) The concession for Gandhidham – Mundra Section of NH-8A (Extn.) has been awarded in March, 2010 under NHDP-III with TPC of Rs. 953.80 crore. The project is targeted for completion in September, 2012.
- (ii) The concession for the 4-laning works of Maharashtra / Gujarat border – Surat – Hazira section of NH-6 in Gujarat has been awarded under NHDP-III in 2009 for TPC of Rs. 1,509.10 crore. The project is targeted for completion in September, 2012.
- (iii) RFQ for development of Vijayawada – Machilipatnam section of NH-9 in Andhra Pradesh under NHDP-III has been invited. The estimated TPC is Rs. 618 crore.
- (iv) The work of feasibility cum DPR preparation for project of 4-laning of road connectivity to Dighi and Jaygad Ports in the State of Maharashtra under NHDP-VII has been awarded in June, 2011.

3.5.6.7 However, keeping in view the volume of non-Major ports in the country, following broad approach may be considered for developing their road connectivity:

Assuming Road Connectivity for 100 minor ports, Fund requirement for average 20 km 2 lane road for 100 minor ports @ Rs. 5 crore/km = Rs. 10,000 crore. However, the allocation for taking up these works may be additionally provided under GBS over and above the allocations under other Central Road Sector Schemes.

### **3.5.7 Special Package for development of Road Connectivity to Airports**

3.5.7.1 Airports, being a part of time-sensitive aviation sector, require smooth connectivity and access. Therefore, development of multi-modal connectivity, particularly, road access to the airport is vital to ensure seamless transportation across the country and, accordingly, needs to be factored in the city Master plan when planning road net work/road corridors and NH.

3.5.7.2 The Ministry of Civil Aviation and the Airports Authority of India have identified specific road connectivity development needs for 24 such Airports which need creation of new approach roads, widening of existing approach road, provision of flyovers with clover leaves and grade separators to de-congest and streamline the moving traffic at road junctions, etc. These airports are Lucknow, Jammu, Dehradun, Kishangarh (proposed), Chandigarh (Mohali side), Agra, Allahabad, Ahmedabad, Bhopal, Goa (Dabolim), Indore, Jabalpur, Trivandrum, Coimbatore, Calicut, Mangalore, Guwahati, Imphal, Dimapur, Shillong, Patna, Raipur, Mysore and Hubli.

3.5.7.3 Considering on an average development of 15 km road connectivity at an average cost of Rs. 5 crore per km, the total estimated cost of development of road connectivity to these 24 airports during the 12<sup>th</sup> Plan is about Rs. 1,800 crore. The allocation for taking up these works may be additionally provided under GBS over and above the allocations under other Central Road Sector Schemes.

### **3.5.8 Special Package for development of roads under Tribal Sub-Plan**

3.5.8.1 Keeping in view the emphasis given by the Government to develop Scheduled Areas (i.e. the areas defined as Scheduled Areas as per Fifth Schedule under Article 244 (1) of the Constitution inhabited by Tribal population), it is proposed to take up development of primarily State roads in such areas (viz. in the districts identified in the Scheduled areas in the States of Andhra Pradesh, Himachal Pradesh, Gujarat, Odisha, Rajasthan, Maharashtra, Chhattisgarh, Madhya Pradesh and Jharkhand) under Special Package under Tribal Sub-Plan. This programme

is intended at taking up development of roads in regions / districts other than those covered under the Special Programme for development of Roads in the LWE affected areas undertaken under Phase-I / proposed to be undertaken under Phase-II. This is also considered essential for enabling an equitable socio-economic development of these scheduled areas to bring them into national mainstream.

3.5.8.2 It may be considered to take up development of about 4,000 km length of roads to 2-lane standards @ Rs. 5 crore / km estimated cost (including cost of LA, utility shifting, etc.) in these scheduled areas in the above mentioned States entailing a total GBS requirement of Rs. 20,000 crore.

### **3.5.9 Expressways**

3.5.9.1 For providing unhindered and high speed movement of traffic, it would be necessary to go in for expressway type facilities. It needs to be appreciated that many of the corridors where four-laning is being done now will again get saturated in 5 to 10 years time. A target of 18,637 km for expressways for the next 20 years has been recommended earlier based upon the Master Plan prepared by MORTH. It would be desirable to initiate detailed investigations on the promising corridors to fix up alignment and start the process of freezing land. These expressways should be built mainly on the principle to fix up alignment and start the process of freezing land. The development of these Expressways shall be in addition to the initiatives taken up under NHDP-Phase-VI to develop about 1,000 km length of Expressways, alignment studies for which have already been finalized and Project Reports are presently under preparation (viz. Vadodara-Mumbai (400 km), Delhi-Meerut (66 km), Bangalore-Chennai (334 km) and Kolkata-Dhanbad (277 km).

3.5.9.2 These expressways should be built mainly on the principle of toll financing. However, it appears that these projects may not be attractive to investors/developers to develop on BOT basis, at least in the initial phases. Therefore, it would be desirable for the Government to take the initiative to develop some of the Expressway corridors from budgetary support, say e.g. at least about 2,500 km length of Expressways; efforts may be made based on the experiences gained to develop the entire network of Expressways through PPP mode inter-alia by exploring the feasibility of taking up projects by giving already developed expressway stretches as sweeteners.

3.5.9.3 Further, it is also recommended that Closed System of Tolling with ITS application (viz. ETC, etc.) may be followed for the National Expressways Network equipped with State-of-Art Advanced Traffic Management System (ATMS) including integrated Way-side facilities, facilities to provide real-time and advance information for Users, etc.

The following Action Plan may be considered particularly for development of Expressways Network in the country: -

- Take up few Pilot Projects through “budgetary resources”.
- Explore feasibility of obtaining External Loan Assistance including Technology Transfer arrangements from abroad, if necessary.
- Observe impacts on Regional Traffic re-distribution / diversion pattern depending upon amount of toll levied to decide future course of action for enhancing network.
- Due emphasis for preserving ecology and environment.

- Develop expressways as fully access controlled facilities by developing closed system of tolling with introduction of ITS, including ETC system, for operation and maintenance and enhancement of safety.
- Traffic segregation and discouraging 2 / 3 wheelers on expressways including tractors, etc.
- Development / construction of “Urban Links” to National Expressways Network.
- The programme would need to be implemented jointly by the Central and State Governments with participation of the private sector.
- Institutional strengthening with development of adequate in-house capabilities and sufficient numbers of skilled personnel.
- Thrust on R&D and acquiring State-of-Art Technologies.
- Encourage formation of JV of Indian contractors with overseas contractors along with Technology Transfer arrangements.

3.5.9.4 Tentatively, it would involve a GBS requirement of Rs. 338,238 crore (including cost of Land Acquisition, utility shifting, project preparation, Viability Gap Funding upto maximum ceiling of 40% of TPC and also the TPC for the projects to be funded by GBS) and private sector investment of Rs. 222,690 crore.

<b>Table 3.8: Proposed Expansion of Expressways and Investment Requirements:2012-32</b>					
	2012-17	2017-22	2022-27	2027-32	2012-32
	<b>Length in km</b>				
Expressways	500	2,500	7,500	8,137	18,637
<b>Investment Requirements for Expressways (Rs Crore in 2011-12 prices)</b>					
Total	15,525	86,975	2,30,920	2,66,792	6,00,212
i. Budgetary Allocation	39,322*	70,415	1,25,707	1,39,978	3,75,422
ii. Toll remittances	90		1,500	500	2,090
iii. Private Investment	4,140	16,560	89,700	1,12,300	2,22,700

\* - includes cost of LA for 3,530 km length under Phase-I

### 3.5.10 Non-NHDP National Highways: -

The physical achievements under non-NHDP during the Eleventh Five Year Plan are given in Table 3.9.

Sl. No	Category	10 <sup>th</sup> Five Year Plan		Eleventh Five Year Plan									
				2007-08		2008-09		2009-10		2010-11		2011-12	
		T	A	T	A	T	A	T	A	T	A	T	A*
1	Missing Link (km)			22	36	26	16	8.8	3.2	2.6	0.1	-	-
2	Widening to 2-lanes (km)	4,529	4,177	919	950	1,176	1,153	1,321	1,234	1,117	1,042	1,070	782
3	Strengthening of weak 2-lanes (km)	2,201	3,510	577	911	706	1,010	1,058	1,013	1,213	1,016	1,080	675
4	Improvement of Riding Quality (km)	10,613	16,250	1,602	1,657	1,350	2,470	2,510	3,168	2,307	2,026	1,672	2,510
5	Widening to 4-lanes (km)	800	157	34	36	51	63	80	69	137	99	104	74
6	Bypasses (No.)	25	16	3	6	8	4	6	0	15	3	7	3
7	Bridges /ROBs (No.)	300	604	107	86	92	77	132	122	187	103	129	92

T: Target; A: Achievements; \* Provisional.

### 3.5.10.1 Two-laning

The target should be to have the entire NH Network, including the proposed addition to the NH Network, of at least 2-lane NH standards. This should be considered as paramount importance keeping in view the requirement of promoting enhancing energy efficiency of traffic (in terms of reduced fuel consumption), more environment friendly (i.e. minimising pollution / emission levels) travel besides enhanced safety. This would imply strengthening of the existing weak and sub-standard 2-lane NH stretches to proper 2-lane NH standards including reconstruction / rehabilitation of weak / damaged bridges, geometric improvements including realignments, etc.

The above would involve giving priority to development of balance NH stretches of about 10,000 km (out of the total NH Network of about 76,818 km at present) having less than 2-lanes at present to proper 2-lane NH standards primarily following item-rate / EPC contracts. Also the balance estimated sanctioned work of 2-laning of NHs spill over in the 12<sup>th</sup> Plan would be about 1,710 km. Besides, it is also recommended that priority may be accorded to bringing the entire target NH Network of 1,00,000 km (i.e. inclusive of the additional length of new NHs of about 29,000 km proposed to added during the 20 year horizon) also to proper 2-lane NH standards.

Keeping in view the thrust given by the Government to take up more and more project on BOT basis through PPP mode and also its obvious implicit advantage to enable leveraging of more resources from the private sector and financial institutions, etc., it is also recommended that possibility may be explored to take up development to proper 2-lane NH standards of about at least 40 % of the total stretches (i.e. on a total length of about 12,000 km) on BOT basis. However, the existing toll policy allowing levy of toll on 2-lane NHs on which average investment for upgradation exceeds Rs. 2.50 crore per km (1<sup>st</sup> April, 2008 prices) is also required to be reviewed to fix toll rates rationally. Development of the balance length of about 17,000 km to proper 2-lane NH standards may be taken up following conventional item-rate/EPC contracts through budgetary allocations. However, the feasibility may be explored to put maximum lengths of such stretches on Operate-Maintain-Transfer (OMT) Contracts after their

development. The above would involve an investment of about Rs. 1,36,140 crore from GBS (including external assistance of about Rs. 10,100 crore), toll remittances of about Rs. 6,020 crore and private sector investment of about Rs. 32,715 crore for the 20 year period. The present policy of tolling 2-laning NHs should be discontinued on account of the following reasons: -

- The Government is not purely a corporate structure operating primarily on cost benefit aspects of a business model where revenue generation becomes the main objective. The Government also has social responsibilities and obligations to be discharged towards the public at large. The moment the Government agrees to declare any road as a NH, it is obliged to bring the road to a certain minimum level, i.e. at least a two-lane facility with a reasonably good riding surface. While, this is a fact that we have not been able to do so due to constraint of funds, it is also inappropriate that we tax the commuters for meeting our minimum basic social obligations.
- (ii) While the policy may appear to make some economic sense in theory, we have no idea of the consequences the same may have upon implementation.
- The issue of tolling was discussed in the recently held Chief Engineers Meeting as part of the Indian Roads Congress session at Lucknow. There was an unanimous opinion against tolling of NH upto 2-laning with pave shoulder configuration. There is substance in the supposition because as long as we do not provide a safer mode of travel by means of a divided carriageway, we do not have a moral right to charge the commuters for these basic needs.
- Tolling of 2-laned NHs also need to be assessed from the perspective of benefits accruing to road users in terms of savings in Vehicle Operating costs (VOCs), travel time costs, on account of post development enhanced road safety features, etc.

#### **3.5.10.2 Four-laning/Six-laning**

Whenever existing 2-lane NHs are to be developed to 4-lane divided carriageway facilities or more, the same should be developed as fully access controlled facilities with closure of all median openings, replacing of all at grade intersections by grade separated intersections, providing vehicular, pedestrian and cattle underpasses, segregation of slow moving traffic by providing service roads / alternate road connectivity wherever required, etc. This is desirable from the perspective of Road Safety. In case it is not possible to do so, feasibility shall be explored to develop separate fully access controlled facilities, i.e. expressways (either as a green field project, or along any other feasible alignment) having 4 or more lanes with divided carriageway if the traffic on the existing 2-lane NH corridors exceed its design service volume.

It is envisaged that leaving apart the ongoing phases of NHDP (viz. NHDP-Phases-I to VI and NHDP-Phase-VII), there may be requirement to upgrade about another 25,000 km length of NHs to 4-lane divided carriageway facilities or more having the above mentioned features. It is recommended the possibility may be explored to develop these entire lengths of NHs to 4-or more lane standards through PPP mode. This would involve an investment of about Rs. 192,500 crore from GBS (to meet the requirement of Land Acquisition, Utility shifting, project preparation and Viability Gap Funding (VGF) considering average requirement of 30 % of TPC for individual project) and private sector investment of about Rs. 201,250 crore for the 20 year period. Development of the proposed Expressways Network of about 18,637 km length, along with 4-laning of about 25,000 km length of NHs beyond ongoing phases under NHDP should enable addressing optimal and efficient traffic dispersal needs with due regard to capacity requirements.

It is strongly advocated that widening of existing facilities to 6-lane standards should not be undertaken unless the facility is made fully access controlled with segregation of slow moving vehicles all along the corridors by providing service lanes.

There is need to address the following issues upfront, where 6-laning has to be provided by government.

- Access management and improving control of access
- Incident management system
- Absence of expressway

However, it is required to examine feasibility of providing service roads, etc. on four lane roads in the first instance.

### 3.5.10.3 Correlation of traffic estimation with length of NH / SH and length proposed for 4-laning, etc.: -

(i) Estimation of Growth Rates: The future growth rate of vehicle fleet, on which depends the passenger and goods movement, can be estimated from:

- Past trends of vehicle population growth
- Past trends of relation between vehicle number and GNP

The growth rate of cars, buses and trucks on an all-India basis and for States for the period 2004 to 2009 for individual vehicle types is given in Table 3.10. Assuming that the past trend continues without any upward rise, the road vehicle fleet for the year 2031 as compared to the year 2009 are estimated to grow as follows: -

<b>Table 3.10: Expected Growth of Road Vehicle Fleet in 2031</b>			
<b>S. No.</b>	<b>Vehicle type</b>	<b>Rate of Growth during 2004 to 2009 (%)</b>	<b>Ratio of 2031 number to 2009 number</b>
1.	Multi Axled/Articulated Vehicles/ Trucks	7.1	4.5
2.	Light Motor Vehicles (Goods)	14.4	19.2
3.	Light Motor Vehicles (Passengers)	7.7	5.1
4.	Buses	15.2	22.5
5.	Taxis	7.7	5.1
6.	Cars	11.2	10.4
7.	Jeeps	5	2.9
8.	Omni Buses	10	8.2

It may, therefore, be tentatively presumed that the vehicles on the inter-city highways will witness a 4-22 fold growth during 2009-2031.

(ii) The growth in road freight and passenger traffic, estimated under four different scenarios (viz. Business as Usual, staggered GDP growth, 9 % GDP growth and 9.5 % GDP growth): - these are expected to be 2.5 to 7 times and 10 to 20 times, respectively, in the next 20 years. However, in the absence of any specific studies, it is difficult to establish a definite co-relation between the projected growth rate of traffic and the network length of NHs and SHs including the requirements to widen the network to 4/6-lanes, etc.

Apart from NHDP and ongoing 4-laning initiatives, whenever existing 2-lane NHs are to be developed to 4-lane divided carriageway facilities or more, the same should be developed as fully access controlled facilities with closure of all median openings, replacing of all at grade intersections by grade separated intersections, providing vehicular, pedestrian and cattle

underpasses, segregation of slow moving traffic by providing service roads / alternate road connectivity wherever required, etc. This is desirable from the perspective of Road Safety. In case it is not possible to do so, feasibility shall be explored to develop separate fully access controlled facilities, i.e. expressways (either as a green field project, or along any other feasible alignment) having 4 or more lanes with divided carriageway if the traffic on the existing 2-lane NH corridors exceed its design service volume.

#### **3.5.10.4 Riding Quality**

Efforts should be made to maintain the Riding Quality of the pavements for the entire NH network excluding the segments proposed for widening/strengthening to proper 2-lane NH standards or more and those in fairly good condition and are expected to remain so for a period of 3 years or more (after which normal maintenance works may suffice to keep them in traffic worthy conditions). It is pertinent to mention in this context that for improving energy efficiency in the road sector, riding quality improvements is also critical operational aspects that contribute to fuel efficiency and higher transport productivity.

Tentatively, it is estimated that Riding Quality of about 30,000 km may need to be improved during 20 year horizon with fund requirement of about Rs. 22,500 crore.

#### **3.5.10.5 Bypasses and Over Bridges**

It is necessary to provide bypasses for congested urban links. For cities with population above 1 million on the NH Network, it is recommended that a desirable strategy would be to plan for bypasses in the form of peripheral expressways to interlink the highways radiating from these cities. Further, there should be no railway level crossings on NH Network and all existing level crossings on NH Network should be replaced by Road Over / Under Bridges. A phase-wise programme may be drawn up accordingly depending upon the traffic and number of gate closures.

#### **3.5.10.6 Bridges**

There are several bridges on the existing NH network that are showing signs of distress. It has been estimated that at present there are more than about 1,650 dilapidated bridges on the existing NH Network of 76,818 km length, which are required to be rehabilitated / reconstructed.

It is necessary to plan for systematic inspection of all bridge structures, diagnosis of ill-health and formulation of remedial strategy for execution on a defined time-frame.

A system of maintaining and updating database on Bridge Inventory and their conditions needs to be set up for enabling timely decision making regarding formulating their maintenance strategies. Development of Bridge Management System (BMS) may be considered to be set up in a time bound manner for this purpose.

**3.5.10.7. The development of road connectivities has to also cater for emergence of a large no. of million plus cities, SEZs, etc. The requirements projected for the horizon period of 20 years for Expressways, NHs, SHs, MDRs, etc., at relevant paragraphs are perceived to be adequate in this context.**

#### **3.5.10.8 Amenities**

In our modernisation effort, attention also needs to be focused on the provision of proper wayside amenities along main roads for road users and truck drivers/operators with facilities like

parking lots, drinking water, toilets, snack bars/restaurants, rest rooms, kiosks, information facilities, petrol pumps with service and repair facilities and communication systems. Roadside rest areas may be viewed as integral to the network. Private sector may be encouraged and supported to provide for such amenities.

It is important the wayside amenities be integrally planned and developed along with Expressways and all projects for 4-laning / 6-laning of NHs. Due provision is required to be made for LA, etc. while conceptualizing and preparing such project reports. If the project is to be developed on BOT (Toll) basis, the concessionaire may develop the facilities and operate the same during the concession period or even after that. For projects developed through BOT (Annuity), Concessionaire may develop the facilities and the Government may consider entrusting operation and maintenance of the facilities through private participation. For projects developed through GBS funding, the facilities may be integrally developed by the Government and entrusted to private sector for operation and maintenance. Broadly, the Integrated Way-side amenities may have the following features: -

- Facilities to be owned by Government operating / construction agencies.
- Operation and maintenance of individual facilities in the wayside amenities through lease on profit sharing basis with private companies.
- Earmark certain facilities in the wayside amenities exclusively to encourage local small scale producer on subsidy basis.
- Due consideration for preservation of ecology and environment including recycling of waste water and harnessing of alternative sources of energy (e.g. solar energy) for captive use.

Further, wherever feasible, State-of-Art Traffic Control Centres shall be provided (especially for stretches developed on BOT basis through Public-Private Partnership) along with facilities for information dissemination and exigency management system for alleviating traffic congestions, promoting more environment friendly, energy efficient and safe travel. For Expressways, as well as any other access control facilities, these provisions should be made mandatory.

The estimated fund requirements for non-NHDP NHs during 2012-32 are as follows: -

**Table 3.11: Scheme-wise Length and investments needed for 2012-32**

	Scheme	2012-2017		2017-2022		2022-2027		2027-2032	
		Length (km)	Amount Rs. Crore	Length (km)	Amount Rs. Crore	Length (km)	Amount Rs. Crore	Length (km)	Amount Rs. Crore
<b>A.</b>	<b>Expressways</b>	<b>500</b>		<b>3,500</b>		<b>7,000</b>		<b>7,637</b>	
	L.A., R&R, utility shifting, project preparation (Budgetary Allocation)	3,530	32,652	3,500	33,375	5,485	52,487	6,122	58,538
	<b>Construction</b>	500		2,500		7,500		8,137	
	Budg Allocation	200	6,670	1,300	37,040	1,000	73,220		81,440
	Toll Remittance		90				1,500		500

	Pvt Sec Invest	300	4,140	1,200	16,560	6,500	89,700	8,137	1,12,300
	<b>Sub-Total (Budgetary allocation)</b>	<b>200</b>	<b>39,322</b>	<b>1,300</b>	<b>70,415</b>	<b>1,000</b>	<b>1,25,707</b>		<b>1,39,978</b>
	<b>Sub-Total (Toll Remittances)</b>		<b>90</b>				<b>1500</b>		<b>500</b>
	<b>Sub-Total (Private Sector Investment)</b>	<b>300</b>	<b>4,140</b>	<b>1200</b>	<b>16,560</b>	<b>6500</b>	<b>89,700</b>	<b>8137</b>	<b>1,12,300</b>
<b>B.</b>	<b>National Highways</b>								
	<b>(i) Four-Laning/Six-Laning</b>								
	L.A. (40 m), R&R, utility shifting, project preparation (Budgetary Allocation)	200	850	4,800	20,400	10,000	42,500	10,000	42,500
	<b>Construction</b> (@ Rs. 11.50 crore per km as fully access controlled facilities)	200		4,800		10,000		10,000	
	Budgetary Allocation (@30% for VGF)		690		16,560		34,500		34,500
	Private Sector Investment (@ 70%)		1,610		38,640		80,500		80,500
	<b>Sub-Total (Budgetary allocation)</b>		<b>1,540</b>		<b>36,960</b>		<b>77,000</b>		<b>77,000</b>
	<b>Sub-Total (Private Sector Investment)</b>		<b>1,610</b>		<b>38,640</b>		<b>80,500</b>		<b>80,500</b>
	<b>(ii) Two-Laning with hard shoulders</b>	<b>14,020</b>		<b>4,780</b>		<b>11,500</b>		<b>8,700</b>	
	<b>Budgetary Allocation</b>	<b>5,100</b>	<b>25,500</b>	<b>5,900</b>	<b>27,700</b>	<b>7,250</b>	<b>36,420</b>	<b>7,250</b>	<b>36,420</b>
	<b>Toll Remittances</b>		<b>1,200</b>		<b>1,300</b>		<b>1,760</b>		<b>1,760</b>
	<b>External Loan Assistance (World Bank)</b>	<b>3,770</b>	<b>10,100</b>						

	Private Sector Investment	5,150	12,640	2,650	4,735	4,250	11,108	1,450	4,232
	(iii) Riding Quality Improvement	5,000		10,000		7,500		7,500	
	Budgetary Allocation		3,750		7,500		5,625		5,625
	(iv) Strengthening Weak Pavements	2,000		8,000		5,000		5,000	
	Budgetary Allocation		3,000		12,000		7,500		7,500
	(v) Bypasses, bridges, over bridges, safety and drainage measures, Misc	Lump sum							
	Budgetary Allocation		4,450		10,550		7,500		7,500
	Total Budgetary Allocation		77,562		1,65,125		2,59,752		2,74,023
	Total External Assistance		10,100						
	Total Toll Remittances		1,290		1,300		3,260		2,260
	Total Private Sector Investment		18,390		59,935		1,81,308		1,97,032

<b>Table 3.12: Proposed Expansion/Improvement for Non –NHDP NHs (excluding Expressways) and Investment Requirements: 2012-32</b>					
	2012-17	2017-22	2022-27	2027-32	2012-32
National Highways	<b>Length in Km</b>				
i. Four/Six Laning	200	4,800	10,000	10,000	25,000
ii. Two Laning with hard shoulders	14,020	4,780	11,500	8,700	39,000
iii. Riding Quality Improvement	5,000	10,000	7,500	7,500	30,000
iv. Strengthening of weak pavements	2,000	8,000	5,000	5,000	20,000
v. Bypasses, Bridges etc	LS		LS		LS
<b>Investment Requirements Rs Crore (in 2011-12 prices)</b>					
Total for non NHDP National Highways	63,790	1,39,385	2,27,413	2,27,412	6,58,000
a. Budgetary	38,240	94,710	1,34,045	1,34,045	4,01,040
b. External Assistance	10,100				10,100

c. Toll Remittance	1,200	1,300	1,760	1,760	6,020
d. Private	14,250	43,375	91,608	91,607	2,40,840

The sources of funding for Non NHDP for 2012-13 to 2031-32 are estimated in Table 3.13.

<b>Table 3.13: Sources of Funds for Non NHDP including Expressways (2012-13 to 2031-32) at 2011-12 prices</b>						
<b>(In Rs. Crore)</b>						
<b>Year</b>	<b>External Assistance</b>	<b>GBS</b>	<b>Estimated surplus from Toll Revenue</b>	<b>Sub-Total</b>	<b>Share of Private Sector</b>	<b>Total</b>
2012-17	10,100	159,030*	1,290	170,420	18,390	188,810
2017-22	0	190,568	1,300	191,868	59,935	251,803
2022-27	0	283,334	3,260	286,594	181,308	467,902
2027-32	0	295,105	2,260	297,365	197,032	494,397
<b>Total</b>	<b>10,100</b>	<b>928,037</b>	<b>8,110</b>	<b>946,247</b>	<b>456,665</b>	<b>1,402,912</b>

\* - includes Rs. 2,000 crore from cess mobilized for non-NHDP NHs during 2012-13

**However, it is pertinent to mention that the cost of LA and R&R (which have been assumed as Rs. 1 crore per Ha) may escalate significantly consequent to promulgation of revised legislations by the Government in this regard, for which necessary actions have already been taken up.**

3.6 There is a need to acknowledge the opening of East Asia through North-East to huge trade opportunities. This will need expansion/upgradation of road network in the North-East part of India. The **Internationally significant road corridors in India** are primarily under the following initiatives: -

- (i) Intergovernmental Agreement on Asian Highways;
- (ii) SAARC Multimodal Transport Corridors.

The development of the routes identified under the above initiatives is being taken up within the framework of National priorities. Certain sections of these identified corridors are, accordingly, included for their development under various programmes (such as NHDP, SARDP-NE, etc.).

Brief status of development of the Asian Highways network in India is at Annexure 3.3.

Brief status of development of the SAARC Multimodal Transport Corridors (Road corridors) in India is at Annexure 3.4.

There is need to acknowledge the fact that the opening of East Asia through North East has immense trade opportunities. Accordingly, emphasis is required to be given to expansion/upgradation of road network in the North East part of India including completion of major programmes such as SARDP-NE, which inter-alia aims at improving roads of international significance also.

### **3.7 Mode of Financing**

3.7.1 The present emphasis of the Government is to take up progressively more and more infrastructure projects through private sector participation on BOT (Toll) basis so that more public funds are available for social sectors. However, it may not be practically feasible to take up development of the majority of the highway stretches on BOT (Toll) mode. Further, BOT (Annuity) projects essentially entail deferred payments to be made to the concessionaire from the public funds over a period of time. Also roads/highway sector require substantial up-scaling if the sector is to serve the broader objective of achieving socio-economic development of the country and maintain the targeted growth trajectory. Whereas, the comparator for BOT (Annuity) projects should be public sector funded project, this model has otherwise one very important advantage which is assured O&M during the concession period.

3.7.2 The above is also particularly applicable for the development of the Green field National Expressways. It needs to be recognised that Government initiatives are required to fully develop certain specific Expressway Corridors upfront entirely through public funding and thereafter explore developing more expressway corridors through BOT (Toll). The remittances of toll receipts are estimated to be about Rs. 1,67,173 crore for the NHDP alone during the next 20 year period. This shall constitute a potent source of funding for the development of NHs and repayment of market borrowings. Therefore, the present policy of the Government of dedicated earmarking of toll receipts as remittances in the Annual Budget for the Central Sector Roads would have to be continued.

3.7.3 The Government may consider levy of cess on petrol and High Speed diesel (HSD) oil as per the provisions of the Central Road Fund (CRF) Act, 2000 on ad-valorem basis in place of the current policy of charging it at Rs. 2.00 per litre of petrol and HSD oil.

3.7.4. The details of the allocation and expenditure for the Central Road Sector during the 11<sup>th</sup> Plan and the total estimated fund requirement for the next 20 years including both NHDP and Non NHDP are given in Tables 3.14 and 3.15.

**Table 3.14: Allocation and Expenditure for the Central Roads Sector (including NHs)  
during the 10<sup>th</sup> and 11<sup>th</sup> Five Year Plans**

(in Rs. Crore)

Plan	Item	Cess	External Assistance	ABS for SARDP-NE and J&K	GBS	IEBR	Toll Revenue	Sub - Total	Share of Private Sector	Total
10 <sup>th</sup> Five Year Plan (2002-07)	Allocation	15,518		-	25,747*	25,500	-	66,765	-	66,765
	Expenditure	15,518		-	20,145	10,382	-	46,045	6,970	53,015
11 <sup>th</sup> Five Year Plan (2002-07)	Allocation	38,771	4,855	680	30,769	31,145	4,316	1,10,536	81,892	1,92,428
	Expenditure (Prov.)	36,708	4,854	680	28,049	17,809	4,316	92,416	65,661	1,58,077

\* - includes External Assistance

**Table 3.15: Estimated Fund Requirement for NHDP and Non NHDP Programmes including Expressways during 2012-32 at 2011-12 prices (In Rs. Crore)**

Year	Cess	External Assistance	ABS for SARDP-NE and J&K	GBS	IEBR	Estimated surplus from Toll Revenue	Sub-Total	Share of Private Sector	Total
2012-17	54,881	10,325	8,342	157,030	64,834	28,490	323,902	200,620	524,522
2017-22	70,667	0	16,205	190,568	685	42,466	320,591	67,222	387,813
2022-27	90,967	0	16,155	283,334	0	53,240	443,696	181,308	625,004
2027-32	91,256	0	9,836	295,105	0	52,848	449,045	197,032	646,077
<b>Total</b>	<b>307,771</b>	<b>10,325</b>	<b>50,538</b>	<b>926,037</b>	<b>65,519</b>	<b>177,044</b>	<b>1,537,234</b>	<b>646,182</b>	<b>2,183,416</b>

Annuity investments have been reflected as net outflow from budgetary allocation (i.e. GBS, cess, remittances of toll receipts, etc.) as these are essentially deferred payments to be met from budgetary allocations. They have not been separately shown as Private Sector Investments.

### 3.8 Multiple Strategies for Development State Highways and Major District Roads

**3.8.1** A total network of about 200,000 km of State Highways is envisaged for the year 2031. A length of 400,000 km of MDRs could be considered as a reasonable target for the year 2031.

#### 3.8.2 Planning for State Highway Development Project

3.8.2.1 There is a need to identify a CORE NETWORK of major arterial routes. It is important that Core road network should have a Corridor Concept. Holistic planning in this corridor needs to be done where necessary, involving SH and MDR under this concept. It should be possible for traffic to move at an average speed of 60-70 km per hour, so that commercial vehicles can cover a distance of 500 to 600 km in one day. The “Core Network” of State Roads should, essentially,

comprise SHs and MDRs, which have high volumes of traffic or have such potential. Further, entire length of existing 4-lanes and stretches on which 4-laning of SHs and MDRs are being / to be undertaken should essentially be part of the “Core Network”. SHs / MDRs having traffic beyond a certain threshold (say e.g. about 5,000 PCUs per day AADT at present) may also be included under ‘Core Network’. Surfacing and 2-laning of such roads under “Core Network” may be done on priority if already not done. Priority may be given for development of “Core Network”. Further, priority may be given for roads under “Core Network” for their future up-gradation as NH.

### **3.8.3 Expressways**

3.8.3.1 Traffic along some of the SHs corridors is so high that it would be expedient to go in for Expressway. The State Governments may also consider developing some stretches of Expressways from Master Plan for Network of about 18,637 km length of Expressways prepared by the MORTH. In any case, the initiatives for development the Expressways by the State Governments shall have to be integral and compatible with the Central Government initiatives and should holistically address the vital issue of efficient traffic dispersal in the overall network of roads in the country.

### **3.8.4 Urban Linkages to National Expressways Network**

3.8.4.1 It is important to provide urban linkages to National Expressways Network or to any inter-city Expressways developed by the State Governments. Considering that Urban Linkages would be provided at every toll plaza (having closed system of tolling) located at about 50 km apart along National Expressways Network, and an average length of about 10 km for each such Urban Linkages, the total estimated length of such linkages would be about 3,750 km. Considering a development cost of about Rs. 20 crore per km (since many of them shall have to be essentially access controlled facilities requiring elevated structures, etc.) and cost of Land Acquisition for 40 m Right of Way (ROW) (average cost @ Rs. 1.5 crore per Ha in urban areas + utility shifting + project preparation costs @ about Rs. 0.25 crore per km) there would be average development cost of about Rs. 26.25 crore per km (including LA, utility shifting, project preparation cost, etc.). This would involve a total fund requirement of about Rs. 98,440 crore.

3.8.4.2 The State Governments shall have to be primarily responsible for development of these Urban Linkages. Feasibility shall have to be explored to develop these Urban Linkages on PPP mode. For the sake of estimation, it is presumed that 50% of total length (i.e. 50% of 3,750 km) would be implemented through budgetary allocation. The balance 50% length would be implemented through private sector participation on PPP mode. For the projects to be taken up on PPP mode, about 30 % of project cost is assumed to be met from budgetary allocations towards payment of VGF, etc. and balance 70 % is to be mobilized by private sector.

### **3.8.5 Four-laning**

3.8.5.1 For augmenting the capacity of existing SHs on High Density corridors, it would be necessary to undertake four-laning of existing roads. Scope of works would need to cover strengthening of pavement, hard shoulders and bypasses around congested towns. Consideration should also be given to provision of service lanes, particularly in urban areas where it is not possible to provide for bypasses.

### **3.8.6 Two-laning**

3.8.6.1 The entire SH network should be of at least 2-lane standards. At present, about 101,049 km length of SHs is still below 2-lane standards. It is proposed that a target of 60,000 km in the first decade and 41,049 km in the second decade may be considered for upgradation of entire SHs to 2-lane standards.

### **3.8.7 Strengthening of Weak Pavement**

3.8.7.1 The structural capacity of the pavement of SHs and MDRs is insufficient to withstand the ever growing traffic in both volume and weight. Inadequate allocations for maintenance have also contributed to fast deterioration of these roads. It will be imperative for the States to undertake thorough evaluation of the existing pavements and provide for adequate strengthening overlays to meet the needs of traffic.

### **3.8.8 Riding Quality**

3.8.8.1 In case of MDRs we still have several roads which are metalled without any blacktopping. It is necessary that all roads in this category are fully paved to improve the riding quality. It is pertinent to mention in this context that for improving energy efficiency in the road sector, riding quality improvements is also critical operational aspects that contribute to fuel efficiency and higher transport productivity.

### **3.8.9 Bypasses and Over Bridges**

3.8.9.1 It is also necessary to provide bypasses for congested urban links. For large cities, it would be a good strategy to plan for bypasses in the form of ring roads to interlink the highways radiating from these cities. The alignment for the bypasses should be decided keeping in view the future growth of the city and in consultation with the town planning authorities. Another activity that is important relates to replacement of existing railway level-crossings with road over/under bridges. There should be no railway level-crossing on SHs. A phase-wise programme may be drawn up depending upon the traffic and number of gate closures. The dedicated fund for roads set up through special levy on petrol and diesel as per the provisions of the Central Road Fund (CRF) Act, 2000 provides for a specific allocation in respect of Railway safety works including construction of Railway Over bridges / under Bridges (ROBs / RUBs). Currently, these funds would be of the order of Rs. 1,050 crore per year. This would increase steadily with increase in consumption of fuel. These funds should also be utilized for this purpose. Apart from this, the State Governments may also consider replacing some level crossings by ROBs / RUBs through PPP mode subject to their viability.

### **3.8.10 Bridges**

3.8.10.1 It is necessary to plan for the systematic inspection, diagnosis of ill-health and formulation of remedial strategy for the distressed bridges on SHs and MDRs for taking up their reconstruction/rehabilitation/retrofitting, etc., on a defined time-frame.

### **3.8.11. Amenities**

3.8.11.1 Attention also needs to be focused on the provision of proper wayside amenities along SHs and heavily trafficked MDRs for road users and truck drivers/operators with facilities, like, parking lots, drinking water, toilets, snack bars, restaurants, rest rooms, kiosks, petrol pumps with service and repair facilities, communication facilities, etc. The details of improvement/expansion of SHs are given in Table 3.16 and Annexure 3.6.

<b>Table 3.16: Proposed Expansion/Improvement of State Highways and Investment Requirements: 2012-32</b>				
	<b>2012-17</b>	<b>2017-22</b>	<b>2022-27</b>	<b>2027-32</b>
State Highways	<b>Length in Km</b>			
i. Urban Linkages to Expressways network	1,000		1,375	1,375
ii. Four/Six Laning	10,000	5,000	7,500	7,500
iii. Two Laning with hard shoulders	30,000	30,000	20,525	20,525
iv. Strengthening of weak pavements	10,000	10,000	15,000	15,000
v. Improvement of Riding Quality	25,000	25,000	25,000	25,000
vi. Bypasses, bridges	LS		LS	
vii. Expansion of State Highways	8,500	8,500	8,500	8,500
<b>Investment Requirements for State Highways (Rs Crore in 2011-12 prices)</b>				
Total for SHs	3,13,500	2,10,000	2,73,781	2,73,781
a. Budgetary	2,16,825	1,51,625	1,91,287	1,91,287
b. Private	96,675	58,375	82,494	82,494

3.8.11.2 As regards MDRs, out of total length of about 238,049 km having less than 2-lane standards, it is proposed that a target of 50 per cent of these roads (i.e.119,025 km) to be widened to two-lane standards in the next 20 years may be considered. The details of improvement/expansion of MDRs are given in Table 3.17 and Annexure 3.6.

<b>Table 3.17: Proposed Expansion/Improvement of MDRs and Investment Requirements: 2012-32</b>				
	<b>2012-17</b>	<b>2017-22</b>	<b>2022-27</b>	<b>2027-32</b>
Major District Roads	<b>Length in Km</b>			
i. Two Laning	25,000	25,000	34,513	34,513
ii. Strengthening of weak pavements	20,000	20,000	20,000	20,000
iii. Improvement of Riding Quality	50,000	50,000	50,000	50,000
iv. Bypasses, bridges	LS	LS	LS	LS
v. Expansion of MDRs	30,000	30,000	37,000	37,000
<b>Investment Requirements for MDR (Rs Crore in 2011-12 prices)</b>				
Total for MDRs (Budgetary Allocation only)	1,50,000	1,50,000	1,83,025	1,83,025

<b>Table 3.18: Broad Assessment of Investment Needs for SHs &amp; MDRs (Rs Crore)</b>					
		<b>2012-17</b>	<b>2017-22</b>	<b>2022-27</b>	<b>2027-32</b>
A.	Total for State Highways	3,13,500	2,10,000	2,73,781	2,73,781
	Budgetary allocation	2,16,825	1,51,625	1,91,287	1,91,287
	Private Sector Investment	96,675	58,375	82,494	82,494
B.	Major District Roads (Budgetary Allocation)	1,50,000	1,50,000	1,83,025	1,83,025
C.	Total (SHs+MDR)	4,63,500	3,60,000	4,56,806	4,56,806
	Total (Budgetary allocation)	3,66,825	3,01,625	3,74,312	3,74,312
	Total (Private Sector Investment)	96,675	58,375	82,494	82,494

### **3.9 Maintenance Needs**

#### **3.9.1 Maintenance of National Highways**

##### **3.9.1.1 Needs**

Roads, in general, and NHs, in particular, are an enormous national investment and require maintenance to keep them in satisfactory condition and ensure safe passage at an appropriate speed and with low road user costs. Without timely maintenance, roads deteriorate considerably, leading to higher vehicle operating costs (VOC), increased number of accidents and reduced reliability of transport services. When the maintenance work can no longer be delayed, it will often involve extensive rehabilitation, and even reconstruction, costing many times more than timely maintenance treatment carried out earlier. Late or inadequate maintenance will increase the ultimate repair costs, road user costs and inconvenience to road users, and reduce safety. Road maintenance is therefore an essential function and should be carried out on a timely basis.

A Committee set-up under the Chairmanship of the Director General (Road Development) and Addl. Secretary, MORTH has revised the norms recently and it has come up with several innovative concepts so as to provide high performance standards of service to users, particularly on high and medium traffic density corridors. The innovative concepts proposed by the Committee are given in Box 2. Table 3.18 provides a broad idea of the funds required and those made available in respect of NH in the past.

#### **Box 3.1**

Innovative concepts proposed by the Committee on Norms for Maintenance of Roads in India, headed by DG(RD)&AS contained in the Report of the Committee on Norms for Maintenance of Roads in India published by IRC in 2001:

- Concept of Performance Indicators/Maintenance Quality Levels – Serviceability Index
- Optimization of Maintenance Programme
- Development of Highway Management System
- Development of Bridge Management System
- Recommended Aim for National Level Policy
- Supplementary Efforts – Maintenance by Contract
- Interim Norms
- Measures for measuring the Progress of Maintenance

- Monitoring at Road Authority Headquarters
- Enforcement Mechanism

### 3.9.1.2 Funds Required and Available for NH Maintenance

The financial resources made available to the Ministry under Maintenance and Repairs (M&R) Head (Non-Plan) have been only about 40% of the requirement based on approved norms and projected by this Ministry as is evident from the Table 3.19.

Year	Requirement as per norms	Amount provided	Shortfall	% Shortfall	Expenditure
2002 – 2003	2,200.00	800.00	1,400.00	63.64	629.54
2003 – 2004	2,200.00	731.74	1,468.26	66.74	731.62
2004 – 2005	2,480.00	745.56	1,734.44	69.94	679.03
2005 – 2006	2,480.00	868.10	1,611.90	65.00	838.31
2006 – 2007	2,480.00	814.38	1,665.62	67.16	784.30
2007 – 2008	2,280.00	1,001.70	1,278.30	56.07	981.35
2008 – 2009	2,500.00	973.97	1,526.03	61.04	969.45
2009 – 2010	2,500.00	1,059.10	1,439.56	57.58	1,053.98
2010 – 2011	2,800.00	2,056.96*	743.04	26.53	1920.27**
2011 – 2012	2,800.00	1,027.25	1,772.75	63.31	335.01***

\* BE outlay 2010-11 raised by Rs1,000.10 Cr under RE 2010-11;  
 \*\* Provisional \*\*\* end August 2011

**3.9.1.3.** The issue of inadequate allocation for M&R of NHs needs to be urgently addressed to prevent premature failure of sections of NHs developed at large capital investments on account of self-accumulation of deficiencies due to thin spreading of available resources for M&R on large NH network. The following suggestions may be considered in this context: -

- Develop sound “Maintenance Strategies” with planned interventions of maintenance inputs to optimally utilize the available resources and prevent progressive deterioration of assets.
- Do away with traditional system of funding M&R activities under non-Plan and take up M&R under Annual Plans separately segregated from construction.
- Ensure assured funding for development as well as maintenance and repair of NHs so as to enable taking up of preventive maintenance works rather than the compulsion to do reactive maintenance works at present due to limited availability of allocations.
- Take up short term maintenance works on already developed stretches through private sector on Operate-Maintain-Transfer (OMT) basis, which are targeted for further upgradation in say within about 4 ~ 9 year period.
- Long term O&M Contracts is a preferred mode and, therefore, performance-based maintenance system to be adopted for non NHDP developed reaches as well which may include Incident management (provision for Ambulance, Patrol Vehicle and Crane, etc.) (approximately Rs.60,000/km/year).
- Since long term maintenance under BOT (Toll) / OMT Concessions and O&M Contracts are evolving concept, the government may consider active dialogue with the construction industry to address their concerns also as implementation goes on.

- Also side by side, some mechanism to get feedback of users should also be instituted. In this regard, the recent initiatives taken by the NHAI in development of Manuals on O&M and Performance based maintenance contracts are worthy of note.
- For annual maintenance, medium term contracts may be preferable for ensuring continuous agency presence.
- Delegation of powers to the field level officers to ensure timely intervention and to take care of immediate maintenance needs and also to fix up responsibilities for the upkeep.
- Communication of standard rates for various urgent items of works and flexibility for local procurement.
- Increase cess on petrol and High Speed Diesel (HSD) oil suitably from present level of Rs. 2 per litre and mobilize additional accrual entirely for NH. Further, as already recommended, the Government may consider levy of cess on petrol and High Speed diesel (HSD) oil as per the provisions of the Central Road Fund (CRF) Act, 2000 on ad-valorem basis in place of the current policy of charging it at Rs. 2.00 per litre of petrol and HSD oil. Earmark a certain fixed percentage of cess dedicated for NHs (say e.g. 25 %) exclusively for M&R of NHs.
- Develop a system of maintaining and periodically updating the database on inventory of roads, bridges and other structures on NHs including their condition as decision support system for prioritizing development and maintenance works.
- Development of Pavement Management System.
- Development of Bridge Management System.

#### **3.9.1.4 Modernisation**

It is necessary to reorganize maintenance operations by replacing the road gang with mechanized mobile units to improve the productivity of the existing labour force. Several equipment manufacturers are coming up with equipment for quick repairs of potholes, slurry seal machines, combined bitumen sprayer and chip spreader and cold/hot recycling plants. Their use would need to be encouraged to improve the maintenance culture.

#### **3.9.2 Maintenance of State Highways and Major District Roads**

General experience has been that there is a shortfall of over 40 to 50 per cent in respect of allocations for maintenance of SHs and MDRs. The failure to address this vital issue tantamounts to an act of disinvestment as the assets created at huge costs to the economy would get lost for want of proper upkeep. A broad assessment shows that for existing system of SHs and MDRs, an annual allocation of Rs. 17,000 crore would be required. Full funds for maintenance would need to be made available to preserve these assets. The State PWDs would also need to gear up their monitoring arrangements and regular inspection of bridges for effective scheduling and planning of various maintenance operations.

### **3.10 Other Major Issues**

#### **3.10.1 PPP Policy Framework**

##### **3.10.1.1 Initiatives taken for Implementation of National Highway Projects through Public-Private Partnership basis: -**

Public Private Partnerships (PPP) to be the main mode of delivery for the future phases of National Highways Development Project. Apart from this, many other projects are also being implemented through PPP mode subject to their viability.

- The common forms of PPP for development of NH are :

- Build, Operate and Transfer (Toll) Model
- Build, Operate and Transfer (Annuity) Model
- Design, Build, Finance and Operate (DBFO) Model
- The Government has put in place appropriate policy, institutional and regulatory mechanisms including a set of fiscal and financial incentives to encourage increased private sector participation in road sector.

### **3.10.1.2 Incentives given by Government for implementation of NH projects on PPP basis: -**

- Viability Gap Funding up to 40% of project cost to make project viable
- Duty free import of high capacity and modern construction equipments; mechanization in road development is expected to get a boost as the decision to allow resale of such machinery on payment of import duty at depreciated value would reduce idling of such machinery and is also expected to make such depreciated machinery more affordable to smaller contractors.
- 100% tax exemption in any 10 consecutive years within a period of twenty years after completion of the project.
- Agreements to avoid double taxation with a large number of countries.
- Provision of encumbrance-free land for construction of roads.
- Procurement procedure
  - Well defined and transparent with standard tender documents
  - Investor friendly Concession Agreement
  - International Competitive Bidding
- Foreign Direct Investment up to 100% in road sector
- Concession period up to 30 years
- Concessionaire to have the right to collect and retain user fee (toll)
- Award of PPP projects based on new Model Concession Agreement (MCA)

### **3.10.2 Issues & Experiences in implementation of projects through PPP**

#### **(i) Delhi-Gurgaon Project on Golden Quadrilateral: - *Better Project Preparation***

The project was conceptualized in 1999 as a part of Golden Quadrilateral project. It was awarded to the consortium of Jaypee Industries and DS Constructions Ltd. in 2002. It was also the first project to be awarded on negative grant basis. The project could be opened to traffic only in 2007 after 5 years of its award.

In between following issues were observed:

1. NHAI relied on old traffic data which resulted in a situation with high traffic levels causing heavy queuing at the toll plaza.
2. The project required various approvals from 15 Government/Civic Bodies, which was a complex and time consuming process. Such delays can be avoided through a single window clearance mechanism
3. The original project cost envisaged was Rs. 547.50 crores. However, the Actual Cost to the Concessionaire turned out to be more than Rs. 1,000 crores. These were substantial changes in the original design keeping in mind future requirements and the convenience of commuters. Out of total of 11 structures, 9 had significant design modifications. Also, various Government Agencies demanded changes in the project alignment and design resulting in change in scope, project cost and consequent delay.
4. The project also faced issues in land acquisition. There were certain small parcels of land which were difficult to acquire.

Experience in this project highlight the importance of reliable and up to date traffic data, single window clearance for large projects, deeper stakeholder consultations for design finalization during project preparation especially in urban areas, and need to closely monitor project performance as well as to ensure that audited results reflect true performance of the project.

**(ii) Ahmedabad-Vadodara (NH-8) 6 laning project combined with Ahmedabad-Vadodara Expressway: - *Innovative Structuring***

Ahmedabad-Vadodara Expressway (NE-1) was constructed by NHAI and was operated under an SPV which was owned by NHAI. Recently, when the need for 6-laning of Ahmedabad-Vadodara NH-8 section was realised, its project structuring faced issues relating to competing facility in form of the existing Expressway. Also, there was issue of correct estimation of traffic on the NH-8 section and thus there was risk of developers allocating high risk premium in their bids.

However, the Expressway and the NH-8 sections were clubbed under one project for bidding out. This reduced the risk perception and also improved viability of the project.

This experience highlights importance of innovative project structuring leading to win-win situations.

**(iii) Mumbai-Pune Expressway: *Importance of Establishing Revenue Streams for PPP Projects on Toll Basis***

This project was developed by Government of Maharashtra. Project involved new-alignment with attendant traffic risk and significant uncertainty in initial years. Government of Maharashtra allowed the project to first establish a definite revenue stream over few years and then awarded the project on operations and maintenance contract with tolling rights. This experience highlights the need of a reliable and established revenue stream for PPP projects to be successful on toll basis.

**3.10.3 Road Pricing (Tolling)**

**3.10.3.1 Present policy**

The present policy for tolling of NHs is governed by the NHs Fee (Determination of Rates and Collection) Rules, 2008 and its subsequent amendments [i.e. the NHs Fee (Determination of Rates and Collection) Amendment Rules, 2010 and the NHs Fee (Determination of Rates and Collection) Amendment Rules, 2011].

**3.10.3.2 The salient features of these rules are as follows: -**

2-lane NH sections to be tolled @ 60 % of rates specified for 4 or more lane NH sections as above provided average investment for its upgradation exceed Rs. 2.50 crore per km at 1.4.2008 prices [sub-rule (3) of rule 4 of the NHs Fee (Determination of Rates and Collection) Rules, 2008 amended vide sub-rule (a) of rule 2 of the Amendment Rules, 2010].

The rate of fee for use of bypass forming part of a section of NH constructed with Rs. 10 crore or more for the base year 2007-08 to be 1.5 times the rates stipulated for section of NHs of 4 or more lanes; provided that while computing the fee for a section of NH of which such bypass forms a part, the length of such bypass to be excluded from the length of such section of NH; provided further that where the cost of such bypass is less than Rs. 10 crore, then the rate of fee for the use of said bypass shall be the same as that of the section of the NH of which it forms a part.

For private investment projects, the fee notified as per the Concession Agreement is leviable till the end of the Concession Period; thereafter the fee is to be collected by the Central Government executing authority at a reduced rate of 40% of the fee on the date of transfer of such section of NHs, bridge, tunnel, bypasses, etc., to be revised accordingly.

For public funded projects, after recovery of the capital cost through user fee realised as per the specified rates, the fee to be collected at reduced rate of 40% of such rates for such sections of NHs, bridge, tunnel, bypasses and to be revised annually.

### **3.10.3.3 Suggestions for Reform in Toll Rates**

- The Road Pricing and rate of user fee should be fixed purely on the basis of the benefits accruing to the users on account of upgradation of the facility as compared the facility existing before (i.e. prior to levy of user fee) in terms of savings resulting in Road Users' costs including VOC (comprising Fuel costs, wear and tear, other oils, maintenance costs, travel time, etc.). The policy should be, accordingly, based on the benefit accruing to the user after the upgraded / developed facility is opened for traffic operation. The Government may also consider undertaking a sound cost allocation study of providing and maintaining roads due to cars, buses and trucks.
- Accordingly, the existing policy of fixation of toll rates needs to be reviewed especially for 2-lane NH sections and bypasses, permanent bridges, tunnels, etc.
- Similarly, the reduction in rate of tolling after recovery of capital cost for public funded projects or after expiry of the concession period for private investment projects need to be reviewed.
- Further, the feasibility of tolling of 2-lane NH sections needs to be reviewed from the perspective of benefits accruing to road users in terms of savings in Vehicle Operating costs (VOCs), travel time costs, on account of post development enhanced road safety features, etc..
- The remittances from toll receipts should be entirely ploughed back and earmarked for development and maintenance of NHs only.
- Standardizing electronic and cash tolling system by using RFID based tolling for electronic toll collection and one toll card for toll payment across all/major toll plazas.
- Weigh in motion (WIM) systems should be used as a primary overweight detection equipment, which should divert only the overweight vehicles to static scale systems.
- Develop holistic approach towards toll road management and ensure proper maintenance and timely overhauling of tolling system
- Integration of Tolling amongst various projects across the country needs to be taken up.
- The current toll policy is one-size fits all and based on the NH Fee Rules. This is philosophically cost based and makes no provision for other functions of toll, such as congestion pricing and related to it, peak time pricing. Rationalized Toll rates should also address broad concerns such as local traffic requirements, etc.
- Closed system of tolling need to be introduced. However, this is possible only if the facility is fully access controlled.
- The "Congestion Pricing" policy may be adopted for levy of additional toll, especially for Heavy Goods Vehicles (HGVs) depending upon number of axles and emission class in line with the existing policies in the countries such as Germany, Czech Republic, etc. This would enable collection of additional revenue, help in protecting environment and encourage mode shift to rail

and water. It is pertinent to mention in this context that for improving energy efficiency in the road sector, management of traffic congestion is also critical operational aspects that contribute to fuel efficiency and higher transport productivity.

- Electronic Toll collection (ETC) system need to be progressively introduced in all the sections in order to avoid congestions at toll plazas and facilitate smooth flow of traffic.

The need for electronic tolling has been recognized and a mechanism for implementation has been suggested by the committee chaired by Shri Nilekani. Electronic tolling will also ease the issue of bonds related to toll collections. To facilitate implementation there is need to address several operational problems, viz.:

- Need to develop a system to track toll avoiders. This is a problem in the absence of an integrated vehicle database, where even if AVI technology is able to identify the registration plates, the tracking down of the vehicles may take an inordinate amount of time.
- Renegotiation of contracts with various toll operators, especially for BOT (Toll) projects, who currently may have incentives to under report collections.
- Inter-operability of technologies and a common information back-end database for reconciling of transactions and payments to various operators.

Currently, in case of significant and unexpected increase in traffic on any NH stretch under DBFOT (toll), the upside is partially shared with the Authority. Such sharing is linked with the capacity of the road and in such situation the project anyways faces issues relating to service levels, capacity augmentation and termination. A suitable methodology is required to be devised so that such upside can be effectively shared with the Authority without unfavourably affecting the rights of the Concessionaire. Expressways might require separate toll policy relating to competing facilities, level of services and congestion management.

#### **3.10.3.4 Tolling Issues relating to Private Parties**

There are leakages in toll collections because of presence of alternate routes to various stretches

In extreme situations, it is difficult to take a decision from user benefit perspective as viability and profitability of project is directly linked to toll collections (in case of DBFOT (toll) projects)

Changes in traffic profile and level based on decisions of various Government agencies relating to development of region, development of alternate roads, level of support to economic activities, etc.

#### **3.10.3.5 Tolling Issues relating to Users**

Users' willingness to pay are affected by factors including socio-economic culture and capacity.

Model Concession Agreements (MCA) provide for partial linkage of toll rates with Wholesale Price Index (WPI) over and above some fixed increment every year. Such continuous increase in toll rates might not be always acceptable to users especially when it is not linked to service levels.

As per the existing Toll Policy, in 6-laning projects users are required to pay the toll rates applicable for 4/6laned roads even during the construction stage when the road is being upgraded

from 4 lanes to 6 lanes. During such period service levels on the roads decline and payment of full toll rates during such period adds to the inconvenience faced by the users.

#### **3.10.4 Key post-award issues in PPP projects: -**

##### **(A) Financing of Projects**

- An underdeveloped bond market has constrained PPP road projects to mainly depend on debt from commercial banks.
- Lack of presence of long-term savings institutions, such as insurance companies and pension funds having long-term liabilities, with appetite for long-term debt instruments in PPP project funding.
- Commercial banks are increasing facing limits on their exposure to infrastructure sector, which would also affect funding of road PPP projects.
- Commercial banks also face issue of asset liability mismatch as PPP projects require long term funding
- Re-financing scheme from IIFCL has not helped the market as initially envisaged because of certain attached conditions relating to tenure and interest rates.
- External Commercial Borrowing (ECB) is limited in road PPPs because of certain constraints in the policy framework.
- Debt to road PPP projects is classified as unsecured by commercial banks since no tangible physical security is available to lenders. Due to this such debts carry higher interest rates and quantum limitations.
- Issues relating to Model Concession Agreement and its provisions, such as, issues of creation of charge on receivables, assignment of project agreements etc.

##### **(B) Financing and Viability**

- Explore other sources or revenue for PPP projects such as advertising, real estate development, way side amenities, mobile towers, additional stamp duty on road side properties, etc.
- Implementing recommendations of committees on financing of PPP infrastructure projects in India and other related initiatives which are being debated with the stakeholders.
- Project specific Value for Money (VFM) analysis to be undertaken to decide the maximum level of Government support for the project rather than having a general cap of 40% of total project cost.

##### **(C) Monitoring Performance of Private Developers**

###### **Performance Indicators for Monitoring**

- Timeliness: Timeliness of tasks and reporting
- Value for Money: Cost justifies the quality and work output as per market standards and best practices.
- Quality: Work meets standards and requirements
- Responsiveness: Coordination with awarding authority and ability to find win-win situations
- Reputation: Market reputation and perception
- Experience and Skills: Level of experience and skills suitable for work.
- Capacity: Resources and organization capacity varying with variety and size of work

- Dispute History: Track record in disputes and litigious nature.

The Central / State Governments must gear up for taking up more projects on PPP basis by:

- Setting up specific Cells for implementation of road projects on PPP mode; such Cells should also have Finance and Legal Specialities to support Technical Staff;
- Capacity development of Central and State level agencies on aspects relating to evaluation of projects, project structuring, bid process management and contract management covering multi-functional skills from legal, technical and financial domain.

**MCA has to evolve on continuous basis in due consultation with all the stakeholders.**

### **3.10.5 Other Major issues**

**(i) State Support Agreements (SSA):** - Umbrella SSA so far concluded with 24 States/UTs. Signing of SSA in itself does not ensure complete co-operation from the concerned state machinery. Steps should be explored to incentivise the States to fulfil their commitments in a time-bound manner.

**(ii) Alternate revenue mechanisms:** Alternative revenue sources need to be explored and tapped. These could be a) advertisement rights, b) Real estate development along the Highway Corridor, c) Way side amenities, and fee from ROW users like fibre – optics cables, mobile towers, etc.

**(iii) Environmental, forest and wildlife clearances:** It has been observed that various PPP projects face issues relating to delays in receiving environmental, forest or wild life clearances and permission to cut trees, etc. Process for taking such clearances from concerned department at centre or State level should be initiated at an early stage of the project cycle. With a view to cut down time and cost overruns in road projects due to various types of environmental clearances it is necessary to review the existing framework for such clearances. The following may be considered (a) De-link the grant of environmental clearance from the forest clearance and exempt environmental clearance if widening is within the standard ROW for NH (i.e. 60m) and upto 100 km length; (b) prescribe a rational timeline for processing and finalising the various clearances. MoEF may also consider enhancing the powers of Regional Offices of MoEF for granting forest clearance. Standard conditions may be laid for forest clearance; and (c) It has also been observed that wildlife proposals also take more than 3 years for clearance. Highway/road projects requiring resurfacing, strengthening and widening be allowed on the existing roads where no diversion is involved. Also, once the approval is granted for certain alignments, for doing surveys, the proposal should not be rejected subsequently on some other grounds. A time line be drawn for granting wildlife clearance.

### **(iv) Land Acquisition and Rehabilitation**

One of the major reasons for delay in implementation of road projects is delay in acquisition of Land required for the project.

At least 80% of the required land should be available at the time of award of the projects; further it also needs to be ensured that the balance 20% of the land shall be available within a period reasonable enough so as not to delay the implementation of the projects as per the stipulations of the Contract / concession agreements (say e.g. balance land should be available within Appointed Date for BOT projects or as per provisions of Contract Agreements so as to enable Contractor to get all the required Work Fronts within stipulated periods, etc.).

The Government has taken up the initiatives for amendment of the Land Acquisition (LA) Act, 1894 and this is in advanced stages of finalization. It needs to be ensured that the LA as per the provisions of the NH Act, 1956 are also amended accordingly in conformity with the same.

The possibility of allowing real estate development on part of the land acquired for the purpose of developing Highways need to be explored so that sweetener could be offered to the potential concessionaires for developing the stretches on BOT (Toll) mode. In addition to real estate development, efforts need to be made to appropriate part of the appreciation in land values. Accordingly, the Government may explore the feasibility of suitably amending the provisions of the NH Act, 1956.

**(v) The Rehabilitation & Resettlement (R&R)** of the project affected persons are in wide variance for the projects implemented through External Aids / Loan Assurances as compared to the public funded projects or BOT projects. The policy for R&R for State Road Projects should also be in harmony with the Central Government policy. It needs to be ascertained that a uniform R&R policy is evolved for all types of projects so that the compensations offered to the project affected persons are uniform and not at variance.

**(vi)** It is of paramount importance to regulate and control the development activities in land abutting ROW of Highways so as to ensure availability of adequate clearances, enhance safety of traffic, obviate possible encroachments of ROW in future, etc. Accordingly, State legislations are required to be promulgated to this effect.

**(vii)** Necessary legislations are required to be promulgated specifically for the Green Field Expressway Projects considering its vast socio-economic implications, land severance issues, consequences due to change in land use, etc., apart from environmental issues. The Government may explore the possibility of inducting the affected persons also as stake-holders in the Green Field Expressway projects.

**(viii) Consolidation and preservation of Road assets**

The cost of providing and maintaining the roads for the society at an acceptable serviceability level is quite high. It is, therefore, essential to attempt establishing an acceptable pavement condition level consistent with economic, safety and environmental considerations. To accomplish this, a system/model needs to be established for assessment and prediction of the functional and structural condition of pavement. With several hundred thousand vehicles moving on the roads every day, even a small saving in vehicle operating cost and in travel time can justify large investments on road pavements.

Developing and maintaining a good road network condition is not an easy task. It requires meticulous planning, funds, strict quality control and other related aspects. Road networks need to be managed now and not just maintained.

Information pertaining to the consolidated inventory of road assets need to be maintained and upgraded at regular intervals. At present, very limited information is available regarding the road inventory, available ROW based on the available revenue records, etc. An elaborate system shall have to be developed for creating the database based on actual ownership details supported by

legally acceptable documentations, etc., and periodic updation of the database. A uniform format should be developed to compile the information starting from panchayat/block levels, etc. and compiled State-wise. The data should be available in electronic form with facility for periodic updation on real time basis as and when land is acquired to augment the existing ROW; further, there should be a facility to add the inventory in case of newly declared NH or Expressways, etc., almost on real time basis.

For the Control of NH land, etc., “The Control of NHs (Land & Traffic) Act, 2002” was promulgated giving quasi-judiciary powers to the “Highway Administrations”. The provisions under this Act inter-alia gives Authority to remove encroachments, prevent occupation of / damage to NH land, control access, regulate construction on NH land and stipulates punitive measures for the offences committed (which are deemed as cognizable) in violation of its stipulations. However, there is lack of enforcement of the provisions of the Control of NHs (Land & Traffic) Act, 2002 legislation in the ground as yet. It needs to be ensured that there is adequate support from State Administrations and Law enforcing machineries so that the stipulations could be effectively implemented.

It is of paramount importance that proactive support and assistance is available to the Highway Administrations from the District Administrations so that the provisions of these legislations could be effectively implemented. Further, District Administrations must ensure, as a part of its overall duties and responsibilities, that the provisions of these legislations are not violated rather than simply providing its support to the Highway Administrations. Similar frameworks may be evolved for all categories of roads in the line of the Control of NHs (Land & Traffic) Act, 2002.

There is urgent need for introducing highway police patrol and incident management system on main highways. Incident Management System is covered under BOT projects being currently bid out by NHAI; however there is need to explore possibilities for establishing the system for the entire Expressways and NH networks. An institutional mechanism needs to be developed for establishing highway police patrol.

Need to involve Private Sector in the Maintenance and repair of the road assets also has to be an inevitable requirement. Thus, the focus has to gradually shift from traditional departmental based maintenance also to those based on outsourcing, whereby the expertise and skills of the experts available in the construction industry shall be fully harnessed and utilized to bring in cost effectiveness in maintaining the road assets being developed at enormous costs in most optimal manner with least maintenance efforts. The concept of Contract Maintenance is evolving gradually for the NH sector and gaining ground in view of the budget constraints and the necessity to maintain the quality road assets being developed.

At present, there is no institutional arrangement / system of maintaining database of road network in the country, i.e. road inventory, bridge inventory, details of improvement / repair / rehabilitation works carried out historically, etc., to analyze deterioration patterns, reasons and take up corrective measures.

NHAI had taken some initiatives to set up road Information system (RIS) primarily based on the data available from the Project Reports prepared for NHDP-Phases-I & II; however, no system could be established so far for periodically updating these data base.

The Ministry had sanctioned an R&D scheme for Development of GIS based National Highways Information System in August, 2005 based upon the proposal forwarded by CRRI. The implementation to be carried out by CRRI involved Preparation of a digital GIS map in 1:1 million scale based on SOI toposheets showing all National Highways network, Inventorization of National Highway network (excluding NHDP Phase-I &II) (collection of only Primary data (e.g. cracks, patchwork, potholes, raveling, bleeding, settlement, edge breaking, details of cross-drainage structures such as chainage, no., landuse character, junctions, carriageway width and road inventory data such as roughness, gradient, curvature, c/way type and width, shoulder type and condition)), Conduction of Traffic Volume Survey for about 50 representative locations taken continuously for 7 days using permanent traffic classifiers ( remaining traffic data was to be arranged by Ministry through PWDs and to be made available to CRRI for integrating with GIS), development of long term maintenance and rehabilitation strategies for NHs based on HDM-IV tool. However, the Project is yet to be completed by CRRI.

Also at present traffic data is being collected twice in a year on non-NHDP NHs entrusted with State Governments by manual method. There is need to shift over to the system of collecting the traffic data by portable Advanced Traffic Counters cum Classifiers (ATCC).

The limitations posed by the present system of maintaining database as mentioned above is a serious handicap in establishing a scientific Pavement Management System (PMS) and Bridge Management System (BMS).

Pavement Preservation Strategy has to be evolved on priority based upon statistically acceptable database pertaining to the performance analysis of various types of pavement compositions under varying traffic, geographical, climatic conditions, etc.

Pavement Management System and Bridge Management System need to be developed also so that the Pavement Preservation Strategies could be optimally implemented. The necessity of establishing system of maintaining detailed inventory of the Road Assets and their periodic updation become indispensable for developing and optimally using the PMS and BMS for effectively maintaining the road assets and avoiding need to take up their premature rehabilitation at much higher costs.

There should be a system for institutionalizing the database for the road sector. Establishment of a Road Information System (RIS) and its periodic updation is also of paramount importance for enabling optimal utilization of resources in development and maintenance of the Road network both at the Central and the State levels.

#### **(ix) Over Loading of Vehicles**

Various studies conducted on the effect of axle loads on road pavements have established that damage to road pavement occurs in the proportion of “Fourth Power”; e.g. an axle load of 16.32 tons (which is two times the equivalent standard axle load of 8.16 tons) causes 24 times, i.e. 16 times damage to a road as compared to the damage caused by an axle load of 8.16 tons. Axle load surveys should be conducted for assessing vehicle damage factor (VDF) for designing a new pavement; notably VDF is a multiplier to convert the number of commercial vehicles of different axle loads and axle configuration to the number of equivalent standard axle load

repetitions. However, in case of difficulty in conducting axle load surveys, the indicative values given in the IRC guideline may be used. The maximum indicative value of VDF given in the guideline is 4.5 for initial commercial traffic volume of more than 1,500 commercial vehicles per day (cvd). However, axle load surveys conducted on various stretches of NH have revealed that a VDF in the range of as high as 10-15 for multi axle vehicles is not uncommon on some of these roads. Therefore, this shows that there are rampant violations of the legally permissible GVW limits by the commercial carriers. Such extent of overloading beyond legally permissible limits are responsible for reducing the pavement service life including the life of structures such as bridges, etc. drastically from the actual design life and in causing premature distress in the road pavements, reduce level of serviceability, result in increased maintenance cost, increased road user costs including vehicle operating costs and fuel costs, etc. It is also an established fact that overloaded vehicles cause higher pollution and are more prone to accidents. Therefore, plying of overloaded vehicle is one of the most serious problems which beset the road transport sector.

Plying of overloaded vehicle is one of the most serious problems which beset the road transport sector. The Hon'ble Supreme Court has made it clear that detection of overloading and collection of compounding fee does not mean authorization for the overloaded vehicles to ply. The excess load needs to be necessarily offloaded before allowing the vehicle to proceed further. It is of paramount importance that the menace of overloading is stopped. There is urgent requirement to ensure strict enforcement of the stipulations of the Motor Vehicles Act, 1988 and the Central Motor Vehicles Rules, 1989 in this context.

The directions of the Hon'ble Supreme Court are yet to be implemented by most of the States in the right earnest. The factors cited for inability to enforce the law regarding mandatory off-loading of the excess loads are such as indivisibility of the load, lack of infrastructure to off-load and store excess loads etc. Implementation of the following measures may help in solving the problems:-

- i. Measures for offloading and handling of the excess load.
- ii. Planning of necessary infrastructures for effective implementation of the policy.
- iii. Financing and Implementation of the policy.

**(x) Need for a Regulator:** There is no independent regulatory authority for India's Roads & Highways sector. Current arrangement both at Centre and States (MORTH, NHAI, MPRDC, PWDs, etc.) results in a potential conflict as the rule making body is also the implementing body and there is no independent assessment of its performance across various parameters. Potential key functions of the regulator could cover; (a) Tariff Setting; (b) Regulation of Service Quality; (c) Assessment of Concessionaire Claims; (d) Collection and Dissemination of Sector Information; (e) Service-Level Benchmarks; and (f) Monitoring Compliance of Concession Agreements.

However, the functions and jurisdictions of the Regulator need to be debated and decided so as to avoid overlap / conflicting areas with the implementing agencies.

**(xi) Capacity Development:** This could cover (a) Enhancing cross-functional understanding of personnel in implementation agencies through training and development programmes; (b) Restructuring of NHAI in order to best use and develop capacity to raise resources, vendor management, concessionaire management and implementation of projects; (c) Segregating

project implementation from project formulation and therefore, the need for a separate procurement division in NHAI; (d) Decentralization of power and enhanced availability of skill manpower at regional levels; (e) Adoption of professional management principles and manpower; (f) Creation of databases as and decision support systems and leveraging information technology; (g) Better synchronization between Central and State level agencies for sharing resources and knowledge; (h) Training policy focusing on needs of training at entry, on job site and periodic refresher courses; (i) Encouraging Engineering and Technical Institutions to attract students in Highway Engineering profession; (j) Respective institutions to carry out Training Needs Analysis to identify the skill gaps; (k) Involvement of contractors/ developers in developing skilled resource pool on a sustainable basis and; (l) Apprenticeship development by contractors/developers with provisions for subsequently deploying trained manpower to authorities.

**Restructuring of MORT&H may be considered so as to entrust all National Highways and National Expressways to NHAI in phased manner with proper restructuring of NHAI and only planning, policy and budget be kept with MORTH.**

3.10.6 The following suggestions may be considered for making projects more bankable from the point of view of investors:

#### **3.10.6.1. Implementation Issues-Mode of Implementation**

The present policy of the Government is deciding mode of implementation of projects on BOT (Toll), BOT (Annuity) and Item rate / EPC contract basis following a water-fall sequence. Only if no response is received from bidders for projects bid out on BOT(Toll) mode, or if the minimum VGF quoted for the project is more than the threshold of 40% of TPC, bidding is permitted on BOT (Annuity) subject to approval of the Competent Authority obtained afresh; further, bids may be invited for such projects to be implemented on conventional item rate / EPC contracts with fresh approval of the Competent Authority only if there is no response for the bids invited on BOT (Annuity) mode. This results in a lot of delays in implementation of projects. It is, therefore, desirable that based upon the project report, the Government may decide the mode of implementation of the projects upfront.

It needs to be recognised that Government initiatives are required to fully develop certain specific Expressway Corridors upfront entirely through public funding and thereafter explore developing more expressway corridors through BOT (Toll). The Government may consider taking up of the initial length of about at least 1,000 km length of National Expressways through budgetary allocations so that these projects may be projected as the iconic projects and may enthruse private investments for successive projects. If considered feasible, these initially developed Expressway stretches may, also, be considered to be given as sweeteners for successive projects to be which may be implemented through BOT (Toll) mode through private sector participation subject to their viability.

Initial seed length of about 1,000 km length of National Expressways may be developed by the Government through Budgetary allocation so that these may be projected as iconic projects and enthruse private investments for successive projects. Subject to feasibility and viability, these initially developed Expressway stretches may be given as sweeteners for successive BOT (Toll) Projects.

Progressive use of technologies should be made for enabling real time monitoring of projects, putting them in right track by taking up of timely necessary corrective actions, fast decision making, etc.

### **3.10.6.2 Use of Advanced Traffic Management System (ATMS) in more and more stretches**

The Government needs to take the initiatives to introduce Advanced Traffic Management System (ATMS) progressively in more and more stretches, especially on National Expressways and 4-lane NHs. ATMS should aim at having facilities such as Facility / Traffic Control Centres, Electronic toll Collection (ETC) systems, Emergency Call Boxes, Variable Message Signs (VMSs), Video Surveillance System, Video Incident Detection system, Meteorological Sensor system, Mobile communication system, Automatic Traffic Counting-Cum-Classifying (ATCC) System, Advance information system regarding state of traffic density / congestions, occupancy at integrated ways-de amenities, etc. This is desirable in order to enhance safety and comfort of the road users in addition to making the journey pleasant.

### **3.10.6.3 Institutional Development and Capacity Building of all Stake holders**

The focus should be towards institutional development and capacity building at the Central Government level, various agencies involved in implementation of projects, viz. NHAI, BRO, State PWDs, etc. Apart from this, their emphasis is required to be given for institutional development and capacity building of consultancy sectors, concessionaires firms, contractors, etc.

Emphasis is required to be given for training of Highway Engineers in tune with the State-of-Art practices and technological developments. The training should be imparted periodically. The Engineering and Technical Institutions are to be encouraged and incentivized for attracting students in Highway Engineering profession.

The activities of Indian Academy of Highway Engineers (IAHE) [formerly NITHE] would need a quantum jump and state level training centres are also required to be developed.

Training Need Analysis (TNA) is required to be carried out by respective organizations and periodic training rosters should be drawn based on the above. The document being published by IRC regarding Human Resource Development (HRD) would be helpful to respective organizations in this context.

Skill development of both skilled and unskilled manpower should also be given due importance. The training and certification courses are being organized by Agencies such as NAC, Hyderabad, various contracting organizations etc. The Agencies such as CIDC, etc. may take the lead and 2-3 ITIs in each States may also be identified where such training can be imparted.

## **3.11 Road Safety (Engg. Aspects) and Research & Development**

### **3.11.1 Road Safety**

#### **3.11.1.1 Standards and Guidelines for Highways and Urban Roads**

- Highway and urban road design standards and guidelines will be made consistent with the safety requirements and in tune with the international best practice. These would be reviewed periodically to take into account the changing profile of the traffic.

- All existing standards/guidelines/ manuals/codes, etc., of IRC/MORTH will be reviewed for their specific Focus to Road Safety, and deficiencies/shortfalls identified in relation to safety.
- New standards and manuals will be prepared for filling the gaps in the current standards.
- There should be adequate engineering measures supported by strict enforcements to ensure segregation of fast and slow moving traffic, especially on the multi-lane (i.e. having 4-or more lanes) highways. To that extent the Project Scopes defined in the Concession Agreements of projects being undertaken under various phases of NHDP need to be adequately reviewed. This should also apply to the O&M contracts / OMT concessions.
- All road projects being delivered at present (either at planning stage, design stage, construction stage, or even at implementation stage and operation stage), whether on BOT or as Item Rate / EPC Contracts, will be reviewed at each stage to identify any issue related to road safety.
- All SH and NH are to be provided with both pavement markings and road signs as per the requirements specified by the standards of IRC/MORTH. These shall be mandatory requirement for road safety.
- Initiatives are required to be taken for taking up adequate State-of-Art Traffic Calming Measures in the relevant areas / places, especially in urban areas, near habitations, etc. for enhanced safety to vulnerable road users.
- For ensuring the construction zone safety for traffic operation, there should be proper estimate prepared at the stage of Detailed Design, and it should be part of the total project cost like any other item in the form of BOQ items.

### **3.11.1.2 Monitoring and evaluation of road designs and traffic management strategies**

- Road Safety Audit should be made an integral part of the project planning, report preparation, appraisal, designing, implementation, operation and maintenance, etc. The project should be duly reviewed and necessary corrective actions should be taken pursuant to the report of the Road Safety Audit at every stage.
- The entire network of NH and SH are to be subjected to Road Safety Audit (RSA) in a planned and time bound manner. The RSA shall identify all the potential hazards in terms of deficiencies observed in the network, which are required to be corrected on continuous basis for making the road network safe.
- The States and MORTH will prioritize the network to be audited, and will implement the improvements recommended by RSA. The priority roads with high accident records are to be taken up first in a time bound manner.
- To carry out RSA for the entire primary network, required capacity is to be developed through proper training of qualified engineers, who are eligible for training. For this purpose, a special committee will be set up to draw up guidelines for a RSA procedure suitable for Indian traffic and safety issues with special reference to vulnerable road users. Teaching and research institutions including IITs, NITs, CSIR, etc. will be identified for establishing training programmes for RSA professionals.
- Road Safety Audit is to be carried out for the roads using the trained auditors available in the country and in accordance with the manual of RSA adopted by IRC. All steps of audit delivery including the initial meeting and audit completion meeting with the Client must be completed with submission of audit report and exception report etc for every road assigned for audit. This will bring out what all is required to be done for the road ensuring highest level of safety.

- No compromise, whatsoever, should be made in essential road safety features and all safety concerns must be addressed as per the recommendations of the RSA Report. This aspect needs to be critically considered especially while analyzing project viability.
- Encourage Institutionalization of conducting RSA by certified Road Safety Auditors.
- An accreditation body is required to be created for Road Safety Auditors, which will control the utilization of these trained auditors and will maintain the register of certified auditors. Such auditors will have to undergo training and retraining as per a set of guidelines to maintain a high standard of auditing.
- Capacity for RSA works in the country is to be enhanced by training and conducting certifications courses for Road Safety Auditors.
- **The recommendations of the Sundar Committee on Road Safety (Engineering Measures) should be implemented at the earliest.**

### **3.11.1.3 Accident Investigation**

- Accident data recording system is to be adopted uniformly across all States for roads in urban and non-urban areas in a standard format. This standard format is to be evolved with national consensus and should include all rational data that are required for accident investigation, accident reconstruction, and also adjudication of the accident cases.
- The data collection should be tech-savvy with hand-held GPS and computer interface so as to collect all data with highest precision.
- There will be standard accident analysis module for accident investigation and adjudication uniformly to be used across the country without any exception.
- Only a few specialized centres shall study selected accidents, using the accident reconstruction technique, etc. and the same data system.
- Institutionalized System of Database storage shall be developed.
- NHAI has taken the initiative of creating a dedicated road safety cell to enhance road safety on their projects. This mechanism needs to be replicated in road agencies of the states as well for the network in their jurisdiction.

### **3.11.1.4 Training**

- The engineers involved in planning, design, construction and operation of roads and highways in the country are to be trained on road safety aspects covering engineering measures, safety at construction sites and hands on experience in road safety audit.

### **3.11.1.5 Research & Development related to Road Safety**

- To establish about five to seven Centres of Excellence for Road Safety Research and Accident Analysis in Academic Institutions across the country in addition to the existing research institutions.
- The capacity in road safety research and accident analysis is also to be developed, for which bright young professionals are to be identified for specialized training.

### **3.11.1.6 National Road Safety & Traffic Management Board**

Government is already initiated the process of approving the Bill for creation of a Road Safety & Traffic Management Board. This Central Body is an urgent requirement along with the counterparts in the States.

### **3.11.1.7 Institutional Arrangements for planning, delivery, evaluation, monitoring and improvement**

The concerned Road Agency should be made responsible for the planning, delivery, evaluation, monitoring and improvement with specific focus to road safety. For this purpose, it is of utmost importance that necessary institutional arrangements be developed within a fixed time frame.

The MORTH has already instituted a system of Results Framework Document for assessment of its capacity and performance. Such frameworks should be mandated for road agencies in the states as well. and gradually such frameworks may include indicators like road network congestion, riding quality, safety, road user satisfaction, etc.

### **3.11.1.8 Inter-Disciplinary Coordination**

It is very important to establish synergy between various stakeholders at various levels (i.e Central, State, District, etc.), which is presently missing, e.g. between the engineering authorities (viz. Road Agency, R&D / Academic organizations,) enforcement authorities (viz. Police, State Transport Authorities), organizations responsible for emergency care (viz. Ministry of Health & Family Welfare, Hospitals, Trauma Care Centres, etc.). The focus should be to establish a robust mechanism to address road safety issues in a comprehensive manner.

### **3.11.1.9 Availability of Resources**

Adequate funds should be made available commensurate to the requirements, especially for development and maintenance of non-NHDP NH Network. It needs to be appreciated that in the absence of required allocations, there is inevitable compulsion of compromising with many of the essential features and requirements which have significantly adverse road safety implications. Similarly, resources provided for State roads shall have to be commensurate with the estimated requirements.

### **3.11.1.10 Capacity Building in Safety Administrations**

Due emphasis is required to be given to fast track capacity building of all stakeholders and organizations associated with Road Safety aspects. Further, these aspects shall also have to essentially reviewed on a continuous basis for needful adaptation with changing environment and evolving State-of-Art practices.

### **3.12 Research & Development**

(i) Specific R&D schemes need to be taken up for possible adaptation of State-of-Art innovative technologies and materials in the highway development and maintenance in Indian context. Field / Pilot testing of such technologies / materials may be taken up under ongoing projects under NHDP, SARDP-NE, and other projects to test their efficacy and for enabling their adaptation.

(ii) Possible use of waste materials / by-products, etc., in highway development and maintenance by necessary treatments for their qualitative improvements (if required) should be explored and R&D should focus on adaptation of such technologies corroborated by field testing in a time bound manner.

Further, recycling of pavement materials should also be considered.

These suggested measures are considered to be very important considering the depletion of natural resources such as aggregates, etc., besides their adverse effects on environmental degradation.

(iii) The R&D schemes, having immediate practical relevance in the context of the initiative of the Government to develop highways in the country, needs to be taken up on priority.

(iv) There are Committees in IRC for giving accreditation to new materials / technologies, etc. However, in numerous occasions, the general experience is that there is reluctance on part of executive agencies to allow field testing of these new technologies / materials, etc., as a means of their performance evaluation for enabling taking up of further necessary action for their possible wider use in the sector.

It is important that the Government encourages field testing of such new technologies / materials, etc., accredited by the IRC Committees, by the executive agencies.

3.12.1 There is an urgent need for quantum jump in R&D and technology upgradation effort in the road sector covering pavements, bridges, tunnels and traffic engineering for knowledge acquisition and knowledge development. R&D vision and strategy needs to be developed for the next 20 years by the Highway Research Board with support of MORTH, MORD, MOUD, CRRI, state governments and academia. Thrust areas for knowledge development are given in Box 1.

### **Box 3.2: Thrust Areas for Research, Development and Technology Innovations**

#### **A. Areas relevant to PPP and government funded projects on main highways**

1. Blending/stabilization techniques to maximise use of locally available and marginal materials. (Pilot projects be undertaken throughout the country).
2. Determining design service volumes at various levels of service for 2-lane, 4-lane and 6-lane roads.
  - with/without paved shoulders
  - with/without service roadsin both urban and non-urban areas.
3. Accelerated bridge construction technologies to achieve faster construction (precasting techniques, concrete-steel superstructures, etc.). Also evolve standard designs.
4. Condition assessment of existing bridges and distress diagnostics of superstructures, substructures and foundations of bridges
5. Evolving models for determining rate of deterioration of road pavements and riding quality with time, traffic and weather (including rural roads). Develop non-destructive evaluation techniques (quick results possible as CRRRI has acquired an APT facility)
6. Evolving bio-engineering and other measures for improving slope stability in hills (including rural roads)
7. Recycling techniques (hot/cold) of bituminous pavements. Evolve guidelines for promoting their use as it would ease the burden on use of aggregates and reduce carbon footprint

#### **B. Areas relevant to rural roads**

1. Identification of locally available materials at district level and determining their strength characteristics and promoting stabilization techniques
2. Use of soil cement, cement blended granular material, brick ballast and other marginal materials
3. Use of bituminous emulsions, chip sealing and surface dressing
4. Evolve low cost water crossing structure designs
5. Evolve low cost drainage and erosion control measures
6. Evolve designs for fabricating low-end technology equipment for construction and maintenance

## CLASSIFICATION OF THE ROAD SYSTEM

### 1. The Background

The Nagpur Plan (1943-61) gave the first classification for the road system in the country, which is still in use. The classes of roads, along with their present definitions, are indicated below:

- 1) **National Highways (NH):** These are main highways running through the length and breadth of the country, connecting major ports, foreign highways and capitals of States/Union Territories and large industrial and tourist centres, and including roads required for strategic movements for the defence of the country.
- 2) **State Highways (SH):** These are arterial roads of a State linking district headquarters and important cities within the State and connecting them with NHs or highways of the neighbouring States.
- 3) **Major District Roads (MDR):** These are important roads within a district, serving areas of production and markets and connecting these with each other or with the main highways.
- 4) **Other District Roads (ODR):** These are roads serving rural areas of production and providing them with outlet to market centres, taluka (tehsil) headquarters, block development headquarters or other main roads.
- 5) **Village Roads (VR):** These are roads connecting villages or groups of villages with each other and to the nearest road of a higher category.

The above classifications are still applicable and also mentioned in IRC: 73-1980 (Geometric Design Standards for Rural (Non-Urban) Highways).

**Section 2 of the National Highways Act, 1956 (48 of 1956) specified a Schedule of National Highways and empowered the Central Government to declare any highway to be a National Highway (NH) by publication of a gazette notification; it also empowered the Central Government to omit / de-notify a NH by publication of a gazette notification.**

**The Lucknow Plan (1981-2001) gave the classification of Expressways as: -  
Expressways**

Certain through routes have a very high volume of traffic at present and represent the obvious choice for a superior highway facility. It is desirable to develop such routes as a separate class, to be termed Expressways. These are superior type facilities with a divided carriageway, controlled access, grade separations at cross-roads and fencing. They permit only fast moving vehicles. Of Course, these Expressways are meant to carry through traffic and are different from those which are planned within localized urban areas to relieve congestion due to city traffic. The Expressways may be owned by the Central Government or State Government, depending upon whether the route is a National Highway or a State road.

**The Primary, Secondary and Tertiary System of Road Network was also described in Lucknow Plan (1981-2001). As per this,**

The primary system shall comprise the proposed Expressways and the National Highways. The secondary system shall consist of the State Highways and the Major District Roads. The tertiary system shall consist of the Other District Roads and the Village Roads. The latter two categories

are also commonly known by the term “Rural Roads” in India, since they represent the links to be rural areas of the country.

**The Lucknow Plan (1981-2001) also discussed about Project Roads**, i.e. Roads constructed by various project authorities such as Irrigation projects, Coalfield development projects, Railways, Forest departments, Fisheries departments, etc. The length of such roads in the country is formidable. The Plan suggested that the most appropriate action would be to bring such roads under the functional classification discussed above, though their actual construction and maintenance can be handled by the respective departments.

**Summary of Classification of Roads suggested in Lucknow Plan : -**

- (a) Primary System
  - 1. Expressways
  - 2. National Highways
- (b) Secondary System
  - 3. State Highways
  - 4. Major District Roads
- (c) Tertiary System (Rural Roads)
  - 5. Other District Roads
  - 6. Village Roads.

The Plan also suggested that the road system within an urban area which would be designed to distribute traffic from one part to other part of the town and provide access to buildings and areas within the town comes outside the purview of the classification mentioned above. Urban roads will be a separate entity to be taken care of by respective urban authorities.

**2. Suggested Road Classifications: -**

**Expressway:** A divided arterial highway for motor traffic, with full or partial control of access, and provided generally with grade separations at intersections.

Expressways may be owned by the Central Government or State Government, depending upon whether the route is notified as a National Highway / Expressway or a State road / Expressway.

**Four/Six lane National Highway/State Highway:** Four/Six lane National Highway/State Highway is a National Highway/State Highway having divided carriageway with two/three lanes on each side.

**Two lane National Highway/State Highway:** Two lane National Highway/State Highway is a National Highway/State Highway consisting of two lanes.

**Major District Roads:** Major District Roads are important roads within a district serving areas of production and markets and connecting these with each other or with the main highways.

**Other Roads:** Other District Roads (which are roads serving rural areas of production and providing them with outlet to market centers, taluka/tehsil headquarters, block development headquarters or other main roads) and Village Roads (which are roads connecting villages or groups of villages with each other and to the nearest road of a higher category).

**Urban Arterials:** A general term denoting a highway/street primarily for through traffic usually on continuous route in an Urban Area.

**Urban Distributaries:** A street or road for collecting and distributing the traffic from and to local streets, and also for providing access to arterial streets.

**Access Roads:** A street or road primarily for access to residence, business or other abutting property.

**Proposed Hierarchical Classification of Roads: -**

- (a) Primary System
  1. Expressways
  2. National Highways
  3. State Highways
- (b) Secondary System
  4. Major District Roads
- (c) Tertiary System (Rural Roads)
  5. Other District Roads
  6. Village Roads.

**3. A World Class Highway in Indian Context** should have desirably the following features: -

- (i) It should enable a safe, comfortable journey to the Road Users.
- (ii) The facility should have State-of-Art features of Intelligent Transport System (ITS); such as

(a) **Highway Traffic Management System (HTMS);**

- Emergency Call Boxes
- Variable Message Signs System
- Video Surveillance System
- Video Incident Detection System
- Meteorological Sensor System
- Mobile Communication System
- Automatic Traffic Counting and Classifying System
- Backbone Transmission System
- Sub-Centers
- Main Control Center

(b) **Toll Collection Systems:**

- Automatic Vehicle Counter cum Classifier System
- Automatic Boom barrier
- Lane Camera
- Electronic Toll Collection (ETC)
- Smart Card System
- CCTV Surveillance system
- Lane Controller
- User's Fare Display unit

- Traffic Light System
- Lane Communication System
- Fog Light
- Violation Alarm
- Toll Management Software

(c) **Weigh –in Motion Systems**

(iii) Integrated Way Side Amenities for Road Users having facilities for rest areas, food plazas, shopping centres, relaxation, parking facilities, traffic information systems, etc.

**4. Proposal for Network of NH, SH and Expressways from Grid Criteria: -**

Nomenclature of Para 3.4.4 modified as “Principle/criteria for proposing Expressways, NHs / SHs”. Para 3.4.4.1 and 3.4.4.2 modified accordingly. Although it would not result into any change in network lengths of NHs and Expressways as total length of (Expressways), NHs and SHs is worked out as 3,17,400 km; this would include Expressways of 18,637 km, NHs of 1,00,000 km and SHs of about 2,00,000 km.

**Augmentation of National Highways Network by 2031: -**

The lack of roads and in the larger context all of infrastructure is a major challenge to our economic reform programme. Against the backdrop of a severe global financial crisis, India continued to move ahead on its growth trajectory clocking a growth of 6.7 % in 2008-09. While in the first quarter of 2009-10 India grew at 6.1%, in the second quarter (July-September) 2009-10 there was a significantly higher growth rate of 7.9%. During 2010-11 also the growth rate in the second quarter had picked up significantly at nearly 8.8%.

The 20 year Road Development Plan 2001—2021 (“The Road Development Plan Vision: 2021”) prepared by MORT&H envisaged a total NH Network of about 80,000 km by the year 2021, inter-alia considering that the country had ambitious plan for GDP growth of 6-8% annually in the ‘coming years’ and improvement of transport infrastructure including its extension should be in tune with the economic growth. This would tentatively result into an average grid length of National Highways of about 80 km for the entire country as compared to the target set for the Lucknow Plan (1981-2001) to have a grid length of about 100 km. However, consideration to have an average uniform grid length of 80 km or 100 km is not practicable from the connectivity requirement point of view as in case of many States (such as Haryana, Assam, Bihar, Goa, Kerala, Punjab, Tamil Nadu, etc.) as traffic density on many of the NHs in these States have been growing significantly resulting into requirement to provide alternate connectivity. For such States, it would, perhaps, be desirable to aim at achieving an NH grid length of about 50 km now in the next 20 years (say by the end of 2031). Also in case of hilly areas, etc. from connectivity point of view it would be desirable to have much closer grid (e.g. say about 25 km or so) in order to provide better accessibility. However, for hilly States such as Jammu & Kashmir, Sikkim, etc., it may be targeted to achieve NH grid length of about 100 km by 2030 considering that the present NH grid length (average) in these two States is about 357 km and 229 km respectively. For backward regions, it may be targeted to achieve NH grid length of about 100 km by 2030. For other states, target NH grid length may be about 80 km by 2030. NH connectivity to international border, minor ports, etc., also need to be provided keeping in view their strategic importance and significance in promoting tourism, trade, etc. It is pertinent to mention in this context that the Government has set a target of growth rate of 9% in the next couple of years. A critical component of this growth story will be the Road sector, which may have the potential of contributing 1.5 – 2 % to the GDP. The Ministry of Road Transport & Highways has received proposals for declaration of various State roads as new NHs from various State Governments / Union Territories for total length of more than about 64,000 km. Keeping in view all these aspects and also the economic growth targeted by the Government, it is desirable to aim at achieving an average grid length of about 60 km for the National Highways Network in the country by the year 2031. This would require the total National Highways network length of about 1,00,000 km in next 20 years (i.e. by 2031). The consequential average length of square grid for National Highways Network would be around 65 km (= 3291080/50000).

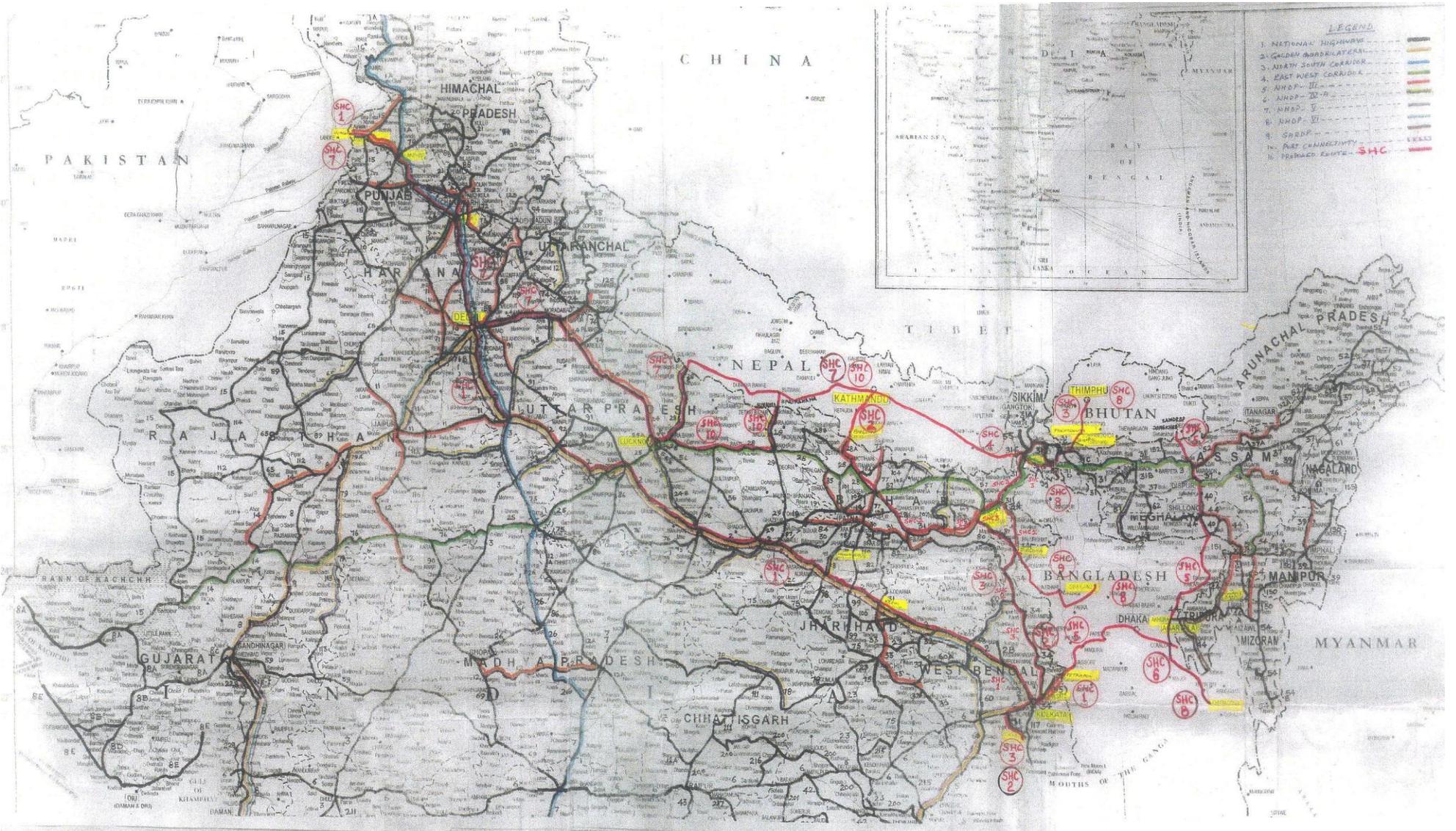
**Asian Highways in India****1. Asian Highways Network in India:**

Two Asian Highways, namely AH1 (from Tokyo (Japan) to the border of Bulgaria) and AH2 [from Denpasar (Indonesia) upto Khosarary (Iran)] are passing through India. AH 1 connects India with Pakistan, Bangladesh and Mynamar and AH 2 connects India with Nepal and Bangladesh. In addition, there are six sub regional routes in India. Out of these six routes, three routes have connections with Nepal, Sri Lanka and Bhutan. The remaining three routes are entirely within India. There are eight Asian Highway Routes in India including AH-48. The total length of the Asian Highways in India is about 11,690 km, comprising 11,646 km of National Highways and 44 km of State roads.

The Inter-Governmental Agreement on the Asian Highway Network inter-alia laid down the Asian Highway Classification and Design Standards for the following four classes: -

- (a) Primary, i.e. Access controlled highways (Asphalt or Cement Concrete);
- (b) Class I, i.e. highways having 4 or more lanes (Asphalt or Cement Concrete);
- (c) Class II, i.e. highways having 2 lanes (Asphalt or Cement Concrete);
- (d) Class III, i.e. highways having 2 lanes (Double bituminous treatment).

Their Geometric Standards have also been specified.



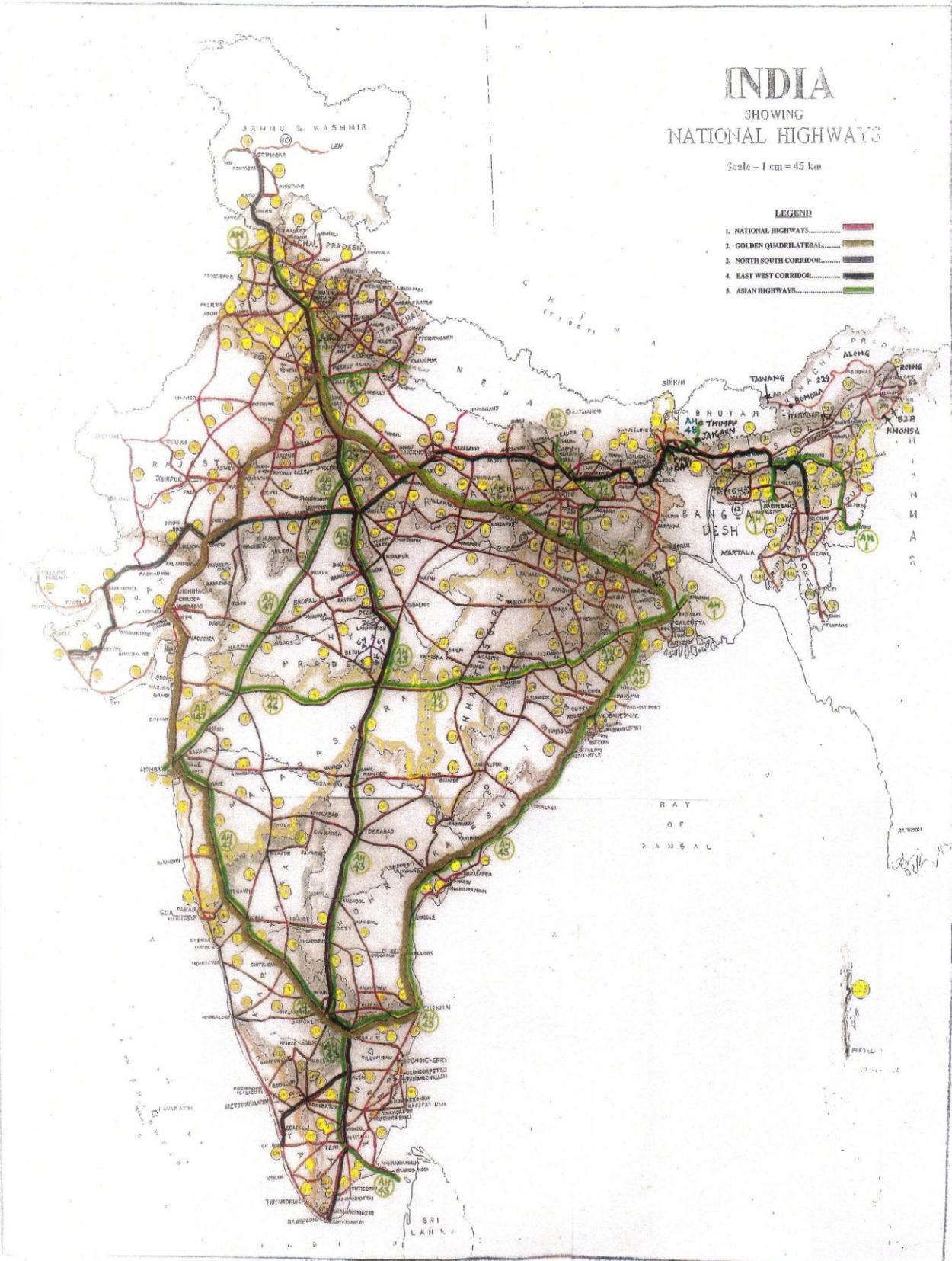
# INDIA

SHOWING  
NATIONAL HIGHWAYS

Scale - 1 cm = 45 km

**LEGEND**

- 1. NATIONAL HIGHWAYS.....
- 2. GOLDEN QUADRILATERAL.....
- 3. NORTH SOUTH CORRIDOR.....
- 4. EAST WEST CORRIDOR.....
- 5. ASIAN HIGHWAYS.....



### Initiatives taken by India

India signed the Inter-Governmental Agreement on the Asian Highways Network on 27<sup>th</sup> April, 2004, subject to ratification, during the 60<sup>th</sup> Annual Session of UNESCAP held from 22<sup>nd</sup> to 28<sup>th</sup> April, 2004 at Shanghai, China. The instrument of ratification by India was deposited with the Secretary General, United Nations, on 16<sup>th</sup> February, 2006. The Agreement came into force with effect from 4<sup>th</sup> July, 2005.

India has participated actively in the Asian Highways programme since its inception. The standards of National Highways portion of Asian Highways in India are generally at least to the prescribed minimum standards of the Asian Highway.

The standards of National Highways portion of Asian Highways in India are generally at least to the prescribed minimum standards of the Asian Highways. The length-wise distribution of Asian Highways Network in India in terms of various classes are as follows: -

- |     |                 |             |
|-----|-----------------|-------------|
| (a) | Primary         | -- 90 km    |
| (b) | Class I         | -- 2,912 km |
| (c) | Class II        | -- 7,823 km |
| (d) | Class III       | -- 813 km   |
| (e) | Below Class III | -- 52 km    |

Out of 11,690 km length of AH in India about 7,823 km length of NHs in India falling on Asian Highways Network have been categorized under Class II only because they do not meet the stipulated standards for Right of Way (ROW) and median widths for Class I. The details are given in table below:

AH No.	Length (km)	Classification*				
		Primary	Cat: I	Cat : II	Cat : III	Cat : Below III
AH 1	2776		828	1,690	258	0
AH 2	383		98	90	143	52
AH 42	457		0	457	0	0
AH 43	2383		286	2,014	83	0
AH 45	1963		1,521	442	0	0
AH 46	1564		0	1,564	0	0
AH 47	2025	90	179	1566	190	0
AH 48	139		0	0	139	0
<b>Total</b>	<b>11690</b>	<b>90</b>	<b>2,912</b>	<b>7,823</b>	<b>813</b>	<b>52</b>

\*The status is of year 2009, the latest data for year 2011 has been recently send to UNESCAP.

Out of 11,690 km of Asian Highways routes, about 6,856 km has been developed to 4-lane standard under National Highways Development Project (NHDP), and 4-laning in about 2,389 km length is under implementation under NHDP and Special Accelerated Road Development Programme in the North East Region (SARDP-NE). Thus, about 9,245 km of National Highways along Asian Highways are either already developed to 4-lane standards or programmed to be developed to 4-lane standard National Highways. The details are given in table below:

Asian Highway No.	Length (km)	National Highways (km)	State Highways (km)	Already 4- Lane (km.)	4 – laning under implementation /likely to be 4 laned	Balance length to be widened (km)
AH-1	2776	2776	Nil	1894	630	252
AH- 2	383	357	26	60	35	288
AH- 42	457	457	Nil	67	131	259
AH- 43	2383	2383	Nil	1413	970	0
AH – 45	1963	1963	Nil	1963	0	0
AH – 46	1564	1564	Nil	296	211	1057
AH – 47	2025	2025	Nil	1163	412	450
AH-48	139	121	18	0	0	139
<b>TOTAL</b>	<b>11690</b>	<b>11646</b>	<b>44</b>	<b>6856</b>	<b>2389</b>	<b>2445</b>

The cost for the development of the parts of AH and the estimated cost required for the development works on the AH is at Annexure. The development of the Asian Highways Network in India, as well as in SAARC and ASEAN countries, will facilitate increase of trade, transport and tourism among these countries as well as development of their economies.

Asian Highway Route No.AH-48 was initially passing through Thimphu – Phuentsholling in Bhutan and extended upto Border of India. As per the proposal forwarded by the Government of India, AH-48 has been extended from Thimphu-Phuentsholling-Jaigaon (in India on India-Bhutan Border) to connect on AH-2 at Phulbari via Hashimara and Jalpaiguri based upon the recommendations of the Working Group on the Asian Highway made during its third meeting held on 4.9.2009. It is envisaged that this would help in improving the international travel for trade and tourism among these countries, i.e. India, Bangladesh, Nepal and Bhutan.

**Progress in installation of the AH route signs:** The development of Asian Highway routes are being taken up within the framework of the national programme in conformity with the Agreement. Necessary instructions in this regard have been issued to the concerned executive agencies by the Ministry of Road Transport & Highways. Necessary modifications in the standards/codal provision for the Roads Signage have been made. The progress made so far is given below:

➤ *Routes Signs installed:*

- AH-I/NH-40 Jorabat-Barapani stretch (km 0 to 61) in the State of Assam and Meghalaya.
- AH-I/NH-37 on Jorabat intersection (km 171) in the State of Assam
- AH-I/NH-35 from km 456 to 492 in State of West Bengal

➤ *Route Signs Works in progress*

- AH-I/NH-34 from km 407 to 456 in State of West Bengal
- AH-I/NH-1 from km 86 to 96 in State of Haryana

Sl. No.	Asian Highway No.	Total Length (km)	Already 4- Lane (km.)	Cost (US \$ Bn)	4 - laning under implementation/likely to be 4 laned	Cost (US \$ Bn)
1	AH-1	2,776	1,894	2.53	630	1.47
2	AH- 2	383	60	0.08	35	0.08
3	AH- 42	457	67	0.09	131	0.31
4	AH- 43	2,383	1,413	1.88	970	2.26
5	AH – 45	1,963	1,963	2.62	0	0.00
6	AH – 46	1,564	296	0.39	211	0.49
7	AH – 47	2,025	1,163	1.55	412	0.96
8	AH-48	139	0	0.00	0	0.00
	<b>TOTAL</b>	<b>11,690</b>	<b>6,856</b>	<b>9.1</b>	<b>2,389</b>	<b>5.6</b>

#### Existing Asian Highways Routes in India

Sl. No.	Asian Highway No.	Itinerary
1.	AH 1	Indo/Pakistan border –Amritsar- Jalandhar- Delhi- Hodal- Mathura-Agra- Etawah- Kanpur- Allahabad-Varanasi- Aurangabad-Barhi- Gobindpur- Panagarh-Calcutta- Barasat- Bangaon-Indo./Bangladesh border- Dawki-Shillong- Jorabat-Nagaon- Dimapur-Manipur—Imphal – Indo. / Myanmar border
2.	AH 2	Delhi- Hapur-Rampur Rudrapur – Sitaganj- Indo/Nepal border near Banbasa- Panitanki- Baghdogra- Siliguri- Phulbari-Bangladesh border
3.	AH 42	Barhi-Mokamah-Barauni- Muzaffarpur Piprakothi- Raxaul-Indo Nepal Border
4.	AH 43	Agra- Gwalior – Jhansi –Lahkhandon – Nagpur—Hyderabad – Karnool – Anantapur- Bangalore- Salem-Dindigul-Madurai- Dhanushkodi
5.	AH 45	Kolkata-Kolaghat- Kharagpur- Balassore- Vishakhapatnam- Vijayawada- Nellore- Chennai- Walajapet- Krishnagiri- Bangalore
6.	AH 46	Kharagpur- Nagpur- Dhule
7.	AH 47	Gwalior- Dewas- Indore- Vadape – Mumbai- Pune-Chitradurga-Nelmangala- Bangalore
8.	AH48	[Thimphu-Phuntesholing]-Border of India (Jaigaon) – Hashimara – Jalpaiguri – Phulbari (connecting AH-2);

**Existing Asian Highways Routes in India**

<b>Sl. No.</b>	<b>Asian Highway No.</b>	<b>Length in km</b>	<b>NH No.</b>	<b>Name of States</b>	<b>Itinerary</b>
1.	AH 1	2776	1, 2, 34, 35, 36, 37, 39 & 40	Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Meghalaya, Manipur, Assam, Nagaland	Indo/Pakistan border –Amritsar-Jalandhar- Delhi- Hodal- Mathura-Agra- Etawah-Kanpur- Allahabad-Varanasi- Aurangabad-Barhi-Gobindpur- Panagarh-Calcutta-Barasat- Bongaon-Indo./Bangladesh border- Dawki-Shillong- Jorabat-Nagaon- Dimapur-Manipur—Imphal – Indo./Myanmar border.
2.	AH 2	383	24, 31, 74, 87 & 125	Delhi, Uttar Pradesh, Uttrakhand,	Delhi- Hapur-Rampur Rudrapur – Sitaganj- Indo/Nepal border near Banbasa- Panitanki- Baghdogra-Siliguri- Phulbari-Bangladesh border
3.	AH 42	457	28, 28A & 31	Bihar, Jharkhand	Barhi-Mokamah-Barauni- Muzaffarpur Piprakothi- Raxaul-Indo Nepal Border
4.	AH 43	2383	3, 7, 26, 49 & 75	Uttar Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu	Agra- Gwalior – Jhansi –Lahkhandon – Nagpur—Hyderabad – Karnool – Anantapur- Bangalore- Salem-Dindigul-Madurai- Dhanushkodi
5.	AH 45	1963	4, 5, 6 & 46	West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka	Kolkata-Kolaghat- Kharagpur-Balassore- Vishakhapatnam-Vijayawada- Nellore- Chennai-Walajapet- Krishnagiri- Bangalore
6.	AH 46	1564	6	West Bengal, Jharkhand, Orissa, Chhattisgarh, Maharashtra	Kharagpur- Nagpur- Dhule
7.	AH 47	2025	3 & 4	Madhya Pradesh, Maharastra, Karnataka,	Gwalior- Dewas- Indore- Vadape – Mumbai- Pune-Chitradurga-Nelmangala- Bangalore
8.	AH48	139	31, 31C & 31D	West Bengal	Jaigaon (India-Bhutan Border) to connecting AH-2 at Phulbari via Hashimara and Jalpaiguri.

### Ten Corridors identified under SAARC Multimodal Transport Study

SAARC Regional Multimodal Transport Study (SRMTS) was taken up by ADB with a view to facilitate improvement of the transport infrastructure and trade in the region.

#### 1. List of SAARC Highways

S. No.	SAARC Highway No.	Route
1.	<b>SHC-1</b>	Lahore-New Delhi-Kolkata-Petrapole / Benapole – Dhaka – Akhaura / Agartala
2.	<b>SHC-2</b>	Kathmandu-Birgunj-Raxaul-Kolkata-Haldia
3.	<b>SHC-3</b>	Thimphu-Phuentsholing-Jaigaon-Kolkata-Haldia
4.	<b>SHC-4</b>	Kathmandu-Kakarvitta(Nepal)-Phulbari-Bagladesh Border-Banglabandha-Mongla/Chittagong
5.	<b>SHC-5</b>	Samdrup Jongkhar-Guwahati-Shillong-Sylhet – Dhaka – Kolkata
6.	<b>SHC-6</b>	Agartala – Akhaura (Bangladesh) – Chittagong
7.	<b>SHC-7</b>	Kathmandu-Nepalganj-New Delhi – Lahore – Karachi
8.	<b>SHC-8</b>	Thimpu – Phuentsholing (Bhutan) – Jaigaon (India) – Burimari (Bangladesh) – Mongla – Chittagong
9.	<b>SHC-9</b>	Malda – Shibganj – Jamuna bridge
10.	<b>SHC-10</b>	Kathmandu-Bhairahawa-Sunauli – Lucknow

2. The relevant decisions taken during the first meeting of SAARC Transport Ministers held in New Delhi on 31.8.2007:-

“Para -12- The Ministers had before them the Report of the SAARC Regional Multimodal Transport Study as contained in **Document No. SAARC/CM.27/SC.32/12.**

Para – 13- The Ministers appreciated the work of the IGG and the following proposals for pilot, sub-regional and regional projects from Member States as recommended by the Second Meeting of Inter-Governmental Group on Transport.

**Sub-regional and regional road projects:**

i) Kathmandu-Birgunj-Kolkata/Haldia (SHC-2)

ii) Agartala-Akhaura-Chittagong (SHC-6)

Para-14- The Ministers decided that the Member States concerned, through mutual consultations, may consider the viability/ desirability of these projects.....”

The development of the following corridors pertaining to this Ministry are relevant in this context: -

**Sub-regional and regional projects:**

i) Kathmandu-Birgunj-Kolkata/Haldia (SHC-2)

ii) Agartala-Akhaura-Chittagong (SHC-6).

3. Present status of development of these routes are as follows: -

(i) **SHC 1- Lahore-New Delhi-Kolkata-Petrapole / Benapole – Dhaka – Akhaura / Agartala;-**

The proposed route shall enable connectivity of Lahore with Delhi, Kolkata and Dhaka (Bangladesh). Further, this would also connect Agartala with Bangladesh. The proposed route in India passes through Wagah, Amritsar, Jalandhar, Ambala, Delhi, Agra, Kanpur, Barhi, Barakar, Raniganj, Kolkata, Barasat upto Bangladesh border at Petrapole, entirely via NH-1, NH-2, NH-34 and NH-35. Thereafter it crosses over to Bangladesh.

The connectivity of Agartala with Bangladesh along Akhaura is available through a State Road of about 5 km length having intermediate lane (IL carriageway (i.e. 3.75 m wide), which is being funded and maintained by the Tripura State PWD. The upgradation of this road to 2-lane standards has been sanctioned by the Ministry in March 2011 under CRF scheme.

Out of the total length of about 1997 km in India, improvement to 4-lane standards have been already carried out in a length of about 1895 km under various phases of National Highways Development Project (NHDP). The stretch from Barasat–Petrapole is programmed for development to 4-lane standards under NHDP-III. Due to local resistance for land acquisition, DPR for 4-laning through alternative alignment/ improvement along existing route is held up and the Project is halted for about 5 years.

Thus it may be seen that apart from the 5 km stretch of State Road connecting Agartala with Bangladesh, the entire length of about 1992 km is either already 4-laned, or being 4-laned, or programmed for 4-laning.

**(ii) SHC 2- Kathmandu-Birgunj-Raxaul-Kolkata-Haldia;-**

The proposed route having a length of about 1026 km in India, is intended to provide connectivity of Kathmandu with Kolkata Port and Haldia Port.

The proposed route in India passes through Raxaul, Motihari, Muzaffarpur, Barauni, Khagaria, Purnea, Baisi, Dalkola, Raigunj, Baharampur, Barasat, and Kolkata, entirely through the National Highways (NH) NH-28A, NH-28, NH-31, NH-34, NH-6, NH-2 and NH-41. The entire stretch of 1026 km length of SHC-2 route in India has been programmed for development under NHDP and other programmes. About 231 km length has already been improved to 4-lane standards under NHDP. Besides, 4-laning is progress in about 634 km length. All these works are expected to be completed in phases by December, 2014.

**(iii) SHC 3-Thimphu-Phuentsholing-Jaigaon-Kolkata-Haldia;-**

The proposed route would facilitate connectivity between Bhutan with Kolkata and Haldia Ports. The connectivity of Phuentsholing (Bhutan) with India is at Jaigaon in India. Jaigaon is connected with Hasimara (on NH-31 C) by a 18.20 km of 2-lane State Road which is presently under the administrative control of the Border Roads Organization (BRO). It is estimated that about Rs. 50 crore will be required to rectify the existing deficiencies in this stretch by undertaking reconstruction/rehabilitation of weak bridges, realignment at some stretches, strengthening of carriageway, etc. Hasimara is connected with Gayarkata and Dhupguri by NH-31 and NH-31 C. It is estimated that about Rs. 75 crore would be the cost of removing the existing deficiencies of the 51 km stretch of existing these 2-lane NHs. The connectivity of Dhupguri to Siliguri would be available via the proposed new alignment of East-West Corridor under NHDP-II via Mainaguri, Phulbari. This stretch of about 80 km length is having about 70 km length of 2-lane carriageway, and realignment would be required in about 10 km length near Siliguri. The stretch from Dhupguri to Mainaguri is programmed for development to 4-lane NH

standards under East – West Corridor and is under consideration to be taken up on BOT (Annuity) mode; DPR for this stretch is under finalization.

In order to provide connectivity with Asian Highway Route AH-2 at Phulbari, existing route of AH-48 has been extended from Thimphu – Phuentsholing – to Bhutan / India border (via Jaigaon (in India bordering Bhutan)) via Hasimara – Gairkata – Dhupguri – Phulbari by the UNESCAP based upon the recommendation of the Working Group on Asian Highways on the basis of the proposal forwarded by the Government of India.

The total length of this corridor from Jaigaon (Bordering Bhutan) to Haldia, via Siliguri, Purnea, Barasat and Kolkata is about 879 km (18 km State Road and remaining 861 km National Highways). Out of 879 km length of SHC-2 route in India about 691 km length has been programmed for upgradation to 4-lane NH standards under different phases of NHDP. The NH connectivity from Hasimara to Haldia via Kolkata and Kolaghat would be available via NH-31, NH-31 C, NH-34, NH-35, NH-81, NH-6 and NH-41 and new NH for modified alignment of E-W Corridor. This includes 235 km completed 4-lane sections and 328 km length where work on improvement to 4-lane standards is in progress.

**(iv) SHC 4 - Kathmandu – Kakarvitta (Nepal) – Phulbari - Bangladesh Border Banglabandha-Mongla/Chittagong:-**

The connectivity within Indian Territory is available through about 53 km long State Road (in West Bengal). Panitanki is on the Indian side (adjacent to Kakarvitta in Nepal) of the boundary and is 0.5 km from the junction of NH-31 C; Phulbari (India) is near Bangladesh border. The most direct route between these two routes is via Siliguri. But due to restrictions imposed on movement of truck traffic in Siliguri, the present connectivity is through NH-31 C, NH-31 and SH-12 and the link roads to both the border posts.

**(v) SHC 5- Samdrup Jongkhar-Guwahati-Shillong-Sylhet – Dhaka – Kolkata;-**

The proposed route would provide connectivity of Bhutan with Bangladesh via Guwahati and Shillong, which are the gateways to the North-Eastern States of India, and also with Kolkata.

The proposed route in India passes through Darranga, Rangia, Guwahati, Jorabat, Barapani, Shillong and Dawki and then on to Sylhet (Bangladesh). In Bangladesh, it passes through Dhaka thereafter and then connects Kolkata via Petrapole (India). In this link, Darranga-Rangia portion is a State Road of about 40 km length having single lane carriageway. This road is being maintained by Border Roads Organization and is in a good condition. The remaining length upto Dawki is about 217 km length of National Highways (26 km length of 4-lane standards, 159 km length of 2-lane standards and 32 km length of single lane standards) and passes through NH-31, NH-37, NH-40. At present, 4-laning is in progress in about 31 km length falling under East-West (EW) Corridor under NHDP-Phase-II; these works are expected to be completed by December, 2012. In addition to this, about 62 km length from Jorabat – Barapani is programmed for improvement to 4-lane standards under the Special Accelerated Road Development Programme for the North-Eastern Region (SARDP-NE)-Phase-A. Work is in progress in this stretch and the target for completion is January, 2014. Proposal for developing 2-lane Shillong bypass (about 18 km length) is under consideration at present. The rehabilitation of the existing single lane Suspension bridge near Dawki on Shillong – Dawki section of NH-40 has already been completed. Dawki is also connected with Shillong through alternative route via Shillong – Jowai section of NH-44 and Jowai – Dawki section of NH-40. This Route is operational without any

load restriction. Construction of a new bridge at Dawki has been sanctioned and is at tender stage for second time.

The proposed route provides connectivity of Kolkata with Dhaka from Bangladesh side via Petrapole (India). The total length of this stretch in India is about 77 km, entirely located on National Highways (NH-34 & NH-35), excluding 14 km falling within municipality limits of Kolkata. This is having about 45 km of 2-lane standards and the remaining length is of intermediate standards. The 60 km length of NH-35 from Barasat to Petrapole is included for improvement to 4-lane standards under NHDP-Phase-III. Due to local resistance for land acquisition, DPR for 4-laning through alternative alignment/ improvement along existing route is held up. Project is halted for about 5 years and there is no break-through in the matter.

**(vi) SHC 6-Agartala – Akhaura (Bangladesh) – Chittagong:-**

The total length of this corridor in India is about 5 km. This is a State Road in the State of Tripura. At present this is less than 2-lane standards. The upgradation of this road to 2-lane standards has been sanctioned in March 2011 under CRF scheme.

Regarding the connectivity of Jorabat (i.e. connecting point of East-West corridor) to Agartala, the following are relevant: -

(a) Existing 62 km stretch of 2-lane of NH-40 between Jorabat to Barapani is programmed for 4-laning under SARDP-NE Phase-A to provide connectivity with East-West Corridor (under NHDP Phase-I) at Jorabat. Work is in progress. Target for completion is January, 2014.

(b) Further, construction of new Shillong Bypass (about 50 km length) is to be taken up to connect NH-40 and NH-44 under SARDP-NE Phase-A.

Target for completion = February, 2014.

(c) The 252 km stretch of NH (NH-44 & NH-53) between Shillong upto Assam / Tripura border (at Churaibari) was programmed for upgradation to 4-lane standards under NHDP Phase-III. Due to low volume of traffic proposal for 4-laning has been dropped from NHDP-III. The entire stretch from Shillong to Tripura border is already of 2-lane standard except for 30km stretch between Ratachera-Churaibari which is being widened to 2-lane under SARDP-NE Phase-A. Target for completion = March, 2015

(d) 330km of stretch from NH-44 from Churaibari to Sabroom via Agartala. 4-laning of Churaibari to Sabroom section of NH-44 under SARDP-NE Phase-A has been dropped due to low volume of traffic. In the first stage, the NH will be improved to 2-lane standard and 4-laning will be taken up later as and when the traffic volume demands it. At present 2-laning of Churaibari-Agartala section will be taken up under NH(O) and 2-laning of Agartala-Sabroom section will be taken under SARDP-NE Phase-A.

**(vii) SHC 7- Kathmandu-Nepalganj-New Delhi – Lahore – Karachi:-**

This route provides connectivity of Kathmandu with Lahore and Karachi in Pakistan via Barabanki, Lucknow, Moradabad, Hapur, Delhi, Ambala, Ludhiana, Jalandhar, Amritsar and Wagah border. The proposed route in India entirely passes through the National Highways NH-28C, NH-28, NH-24 and NH-1. The total length of this corridor in India is about 1166.5 km. The entire stretch is programmed for development under different phases of NHDP. So far 737.35 km has been developed to 4-lane standards under NHDP and 4-laning is in progress in a length of about 258.15 km. The 151 km stretch of NH-28 C connecting Rupaidiha (Nepal border) – Baharaich – Barabanki is to be improved to 2-lane standards with paved shoulders under NHDP-IV B; DPR preparation is in progress. Anticipated date for completion of development of this stretch is March 2014.

Thus the entire route in India is covered under some planned improvement programme or the other. Further, the 166 km stretch of NH-24 between Moradabad, Hapur and Delhi is also included in the programme of 6-laning under NHDP-V.

**(viii) SHC 8-Thimpu – Phuentsholing (Bhutan) – Jaigaon (India) – Burimari (Bangladesh) – Mongla – Chittagong:-**

The SHC 8 route would enable connectivity of Bhutan with Chittagong port of Bangladesh via India. The alignment of SHC 8 follows the same route as that of SHC 3 from Jaigaon (on Border of India with Bhutan) to Mainaguri via 18.2 km long State Road upto Hasimara, and from Hasimara to Mainaguri via Dhupguri and Gayarkata via NH-31 C and NH-31 having a length of about 69 km. 18 km of the NH stretch between Dhupguri and Mainaguri is programmed to be developed to 4-lane standards under East-West Corridor. Project is under consideration and is to be taken up on BOT(Annuity) mode. Finalization of DPR is in progress. The details of this route in India upto Dhupguri is given under description of SHC 3 in para (iii). Thereafter, the connectivity from Mainaguri to Changrabandha (in India on Bangladesh border) is available via about 30 km long State Road.

**(ix) SHC 9-Malda – Shibganj – Jamuna bridge:-**

The connectivity of Malda (in India) with Bangladesh border is available at this location via a State Road, which takes off from Malda (km 330 on NH-34 in West Bengal). The total Length of this is about 13.5 km of Intermediate Lane standards; however, the condition of this road is poor.

**(x) SHC 10- Kathmandu-Bhairahawa-Sunauli – Lucknow;-**

The proposed corridor provides connectivity of Kathmandu with Lucknow via Sunauli (India) and Gorakhpur. The total length of this stretch in India is about 367 km, entirely along National Highways, having 2-lane carriageways. Entire length of the corridor is programmed for development (to be 4-laned in 275 km and to be developed to 2-lane with paved shoulders in 92 km). The work of improvement to 4-lane standards is completed in 270.5 km length located on EW Corridor, under NHDP-Phase-II. The 4-laning of balance 4.5 km is targeted for completion by June 2012.

The 92 km long stretch of NH-29 from Sunauli to Gorakhpur is proposed to be developed under NHDP-Phase-IV-B to 2-lane with paved shoulders. DPR is presently under preparation. Anticipated date for completion of development of this stretch is March 2014.

## Annexure 3.5

Vision for 20 Years for Programmes outside NHDP					
	Scheme	Period 2012-2121		Period 2022-2031	
		Length (km)	Amount Rs. Crore	Length (km)	Amount Rs. Crore
<b>A.</b>	<b>Expressways</b>	<b>4,000</b>		<b>14,637</b>	
	L.A., R&R, utility shifting, project preparation (Budgetary Allocation)		38,000		139,052
	<b>Construction</b>				
	Budgetary Allocation	1,500	43,800	1,000	154,660
	Private Sector Investment	1,500	20,700	14,637	202,000
	<b>Sub-Total (Budgetary allocation)</b>	<b>1,500</b>	<b>81,800</b>	<b>1,000</b>	<b>293,712</b>
	<b>Sub-Total (Private Sector Investment)</b>	<b>1,500</b>	<b>20,700</b>	<b>14,637</b>	<b>202,000</b>
<b>B.</b>	<b>National Highways</b>				
	<b>(i) Four-Laning/Six-Laning</b>				
	L.A. (40 m), R&R, utility shifting, project preparation (Budgetary Allocation)	5,000	21,250	20,000	85,000
	<b>Construction (@ Rs. 11.50 crore per km as fully access controlled facilities)</b>	5,000		20,000	
	Budgetary Allocation (@30% for VGF)		17,250		69,000
	Private Sector Investment (@ 70%)		40,250		161,000
	<b>Sub-Total (Budgetary allocation)</b>		<b>38,500</b>		<b>154,000</b>
	<b>Sub-Total (Private Sector Investment)</b>		<b>40,250</b>		<b>161,000</b>
	<b>(ii) Two-Laning with hard shoulders</b>	<b>16,000</b>		<b>23,000</b>	
	Budgetary Allocation	11,000	55,000	14,500	76,360
	Private Sector Investment	5,000	10,500	8,500	22,215
	<b>(iii) Riding Quality Improvement</b>	<b>15,000</b>		<b>15,000</b>	
	Budgetary Allocation		11,250		11,250
	<b>(iv) Strengthening Weak Pavements</b>	<b>10,000</b>		<b>10,000</b>	
	Budgetary Allocation		15,000		15,000
	<b>(v) Bypasses, bridges, over bridges, safety and drainage measures</b>	<b>Lump sum</b>			
	Budgetary Allocation		15,000		15,000
	<b>Total Budgetary Allocation</b>		<b>216,550</b>		<b>565,322</b>
	<b>Total Private Sector Investment</b>		<b>71,450</b>		<b>385,215</b>

**Annexure 3.6**

Vision for Next 20 Years for State Highways & Major District Roads					
S.No.	Scheme	Period 2012-2021		Period 2021-2031	
		Length (km)	Amount Rs. Crore	Length (km)	Amount Rs. Crore
<b>A.</b>	<b>State Highways</b>				
	<b>(i) Expressways including Urban Linkages to National Expressways Network</b>				
(a)	LA, utility shifting, project preparation (from budgetary allocations)	1,000	9,250	2,750	25,438
(c)	Construction through PPP	1000		2,750	
	Budgetary allocation (40%)		9,200		25,300
	Private Sector Investment (60%)		13,800		37,950
	<b>Sub-Total (Budgetary allocation)</b>		<b>18,450</b>		<b>50,738</b>
	<b>Sub-Total (Private Sector Investment)</b>		<b>13,800</b>		<b>37,950</b>
<b>(ii)</b>	<b>Four-laning / Six-laning</b>	15,000		15,000	
(a)	LA (40 m), R&R, utility shifting, project preparation (Budgetary Allocation)	15,000	63,750	15,000	63,750
(b)	Construction @ Rs. 10 crore per km; 30 % through budgetary allocation	4,500	45,000	4,500	45,000
(c)	Construction of 70 % through PPP	10,500		10,500	
	Budgetary allocation (30% for VGF)		31,500		31,500
	Private Sector Investment		73,500		73,500
	<b>Sub-Total (Budgetary allocation)</b>		<b>140,250</b>		<b>140,250</b>
	<b>Sub-Total (Private Sector Investment)</b>		<b>73,500</b>		<b>73,500</b>
<b>(iii)</b>	<b>Two-laning with hard shoulders</b>	<b>60,000</b>		<b>41,049</b>	
	Budgetary allocation (70 %)		105,000		71,836
	Private Sector Investment (30%)		45,000		30,787
<b>(iv)</b>	<b>Strengthening weak pavement</b>	<b>20,000</b>	<b>30,000</b>	<b>30,000</b>	<b>45,000</b>
<b>(v)</b>	<b>Improvement of Riding Quality</b>	<b>50,000</b>	<b>25,000</b>	<b>50,000</b>	<b>25,000</b>
<b>(vi)</b>	<b>Bypasses, bridges, over bridges, safety and drainage measures</b>	<b>LS</b>		<b>LS</b>	
	Budgetary allocation		20,000		20,000
	Private Sector Investment		10,000		10,000
<b>(vii)</b>	<b>Expansion of SH system, missing gaps to link new SEZs, ports, etc.</b>	<b>17,000</b>		<b>17,000</b>	
	Budgetary allocation (for 70 %)		29,750		29,750
	Private Sector Investment (for 30 %)		12,750		12,750
	<b>Total for State Highways</b>		<b>523,500</b>		<b>547,560</b>
	<b>Total (Budgetary allocation)</b>		<b>368,450</b>		<b>382,573</b>
	<b>Total (Private Sector Investment)</b>		<b>155,050</b>		<b>164,987</b>
<b>B.</b>	<b>Major District Roads</b>				
<b>(i)</b>	<b>Two-laning</b>	<b>50,000</b>	<b>100,000</b>	<b>69,025</b>	<b>138,050</b>
<b>(ii)</b>	<b>Strengthening weak pavement</b>	<b>40,000</b>	<b>40,000</b>	<b>40,000</b>	<b>40,000</b>
<b>(iii)</b>	<b>Improving riding quality</b>	<b>100,000</b>	<b>30,000</b>	<b>1,00,000</b>	<b>30,000</b>
<b>(iv)</b>	<b>Bypasses, bridges, over bridges, safety and drainage measures</b>	<b>LS</b>	<b>10,000</b>	<b>LS</b>	<b>10,000</b>
<b>(v)</b>	<b>Expansion of MDR system</b>	<b>60,000</b>	<b>120,000</b>	<b>74,000</b>	<b>148,000</b>
	<b>Total for Major District Roads</b>		<b>300,000</b>		<b>366,050</b>
	<b>Grand Total (Budgetary allocation)</b>		<b>668,450</b>		<b>748,623</b>
	<b>Grand Total (Private Sector Investment)</b>		<b>155,050</b>		<b>164,987</b>

## **Chapter IV**

### **Energy, Environment, Technology and Modernization of trucking industry**

#### **4.1 Introduction**

4.1.1 Road based freight traffic is the backbone of the Indian economy. This chapter addresses some aspects relating to energy, environment and modernization of the trucking industry in India. Its focus is on 1) improving operating efficiency of road transport; 2) improving fuel efficiency of vehicles; 3) improving fuel quality and fuel switching. Improvement of operating efficiency requires action on many fronts, including structural and institutional interventions. Addressing these issues would require action on a number of fronts. On some issues, like operating efficiency of road transport system there is a need to understand the structural features of the trucking industry. Similarly, improving the fuel efficiency of vehicles requires action not only on technical innovation but also on vehicle maintenance. While a robust Inspection and Maintenance (I&M) Program could improve efficiency of trucking fleet, the key benefit to operators may lie in the reduced down time due to vehicle breakdowns. The quality of such maintenance needs to be addressed through suitable capacity building in partnership with vehicle manufacturers.

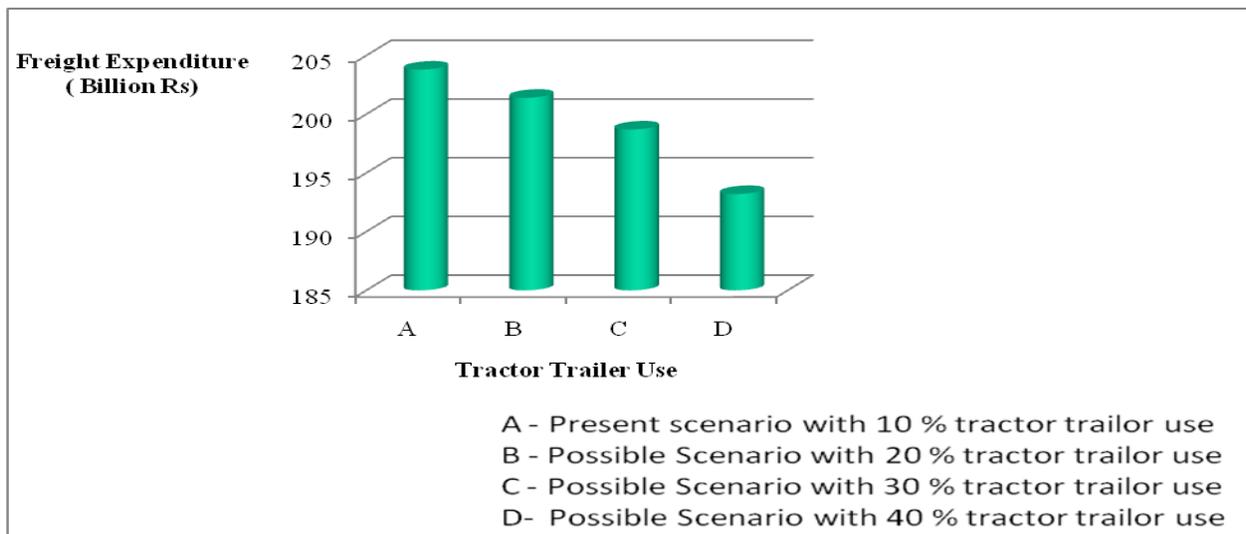
4.1.2 The modal mix for freight transport is substantially skewed towards road, to the exclusion of water (both inland waterways and coastal shipping) and rail modes. This is especially true for non-bulk cargo. A more sustainable transport system would require re-optimization of the mix. However, this can only be done through market mechanisms since it is not possible to mandate modal choices. There is also the issue of choice of mode within road freight and of in-city and inter-city transport choices. In order to facilitate appropriate modal choices from a broader social and environmental perspective, a critical infrastructure need is trans-shipment facilities, both rail and road trans-shipment, on which there is some initiative now from the Railways (including the use of PPP for such trans-shipment facilities) and the use of ‘transport nagars’, i.e., facilities where goods can be trans-shipped from larger inter-city vehicles to smaller in-city vehicles. The development of ‘transport nagars’ can also be expected to assist in acceleration of fuel switching. A number of large cities now have distribution infrastructure in place for CNG. In addition, there needs to be support for improving fuel quality. However, it is important to reiterate that this is both a vehicle technology issue as well as a refining and distribution infrastructure issue. Engines built for high quality fuel have limited tolerance for lower quality fuel, leading to reduction in engine life and efficiency. Without a robust regime that assures fuel quality, it is impractical to insist higher standard engines.

#### **4.2 Improving Operational Efficiency in Road Transport**

##### **4.2.1 Trucking Fleet**

4.2.1.1 According to a statistics provided by TCI (2011), freight industry structure is deregulated and highly fragmented, 90% of the industry consists of unorganized players having less than 5 trucks contributing 80% of the revenue. The organized component of the industry consisting of the fleet operators is small in number and has a fleet with varying payloads. The fleet is primarily used for general goods transportation with the operators working on the basis of “hub and spoke” distribution model. With transportation companies (big fleet operators) gradually moving from

an asset based to a non asset based model, it is widely recognized that dependence of small fleet operators and small operators on brokers is expected to continue to have an impact on the physical as well as the financial performance of these operators. Profitability of truck operations depends on the following factors (a) Capacity Utilization; (b) Freight Trips; (c) Fuel Prices; and (d) Other Operating Costs. In order to maximize their profitability, truck operators can: (i) Increase their revenue by overloading the vehicles in general; (ii) Maintain a suitable vehicle mix according to payload capacity of the vehicles, based on the freight availability, type of freight carried and long term contracts with customers and (iii) Use Tractor Trailers. The impact of tractor trailers is shown in figure 1. Increasing use of tractor trailers reduce the freight expenditure. The toll rates for multi axle tractor trailers should be incentivized.



**Figure 4.1: Impact of Tractor Trailers on Road Transport**

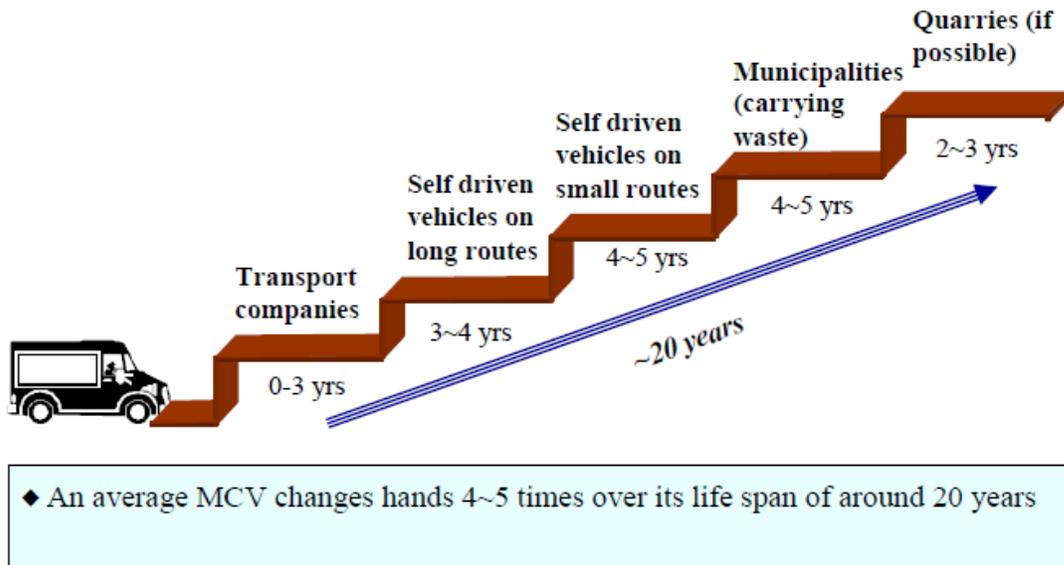
### 4.3 Use of Technology

#### 4.3.1 End of Life and Vehicle Quality

4.3.1.1 End-of-life motor vehicles (ELV) are a significant contributor to waste volumes. The number of ELVs arising each year is likely to increase as the result of a continuing upward trend in the rate of vehicle ownership, falling average age of vehicles at end-of-life, erosion in cost effectiveness of owning older vehicles and the declining cost of new cars. As the number of ELVs continues to increase, the proportion being recycled will need to be maximized to limit environmental impacts and resource loss. At the moment, the most common method for ELV recycling involves dismantling of vehicles and removal of parts that can be sold for reuse, removal of potential environmentally damaging materials, shredding of metal content and the residual materials. The main output from the shredding of car bodies is ferrous and nonferrous materials.

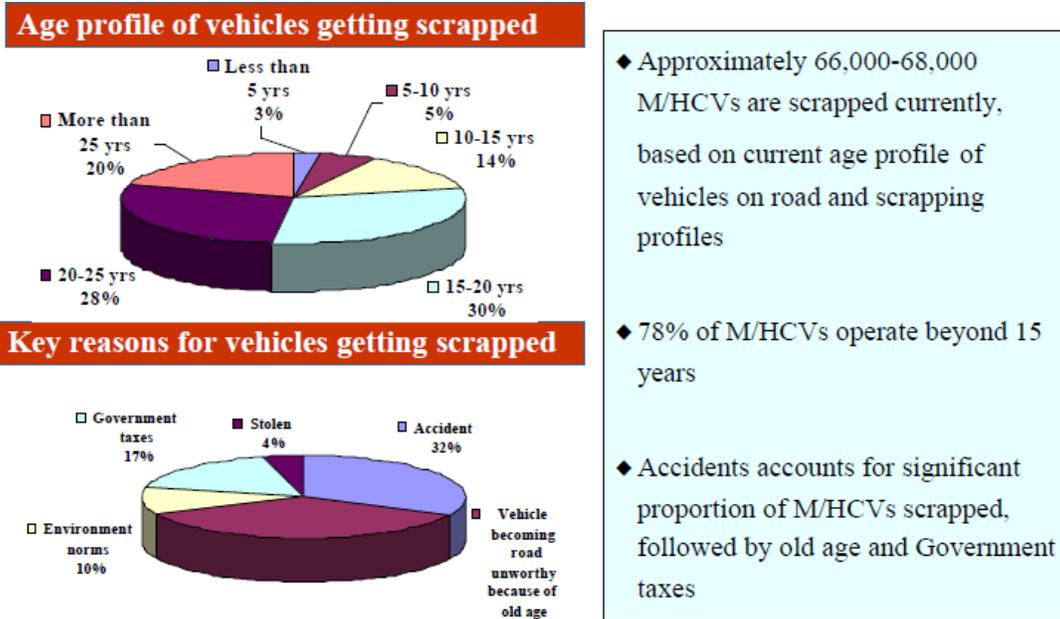
4.3.1.2 The residual mixture, once the metal content has been removed, is classified as 'shredder residue' which is not recycled but disposed of to landfill as waste. This material is made up of plastics, rubber, glass, dirt, carpet fibres and seat foam. Shredder residue is a key area of potential environmental concern in relation to ELVs.

4.3.1.3 India is yet to develop a proper mechanism for disposal of ELVs and used vehicles. With the informal sector handling much of the existing vehicle scrap market, managing the large volumes of waste generated from end-of-life or used vehicles would pose a challenge in the future. It is expected by 2020, recoverable materials from recycling will be 1.5 million tons of shredded steel scrap, 180,000 tons of aluminium scrap, 750,000 tons of recoverable plastic and 75,000 tons of rubber. This requires developing an industry to recycle end-of-life and used vehicles. Though standards for recycling used cars exist in the European Union, there are none available for recycling two-wheelers anywhere in the world. The components of old vehicles such as connecting rods, pistons and engine components can be easily reused if proper standards for these are developed. There are hazards of unhygienic disposal of old cars. In India an average CV has a life span of 20 years as shown in Figure 2.



**Figure 4.2: Life span of CVs in India (ICRA, 2006)**

4.3.1.4 Most of the vehicle components are non-biodegradable. If promoted in an organized way, recycling used vehicles can help scrap handling. Some experts opine that buy-back arrangement by vehicle manufacturers should be encouraged. The age profile of vehicles getting scrapped in India is given in Figure 3.



**Figure 4.3: Life span of CVs in India (ICRA, 2006)**

4.3.1.5 On an average, 1.6 million vehicles are scrapped currently (representing about 2% of vehicle population), based on current scrapping profiles. Of the above, more than 70% vehicles are cut, the rest are dumped (*except for 2- wheelers, where the figure is considerably lower ~30%*). More than 50% of non-metallic scrap is wasted, the proportion is much higher for fluids and gases. There is no proper management of waste. Most of it is dumped along with other municipal waste. Significant environmental pollution is created on account of the above.

4.3.1.6 There are four main players in vehicle scrapping viz. producers, users, dismantlers/recyclers and Authorities. Producers have an essential role not only in terms of improvement of waste prevention, but also in organizing the recycling network through their allocated physical and financial responsibility. Besides the conventional producer responsibility, which is often limited to production and user phases of products, the producer responsibility has been extended to the end-of-life phase in the ELV policies of certain countries, which is defined as the Extended Producer Responsibility (EPR). Customers have an equally important role in terms of financial responsibilities. Authorities are important actors in terms of designing and enforcing basic policies to facilitate the system. Commitment of Authorities, presence of legislation and the level of enforcement affect the general success of the system. Therefore, it is imperative that for any ELV management and processing policy to be effective, the role of each participant is clearly defined and monitored and appropriate financial mechanisms be set in place. Government of India approved to establish a Recycle Demo Unit under Auto R&D cess fund at GARC, Oragadam near Chennai.

4.3.1.7 ELV will go hand in hand with I&M regime. Vehicles will need to be scrapped through ELV procedure. In cities like Mumbai the CVs are required to go off the road after 15 years. Such vehicles then operate in smaller towns/villages and finally end in scrap after many years in service. India needs to consolidate following steps in future to evolve a proper ELV regime: (a) Establishment of a robust I&M regime; (b) Establishment of scrapping methodology including

deregistration of vehicles; and (c) Setting up of centres to disassemble vehicles, sort out the materials and methodology to reuse the scrap material.

#### **4.3.1.8 Key Recommendations on ELV:**

- 1) Developing end of life regulations of vehicles for future implementation in India.
- 2) Establishment of commercially viable recycling centres.
- 3) Incentivizing scrapping of old vehicles which are high contributors to environmental damage.
- 4) Ensuring optimum investment and operating costs for scrapping infrastructure.
- 5) Ensuring that data related to deregistration, number of scrapped vehicles is appropriately generated, stored and disseminated.

#### **4.3.2 Smart Transport – ITS and RFID**

4.3.2.1 Electronic toll collection (ETC), aims to eliminate the delay on toll roads by collecting tolls electronically. Nandan Nilekani led Experts Committee on Electronic Toll Collection (ETC) has submitted its report to MORTH. The committee has recommended adopting Radio Frequency Identification (RFID) technology (based on EPC, Gen-2, and ISO 18000-6C Standards) for electronic toll collection on NHs in India. The committee has studied different ETC technologies being used world over such as Dedicated Short Range Communications (DSRC), Radio Frequency Identification (RFID), Global Navigational satellite System/ Cellular Network systems (GNSS/CN) and Vehicle Identification System using number plates. It has recommended adopting RFID technology which is maintenance-free and does not require a battery, and has a long life. It is simple to install (an RFID tag can be simply stuck on the windscreen of a vehicle), and the reliability of identification is high. Most importantly, the cost of the passive RFID tag for the vehicle owner is a fraction of the cost of the other alternatives. It costs about Rs 100 per Tag and about Rs 2 lakhs per Reader as compared to other technologies which cost Rs 1,000 to Rs 2,000 for On Board Unit (OBU) and Rs 2 to 5 lakhs for the reader. RFID is the only technology (besides DSRC Passive Microwave) which has multiple suppliers. It allows tamper resistant “stickers” which are small, light, very cheap and with almost unlimited life. The technology is being used successfully in USA, and other countries.

4.3.2.2 The Committee also recommended a prepaid system for toll collection similar to the prepaid phone cards which is people friendly. With prepaid systems, a vehicle owner can “recharge” the account for the vehicle (the account number will be the RFID tag number), and when the vehicle passes through the ETC lane of any toll plaza, appropriate toll will be debited from the account. All Toll plazas on NHs will be equipped with systems to read the tags. In order to manage the financial transactions relating to toll collection (recharging, toll debiting, payment to the toll concessionaires, etc.) a Central Toll Clearing House has been proposed. The RFID Tag system has additional advantages as it can be used for other applications like vehicle tracking, parking, traffic enforcement etc. It is expected that the ETC system will be beneficial to users, toll operators and NHAI.

#### **4.3.3 ITS Applications**

- i) **Advanced Traveller Information Systems** provide drivers with real-time traffic information.

- ii) **Advanced Transportation Management Systems** include traffic control devices, variable message signs, and traffic operations centres.
- iii) **ITS-Enabled Transportation Pricing Systems** include systems such as electronic toll collection (ETC), congestion pricing, fee-based express lanes (High Occupancy Toll - HOT lanes), and vehicle miles travelled (VMT) usage-based fee systems.
- iv) **Advanced Public Transportation Systems**, for example, allow trains and buses to report their position so passengers can be informed of their real-time status (arrival and departure information), electronic fare payment
- v) **Fully integrated intelligent transportation systems**, such as vehicle-to-infrastructure (VII) and vehicle-to-vehicle (V2V) integration, enable communication among assets in the transportation system, for example, from vehicles to roadside sensors, traffic lights, and other vehicles. Typical applications include Intersection Collision Avoidance System, Intelligent Speed Adaptation, etc.

4.3.3.1 ITS deliver five key classes of benefits by: (i) increasing safety; (ii) improving operational performance, particularly by reducing congestion; (iii) enhancing mobility and convenience; (iv) delivering environmental benefits; and (v) boosting productivity and expanding economic and employment growth

#### **4.3.3.2 Key Recommendations:**

- 1) Provision of real-time traffic information in vehicles
- 2) Electronic toll collection on all major highways/expressways using RFID technology and smart card system as proposed by Nilekani Report.
- 3) Public transportation information system in major cities
- 4) Adaptive traffic signals, congestion charging, parking guidance system in major cities
- 5) Weighing-in-motion (WIM) of goods carriage vehicles on roads to curb overloading problems.

## **4.4 Increasing Fuel Efficiency**

### **4.4.1 Energy Scenario for Transportation**

4.4.1.1 Road sector will remain the most dominant player in the transport sector carrying 84% of passengers and 68% of freight. Of the total energy consumed in the transport sector 98.5% is met through petroleum products and the rest by electric power. Transport sector consumed 27% of total oil and oil products in India during 2006-07. This is likely to go up to 45% by 2030; 97% of its fuel requirement will be met by the liquid fuels (petroleum products), where India is already import dependent for crude oil (WEO-2008).

4.4.1.2 As per RITES, 2009 study, India's energy demand for transport grew by 1.9% per annum in 2000-2005. As already stated, these figures do not match up the actual physical growth of transport during this period. According to IEA's estimate, the transport demand will grow at a brisk pace of 6.1 % per annum. The demand almost doubles by 2015 and more than quadruples by 2030, reaching 162 Mtoe. The share in the primary energy increases from 10% in 2005 to 20% in 2030. Further, the share of global transport energy is likely to triple from 2% in 2005 to about 6% in 2030 (WEO 2007). Transport sector currently consumes 27% of the total primary

oil demand (2005). This is likely to increase to 47 % in 2030, with road transport consuming a hefty 40 % of this. The likely mode-wise projection for share of energy is given in Table 4.1.

Mode	2006-07	2029-30
Road	78	86
Aviation	11	9
Railways/IWT	11	5

Source: WEO 2007, IEA

#### 4.4.2 Energy Efficiency Public Road Transport Vs Personalised Mode

4.4.2.1 In general, energy consumed in the road transport sector are petroleum products, mainly gasoline and High Speed Diesel (HSD). The energy consumption in road transport largely depends on the modal split as well as the speed of the vehicle. On average, energy consumption per passenger-km is the least by bus and the highest by car among different modes of road-based passenger transport. Buses, which carry around 50% of motorized urban passenger traffic, consume far less energy as compared to cars, jeeps, and two-wheelers, which carry around 40% of this traffic. On average, a car consumes nearly six times more energy than an average bus, while two-wheelers consume about 2.5 times and three-wheelers 4.7 times more energy. In terms of fuel cost per passenger-km, a two-wheeler is 6.8 times, a three-wheeler 7.0 times, and a car is 11.8 times costlier than a bus. Furthermore, a car occupies over 38 times more road space in comparison to a bus to provide the same level of passenger mobility (in terms of passenger-kms). The corresponding figures for two- and three-wheelers are 54 and 15, respectively. This shows that bus transportation is not only favourable in terms of environmental consideration but also in terms of energy efficiency and best possible use of scarce road space (Table 4.2).

Mode	Fuel Type	Fuel Efficiency (Km/Litre)	Energy Intensity	Relative Energy Efficiency
Bus	Diesel	4.30	0.006	1.00
Two Wheeler	Petrol	44.00	0.015	2.50
Three Wheeler	Petrol	20.00	0.028	4.70
Car	Petrol	10.90	0.038	6.30

Number of passengers estimated for Bus, 2 Wheeler, 3 Wheeler and car are 40, 1, 2 and 3, respectively; higher number for relative efficiency indicates a poor efficiency for the mode

#### 4.4.3 Use of Alternative fuels like CNG & LNG

4.4.3.1 Natural gas has been considered as the most promising alternative fuel for its cleanliness and abundance. CNG can be used for buses with a typical range of 250 km for dedicated or dual fuel i.e. Diesel-CNG operation. CNG has benefits of lower hydrocarbon emissions, whereas NOx emissions are of the same order as of diesel engines. CNG is recommended for buses in cities. There could be transfer stations or hubs designed at the outskirts of the cities for transfer of goods from diesel trucks running on the highways to smaller natural gas commercial vehicles running in the cities. Liquefied natural gas (LNG) can be used to improve the range of natural gas buses. LNG has been used in countries like Australia to improve range of buses and trucks operating in desert regions.

#### **4.4.4 Use of Electric Buses**

4.4.4.1 There are two main electric bus categories. The trolleybus is a type of electric bus powered by two overhead electric wires, with electricity being drawn from one wire and returned via the other wire, using two roof-mounted trolley poles.

#### **4.4.4.2 Key Recommendations**

- In order to conserve precious fuel, suitable strategy needs to be evolved to adapt electric buses in urban areas.
- Encourage use of natural gas for vehicle transportation to reduce pollutants like CO, HC and PM. NO<sub>x</sub> emissions are however not reduced by natural gas.
- Focus on improving fuel economy of heavy commercial vehicles.
- Promotion of research in renewable sources such as solar, wind, hydroelectric energy sources for transport
- Improve operating efficiency of trucks on highways by improving road quality, electronic toll collection to reduce fuel consumption

#### **4.5 Technological Roadmap and Research Focus**

3.5.1 The focus will be on developing safer and environmentally friendly new generation engines and vehicles. This includes development of advanced fuel efficient, light weight and compact engines with CRDI and alternative fuel technologies. The vehicle development will focus on improved vehicles with alternative power trains such hybrid electric.

#### **4.5.2 Engine Technologies**

4.5.2.1 Modern engines require higher specific power and torque output with faster response and lower fuel consumption and emissions. As far as truck CI engines are concerned there is need to develop superior performance CRDI engines. Focus is required on developing superior quality injectors capable of withstanding harsh environment and advanced electronic controls. Furthermore, there is a need to enhance engine calibration competency. Low emission engines should be developed using concepts such as variable valve timing (VVT), variable compression ratio (VCR), variable geometry turbo charging (VGT) and advanced after treatment solutions like Selective catalytic reduction (SCR), lean NO<sub>x</sub> traps (LNT) and diesel particulate filters (DPF). All these technologies are elaborated below.

#### **4.5.2.2 Engine Friction Reduction**

All reciprocating and rotating components in the engine are candidates for friction reduction, and minute improvements in several components can add to a measurable fuel economy improvement. CO<sub>2</sub> reduction potential ranges from 1 to 3 percent for engine friction reduction technologies.

#### **4.5.2.3 Variable Valve Timing (VVT) Systems**

VVT has now become a widely adopted technology. Manufacturers are currently using many different types of variable valve timing mechanisms, which have a variety of different names and methods. The major types of VVT are Intake Camshaft Phasing (ICP), Coupled Camshaft Phasing (CCP) and Dual (Independent) Camshaft Phasing (DCP). ICP designs may enable a 1 to 2 percent reduction in CO<sub>2</sub> compared to fixed-valve engines. EPA estimates that DCP designs may enable a 2-4% reduction in CO<sub>2</sub> emissions compared to fixed-valve engines.

#### **4.5.2.4 Variable Compression Ratio Systems**

Variable compression ratio is the technology to adjust internal combustion engine cylinder compression ratios on the fly. Variable compression ratio is becoming increasingly desirable as oil prices increase and car buyers have an increased interest in fuel economy.

#### **4.5.2.5 Homogeneous Charge Compression Ignition (HCCI)**

HCCI also referred to as controlled auto ignition (CAI), is an alternate engine operating mode that does not rely on a spark event to initiate combustion. The engine is operated with a higher compression ratio, and with shorter combustion duration, resulting in a higher thermodynamic efficiency and the engine can be operated virtually unthrottled, even at light loads. Combined, these effects have shown an increase in engine brake efficiency (typically 25-28%) to greater than 35% at the high end of the HCCI operating range. Criteria pollutant emissions are very favourable during HCCI operation. Lower peak in cylinder temperatures (due to high dilution) keep engine-out NO<sub>x</sub> emissions to a minimum – realistically below Tier 2 levels without after treatment – and particulates are low due to the homogeneous nature of the premixed charge. Due to the inherent difficulty in maintaining combustion stability without encountering engine knock, HCCI is difficult to control, requiring feedback from in-cylinder pressure sensors and rapid engine control logic to optimize combustion timing, especially considering the transient nature of operating conditions seen in a vehicle. The HCCI engine achieves 10-12% reduction in CO<sub>2</sub>.

#### **4.5.2.6 Common Rail Diesel (CRDI) Engines**

CRDI have several characteristics that give them superior fuel efficiency to conventional CI engines. Additionally, diesel fuel has a higher energy content per gallon; all of these effects combine for dramatically lower CO<sub>2</sub> emissions.

#### **4.5.2.7 After treatment: Diesel Particulate Filters (DPF) & Selective Catalytic Reduction (SCR)**

All diesel engines require a particulate filter, an oxidation catalyst, and a NO<sub>x</sub> reduction strategy to comply with Tier 2 emissions standards. The PM reduction strategies include using a diesel particulate filter for reducing the particulate. Various designs are available. The DPF needs to be periodically regenerated using thermal or chemical methods.

**SCR** After treatment uses a reductant (typically, ammonia derived from urea) continuously injected into the exhaust stream ahead of the SCR catalyst. Ammonia combines with NO<sub>x</sub> in the SCR catalyst to form N<sub>2</sub> and water. CO<sub>2</sub> reduction estimates for diesel engines with an SCR system range from 21 to 32 percent over conventional, gasoline engines (which translates to a fuel consumption reduction of 30 to 40 percent).

The SCR technology, by converting directly NO<sub>x</sub> to N<sub>2</sub> outside the engine, is the best compromise between fuel consumption and the formation of pollutants during the combustion process. Thus, it is possible to comply with the Euro IV emission standards and, at the same time, achieve fuel consumption levels which are 7% lower than those of equivalent Euro III engines, while the consumption of the urea solution will amount to 3% to 4% of the fuel consumption. It is also possible to comply with the Euro V emission standards and, at the same time, achieve fuel consumption levels which are 6% lower than those of equivalent Euro III engines, while the consumption of the urea solution will amount to 5% to 7% of the fuel

consumption. SCR system remains stable even when installed on HD vehicles. Other issues to be addressed are the technology to be used for dispensing urea at the filling stations. As far as India is concerned the CRDI technology along with SCR & DPF holds promise for future truck CI engines. For implementing SCR infrastructure needs to be developed for supplying the Ad-blue liquid (32 % urea solution in water).

#### **4.5.2.8 Biodiesel Engines**

Biodiesel is a clean-burning diesel fuel additive produced from soybean and other vegetable oils instead of petroleum. Biodiesel is used in compression ignition (diesel) engines to enhance engine combustion performance, improve engine lubrication, and reduce air pollution caused by the exhaust. Biodiesel blends operate in diesel engines, from light to heavy-duty, just like petroleum diesel fuel. No engine conversions are required at all, unless an engine has old fuel lines. Biodiesel and a 20% blend of Biodiesel in petroleum diesel are DOE-designated alternative fuels and contain no sulphur and no aromatics.

#### **4.5.2.9 Hybrid Electric Vehicles (HEV)**

A Hybrid is a vehicle that combines two or more sources of propulsion energy, where one uses a consumable fuel (like diesel), and one is rechargeable (during operation, or by another energy source). Hybrid technology is established in the U.S. market and more manufacturers are adding hybrid models to their lineups. Hybrids reduce fuel consumption. Hybrid vehicles also reduce CO<sub>2</sub> emissions.

#### **4.5.2.10 Key Recommendations:**

- High performance advanced combustion engine development
- Alternative fuel engine Development
- Low cost SCR & DPF After treatment
- Material recycling for HCVs
- Battery and controller development for Hybrid electric buses
- Fuel economy improvement by friction reduction
- Superior manufacturing techniques for components

### **4.6 Enhancing Fuel Quality**

#### **4.6.1 Environmental Scenario for Transportation**

4.6.1.1 Transport sector is one of the major contributors to air pollution in urban India. Emissions from motor vehicles pollute the air, which, in turn, affects the health of people who are living in the city. With the deteriorating level of mass transport services and the increasing use of personalized motor vehicles mostly with very low load factors, vehicular emission is assuming serious dimensions in most Indian cities. Data collected in various cities show that Suspended Particulate Matter (SPM) levels in India exceed substantially the limit set by World Health Organization (WHO).

#### **4.6.2 Impact of traffic congestion on pollution**

4.6.2.1 Congestion is a major cause of concern in most of the cities. The average peak hour speed in Indian cities is far less than the optimum one. Experiments world over indicate that the quantity of all the three major air pollutants (namely CO, hydrocarbons, and nitrogen oxides) drastically increases with a reduction in motor vehicle speeds. For example, at a speed of 75

km/hr, emission of CO is 6.4 g/veh.-km, which increases fivefold to 33.0 g/veh.-km at a speed of 10 km/hr. Similarly, emission of hydrocarbons, at the same speeds, increases by 4.8 times from 0.93 to 4.47 gm/veh.-km. Thus, traffic congestion not only decreases the vehicle speed but also increases the pollution level. Use of CNG has substantially reduced air pollution. However, the other aspects of such fuels also need to be considered. Such fuels increase the NO<sub>x</sub> emissions due to higher operating temperatures. Diesel engines have attained a very high level of efficiency and are quite clean due to advances in combustion and advanced high pressure fuel injection systems.

### 4.6.3 Vehicle Emission Norms

4.6.3.1 India has been able to close the lag between India and Europe from the earlier 15 years to about 5 years. Emission Road Map since 2000 is given in the Table 20. Over the last 11 years we have already moved from BS II regulations to BS IV regulations. Further reduction in emission levels in the commercial vehicle industry will depend upon the availability of cleaner diesels with low sulphur content. Europe has already established 10 ppm sulphur supply all across whereas in India we have 50 ppm sulphur diesel fuel in metro cities and 350 ppm in rest of the country. Non-availability of BSIV fuel becomes a major hurdle in operation. Use of 350 ppm fuel in BSIV vehicles will have a major damaging effect on the after treatment devices which in turn will totally defeat the purpose of reducing the tailpipe emission levels. It may also be noted that considering the complexity of design solutions for achieving lower emission levels, European Union provides a lead time of around 5 years for the implementation of norms and the same practice needs to be adopted here in India. As the emission levels are reduced, engineering solutions to achieve such low levels become complex and are closely linked with engine and vehicle parameters which require adequate time for implementation. Current and future emission norms in India are given in Table 4.3.

<b>Table 4.3: Emission Norms for Heavy Commercial Vehicles (g/Kwh)</b>				
<b>Standard (Year)</b>	<b>CO</b>	<b>NO<sub>x</sub></b>	<b>HC</b>	<b>PM</b>
BS I (1988)	4.9	9.0	1.23	0.40
BS II (2000)	4.0	7.0	1.1	0.15
BS III (2005)	2.1	5.0	0.66	0.1
BS IV (2010)	1.5	3.5	0.46	0.02
As far as BS V norms are concerned there are concerns regarding fuel availability				

4.6.3.2 Emission of vehicles while operating in the field is largely dependent upon the quality of fuel, average speed of operation and the condition of the vehicle depending upon the maintenance practices followed by the operator.

### 4.6.4 Worldwide Emission Scenario

4.6.4.1 The comparison of emission norms for major countries is given below in Table 4.4.

**Table 4.4: Comparison of emission norms of US, Japan and EU**

REGION	REGULATION AND YEAR	AVERAGE STANDARD VALUES (g/kWh)	
		NO <sub>x</sub>	PM
United States	2002-2004	2.7	0.13
	2007	1.6	0.013
	2010	0.27	0.013
European Union	Euro III (2000)	5	0.1
	Euro IV (2005)	3.5	0.02
	Euro V (2008)	2	0.02
	Euro VI (Proposed) <sup>1</sup>	0.2 - 1.0	0.01 - 0.02
Japan	2003-2004	3.38	0.18
	2005	2	0.027
	2009-2010	0.7 <sup>2</sup>	0.01

4.6.4.2 The EU has been the global leader in pursuing ultra-low sulphur diesel fuel. As early as the mid-1990s, Sweden established tax policies that successfully encouraged domestic oil companies to produce 10 ppm sulphur fuels. Ultra-low sulphur (<10 ppm) diesel already dominates fuel markets in several EU countries, while the Euro IV program limits sulphur levels to 50 ppm for both gasoline and diesel. The EU further reduced fuel sulphur levels for gasoline and diesel to a maximum of 10 ppm in 2009. The European Commission is deliberating on a proposal for Euro VI emissions standards likely to be enforced from 2012. The new standards are expected to introduce more stringent requirements for NO<sub>x</sub> and include limits on particle emissions in terms of numbers.

4.6.4.3 Japan mandated ultra-low sulphur (<10 ppm) fuel by 2007. Japan's PM limits for 2009 are more stringent than the Euro V standards and are comparable to the US's 2007 PM standards. Japan's 2009 NO<sub>x</sub> limits are also more stringent than Euro V but less stringent than US heavy-duty standards for 2010. Combined US NO<sub>x</sub> and PM standards are the most stringent currently in place for any of the three major developed-nation vehicle markets.

#### 4.6.4.4 Key Recommendations:

- Uniform fuel quality throughout the country
- Uniform emission standards throughout the country
- Well defined road map of propagation of clean diesel, alternative fuels and electric mobility
- Appropriate time lag of at least five years between each successive stage of emission norms;
- Maintain an emission inventory database for facilitation of storage and retrieval of data for policy analysis
- Make inspection and certification mandatory of all motor vehicles and compulsory retirement of vehicles which do not obtain road worthiness certificate

## 4.7 Fuel Quality Standards

4.7.1 At present, petrol and diesel are the main auto-fuels used in India. Bureau of Indian Standards (BIS) notifies standards for auto fuel quality including petrol, diesel, CNG, LPG etc. There are a total of 15 parameters in petrol specifications out of which 4 are environment related parameters. Similarly, there are a total of 16 parameters in diesel specifications, out of which 4 are environment related parameters. Current BIS 2000 specifications for petrol (IS 2796) and diesel (IS 1460), respectively, are applicable in the country. The auto fuel policy (2003) outlines the roadmap for quality of fuel supplied throughout the country in light of the forthcoming stringent emission norms.

<b>Fuel Quality</b>	<b>Mega Cities</b>	<b>Major Cities</b>	<b>Rest of India</b>
Euro II	April 2001	April 2003	April 2005
Euro III	April 2005		April 2010
Euro IV	April 2005		Not decided

4.7.2 As per the directions of the Hon. Supreme Court in 1999, the government intervened to upgrade the fuel quality standard in India and specified that the sulphur content of commercial fuel for meeting the emission standards both in gasoline and diesel engines shall be up to a maximum weight of 0.05 percent, and the benzene content up to a maximum volume of 1 percent for the supply of motor spirit (MS) in the National Capital Region (NCR) by April, 2001. The notifications of the government in these respects essentially meant that only fuel quality of *Euro-IV* specifications with respect to benzene and sulphur could be sold in the NCR. The regulation of fuel quality in India is now being effected through the introduction of the norms of *Bharat Stage III* for the entire country by October 2010 and *Bharat Stage IV* for the 13 metro cities from April, 2010. These norms for sulphur and benzene require the fuel quality parameters for oil to lie in the range between *Euro-III* and *Euro-IV* which are targeted to be achieved in major metro cities of India.

4.7.3 The public sector refinery industry in India accordingly targeted to upgrade their refineries so that motor spirit and high speed diesel could match these ultimate quality requirements. As these refineries are located at different places of India, having different vintages of technology and productive efficiency, the upgradation to the target norms of fuel quality involved varying costs per unit of the fuel upgraded across the refineries. The upgradation cost was derived from the difference between the cost of fuel per litre with and without upgradation, respectively from the pre-*Euro* to a standard between *Euro-III* and *Euro-IV*. The cost of upgradation of fuel from BS-II to BS-III and from BS-III to BS-IV is given below as on 2004.

The cost of upgradation of fuel from BS-II to BS-III

- Investment over Rs 15,000 Crore for refineries
- Increase in production cost by approx. Rs1 per litre

The cost of upgradation of fuel from from BS-III to BS-IV

- Investment over Rs 25,000 Crore for refineries
- Increase in production cost by approx. Rs1.50 per litre

4.7.4 As of now, Euro IV emission levels are applicable in 13 major cities of India and rest of the country has Euro III norms. Introduction of new norms depends on improvement in vehicle engine technology and availability of cleaner fuel by petroleum companies. The petroleum companies had to invest Rs 40,000 crore to meet Euro V norms and it is estimated that similar amount will be required to meet Euro VI norms.

4.7.5 Fuel quality has significant direct and indirect consequences for diesel vehicle emissions. Reducing sulphur in diesel reduces direct emissions of sulfate particles as well as emissions of sulphur dioxide (SO<sub>2</sub>), which can convert into particles and acids in the atmosphere. These reductions will occur in new vehicles and throughout the existing fleet of diesel vehicles. In addition, sulphur is a catalyst poison. All advanced after-treatment control technologies perform better with the use of lower sulphur fuel and some of the most important technologies require fuels with sulphur levels of 15 ppm or less. Because low-sulphur fuels are a prerequisite for many advanced after-treatment technologies for diesel engines, fuel sulphur standards have preceded emissions standards for heavy-duty vehicles in the EU, Japan, and the United States, as well as in some developing countries. Many of the developing countries in the world have not yet adopted the necessary low sulphur fuel quality. Reducing sulphur levels in fuels can reduce vehicle emissions in three general ways: (a) by directly reducing SO<sub>2</sub> and sulphate PM; (b) by achieving better performance from emissions control systems in existing vehicles; and (c) by enabling new emissions control technologies and more efficient vehicle designs.

#### **4.7.6 Key Recommendations:**

- Uniform fuel quality is required throughout the country
- Sulphur content of diesel fuel to be reduced further
- Effective steps should be taken to curb fuel adulteration
- Fuel delivery infrastructure should be strengthened.

### **4.8 Safety Technologies**

4.8.1 Special emphasis on process electronics need to be given including development of embedded software. Development of safety critical systems such as Antilock Braking Systems (ABS), intelligent suspension, adaptive cruise control, steer by wire, air bag deployment, collision avoidance systems, development of navigation, infotainment, climate control and other systems. Details of some processes are given below.

#### **4.8.2 Antilock Braking Systems (ABS)**

4.8.2.1 ABS is a safety system which prevents the wheels on a motor vehicle from locking up or ceasing to rotate while braking. ABS offers improved vehicle control, and decreases stopping distances on dry and slippery surfaces. ABS is recommended for trucks for increased safety.

#### **4.8.3 Intelligent Suspension**

4.8.3.1 This new concept of intelligent suspension has been created relying on today's technological development of data exchange performed by computerized units of control. In this new system, however, the dampers are monitored by a sensor (linked to an electronic memory unit and data microprocessor) which receives the compression rate, transfers it to the memory unit which, hence, processes the data and forwards instructions to each damper, according to the degree of demand. This active system compensates and conforms the road conditions to the

desired vehicle performance. This improvement of commonplace suspension mechanisms concerns not only practicality and performance, but, primarily, the driver's safety. ISUZU has used intelligent suspension for its trucks.

#### **4.8.4 Electronic Stability Control (ESC)**

4.8.4.1 ESC is a computerized technology that improves safety of a vehicle's stability by detecting and minimizing skids. When ESC detects loss of steering control, it automatically applies the brakes to help "steer" the vehicle where the driver intends to go.

#### **4.8.5 Tyre Pressure Monitoring System**

4.8.5.1 The tyre-pressure monitoring system (TPMS) is an electronic system designed to monitor the air pressure inside the pneumatic tires on various types of vehicles. These systems report real-time tyre-pressure information to the driver of the vehicle, either via a gauge, a pictogram display, or a simple low-pressure warning light.

#### **4.8.6 Hydrodynamic Retarder**

4.8.6.1 The Voith Hydrodynamic retarder is the world's first water retarder for commercial vehicles. It operates with the cooling fluid of the engine. The Hydrodynamic Retarder is maintenance-free and improves safety of trucks on sloping tracks.

#### **4.8.7 Fire Safety in Vehicles**

4.8.7.1 For vehicles cartridge-operated extinguishers are the premium fire-fighting units recommended by safety consultants. Cartridge-operated means increased reliability, on-the-spot recharge and ease of service. Sensor based Fire suppression systems represent the most effective fire protection on the market today. These systems are especially suited to suppress fires in areas where an electrically non-conductive medium is required, where electronic systems cannot be shut down.

#### **4.8.8 Multiplex wiring system**

4.8.8.1 Conventional wiring systems use separate wires to control each electrical function. The multiplex wiring system allows multiple electronic messages to travel back and forth through the same datalink wire, just as broadband cable allows telephone, television and Internet connections to travel through the same line.

#### **4.8.9 Navigation Tools**

4.8.9.1 The Global Positioning System (GPS) is a radio navigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis -- freely available to all. Equipped with these GPS receivers, users can accurately locate where they are and easily navigate to where they want to go driving.

#### **4.8.10 Key Recommendations:**

- The police data collection systems need to be modified so that essential base line data become available to policy makers and researchers for meaningful analysis.
- Traffic injury surveillance systems need to be established at hospitals and medical colleges around the country according to international guidelines suggested by the WHO.

- A highway crash data system needs to be developed to monitor the details of vehicle and road design features associated with crashes.
- Three or four multidisciplinary crash investigation centres should be developed and personnel trained for the same.

## **4.9 Regulatory Issues**

### **4.9.1 Setting up of National Automotive Board (NAB)**

4.9.1.1 NAB is proposed to be specialized body for promoting sustainable development of the Indian auto sector. It will act as a facilitator between the government and the industry, promote R&D and help developing skills for the auto sector. NAB will be an autonomous body under Department of Heavy Industry instead of a statutory or regulatory body. It will be a successor of the National Automotive Testing and R&D Infrastructure Project (NATRIP). NAB is not intended to carry out functions of a regulatory nature which are in the domain of MORTH. The functions of NAB are envisaged as follows; (a) Capacity building, standardization of test procedures, technical Audit/Accreditation and Upgradation needs of the test centres; (b) Facilitating collaborative automotive R&D; (c) Development of skill sets in the area of automotive testing and R&D; (c) Framework for fair competition; (d) Alternative mobility-electric & hybrid vehicles; (e) Intelligent Transport Systems; (f) New vehicle assessment programme; (g) Framework for end of life vehicles.

### **4.9.2 Truck and Bus Body Codes**

4.9.2.1 Trucks and buses are made up of three primary parts—the chassis, the body, and the engine. A sub-committee of the CMVR - Technical Standing Committee looked into all the related aspects and formulated the “Code of Practice for Construction & Approval of Truck Cabs, Truck Bodies and Trailers”. The provision of the code shall be applicable to trucks of Gross Vehicle Weight (GVW) above 3.5 tonnes. The requirements shall not apply to the special purpose vehicles of categories as defined in CMVR, except in respect of those provisions, which are not compatible with the intended use and function of these vehicles. The requirement of this code shall apply to the following types of truck bodies used in conjunction with following categories of trucks: (i) Flat Bed or Full Open Body; (ii) Semi Open or Half Body; (iii) High Side Deck Body; (iv) Closed Body; (v) Bodies for Carrying ISO Tankers; (vi) Special Purpose Vehicles.

4.9.2.2 In respect of those provisions which are exclusively meant for the use and function of special purpose vehicles, the requirements shall be notified separately by the appropriate authorities. The truck and bus code deals with general requirements, overall dimensions, external projections, seat arrangements, safety belt assemblies, driver steering wheel, structural strength, lightening & signalling, etc

### **4.9.3 Key Recommendations:**

- Bus body and truck codes need to be implemented
- Bus and truck body manufacturers should be encouraged for technology up gradation

#### **4.10 Inspection & Maintenance (I & M)**

4.10.1 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.

4.10.2 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. 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

4.10.3 Vehicle inspection has been mandatory for decades in developed countries where motorized vehicles are inspected to ensure not only their road worthiness but also to reduce the pollution from vehicle emissions. The "Safety Regulations for Road Vehicles" within the Road Vehicles Act, obligates motor vehicle users to carry out periodical checks and maintenance to meet these safety standards. No motor vehicle that is subject to inspection can be operated unless it has undergone inspection conducted by the authorized agency/ministry and is provided with a motor vehicle inspection certificate and sticker. Motor vehicle users are obligated to undergo periodical checks and maintenance in order to keep their motor vehicles in proper condition at all times. Types of inspections carried out in a typical Inspection and Certification (I&C) centre cover: structure-condition of the chassis frame; wheel system, braking system, steering system, propulsion, tyres, etc.

4.10.4 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 cities like Delhi, the CNG/LPG safety inspection should be included in the program. For inspection of the vehicles in the automated vehicle inspection centres, detailed vehicle inspection manuals need to be developed. These manuals should prescribe the procedure for testing a vehicle, list of tests to be conducted, methods for conducting the tests. These manuals would have to be prepared for different categories of vehicles and should be available at all test centres and others concerned with the I&C program. Different manuals will be required to cover different types of vehicles.

4.10.5 A handbook for administrators would also need to be prepared specifying the role, and responsibility of the inspectors in the vehicle inspection centre and the auditors. A suggested list of items that needs to be included in the centralized test centre is listed below.

<b>Table 4.5: Safety Inspection Contents</b>
<b>Visual inspection</b>
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)
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,
Horn
Availability of Tool Box, First Aid kit, Fire Extinguisher and Warning Triangle
Registration plates

<b>Table 4.6: Tests with Automated Equipments</b>		
<b>Test Items</b>	<b>Tests</b>	<b>Equipment</b>
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

<b>Table 4.7: Emission Inspection</b>		
<b>Vehicles</b>	<b>Test</b>	<b>Equipment Required</b>
Diesel	Free Acceleration test	Opacity meter
Petrol / CNG / LPG	Idle Test	Gasoline (4 Gas Analyzer)

4.10.6 While the present PUC emission testing will be continued in the vehicle inspection and certification centres with prevailing test procedures and audit systems. The kind and type of inspection and maintenance program to be implemented in a country differs from country to country as vehicle fleet varies. The main aim is to build a sustainable Inspection and certification system to reduce emissions and improve the safety. The vehicle inspection and maintenance program is an effective tool to improve the condition of the in use vehicle fleet.

#### **4.10.7 Requirement of I&C Lanes in the Country**

4.10.7.1 Based on average annual growth rate consideration with business as usual scenario, requirement of number of heavy duty and light duty lanes in India (covering all States and UTs) for year 2015 has been worked out to put in place an effective I&C system. Requirement of I&C Lanes in the Country is estimated as below.

##### Expected commercial vehicle population in India by 2015

Heavy Duty: More than 7.5 Million

Light Duty: More than 10.5 Million

##### Number of Test Lanes required

Heavy Duty: More than 320 numbers

Light Duty: More than 300 numbers

#### **4.10.8 Key Recommendations:**

- Institutional structure of I&M regime to be developed
- Capacity Building - I&C centres – 318 required by 2015.
- Phasing of I/C regime through a nodal agency
- Auditing of the Vehicle Inspection Centres
- Human Resource Development and Public Awareness Programs
- Data Collection and analysis and Networking of centers
- Maintenance Program for Centres

#### **4.11 Summary of Recommendations**

- The purpose of the national transportation policy should be to provide emphasis on improving efficiency, safety, reduction of emissions and promoting sustainability.
- It has been estimated that a large percentage of future global emissions would be from China and India. We need to consider and adopt various measures for greenhouse gas mitigation such as promotion of green vehicles like hybrid electric through incentivization.
- I&M is a very important effort to improve the air quality, reduce fuel consumption and increase safety of the present fleet of vehicles. I&M centres should be commercially viable. I&M regime should be introduced at the earliest and should include a sound auditing system by MORTH.
- In order to mitigate congestion problem in cities, transport hubs or nagars on outskirts of the cities, need to be developed across the country. Suitable restrictions on the commercial vehicles entering the city on the basis of size and tonnage need to be fixed.
- Freight vehicles in the city can be mandated to use CNG as this will improve the fuel mix of the overall freight fleet.
- Driving license test has to be made stringent. Sundar Committee has given a good proposal for giving the driving license as well as penalizing the traffic violation. The Committee recommends that with effect from 2015 the minimum education qualification should be 10th standard pass and recommends that the applicant should be required to hold a learner's license for a period of four months and obtain a competency certificate from a government recognized school.
- Accident investigation is absent in India. This is extremely important to get to the root cause and address the issues related to vehicle, road or driver as required. For this analysis,

experts will be required to work with police and other concerned stakeholders. This has to be properly addressed with proper resource allocation annually.

- There need to be statutory regulations for the bus/truck drivers' working conditions. Tachographs or similar devices can be used to track their working hours.
- Good driving schools are required with sophisticated simulators for driver training. Steps can be taken to establish such schools across the country.
- Traffic management system on highways through automatic tolling system (ITS / RFID /Smart Card) which would ensure smooth movement of trucks and maximize returns needs to be introduced.
- Uniform fuel quality and emission standards need to be implemented throughout India.
- End of life norms for vehicles need to be adopted for India.
- Toll rate structure for the highways to be rationalized for promoting multi-axle vehicles which, have lower cost of carriage and cause less pavement damage.
- Bus body and truck body codes need to be uniformly implemented throughout the country for enhancing the safety and efficiency of vehicles.
- In order to overcome the lack of vehicle financing to the trucking industry, the industry needs to be recognized and financial institutions like NBFC need to be encouraged to enhance their level of financing.
- A more sustainable transport system would require re-optimization of the rail road freight distribution mix. Rail Transport needs to be encouraged in order to offset the increasing shift towards road freight.
- Creation of the National integrated logistics policy and Investment of USD 700 Billion in India for road logistics infrastructure till 2030

## **Chapter V**

### **Road Safety and HRD**

#### **5.1 Introduction**

5.1.1 Road safety is both a health and development issue of concern considering its magnitude and gravity and the consequent negative impacts on the economy, public health and the general welfare of the people, particularly those with low incomes. Although we have undertaken initiatives and are implementing various road safety improvement programmes, the overall situation is far from satisfactory. With rising motorization and expanding road network, travel risks and traffic exposure grow at a much faster rate, as the growth of registered vehicles always outnumbers population growth and new roads are constructed. Today road traffic injuries are one of the leading causes of deaths, disabilities and hospitalizations with severe socioeconomic costs across the world. Road safety is essentially a multi-sectoral activity. It requires a systems approach with coordinated efforts of health, law, transport, police, insurance agencies, NGOs and road agencies.

#### **5.1.2 Magnitude & Dimensions of Road Accidents and Fatalities in India**

5.1.2.1 As per the Commission for Global Road Safety (2009), road traffic accidents kill an estimated 1.3 million people and injure 50 million people per year globally, and global road fatalities are forecast to reach 1.9 million by 2020. It is estimated that the number of deaths from road accidents in Asia is about 700,000 per year, accounting for more than half of the world's road fatalities even though Asia accounted for only 43% of the global vehicle population in 2007.

5.1.2.2 During the year 2009 there were around 4.9 lakh road accidents which killed 125,660 people and injured more than 5 lakh persons in India. These numbers translate into one road accident every minute and one road accident death every four minutes. Road traffic injuries and fatalities impose a huge economic burden on developing economies, in particular. In India, more than half of the road accident victims are in the age group (25-65 years), the key wage earning and child raising age group. The loss of the main bread-earner and head of household due to death or disability can be catastrophic, leading to lower living standards and poverty, in addition to the human cost of bereavement. For India, the socio-economic cost of road accidents in 1999-2000 was estimated at 3% of GDP (Tenth Five Year Plan Vol II page 963).

5.1.2.3 To get an appropriate measure of incidence of accidents, normalized/standardized accident rates for India have been worked out in terms of number of accidents (a) per lakh persons, (b) per ten thousand motor vehicles and (c) per ten thousand kilometre of the road length. Some of the broad trends at the all-India level are summarized below:

- Number of accidents per lakh population indicates a rise from 21.2 in 1970 to 22.8 in 1980, followed by a sharp increase to 33.8 in 1990. Between 1995 and 2005, the figures fluctuated in the range of 38 to 40; increasing to above 42 in recent years (2007 and 2008); a slight dip to 41.9 in 2009. Between 1970 and 2009, there had been an increase of about 97%;
- A significant decline in the number of accidents per ten thousand motor vehicles is discernible from 814 in 1970, 339 in 1980, 148 in 1990, 80 in 2000 and further to 42 in 2009, i.e. decline of almost 95% since 1970;

- The trend in the number of accidents per ten thousand kilometre of the road length shows that the number of accidents have increased over the last few decades, from 960 in 1970 to 1,027 in 1980; peaked to 1,424 in 1990; but declined thereafter, fluctuating within a band of 1,100 to 1,200 per ten thousand kilometre. For the latest year 2009, the figure stood at 1,179.
- The number of persons injured per lakh of population indicates a more than three-fold increase from 13 in 1970 to 44.4 in 2009. Similarly, the number of persons killed per lakh of population indicates a fourfold jump from 2.7 in 1970 to 10.8 in 2009. Exposure of population to road accidents leading to deaths and injuries largely depends on the amount of travel undertaken, defined as the number of trips, the distance travelled, or time in the road environment, number of motor vehicles and the amount of motorized traffic, etc. These factors are associated with development and income levels. In high income countries, the risk of road accidents arising out of these factors have been reduced through effective road safety engineering, traffic management, enforcement of traffic laws and the severity of penalties for infringement.
- As regards the number of persons injured and killed per 10,000 vehicles, the decline has been dramatic. To some extent, the decline in this parameter has been brought about by improvements in vehicle crashworthiness and occupant protection. The number of persons injured per 10,000 vehicles has plummeted from 500 in 1970 to about 45 in 2009. It is noteworthy that this parameter has consistently declined since 1996 despite sustained high growth in vehicle population. Similarly, the number of persons killed per 10,000 vehicles in the country has also fallen from about 104 in 1970 to less than 11 in 2009. However, injuries and deaths per 10,000 motor vehicles as a parameter has a limitation as it does not capture road related accidents and deaths connected with non-motorized forms of transport which are significant in rural areas.
- The number of persons injured and killed per ten thousand kilometre of road length has more than doubled since 1970. Modern road systems are largely designed for the motor vehicles exposing vulnerable road users to greater risk of accidents. In developing countries, lack of foot-paths, cycle tracks, traffic calming measures to reduce speed where non-motorized mode of transport blend with motorized traffic, increases the risk of accidents and its severity. These factors have contributed towards the increase in road related accidents, injuries and deaths in relation to rise in terms of road length. High-income countries have made progress in providing facilities for pedestrians and cyclists alongwith speed reduction schemes thereby weakening the nexus between road accidents, injuries and deaths with expansion in road network. The numbers of persons injured per ten thousand kilometre of road length have risen from 590 in 1970 to 1,273 in 2008; similarly persons killed per ten thousand kilometre of road length more than doubled from 122 in 1970 to 292 in 2008. However, both these parameters have undergone ups and downs over the last decade.
- NHs accounted for 29.3% in total road accidents and 36% in total number of persons killed in 2009. SHs accounted for 23.8% of total accidents and a share of 27.1% in the total number of persons killed in road accidents in 2009. Highways permit greater speed resulting in relatively greater number of road accidents and fatalities.

5.1.2.5 Road traffic accidents are amenable to remedial action. Many developed countries have witnessed a drop in road accidents and casualty numbers by adopting a multipronged approach to road safety that encompasses traffic management, road design, safer vehicles, law enforcement, provision of accident care, etc. Road safety is essentially a multi-sectoral activity. It requires a

systems approach with coordinated efforts of health, law, transport, police, insurance agencies and NGOs. The challenge for us is to adapt and evaluate these approaches to suit our needs.

5.1.2.6 Road accidents are non random events occurring due to a complex mix of a number of factors which amongst others include: (a) type of road users and colliding vehicles; (b) environmental/road related factors: These include visibility, road design and geometry, access control, intersections (areas of traffic conflict), provision of segregation of NMT and heavy vehicle traffic; (c) vehicle related factors – visibility of vehicles, use of protective devices (helmets and seat belts) by vehicle occupants; problems with head and tail lights, mechanical failure, etc.; (d) nature of traffic management : use of automatic signals, traffic calming devices (e) emergency care for accident victims.

5.1.2.7 The main thrust of accident prevention and control across the world has been on **4 E's**, viz. (i) Education, (ii) Enforcement, (iii) Engineering and (iv) Environment and Emergency care of road accident victims.

### **5.1.3 Vehicle Safety Standards, Fitness and I&C**

5.1.3.1 Considering the growth of vehicle population, a large number of I&M test centres need to be established which would need a large investment (one estimate puts this requirement at Rs. 7,000 Crore) to cover Heavy/Light Vehicles and Private Vehicles category by year 2015. Hence, the operation and establishment of I&C centres can be worked out on Public Private Partnership (PPP) model. Based on the experience of I&C centres established as capacity building in each state, these centres will be replicated throughout country, depending upon state government initiatives and priorities. For the UTs, 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.

### **5.1.4 Overall Benefits of I&C Programme**

- Improvement in overall vehicle condition is expected to ensure safer and cleaner vehicles
- Reduction in accidents and fatalities.
- Identification and reduction of gross polluting vehicles.
- Improvement in fuel consumptions.
- The programme will facilitate establishment of requisite number of garages with necessary equipments.

### **5.1.5 Implementation Plan**

5.1.5.1 For the implementation of effective I&C regime in India, there is a 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 objectives to develop an effective I&C regime for the country:

- Develop a detailed programme content in consultation with State Governments;
- 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 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 centres;
- Analyze the data and suggest further changes in the test procedures and standards;
- Prepare an enforcement plan and monitor the implementation at the state level;
- Set up an audit system and monitor the inspection centres.

5.1.5.2 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. Both emissions and safety tests should be introduced simultaneously for commercial vehicles. Hence, a phased approach has been suggested for ensuring effective implementation of inspection and maintenance program. Thus, the following phasing is suggested:

**Phase I: (upto the year 2015)**

- In the first phase, cities with significant transport vehicles (Metros) should introduce a modern I&C regime.
- In these cities, a modern inspection regime should be first introduced for commercial vehicles, and then subsequently to private vehicles.
- And then it must be extended to the rest of India for commercial vehicle category.

**Phase II: (2015 to 2020)**

- Introduce the I&M regime to private vehicles including two wheelers.
- Start initially with older vehicles (more than 9 years old).

**Phase III: (2020 onwards)**

- And then extend the regime to newer fleet in private vehicles category (3 to 9 years old).

5.1.5.3 For cities where the regime would be introduced later or for vehicle categories that are not being covered at the first instance, the current (Pollution Under Control) 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.

5.1.5.4 While it would be ideal to have a large number of testing centres 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 trade-off 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: (a) Commercial vehicles with a higher utilization should be tested more often; (b) Older vehicles should be tested more frequently than newer vehicles; and (c) Private vehicles including two wheelers to be included in I&M regime.

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

### **5.1.6 Road Accident Emergency Care**

5.1.6.1 Trauma care includes multifarious activities from the time of occurrence of injury till the injured returns to normal functioning. **Availability, Accessibility and Affordability** of emergency care play crucial role in accessing emergency services and pre-hospital care.

- Review and Audit of existing National Highway Trauma Care Project (NHTCP) and National Highways Relief Services Scheme (NHARSS)
- Periodic audit of medical equipment, ambulances, cranes with respect to their utilization, availability, location, etc.
- All Crash Rescue Vehicles (CRVs) and Ambulances should be accessible through National Medical Toll Free Number integrated under National Highways Relief Network and closely linked with State EMS;
- The specifications for the Ambulances, Patrol Cars, CRVs should be revised and updated;
- Enunciate a National Accident Relief Policy and a National Trauma System Plan
- Deployment of a Pan-India Pre-Hospital Emergency Medical Care Network to ensure a primary crash response time of 8–10 minutes. This network should be adequately supported by a unified toll free number, seamless communication, centralized dispatch, medical direction, triage protocols & crash rescue units.
- To verify and designate the existing healthcare facilities along the Highways and upgrade those found deficient to minimum defined levels and to plan for new facilities where there is a deficit so as to ensure the availability of one emergency care facility at every 50 km along NH.
- Short term EMS programmes to train paramedics working in trauma centres
- Plan for seamless networking amongst health facilities, rescue services, existing fleet of ambulances, etc.
- Capacity building and regular training in Emergency Medical Services (EMS) to all involved in trauma care supplemented by training in First Aid to the public
- Encourage research and development into post-crash response.
- Establish minimum standards, guidelines and protocols for various components of EMS, viz, Ambulances, Trauma Centres, Emergency Medical Technicians, Communications, Command and Control.

### **5.1.7 Long Term Measures (three – five years for realization)**

- All district hospitals /community health centres across the country to be developed as

integrated trauma care centres with appropriate manpower and facilities

- Augmentation in capacity and resources of available Medical establishments
- Setting up of Regional Referral Trauma Centres in tertiary hospitals across the country.
- Plan for rehabilitation centres for the trauma care victims
- Standardize minimum national specifications for various types of Emergency Response Vehicles viz. First Responders, Patient Transport Ambulances, BLS Ambulances and ALS Ambulances, Crash Rescue Vehicles, Dispatch Centres, Command & Control Centres, etc. so as to bring homogeneity in the system across the country.

## **5.2 Road Engineering**

5.2.1 Road design standards and guidelines will be made consistent with the safety requirements and in tune with the international best practice.

- Promote the development and implementation of *Safe System* road design principles and standards that subordinate mobility requirements to safety requirements, rather than vice versa, to put the priority on enhancing the protective quality of the road network for all road users.
- Set and manage speed limits in accordance with the protective quality of the road environment provided rather than the desired speed behaviour of road users considering road user behaviour practices.
- Development of pilot fully access controlled freeway system and adjacent structured road networks.
- Provide service roads along all 4 and 6-lane highways.
- Implement most effective physical engineering countermeasures to improve road safety on the existing national and state highway network, such as (countermeasures below are indicative only and should be selected through research efforts under section 5 below; research should also select highways, establish typical standards, layouts, criteria and cost-benefits)
- Speed control and reduction of exposure of vulnerable road users to the through traffic in built up areas;
- Centreline and shoulder rumble strips, which have shown to be low cost and highly effective for the reduction of run-off-the road crashes.
- Introduce traffic calming measures where necessary.
- 1% of cess money should be earmarked for engineering aspects of road safety which should be utilised for research, pilot projects for show casing, before and after studies and safety audits
- Cost cutting approach in road development should be abandoned and forgiving highways should be planned and provided
- More Expressways should be planned rather than upgrading existing 4- lane highways.
- Focus be on VRUs
- Special attention should be given to the stretches passing through linear settlements (built up areas) for conflict removal.
- Incorporate road safety audits in the planning, design, construction and operation of the highways

### **5.2.2 Monitoring and evaluation of road designs and traffic management strategies**

- Encourage institutionalization of conducting Road Safety Audits by certified Road Safety Auditors.

- An accreditation body is required to be created for Road Safety Auditors, which will control the utilization of these trained auditors and will maintain the register of certified auditors. Such auditors will have to undergo training and retraining as per a set of guidelines to maintain a high standard of auditing.
- Capacity for Road Safety Audit (RSA) works in the country needs to be enhanced by training and conducting certifications courses for Road Safety Auditors.
- The entire network of NH and SH are to be subjected to RSA in a planned manner over the next three years. The RSA shall identify all the potential hazards in terms of deficiencies observed in the network, which are required to be corrected on a continuous basis for making the road network safe.
- The States and MORTH will prioritize the network to be audited, and will implement the improvements recommended by RSA. The priority roads with high accident records are to be taken up first within the first six months.
- To carry out RSA for the entire primary network, required capacity is to be developed through proper training of qualified engineers, who are eligible for training. Teaching and research institutions including IITs, NITs, CSIR, third- tier engineering colleges, B. Tech and M. Tech will be identified for establishing training programmes for RSA professionals.

### **5.2.3 Accident Investigation**

- Accident data recording system is to be adopted uniformly across all States for roads in urban and non-urban areas in a standard format. This standard format is to be evolved with national consensus and should include all rational data that are required for accident check investigation, accident reconstruction, and also adjudication of the accident cases.
- The data collection should be tech-savvy with hand-held GPS and computer interface so as to collect all data with highest precision.
- There will be standard accident analysis module for accident investigation and adjudication uniformly to be used across the country without any exception.
- Specialized centres shall study selected accidents, using the accident reconstruction technique, etc., and the same data system.

### **5.2.4 Training**

- The engineers involved in planning, design, construction and operation of roads and highways in the country are to be trained on road safety aspects covering engineering measures, safety at construction sites and hands on experience in road safety audit.

### **5.2.5 Research & Development**

- To establish about five to seven Centres of Excellence for Road Safety Research and Accident Analysis in Academic Institutions across the country in addition to the existing research institutions.
- The capacity in road safety research and accident analysis is also to be developed, for which bright young professionals are to be identified for specialized training.

5.2.6 The Government has already initiated the process of approving the Bill for creation of a Road Safety and Traffic Management Board. This Central Body is an urgent requirement along with its counterparts in the States.

## **5.2.7 Availability of Resources**

5.2.7.1 Adequate funds should be made available commensurate with the requirements, especially for development and maintenance of non-NHDP NHs Network. Similarly, resources provided for State roads shall have to be commensurate with the estimated requirements.

## **5.2.8 Indicative Action Plan**

5.2.8.1 An Action Plan (Engineering Measures) showing the time frame for implementation of the various activities along with estimated cost and the agencies responsible for implementing and monitoring, is imperative.

## **5.2.9 Funding**

5.2.9.1 The estimate-wise requirements worked out suggest that most of the expenditure will be in the initial three years. It is estimated that approximately Rs. 800 crore to Rs. 900 crore will be required for the suggested Engineering Measures, requiring an annual average of Rs. 300 crore from the road safety perspective alone. Funding for this has to be arranged from different sources. The following are potential sources of funding:

- 1% cess earmarked from cess for road safety ( $\approx$  Rs. 90 crore annually);
- Rs. 50 crore annual contribution from NHA as a part of their corporate responsibility;
- Specific earmarking of at least about 10 % of annual available allocation under National Highways (Original) [NH(O)] for road safety related measures (annual level of available NH(O) allocation is about Rs. 400 crore at present, which need to be augmented to at least about Rs. 5,500 crore; further enhancement may be required in case there is an addition to the existing NH network of 70,934 km).

## **5.3 Enforcement of Traffic Rules**

**5.3.1 Enforcement** primarily involves implementation of statutory provisions, rules and regulation, which enhance road safety. The main statutory provisions in vogue are MVA, 1988 and CMVR, 1989. The State Governments and UTs enforce these. The enforcement measures under the said rules/act *inter alia* include inspections at the time of licensing/issue of permits and periodical fitness, verification of vehicles for commercial use. Prime emphasis of **enforcement** is on restraining road users from undertaking behaviours which expose road users and others to risk of accidents and injuries. Chapter 8 and a portion of Chapter 13 of MVA, 1988 have many rules and regulations with regard to the use of safety devices (helmets), speed limits, etc.

### **5.3.2 Amendment in the MVA, 1988**

5.3.2.1 A Motor Vehicles (Amendment) Bill, 2007 was introduced in the Rajya Sabha on 15.5.2007. The basic objective was to amend the provisions of the MVA to enhance penalties for various traffic offences such as rash and negligent driving, drunken driving, driving at excessive speed, driving without licence, use of mobile phone while driving, etc., so as to serve as a deterrent for the drivers to follow traffic rules and maintain discipline on roads. Amendments have also been suggested to rationalize the provisions relating to the payment of compensation to road accident victims. It is proposed not only to enhance the amount of compensation but also to revise it every three years, so that it is commensurate with the rising cost of living and also to expedite the claim settlement process. An element of civil liability is also proposed to be inserted in the Act by making a provision for penalty up to Rs. 5,000/- by a person who drives in a rash or

negligent manner and causes injury to a person or damages any property. The amount so realized shall be utilized for making payment to the road accident victims.

### **5.3.3 Suggestions for Amendment of certain provisions of MVA to deter traffic/road safety violations**

5.3.3.1 Compulsory provision of basic additional security requirements such as steering locks/clutch locks and ignition cut off lock systems by automobile manufacturing companies. Vehicles costing more than Rs. 5 lakhs to be provided with GPS based vehicle tracking system. Driving license for heavy goods vehicles/light goods vehicles, taxis, three wheeler scooters be issued only after a police verification to confirm the address and identity. Duplicate driving licenses need to be issued with caution and after getting a No Objection Certificate (NOC) from the Traffic Unit. Commercial Vehicle drivers should be given driving licenses only after passing from a training school. Driving licenses and Registration Certificates to be in smart card mode and have the history of all challans, penalties and accidents, drivers causing fatal accidents to be taken action against and driving licenses to be cancelled.

### **5.3.4 Proposals for Enhancement of Fines for Traffic Violation**

**5.3.4.1 Drunken Driving:** Section 185 of MVA requires amendment to make it a compoundable offence under section 200 of MVA. The officers of the rank of ACPs and above should be empowered to suspend the Driving License of the violator. After compounding of the offence, the prosecuting officers shall recommend the suspension of Driving License of drivers violating section 185 of MVA to ACPs. For the first offence, in case 30-60 mg alcohol per 100 ml of blood is found, the penalty should be Rs 5,000 or imprisonment for a term which may extend to six months or both and for the second and subsequent offences, if committed within three years of commission of the previous similar offence in the first slab, the penalty should be Rs 7,500 or with imprisonment for a term which may extend up to two years or both.

**5.3.4.2 Obstructive Parking:** Another section renumbered at Section 177 A shall be substituted in which penalty for obstructive/unauthorized parking may be specified. It is recommended that for obstructive/unauthorized parking for the first offence, the penalty should be Rs. 1,500 and for any subsequent offence, the penalty should be Rs. 3,000.

**5.3.4.3 Allowing unauthorized person to drive:** Abetment of allowing an unauthorized person/minor driver to drive a vehicle in a public place not only endangers the safety of the driver, but other road users also, which can lead to road accident. The penalty under the act should be Rs. 2,000 subject to maximum of Rs. 4000. In case of repeated violations, imprisonment may extend to three months or fine of Rs. 10,000 or both.

**5.3.4.4 Over speeding:** For Private Vehicle, for the first offence, the penalty should be Rs. 1,500 and for the second or subsequent offences, it should be Rs. 3,000. For Commercial Vehicles, for the first offence, the penalty should be Rs. 2,500 and for the second or subsequent offences, it should be Rs. 5,000.

**5.3.4.5 Dangerous Driving:** For private vehicle, for the first offence, the penalty should be Rs. 1,500 and for second or subsequent offences, it should be Rs. 3,000. If the third or subsequent offence is committed within three years of the commission of a previous similar offence, imprisonment may extend to fifteen days and fine which may extend to Rs. 10,000 or both. For

commercial vehicles, for the first offence, the penalty should be Rs. 2,500 and for second or subsequent offences, the penalty should be Rs. 5,000. If the third or subsequent offence is committed within three years of the commission of a previous similar offence, the imprisonment may extend to one month or with fine which may extend to Rs. 10,000 or both. In addition, it is proposed that the following changes be made in the MVA 1988 keeping in view the fact that the act was introduced in the year 1988 when per capita income was low. Besides, over the years prices have gone up and so have the levels of income, making low levels of fine out of tune with current economic realities.

**5.3.4.6 Section 9:** Driving license - It should be mandatory for all driving license holders to possess training in First Aid and a Medical Insurance Policy and the same should be ensured at the time of issue/renewal of the driving license.

**5.3.4.7 Section 140:** Liability to pay compensation in certain cases on the principle of no fault - The amount of compensation for death at present is Rs. 50,000 and it should be enhanced to two lakh and in the case of injury it should be one lakh (presently amount is Rs. 25,000)

**5.3.4.8 Section 146:** Necessity for insurance against third party risk - There should be one-time insurance for third party on the lines of road tax.

**5.3.4.9 Section 163:** Special provision as to compensation in case of hit and run motor accident - The amount of compensation for death at present is 25,000 and it should be enhanced to Rs. Two lakh and in the case of injury it should be one lakh (presently amount is 12,500).

**5.3.4.10 Section 163A:** Notional Income is taken as Rs. 15,000 for computing annual loss of income for the non-earning person like children, housewives etc. The same should be enhanced to Rs. 100,000. The act does not provide any kind of compensation for the **Gratuitous Passengers** nor does any insurance policy cover the same. Necessary provision to provide compensation for the same maybe incorporated.

**5.3.5 Changes in CMVR 1989: Ambulances and rescue vehicles** meeting with the National Ambulance Code should only be registered as an Ambulance or as Specialized Rescue Vehicle. To ensure this, necessary changes should be made in the CMVR.

**5.3.6 Standardized Signage System (S<sup>3</sup>):** A Standardized Signage System (S<sup>3</sup>) should be introduced across all highways in the country for uniformity and to enhance visibility thereby ensuring road safety.

IRC Code of Practice on road signs have been updated and revised in line with International Standards and Vienna Convention; these needs to be made applicable for entire country for uniformity.

**5.3.7 Awareness and Implementation of the Hon'ble Supreme Court of India's directives regarding the Right to Emergency Care**

5.3.7.1 In the case of **Pt. Parmanand Katara vs Union of India** in Criminal Writ Petition No. 270 of 1988, D/-28.8.1989, [AIR 1989 Supreme Court 2039], the Hon'ble Supreme Court had

observed that all injured persons, especially in the case of road traffic accidents, assaults, etc., when brought to a hospital/medical centre, have to be offered first aid, stabilized and shifted to a higher centre/government centre if required. It is only after this that the hospital can demand payment or complete police formalities. If a bystander wishes to help someone in an accident, his responsibility ends as soon as he leaves the person at the hospital. He will not be questioned by the police. The hospital bears the responsibility of informing the police and providing first aid.

## **5.4 Road Safety Education**

**5.4.1 Educational approach:** It relies on dissemination of road safety awareness and regulation through media, classrooms and non-governmental organizations (NGOs). This approach takes a longer time to achieve the desired change in individual perceptions and attitudes. The WHO/World Bank Report on Road Traffic Injury prevention in the light of global experience about education has observed, “When used as a single, isolated intervention, do not deliver tangible and sustained reductions in deaths and injuries”.

### **5.4.2 Implementation Issues**

5.4.2.1 Millennium Development Goals like activities should be adopted by the government to organise road safety awareness and education programmes on a regular basis for children, youth and adults. These programmes should be a part of the development agenda of the government and should also be taken up at the panchayati raj and zilla parishad levels.

5.4.2.2 This Council could act as the nodal agency at state level to coordinate amongst State governments, PWD, emergency care of health departments, education department, enforcement department and local governments.

5.4.2.3 A separate Road Safety Education and Awareness Fund needs to be created, which would be solely used for this purpose, in partnership with the government, corporate, voluntary organizations, etc. **Possible sources of funding: Share of fines, and voluntary contributions from insurance companies, automobile companies, tyre companies, private hospitals, etc.**

5.4.2.4 **Road safety policy is needed for all large fleet owners, such as firms, State Road Transport Undertakings, tour operators, etc. Organisations** should also be asked to draw up proper Road Safety Policy for employees, based on guidelines given by MORTH like use of seatbelts, non-usage of mobiles while driving, sober driving, etc., similar to the policies which they have on work ethics and safety in work space.

5.4.2.5 RSE should also focus on providing adequate procedural information and training on an immediate after-accident plan, ‘Victim support during Golden Hour’, which should include measures such as informing police, ambulance, basic first aid, paramedic aid, etc.

5.4.2.6 Traffic police should also be given exposure and training round the year on Road Safety.

5.4.2.7 Have Road Safety Education (RSE) programmes where both States and NGOs would be involved.

5.4.2.8 State Road Transport Undertakings, city transporters and other large fleet owners should have mandatory training on RSE.

5.4.2.9 Road safety issues on social networking sites, as already being done by many government departments **along with FM radio, TV and printed media** could also be promoted.

5.4.2.10 An effective communication strategy on Road Safety would need services of Brand Ambassadors to spread the message of road safety. In this context, for example, eminent sports and film personalities could be tapped. In addition, interesting campaigns can also be run like gold medalist boxer, Vijendra Singh's campaign on blood donation.

5.4.2.11 RSE should be part of a **Value/Life Education Programme in schools and colleges** which should be promoted through activities such as mass rallies, quiz, drawing and essay competitions and Certification. This should be combined with free distribution of films and booklets on road safety, mandatory, cautionary and informative signage, informative boards along the roads, development of road safety parks and multiple road safety weeks in a year.

5.4.2.12 Parent-Teacher Associations could be involved in Road Safety Awareness programmes for children.

5.4.2.13 Authorities/departments/corporate/media/individual to be awarded for their outstanding performance at state level.

5.4.2.14 Especially for rural areas, where illiteracy is high, road signage and hoardings should be designed professionally and targeted at hot spots/accident prone spots.

**5.4.3 Educational & Training:** These primarily involve spreading road safety awareness and imparting training to drivers. Some of the important initiatives undertaken in the field of training are:

- **Refresher Training for Heavy Vehicle Drivers:** To this end, a scheme of MORTH titled "Two days refresher training to heavy motor vehicle drivers in unorganized sector" was envisaged to inculcate safe driving habits, to acquaint drivers with road safety regulations and upkeep of vehicles in road worthy condition.
- **Model Driving Training Schools:** These need to be set up across the country on PPP to produce well trained drivers and impart refresher courses to drivers.

#### **5.4.4 Road Safety Policy and Institutions**

5.4.4.1 The Central Government already has a National Road Safety Council (NRSC) which advises on all matters pertaining to planning and coordination of policies and standards of safety in Road Transport Sector. NRSC was established under Section 215 of MVA, 1988 and is chaired by Minister of Road Transport & Highways with Minister-in-Charge of Road Transport of States/UTs, DG Police of all States and also representatives from various Ministries/Departments. Under Section 215 of MVA, 1988, a State Government by notification in Official Gazette can constitute a State Road Safety Council comprising a chairman and such other members as the Government considers necessary and on such terms and conditions that Government may determine. Similarly, there is also a provision for District Road Safety Committee for each district.

5.4.4.2 Amongst the States the State Road Safety Council in Tamil Nadu has been very active and is a model worth emulating. The Government of Tamil Nadu has constituted a 19-member apex body known as “State Road Safety Council”, entrusted with the policy making in the year 2007 under the Chairmanship of Hon’ble Minister for Transport. This high level body meets once in three months and advises the Government on Road Safety related issues. Transport Commissioner/Road Safety Commissioner is the Member Secretary.

5.4.4.3 In addition, Government of Tamil Nadu has constituted District Road Safety Councils since 1989 in each District under the Chairmanship of the District Collectors under Section 215 of MVA, 1988. It is a 13 member body with the following composition:

5.4.4.4 This District Road Safety Council meets once in a month and recommends the Transport Commissioner/Government relating to Road Safety issues confronting their respective districts. This council has been entrusted with the job of considering various measures needed to promote Road Safety, prepare Road Safety plans with special attention to the accident prone spots/stretches, maintenance of roads, drivers’ training, accident analysis, publicity initiatives and efforts, traffic planning, highway patrol, passenger amenities, etc. in the districts. Besides, Government of Tamil Nadu has set up a Road Safety Fund administered by an Inter-Departmental Committee on Road Safety Fund with the Principal Secretary to Government, Home Department as its Chairperson and other members including Transport Commissioner as one its members.

5.4.4.5 State Road Safety Councils need to be constituted/activated at the State level. These Councils would have representatives from all stake-holders. **This is a ubiquitous problem and needs to be legislated and compliance reporting system should be included.**

## **5.5 Human Resource Development and Manpower Needs**

### **5.5.1 Road and Highways Sector**

5.5.1.1 Capacity building of various stake holders in the road sector, thus, leaves a lot to be desired and it is now posing one of the formidable challenges. While undertaking this exercise, attention should also be focused on training of supervisors and junior engineers who have so far largely been bypassed from skill enhancement. The training in this area should cover a wide array of technical personnel engaged in road construction like engineers, surveyors, equipment operators, workers.

5.5.1.2 There is a need for utilizing the existing infrastructure of IITs, Regional Engineering Colleges for R&D; and the use of these institutions for training and skill enhancement of engineers working in central and state governments, in particular. Besides IITs, NITs and CSIR, third- tier engineering colleges in each state can also be targeted, as the majority of civil engineering graduates are being produced there. The course curriculum in B. Tech and M. Tech should include safety engineering and traffic engineering principles as a specific course in all technical colleges.

**5.5.2 Funding:** Sufficient funds must be budgeted by the various stakeholders (government, contractors and consultants) for training of staff. The road agencies of the government may consider making a provision of 0.25% of the project cost in each estimate towards training of

staff. For workers, there could be a dialogue with the DG (Labour Welfare) and DG (Employment & Training). Ministry of Labour and Employer for earmarking 0.25% of the cess collected under the Workers Welfare Cess Act, 1996 for training of Construction workers as this is also a welfare measure.

5.5.3 National Academy of Construction, Hyderabad: This is a model training centre for the construction industry at the state level. It was set up in 1998 at the initiative of the Government of Andhra Pradesh with the objective of training and skill upgradation of workers, supervisors and contractors in the construction industry. For funding the activities, an amount of 0.25% was being deducted from the payment bills of the contractors in the state. This has been reduced to 0.10%.

5.5.4 To meet the growing demands of the road sector alone, there is an urgent need to set up one Construction Training Centre in each State. These centres can be set up through the joint efforts of the government and the contracting industry. National Institute for Training Highway Engineers (NITHE) can be mandated to organize training programmes for Central and State Government officials engaged in road construction.

5.5.5 MORTH in consultation with the Ministry of Rural Development and State Governments may take the lead in formulating a training strategy for the road sector in India. Such a strategy may cover:

- All stakeholders: Road agencies, contractors, consultants.
- Different aspects: Project management, quality assurance, legal, contract administration, dispute resolution, public private partnership approaches, social and environment aspects, safety.
- System of incentives: Weightage in construction contracts to workers and site engineers who hold competency certificate from accredited training institutions.
- Financing strategies: Both government budget and private sector.
- Institutional framework: Strengthening and networking of existing training and academic institutions, collaboration with international agencies.

**5.5.6 Manpower needs for Motor Vehicle Workshops:** For ensuring effective maintenance of vehicles, the motor vehicle repair workshops must have trained mechanics, proper equipment and procedure, and quality assurance checks. Therefore, there is an urgent need for the upgradation of motor vehicle repair workshops. The certification of motor vehicle repair workshops will allow individual vehicle owners and vehicle fleet owners to make informed choices in engaging certified workshops for the maintenance of their vehicles to ensure vehicles working in good condition with respect to emission and safety. The certification scheme will also encourage operators of motor vehicle repair workshops to develop and enhance their technical expertise in maintaining vehicles.

### **5.5.7 Road Transport**

5.5.7.1 Road Transport accounts for the bulk of the employment in the transport sector. It has been estimated that about 0.5 million commercial vehicles are being added every year, resulting in an annual requirement of the same number of commercial vehicle drivers. Assuming that one training establishment can turn out 25 trainees every month there is a need for more than 1,660

drivers' training schools for commercial vehicles alone. Given these numbers, meeting this requirement will be quite a challenge.

5.5.7.2 CMVR, 1989 have laid down the minimum educational qualification of a driver of a transport vehicle for obtaining a driving license as Class VIII pass. With the induction of new technology in transport sector it would be desirable to raise the minimum qualification to passing of class X for transport vehicle drivers.

5.5.7.3 One alternative for this could be to establish a centralized accreditation and quality assurance system for training institutions. It is recommended that, while the licensing of training institutions for driving may continue to be with the State governments, the law may be amended to require them compulsorily to adhere to an accreditation and quality assurance system. CMVR, 1989 will need to be amended for this and, if necessary, the MVA, 1988 will also need an amendment. The Central Institute of Road Transport (CIRT) at Pune will be a suitable body for being entrusted with the task of establishing and running such an accreditation system. An important element in the strengthened regulation of training institutions for transport vehicle drivers will be to ensure that these institutions have adequately trained staff. For this purpose adequate facilities need to exist for training of trainers. MORTH should carry forward the Scheme for establishing Model Driver Training Institutes across the country for addressing the training needs of driving motor vehicles. The central task of these institutes should be to produce training instructors. It may also be necessary for CIRT to oversee the establishment of courses for training of instructors in the model schools besides undertaking training activities itself for the production of training instructors on a larger scale. In due course it should be made compulsory for the licensed driving schools to engage instructors who have passed out from these institutions.

5.5.7.4 An important element in the strengthened regulation of training institutions for transport vehicle drivers will be to ensure that these institutions have adequately trained staff. For this purpose adequate facilities need to exist for training of trainers. MORTH should carry forward the Scheme for establishing Model Driver Training Institutes across the country for addressing the training needs of driving motor vehicles. The central task of these institutes should be to produce training instructors.

5.5.7.5 A three tier Structure to integrate driving training at local level to a standards monitoring body. Objective of the proposed structure is to formalize the driving training standards and monitoring the same. This consists of three components: (a) Local Driving Training Schools (LDTS) and Regional Driving Training Schools (RDTS); (b) IDTR (Institute of Driving & Traffic Research) and DTI (Driving Training Institute); (c) Forum comprising of IDTR and DTI. The forum shall be a body comprising of all IDTR and DTI and headed by each IDTR/DTI on rotation basis. The IDTR/DTI shall also help Transport Department in auditing and giving accreditation to the DTS and RDTS.

5.5.7.6 All the trainers shall be selected, trained and certified only by IDTR/DTI. All DTS shall employ only certified and licensed trainers. Based on level of compliance to rules for setting up driving schools, the driving schools shall be graded as A, B, C, D or E. A grade schools are such that they fully comply with the rules. B, C, D or E grades are for lesser compliance. To ensure that the needs are met driver training schools should be encouraged to come up in the PPP mode.

## **Chapter VI**

### **IT and Data issues**

#### **6.1 Introduction**

6.1.1 Road transport sector accounts for a share of 4.8 per cent in India's Gross Domestic Product (GDP). Road transport is both a service and infrastructure. It is an important element in value addition process. The Indian system for generating statistics, not just transportation statistics, is to a large extent decentralized. Many agencies are engaged in the production, use and dissemination of statistics. Road transport statistics are used in national accounts, formulation of transportation policy and in regulation.

#### **6.2 Coverage of Road Transport Statistics**

6.2.1 Transport sector consists of transport infrastructure, rolling stock and other equipments that are typically utilized towards provision of transport services. Road transport statistics can generally be divided in three broad categories viz., (a) road statistics covering network length, distribution, standard, quality etc.; (b) road transport statistics covering numbers of different categories of motor vehicles, its distribution, applicable taxes, road accidents etc.; and (c) other statistics collected with specific purposes/objectives.

#### **6.3 Statistics on Road Network**

6.3.1 The Road network in India is classified under different categories depending upon the agency/level of government that is primarily responsible for its development, construction, operation and maintenance. Based on this criterion the road network is classified as (i) NH; (ii) SH; (iii) District Roads; (iv) Urban Roads; (v) Rural Roads and (vi) Project Roads. The road statistics provides data in respect of length of surfaced or un-surfaced road in different categories of roads, the type of surface, major and minor bridges and culverts etc. It is basically a census statistics covering the entire road network in India.

6.3.2 The 'Basic Road Statistics' (BRS) published by Transport Research Wing (TRW) in MORTH contains data/information concerning the road network including NH, SH, urban roads, rural roads and project roads. The data for these roads is obtained from various source agencies/bodies spread across different levels of government administrative hierarchy viz., national, state and local. At the national level, MORTH along with NHAI are the main source agencies for information/data for the entire NH network. Data on roads under the jurisdiction of States/UTs is obtained from their various Departments viz. Public Works Department, Rural Development Department and Panchayati Raj Department which pertains to State Highways, other PWD Roads, and Panchayat Roads. Besides, data on urban roads is obtained from various municipal bodies, ports, railways and defense establishments that may be in possession of road in urban areas. In addition, roads constructed by agencies for their own use, like Forest, Irrigation, Electricity Departments etc are also obtained so as to obtain a complete picture of total road network.

6.3.3 The data on road statistics become available with considerable time lag. This is primarily attributed to (a) Multiplicity of agencies - the data on different parameters incorporated in the BRS is collected from about 280 source agencies spread across centre, states and local levels (b) non-response or delayed response from the agencies (c) incomplete data (d) inconsistencies in

the data - as the data is received from a number of different sources, validation and reconciliation takes time. The latest issue of BRS covers data ending fiscal year 2007-08 was released in July 2010. It is suggested that the data on road network may be categorized into

- Primary Roads (Expressways & NH);
- Secondary Roads (SH & MDR);
- Rural Roads (Other district roads & village roads);
- Urban Roads;
- Panchayat Roads (intra village roads); and,
- Project Roads (dedicated roads serving specific sector/industry).

6.3.4 Creation of a Road Data Centre by MORTH, based on the wealth of data on roads which gets generated through preparation of Feasibility Reports and DPRs, would help in a system of retrieval and documenting the data needs.

## **6.4 Statistics on Motor Vehicle**

6.4.1 The motor transport statistics cover the details regarding total registered motor vehicles across states/UTs in terms of vehicle classification; public and private ownership of buses; road accidents; motor vehicle taxation and fare structure; revenue realized from vehicle taxes, fees etc. The Constitution of India has put road transport under List-II of Seventh Schedule thereby placing road transport primarily in the domain of State administration. The availability of relevant data or relative absence of it essentially depends on the efforts of States. A major source of data in respect of road transport statistics is the publication entitled 'Road Transport Yearbook' brought out by TRW. The Road Transport Yearbook provides the data on the total registered vehicle and its break-up under different categories of vehicles; applicable rates of motor vehicle taxes on vehicle categories; rates of taxes on goods and passenger transport; revenue realised from motor vehicle taxes; physical and financial performance of State Road Transport Undertakings (SRTUs); road accident data; and Plan outlays and expenditure in road sector

6.4.2 The data on the number of registered vehicles, taxes on motor vehicles and goods and passenger transport and revenue realized are obtained from Transport Departments of various States and UTs. The data on physical and financial performance of SRTUs is obtained from respective SRTUs. The road accident data is obtained from the Police Headquarters/Commissionerates of the various States and UTs. The latest issue of Road Transport Yearbook covers data ending fiscal year 2008-09 and was released in March 2011.

6.4.3 Statistics pertaining to various facets of road and road transport sector are also being generated by other agencies. For example, RBI's annual publication on State Finances contains the state-wise data on revenue raised through Motor Vehicle Taxes, passenger taxes and freight taxes on road transport sector. Similarly, Directorate of Data Management, Central Excise and Customs, maintains data on tax revenue realized, both through customs and excise on motor vehicles and parts thereof. Planning Commission is the storehouse of the data on Plan allocation and expenditure in various sectors including that of transport. It also brings out statistics on inter-modal share of transport, though not on a regular basis. Central Statistical Organisation (CSO) estimates the contribution of various sectors in GDP including that of the transport sector and thus brings out the data on the value added by them. Ministry of Finance in its annual publication

‘Indian Public Finance Statistics’ provides the data on revenue and expenditure on various sectors including roads for the centre, all states taken together and combined i.e., centre and the states.

6.4.4 A weak database on traffic flows makes realistic traffic forecasts and judgement about viability of BOT (Toll) roads a challenge. This could be overcome through : (a) assigning work relating to collection and compilation of road traffic to institutions involved in road research, transport planning, etc. e.g. CRRI, CIRT; (b) setting up of permanent traffic round the clock count centres at important stretches; and (c) periodic traffic surveys.

## **6.5 Data Gaps in Road Transport Sector**

6.5.1 There are significant data gaps in the road transport sector that needs to be addressed. In case of India, the data in respect of vehicles is available in terms of number of registered vehicles. However, internationally it is the data on ‘vehicles in use’ that is used for the purpose of analysis, comparisons and policy formulation. *Vehicle in use* is a more accurate indicator of the number of vehicles plying on road as compared to total registered vehicles which provides data on the cumulative total of vehicles registered without accounting for decommissioned/scrapped vehicles.

6.5.2 The absence of data on “vehicles in use” could be addressed through a specially created Motor Insurance Database wherein all insurance companies should provide details of the first insurance policy as well as for renewals for each vehicle covered under their motor insurance policy.

6.5.3 As of now there is no mechanism in place which generates regular data on freight movement (in terms of tonne kilometre) and passenger movement (in terms of passenger kilometre) by the private sector bus operators and other motorized means in road transport sector. This is major lacunae as the freight and passenger operation by road in the country are primarily carried out by private operators or by personalized mode (cars, three-wheelers, two wheelers). Some of the important variables on which data needs to be reported/collected are (a) ownership patterns of freight carriers; (b) fleet utilization of trucks and buses (number of Kms/day/month/year); (c) age profile of vehicles; (d) vehicle productivity; (e) fuel efficiency; (f) cost of operation (Rs/tonne Km); and (g) volume of passenger traffic (passenger Km) and freight tariff (tonne Km and type of good). There is need to explore use of existing provisions of Motor Vehicle Act, 1988/CMVR Section 90 (3) and evolve some mechanism to collect data on freight movement in the country. The data on some of these variables could be estimated through large scale sample surveys depending on the purpose at hand. Lack of data on these parameters makes it a daunting task to assess current capacities and plan expansion of road networks.

## **6.6 Road Accidents**

6.6.1 In view of the significant economic and welfare implications of accidents Government of India through MORTH is associated with the UNESCAP Project on ‘Asia Pacific Road Accident Database (APRAD) – Indian Road Accident Database (IRAD)’. The APRAD database is designed to capture the various factors contributing to road accidents so that appropriate policy measures may be adopted and implemented. Under APRAD data is collected in format that consists of 19 item/tables each of which captures various accident parameters. This facilitates

identification of the causes of accidents across States/UTs and also over time. Under APRAD, road accident data for 28 States, 7 UTs and 23 metropolitan cities of the country is collected, compiled and collated since 2002.

6.6.2 The First Information Report (FIR) of accidents registered with the Police Post/Thana is the primary source of data for formulating the 19 item APRAD data base. Based on these FIRs, the Police Posts generate the 19 item data for APRAD, which is subsequently collated and consolidated for the entire district at the district headquarters. The Police Headquarters of the States in turn obtain the data from various district headquarters and consolidate it in 19 item APRAD format for their respective States. TRW in MORTH collects the data from the Police Headquarters of various States and UTs through specially designated nodal officers [DGP/ADGP (Crime)/ADGP (Traffic)/Director (State Crime Record Bureau)] at the state level and also for 23 selected metro cities in the country. The data is subsequently scrutinized for consistency, validated and consolidated and uploaded on the website of the MORTH by TRW.

#### **Box 6.1: Major Gaps in Road Transport Statistics in India**

- No data on movement of people, goods & vehicles.
  - Hence lack of data on volume & geographic flow of traffic
- Passenger & freight flows measured in a variety of ways
  - Vehicle Km/miles of travel (passenger and freight)
  - Passenger Km : (Distance traveled x No. of passengers carried)
  - Freight flows: Tonne Km (movement of tonnes of cargo over Kms)
- No Price Index to measure changes over time in actual prices paid by the users.
- Data on vehicle population in terms of registration rather than “vehicles in use”.
- Vehicle weights impact condition and longevity of infrastructure. No information on vehicle weights.
- Lack of data on other dimension make it difficult to assess current capacities and plan expansion

### **6.7 Application of IT in Road Transport Sector in India**

6.7.1 MORTH with the help of the National Informatics Centre (NIC) is implementing a project for creation of National Registers and State Registers of Driving Licenses and Registration Certificates of motor vehicles. The project involves computerization of Regional Transport Offices (RTOs) / State Transport Authorities (STAs) and subsequently links them to the National and State Registers.

6.7.2 Under the New National Permit System (NNPS), composite fee are being collected through an e-payment system with the help of software developed by the NIC. Once the system is fully integrated with leading banks, States would be advised to collect composite fee on National Permits through e-payment which would help States in checking revenue leakages and

lessen the time at border check posts to cross-check validity of payment of taxes, thus, paving the way for seamless movement of inter-state traffic.

6.7.3 In order to assess traffic flows across important stretches of NHs, there is a need to put in place regular and permanent traffic count stations throughout the NH and SH network and data retrieval from current toll plaza locations and linkage with agricultural and industrial growth in various regions could help.

6.7.4 There is a need for periodic traffic studies in different regions of the country. Besides this, there needs to be a system of permanent traffic counts and axle load surveys to refine the methodology of traffic assessment and development of sound road designs and upgradation strategies.

## **Chapter VII**

### **Public transportation and Seamless Freight and Passenger Movement**

#### **7.1 Overview of Road Transport Sector**

7.1.1 Easy accessibility, flexibility of operations, door-to-door service and reliability have earned road transport an increasingly higher share of both passenger and freight traffic vis-à-vis other transport modes. Road transport has emerged as the dominant segment in India's transportation sector with a share of 4.8 per cent in India's GDP in comparison to railways that has a mere 1.0 per cent share of GDP in 2008-09 as per the revised data on National Accounts released by CSO.

#### **7.2 Barriers to Road Transport**

7.2.1 A typical truck operator has to face a number of different agencies for either obtaining clearances for carrying goods or paying certain charges at the check post. These agencies include (i) Sales Tax, (ii) Regional Transport Officer (RTO), (iii) Excise, (iv) Forest, (v) Regulated Market Committee, (vi) Civil Supplies (check on the movement of essential commodities, black marketing, weights and measures, food adulteration) and (vii) Geology and Mining. These checks are generally conducted by respective agencies at separate points, resulting in more than one detention. Detention of vehicles causes lower speed, loss of time, high fuel consumption and idling of vehicles, leading to under-utilization of transport capacity and adversely affecting their operational viability. Besides, it imposes economy wide costs which are not easy to assess. By introducing checks at each interstate border the road freight transport experiences significant inequity compared to the freight/cargo transport by the railways, aviation and even inland transport, which do not face such rigorous en-route checking. The system in vogue hinders rather than facilitates smooth flow of freight and passenger movement across the country and has thwarted the formation of single common market.

7.2.2 Further road transport sector is subject to myriad levies/taxes (both Central and State) with no provision of set-offs in many taxes/levies leading to cost and price escalation which erodes competitiveness of domestic manufactures. Taxes and non-tax charges on road transport sector can be broadly classified into the following categories: (i) taxes on the vehicle purchase, (ii) taxes on operation of motor vehicles, fuel taxes, motor parts, tyres & tubes etc (iii) Sales tax/VAT levied by the States (iv) Registration and Transfer fees, licence/permit fees, (v) periodical vehicle tax (also called road tax), (vi) tolls, (vii) parking fees, (viii) Octroi, (ix) Entry tax, (xi) Lease tax, and (xii) passenger and goods tax.

Essentially the checks made at border posts aim to ensure that:

- Taxes in the State of destination paid on the goods being carried
- Trucks not overloaded
- Trucks being operated safely
- Trucks carrying valid papers.

### **7.3 Motor Vehicle Taxation**

7.3.1 MVT is being levied in all States and UTs except the UT of Lakshadweep. Existing tax structure for commercial vehicles shows wide variations among States. There are different bases for computation and different rates, leading to differing incidence of taxes per vehicle in different States. In fact, it is not easy to make comparisons of rates levied on different types of vehicles in different States. Inter-State comparisons are difficult for the following reasons:

- different classification principles for the taxation of vehicles in different States;
- variations in the application of ‘lifetime’ and annual tax rates to vehicle categories;
- use of specific and *ad valorem* rates;
- multiplicity of rates.

### **7.4 Implementation of New National Permit Scheme**

7.4.1 In pursuance of the agreement signed with All India Motor Transport Congress (AIMTC) during their strike in January, 2009 a Committee was set-up under the Chairmanship of Secretary (RT&H) to look into the issue of streamlining national permit system. The Committee recommended that the composite fee for National Permit could be levied @ Rs. 15,000 per annum per truck authorising the permit holder to operate throughout the country. The composite fee so collected would be distributed among the States/UTs on the basis of an agreed formula. Earlier, the national permit was granted on payment of Rs. 5,000 per annum per State per truck (not less than 3 contiguous States other than the home State) for operation within the authorised States. The recommendations of the Committee were further deliberated by the Empowered Committee of State Transport Ministers headed by Hon’ble Transport Minister, Government of Rajasthan and, subsequently, endorsed by the Transport Development Council (TDC) in its meeting held on 16.4.2010. The Central Motor Vehicle Rules, 1989 have been amended w.e.f. 8.5.2010 for implementation of the New National Permit Scheme as recommended by the Committee and endorsed by the TDC. As per the new system, national permit can be granted by the home State on payment of Rs. 15,000/- per annum per truck for operation throughout the country. State Bank of India has been authorized for collection of consolidated fee of Rs.15,000. The system has been further streamlined and is now being implemented electronically through web portal developed by National Informatics Centre (NIC). As per the information available with the Ministry, upto March 2011, an amount of Rs. 670.52 crore has been collected.

### **7.5 Major Issues concerning road transport & seamless movement of passenger and freight in India**

- Lack of uniformity in motor vehicle taxation including taxation for various passenger transport vehicles like tourist taxis, maxi cabs, All-India tourist buses, etc.
- Issue of Inter-State Agreements for Stage Carriage buses.
- Problems faced by private service vehicles and educational institutional buses transporting workers and students respectively between neighbouring States.
- Absence of any holistic transport planning including non-availability of benchmarks for bus operations in India, assessment of passenger and goods travelled demand on a regular basis.
- Absence of any inter-modal integration in terms of common ticketing, transfer stations, etc.
- Problems affecting SRTUs including recurrent losses resulting from various internal and extraneous factors.

## **7.6 Recommendations/ Suggestions for improving the system**

### **7.6.1 Rationalisation of tax structure**

7.6.1.1 Immediate efforts should be made to harmonize the categories of vehicles and achieve uniformity in the taxation rates. Although, there could be specific issues relating to specific States. In a federal set up this would require consensus of all the States/UTs. It is recommended that a floor rate of taxation as a proportion of sales price be fixed as a one-time tax for two-wheelers, light motor vehicles and cars. The tax distinction between cars and taxis should be done away with because many private cars have been found to be operating as taxis. The tax rate on goods vehicles may be fixed in accordance to their gross vehicle weight. For buses, a permit system similar to the New National Permit System for trucks may be introduced.

### **7.6.2 Intermodal integration**

7.6.2.1 For the overall system to be efficient it is necessary to establish linkages between different transportation systems. There is an urgent need to provide proper integration of modes such as rail, bus, and other para-transit modes with respect to the following: (i) transfer station, (ii) ticket and (iii) arrival/ departure schedule, etc.

### **7.6.3 Regulation of various modes of transport operating in a State.**

7.6.3.1 There is a need to take a re-look at the regulatory framework, keeping in view the overall requirement of passenger transport for an area / region. The regulatory mechanism should give primacy to mobility to ensure access of people to socio economic services.

### **7.6.4 Guidelines for Inter-State Agreements**

7.6.4.1 The present system of entering into inter-State agreements between States as required under section 88 of the M.V. Act is a long drawn process and hampers smooth movement of passenger buses between States. Hence, it was unanimously agreed that the Government of India could frame basic guidelines for uniformity in the inter-State agreements on stage carriages including delegation of powers to Transport Commissioners of States for entering into inter-State agreements. This would facilitate speedy finalization of the inter-State agreements and provide better transport facilities to the public. Control over the inter-State agreements may, however, still remain with the respective State Governments.

### **7.6.5 Need for Holistic transport planning.**

7.6.5.1 The Government of India should establish benchmarks for bus operations in India and establish the future needs for all categories of buses. The plan should address financial issues as well as safety issues.

### **7.6.6 Seamless movement of passenger transport vehicles in line with NNPS for goods vehicles.**

7.6.6.1 NNPS for goods vehicles which came into effect from May 2010 has facilitated the free movement of goods vehicles throughout the country on payment of a composite fee of Rs. 15,000 per annum together with the authorization fee to the home State where the vehicle is registered. It is essential that All India Tourist Taxi Cabs, Maxi- Cabs, All India Tourist Buses and buses covered by Special Permits under section 88(8) of the M.V. Act should also be subjected to uniform fees for free movement throughout the country.

### **7.6.7 Scientific assessment of passenger and goods travel demand**

7.6.7.1 By carrying out traffic studies for major travel corridors in different regions of the country periodically, travel demand for both passengers and goods can be assessed scientifically for the present and over medium term. Based on travel demand (number of commuters and their need for travel), proper assessment of bus fleet, bus frequency, augmentation of routes, etc. can be done. Norms regarding minimum requirement of buses for different category of operations including hilly areas, mofussil and city operations should be evolved. Similarly, requirement for necessary infrastructure for goods transport such as parking facilities, rest facilities for operators, weighing bridges, fuel stations, etc. can be assessed and planned.

### **7.6.8 Free movement of personalized vehicles**

7.6.8.1 In order to facilitate free movement of personalized vehicles covered by “Life Time Tax” in one State should be exempted from payment of tax to other States if the stay of vehicles concerned does not exceed six months in the other State.

### **7.6.9 Adopting a single window clearance system for all authorized charges**

7.6.9.1 At present, respective States are collecting various taxes at border check posts. Owing to non-integration of various offices (Motor Vehicles, Excise and Taxation, Forests, Sales Tax, etc.) dealing with taxes/checking of goods in many States, the drivers are required to halt lorries at several places before the border. In addition, manual processing of tax papers at inter-state checkpoints, lead to delays and hampers smooth traffic flow. Single window integrated border check posts would help in drastic reduction of waiting time and smooth flow of traffic at State borders.

### **7.6.10 Strategies to Revive SRTUs**

7.6.10.1 A framework should be evolved which could provide flexibility and freedom to SRTUs for automatic fare revision, depending on the increase of fuel and wage costs. SRTUs should be enabled to mobilize funds for capital expenditure, on their own strength and financial capability from banks/ financial institutions in terms of soft loan, tax free bonds etc. Expansion of fleet is needed to augment services in the rural areas. Government of India could consider providing financial assistance to SRTUs for purchase of new buses exclusively for rural operations in line with stimulus package similar to one sanctioned under JNNURM for purchase of buses with regard to urban operations. Technical capacity of SRTUs shall have to be improved through training programmes and workshops. SRTUs should explore the possibility of tapping non-ticket revenue sources.

## **7.7 Expenditure on Road Transport during 10<sup>th</sup> and 11<sup>th</sup> Five Year Plans**

7.7.1 The details of the scheme-wise expenditure on road transport during 10<sup>th</sup> and 11<sup>th</sup> Five Year Plans are given in Table 7.1.

<b>Table 7.1: Statement showing scheme-wise expenditure on Road Transport during 10<sup>th</sup> &amp; 11<sup>th</sup> Five Year Plan</b>			
<b>(Rupees in crores)</b>			
<b>Sl.No.</b>	<b>Scheme</b>	<b>Total Exp.in 10th FYP</b>	<b>Total Exp.in 11<sup>th</sup> FYP</b>
<b>1</b>	<b>Road Safety</b>		
i	Refresher training to drivers in unorganised sector	13.81	40.28
ii	Publicity measures and awareness campaigns	59.96	136.92
iii	Human Resource Development including training	1.38	
iv	Road Safety Equipment & Programme Implementation	5.14	11.26
v	National Highway Accident Relief Service Scheme	56.89	70.12
vi	Pollution Testing and Control	3.32	
<b>2</b>	<b>National Database Network</b>	9.41	82.14
<b>3</b>	<b>Model Drivers Training School and public transport system</b>	29.45	
<b>4</b>	<b>Setting up of Inspection and Maintenance Centre</b>	-	14.98
<b>5</b>	<b>Strengthening public transport system including introduction of IT like Automatic Fare Collection based on GPS</b>	-	37.90
<b>6</b>	<b>Creation of National Road Safety Board</b>	-	0
	<b>Total</b>	<b>179.36</b>	<b>393.60</b>

\* HRD has been merged with Refresher Training to drivers

\*\* Pollution Testing and Control has been merged with Road Safety Equipment & Programme Implementation

\*\*\* Model Drivers Training School and public transport system has been included in Refresher Training

## 7.8 Fund Requirements

7.8.1 The estimated scheme-wise fund requirements for road transport sector for the period 2012-2032 is given in Table 7.2.

**Table 7.2: Estimated fund requirements for 2012-32****(Rs. in crores)**

<b>Name of the Scheme</b>	<b>2012-17</b>	<b>2017-22</b>	<b>2022-27</b>	<b>2027-32</b>
(i) Setting up of NRSTMB & similar mechanism at State level.	250.00	287.50	330.65	380.20
(ii) Accident data collection & evaluation (TN model)	245	281.75	324.00	372.60
(iii) Centres of excellence	45	51.75	59.50	68.45
<b>(B) HRD</b>				
(i) Setting up of Driving Training institutes	1000.00	1150.00	1322.50	1520.85
(ii) Refresher training for heavy vehicle drivers	75.00	86.25	99.20	114.00
(iii) Training of Driving Training Instructors	7.50	8.65	9.90	11.40
(iv) Training of Engineers on Road Safety	0.75	0.85	1.00	1.15
(v) Training in First-Aid	15	17.25	19.85	22.80
(vi) Training of Road Safety Auditors	2.50	2.85	3.30	3.80
(vii) Training of Traffic police and Transport officials	25.00	28.75	33.05	38.00
<b>(C) Publicity measures &amp; Awareness Campaigns</b>	500	575.00	661.25	760.45
<b>(D) Setting up of Inspection and certification centre I&amp;C Centre</b>	1040	1196.00	1375.40	1581.70
<b>(E) Road Engineering</b>	RW will provide separately in their 5-year plan			
<b>(F) Road Safety Equipments</b>	275	316.25	363.70	418.25
<b>(G) National Highway Accident Relief Service</b>	213	244.95	281.70	323.95
<b>(H) Road Safety Fund</b>	90	103.50	119.00	136.85
<b>(I) Assistance for setting up of additional No. of Motor Accident Claim Tribunals(MACT) to the States</b>	50	57.50	66.15	76.05
<b>(J) National Data Base Network including research and development</b>	300	345.00	396.75	456.25
<b>(K) Strengthening public transport system</b>	---			
(i) Provisioning of services in rural areas	1000	1150.00	1322.50	1520.85
(ii) Introduction of ITS like Automated fare collection based on GPS	200	230.00	264.50	304.20
<b>Total</b>	<b>5333.75</b>	<b>6133.80</b>	<b>7044.00</b>	<b>8111.80</b>

## Chapter VIII

### Rural Roads

#### 8.1 Introduction

8.1.1 There is a need to effectively develop and scientifically manage the network of Rural Roads. The management principles need to examine the level of connectivity, functional changes and mobility requirements for the future generations. Road safety, Maintenance, Quality and Environmental aspects are also required to be given equal importance. The application of advance technologies such as Geographic Information System (GIS), Global Positioning System (GPS), etc. is highly relevant in the development of Rural Roads. However, the development of Rural Road Infrastructure involves multifaceted, dynamic and challenging issues. For formulating appropriate strategies to address these issues, a sub-committee on Rural Roads was constituted. The following were the main Terms of References for framing the insights into the Rural Road Development in India:

8.1.2 Key recommendations are as under:

- Following a need based approach, Rural Roads should be classified with reference to road utility, terrain / topography, climatic conditions, traffic intensity, population coverage, prevailing socio – economic status etc. The classification of Rural Roads will be dynamic which will change over a period of time.
- Interfacing roads like Major District Roads should be given proper attention to improve mobility patronages, road safety, environment sustenance and economic interactions.
- Development of road user preferred paths and link/ node overlap size should be evolved to facilitate the identification of roads for Public Private Partnership mode of operation and for identification of through routes which are dynamically changing over a time and space in the planned period.
- Some dispensations have been given to accelerate the pace of implementation of PMGSY roads in Left Wing Extremism (LWE) Affected Areas/ Integrated Action Plan (IAP) districts. These dispensations should be reviewed from time to time and may be extended for other categories of roads.
- Some relaxations in PMGSY norms such as number of Cross Drainage (CD) Works, adequate length of CC drains, suitable road way width, changes in pavement design, addressing of higher cost due to transportation, and mapping for effective drainage system should be considered for the North- Eastern States. Such dispensations may also be given, if required, for other roads as well.
- Geographic Integrated System (GIS) supported and Global Positioning System (GPS) enabled transect walk mapping should be carried out to address many obligatory issues in planning, construction, quality assurance and maintenance aspects of Rural Roads.
- GIS interventions with specific modules/ layers additions at Graphical and Non Graphical data like naturally formed drains, socio- economic profiles, changes in land use pattern etc should be accommodated at the main server and the slave servers for constructive use in the Central and the State Governments. These modules will be in addition to the usually digitized data/ base map.
- The cess on High Speed Diesel (HSD) be made '*ad valorem*' by linking it to the price of HSD, instead of being a specific amount per liter as at present.

- Rural Roads, where heavy mining vehicles ply, should be identified. These roads need to be designed to bear heavy traffic. Additional cost on account of construction as per modified design and maintenance should be shared between the State Governments and the Mining Agencies.
- Maintenance policy should be evolved using audits of different indicators such as surface condition, structural condition, material characterization, traffic intensity etc. In fact, periodic road health survey should be undertaken and documented by the State Governments using GIS and other advanced technologies.
- An effective HRD Policy should be put in place for Rural Road Sector.
- A proper evaluation of performance after training through examination or other means should be carried out to obtain feed backs for further improvement in the training system.
- Training on Detailed Project Report (DPR) preparations should be imparted. DPR preparation needs to be more scientific which may also require IT enabled scrutiny.
- Research should be carried out on the construction of bridges and other hydraulic structures for improving the life of the pavement and facilitating All Weather Connectivity to the rural people.
- Road safety should be given prime importance right from the planning to the construction and the maintenance of Rural Roads.

## **8.2 Status of Rural Road Network in India**

8.2.1 Roads in India as classified by Indian Roads Congress (IRC) are as follows: (a) **Primary**- NH and Express Ways; (b) **Secondary** - SH and MDRs and; (c) **Tertiary** - Other District Roads (ODRs) and Village Roads (VRs) also called as Rural Roads. The functional classification of roads helps in fulfilling various requirements of transportation, namely, mobility, connectivity and accessibility. Primary, Secondary and Tertiary roads facilitate and promote mobility, connectivity and land access respectively. A major portion of accessibility, of course, is facilitated by rural Roads. In India, rural roads are being planned and programmed in the context of overall rural development. These, including those of **Pradhan Mantri Gramin Sadak Yojna (PMGSY)** clubbed with States initiatives, provide all-weather connectivity to rural habitations. As a part of it under PMGSY, till July 2011 a total number of 79,931 habitations have been provided all-weather connectivity. It is of paramount importance that unless an appropriate transitional interface is created, the functionality of the road system may suffer.

8.2.2 Rural roads encompassing ODRs and VRs are given special emphasis for their development by Government of India through PMGSY, the State Governments are also focusing on renewal of roads eligible under PMGSY and also constructing such roads that are not eligible under PMGSY through their own efforts supplemented by Government of India schemes like Mahatma Gandhi National Rural Employment Guarantee Act (MGNREAGA), Backward Regions Grant Fund (BRGF), Finance Commission Grants etc.

8.2.3 Rural roads are serving to the extent of minimum needs based policy as adopted in PMGSY as an all-weather connectivity to the population of different sizes in a phased manner. Rural roads act as immediate access providers and some of the linkages that cover more than one habitation to provide access to a market centre are termed as '**through routes**', which provide connectivity to higher order roads and economic centres or market centres. Further, the interface

like identification of the growth corridors in rural areas with mobility characteristic as base may further improve the connectivity levels with State and National transportation.

8.2.4 Interface of rural road network with overall road network must be planned by identifying the road user preferred paths, link overlap size, node intensity among the elements of rural road network.

### 8.3 Progress of Road Network in India

8.3.1 The growth of rural roads till the advent of PMGSY, does not give a structured picture because rural roads were being constructed under relief programmes like calamity relief fund, minimum relief programme and other rural development scheme like National Rural Employment Programme (NREP), Rural Landless Employment Guarantee Programme (RLEGP), Jawahar Rojgar Yojna (JRY), Sampoorna Grameen Rozgar Yojana (SGRY), EAS, MGNREGA and various Finance Commission grants where quality and plan intervention in a technical and scientific manner were not generally structured. Table 8.1 gives a broad profile of road network achieved as a result of investments in the road sector since 1951.

<b>Table 8.1: Progress of Rural Road Network in India (Thousand Km)</b>							
	<b>1950-51</b>	<b>1960-61</b>	<b>1970-71</b>	<b>1980-81</b>	<b>1990-91</b>	<b>1991-00</b>	<b>2007-08</b>
Major District Roads/ PMGSY roads and other Rural Roads	333	429	821	1,358	2,166	2,994	2,540
Percentage of villages with population above 1000 connected with all-weather roads	32%	36%	40%	46%	73%	90%	89%*
Overall village accessibility	20%	22%	25%	28%	44%	54%	
*:As per PMGSY 1000+connectivity status							

### 8.4 Progress and Funds requirement under PMGSY

8.4.1 The primary objective of the PMGSY was to provide Connectivity, by way of an all-weather Road, to the eligible unconnected Habitations in the rural areas, in such a way that all Unconnected Habitations with a population of 1,000 persons and above would be covered in three years (2000-2003) and all Unconnected Habitations with a population of 500 persons and above by the end of the Tenth Plan Period (2007). In respect of the Hill States (North-East, Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttarakhand) and the Desert Areas (as identified in the Desert Development Programme) as well as the Tribal (Schedule V) areas, the objective was to also connect Habitations with a population of 250 persons and above. Tables 8.2 and 8.3 reflect physical and financial progress of PMGSY.

	<b>Total Eligible</b>	<b>Projects Cleared (Sanctioned)</b>	<b>Completed</b>
Habitations (in Nos.)	Net 136,464 (Original 1,68,268)	109,036 (80%)	79,931 (59% of eligible)
New Connectivity (km.)	367,673	259,817 (71%)	196,602 (52% of eligible)
Upgradation (UG)(km.)	374,844 (224,900 UG <i>per se</i> 149,944 Renewal)	164,096 (73%) UG	132,788

8.4.2 PMGSY guidelines permit Upgradation (to prescribed standards) of the existing roads in those districts where all the eligible habitations of the designated population size had been provided all-weather road connectivity. However, Upgradation is not central to the Programme and should not exceed 20% of the State's allocation as long as eligible Unconnected Habitations in the State still exists and is to the extent of targets fixed. In Upgradation works, priority is to be given to Through Routes of the Rural Core Network, which carry more traffic.

<b>Estimated cost of projects cleared (Sanctioned)</b>	<b>Funds Released upto 31<sup>st</sup> July 2011</b>	<b>Expenditure upto 31<sup>st</sup> July 2011</b>	<b>Funds required only completing cleared projects</b>
118,949	88,814	84,745	30,135

8.4.3 Funds requirement for completion of PMGSY are given in Table 8.4.

Funds required for completion of works already sanctioned	34,218
Funds required for balance sanctions	118,438
Total Funds needed	215,656
Funds available in year 2011-12	20,000
Net Funds needed in 12 <sup>th</sup> Plan (at 2010-11 prices)	195,656

## **8.5 Special Dispensation for Left Wing Extremism (LWE) Affected Areas/IAP Districts**

8.5.1 Some relaxations in guidelines were accorded initially to 34 LWE affected districts, which were subsequently extended to 60 districts under Integrated Action Plan (IAP). These relaxations are as under:

- All habitations in LWE affected areas/IAP districts, whether in Schedule-V areas or not, with a population of 250 and above (in 2001 Census) will be eligible for coverage under PMGSY. Notably, earlier habitations with population 500 and above only were eligible under PMGSY in non – Schedule-V areas in LWE affected areas/IAP districts.

- In IAP districts, cost of bridges up to 75 meters under PMGSY will be borne by the Government of India as against 50 meters for other areas. In case of IAP districts, the minimum tender package amount has been reduced to Rs. 50 lakh to attract more response to bids.

8.5.2 LWE affected areas/IAP districts have been included in the categories of proposals which are presently being considered for clearance under PMGSY. The categories of project proposals presently being considered for clearance under PMGSY are: (a) Residual new connectivity coverage envisaged under Phase – I of Bharat Nirman; (b) Projects to be taken up with the assistance of World Bank/Asian Development Bank; (c) **New habitation connectivity in identified LWE affected districts (now extended to 60 LWE affected/ IAP districts) ; and (d) Special road connectivity packages announced for the border areas**

8.5.3 Besides, special Dispensation has been accorded to LWE Affected Areas/IAP Districts by the Ministry of Environment and Forest. General approval under Section 2 of Forest (Conservation) Act, 1980 for diversion of forest land up to 5 ha for selected public infrastructure projects in 60 IAP districts has been given and orders have been issued.

## **8.6 Specific problems for implementing PMGSY in North-Eastern States in view of difficult terrain and difficult working conditions.**

8.6.1 By considering various issues related to implementation of PMGSY in North-Eastern States, a number of relaxations have been made which include: (a) On roads subjected to heavy snow fall and landslides, roadway width is being increased by 1.5 m; (b) States are being permitted to provide 50 mm thick Bitumen Bound Macadam in place of 75 mm thick Water Bound Macadam (WBM) Gr III ; (c) States are being permitted to provide adequate length of cement concrete drains along slopes to reduce the damage to roads and; (d) States are being allowed to provide requisite number of Cross Drainage (CD) Works keeping in view the terrain, snow fall and deposition of snow in high altitudes areas.

## **8.7 Strengthening institutional arrangement and contracting capacity**

8.7.1 It is planned to achieve PMGSY targets by March, 2017 subject to availability of funds, implementation capacity of the States etc. Further, Government of India has recently relaxed the norms for New Connectivity for IAP districts bringing habitations of 250 and above eligible even in Non- Schedule V Areas, which will lead to more habitations becoming eligible for coverage under PMGSY requiring enhanced investments.

8.7.2 Appropriate financial model needs to be evolved by joint funding from State and Central Governments for the habitations that may become eligible after the revised census, in order to provide benefit of rural connectivity to rural areas.

8.7.3 It is further recommended that in order to estimate the overall requirements of rural connectivity for any given threshold population, proper GIS Maps are generated covering all habitations in terms of new roads as well as those requiring upgradation.

## **8.8 Assessment of investment of Rural Road asset creation and asset management with clear definition of role of Central and State Governments**

8.8.1 Keeping in view the balance requirements state-wise and present estimated cost, an investment of around Rs.38,000 crore at current prices would be required to complete the balance work of new connectivity roads. For upgradation of existing roads, an amount of around Rs. 42,000 Crore at current prices would be required.

8.8.2 Projected estimation of investment is expected to increase at 10% p.a. However, the total investment in each year would depend upon the habitations remaining to be connected based on the pace of the work in each State.

8.8.3 In initial stage, it was decided that Rs. 0.75 / litre Cess may be imposed for PMGSY funding. At that time cost of Diesel was approx. Rs.17 / litre. After review of current scenario, it is proposed to move fixed Cess to percentage of the cost of the HSD as *ad valorem* Tax which will enable to generate higher resources for the implementation of the programme.

8.8.4 There are special zones where heavy mining vehicles keep plying on rural roads. The States should identify such roads and sign MOUs with Mining Operators to build roads with better specifications and properly ensure to maintain these.

8.8.5 PMGSY is a one-time intervention necessitating States to evolve mechanisms for institutional arrangements and funding including PPP, for the construction and maintenance of Rural Roads.

8.8.6 In the process of Asset creation, there is a need to Geo-fence the total road network configurations prevailing in the Core network and non-core network. In order to sustain a good functional road asset, the asset maintenance policy should be scientifically framed.

## **8.9 Exploring the possibility of Public Private Partnership (PPP) in the Rural Roads Sector and recommend a suitable model**

8.9.1 It is proposed to compliment the implementation of PMGSY through a few pilot projects mooted in the Public Private Partnership (PPP) mode. A few pilot projects of construction, up-gradation and maintenance of rural roads can be taken up in willing States through the modified Engineering, Procurement and Construction (EPC) mode. It could have following features. (a) Rural road-works aiming at either providing new connectivity or up-gradation or a combination of the two in a specific area which could be a block or a group of blocks, under PMGSY can be given on a concession basis to a private partner (Concessionaire) in an economically viable package of about Rs. 75-100 crore. The contracting would be based on the principles of EPC, which would include the following: (i) Financing of construction, up-gradation and maintenance for seven years (two-year construction period and five-year period for routine maintenance); (ii) Construction, up-gradation or renewal of selected roads (hereinafter referred to as project roads), and; (iii) Maintenance as per pre-determined performance parameters or service-level standards during the period of the concession.

8.9.2 The bidding parameter would be the lowest annuity sought. A periodic escalation clause to factor inflation would be in-built in the financial design.

8.9.3 The Concessionaire may be given an opportunity to carry out detailed investigations pertaining to traffic, soil and material, required for designing the road for a period of 10 years as per PMGSY guidelines. The State Government may prepare a DPR on the basis of the PMGSY guidelines that can be used as the public sector comparator.

8.9.4 The concession should be formulated in such a way that the Concessionaire would have to guarantee the performance of the roads in the package for the period of 10-year traffic for which it has been designed.

8.9.5 The payment of annuity will be performance based, i.e. linked to the maintenance standards, usability and availability of the road for the users. These will be monitored by an Independent Engineering firm and payment will be made on the 'assured lane km' available for the period of operations, on a model of payment similar to the one adopted by NHAI in its BOT annuity road projects. The assured lane km will be calculated on the lane km available for the period of payment and an assured quality of the riding surface (roughness index).

8.9.6 National Rural Road Development Agency (NRRDA) would develop construction standards and service-level standards based on which maintenance performance would be validated periodically.

8.9.7 The Concessionaire would be selected on the basis of a single stage two-part transparent competitive bidding process; the selection would be based on the evaluated lowest rate of anticipated equated annuity amount for the package quoted by the technically qualified bidders.

8.9.8 The anticipated equated annuity amount, i.e., the amount required to build new roads as well as to up-grade the rural road network as per PMGSY guidelines and norms (2001 population census), would be extended by the Ministry of Rural Development over a period of seven years. The financial burden would be shared by the Central and the State Government in the ratio of 93:07, which broadly reflects the respective shares of the Centre and State Governments under PMGSY.

8.9.9 An appropriate mechanism for the payment of annuity to the Concessionaire will be worked out to ensure that the project gets funds on time through various streams.

8.9.10 In order to address this risk arising out of limited capacity of small contractors, the option of part funding the project during the construction period to the extent of 40%-60% of the cost of construction paid on completion of specific milestones and the rest paid through an annuity, may be explored. In this model, a fixed grant will be stated by the bidding authority at the time of project bidding and the lowest annuity amount would be quoted by the bidder.

8.9.11 The State Governments may consider the above proposals and methodology for PPPs in rural roads through modified EPC contracts.

## **8.10 Improvements in Quality Assurance System in construction/ upgradation/ renewals of Rural Roads**

### **8.10.1 Rural Roads Constructed under PMGSY**

8.10.1.1 A three-tier quality mechanism is prevalent under the PMGSY. The State Governments are responsible for the first two tiers of the Quality Control Structure. The Programme Implementation Unit (PIU) is the first tier, the primary responsibility of which is to ensure that all the materials utilized and the workmanship conform to the prescribed specifications. Second tier is the quality check of each work at least at three different stages during construction, by independent State Quality Monitors (SQMs) by way of structured inspections in the prescribed format. Third-tier is the quality check by way of random inspections of selected works by Independent National Quality Monitors (NQMs) who are retired senior engineers deployed by NRRDA. Rural Roads Constructed under Non-PMGSY Schemes the quality control aspect in construction of Rural Roads is being monitored by two tier structure and the responsibility of both tiers of quality mechanism fully vests with the State Government. Suggested Improvements in Existing Quality assurance system for Rural Roads could be on following lines: (i) Uniform specifications for all Rural Roads; (ii) Introduction of three tier Quality System; (iii) Single Agency for Rural Roads in-charge for construction and maintenance of Rural Roads in the States for comprehensive planning, construction and maintenance of Rural Roads to be constructed under different schemes; and (iv) Use of Modern Equipment and GIS in Quality Monitoring of Rural Roads.

### **8.10.2 Appropriate Maintenance Management Strategy for Rural Roads with necessary institutional arrangements and well defined roles and responsibility.**

8.10.2.1 It is evident that a road constructed with higher degree of engineering standards and quality would be more durable and lessen the burden of maintenance.

8.10.2.2 It is a difficult task to assess the value of the vast rural road assets due to problems faced in any aggregation involving wide diversity. For instance, one can't compare cost of a rural road in steep hills of Arunachal Pradesh; with one in plains of Uttar Pradesh; of a road laid a few decades back with one laid recently. A broad assessment may, however, be made of current replacement value of the asset base that the rural road network surely represent. This is estimated at Rs. 425,000 crore as a ball park figure (Table 8.5).

<b>Sl. No.</b>	<b>Particulars</b>	<b>Rough cost of replacement (Rs.lakh/km)</b>	<b>Estimated value (Rs. crore)</b>
1.	PMGSY – 3,00,000 km	40.0	1,20,000
2.	Non-PMGSY		
	(a) Core network – 1,100,000 km	15.0	165,000
	(b) Non-core roads – 1,400,000 km	10.0	140,000
	<b>Total – 2,800,000 km</b>		<b>425,000</b>

8.10.2.3 While this is a broad assessment, there can be no two opinions that these are huge assets and deserve our serious attention. The annual loss in asset base may be over Rs. 20,000 crore, which the Nation cannot afford to lose.

8.10.2.4 The 12<sup>th</sup> Finance Commission considered the issue of maintenance of State roads and bridges by the State governments. The Thirteenth Finance Commission (FC) has also been more

specific and agreed to provide maintenance funds for the core rural roads network including for PMGSY roads that have come out of their initial five-year maintenance contracts. The FC will provide grants-in-aid for roads maintenance to the extent of 50 percent of the requirement assessed for non-PMGSY roads on the core rural roads network and 90 percent of the requirement assessed for PMGSY roads for four years starting 2011-12.

8.10.2.5 The State governments should declare as a policy that rural roads would receive dependable and adequate allocation of funds on a continuous basis. For ensuring flow of funds, the States may consider setting up dedicated funds for maintenance. While PMGSY roads are being built/upgraded to proper engineering standards, much of the remaining rural road network needs substantial improvement and upgradation and represents a serious backlog. Before any maintenance interventions on such roads, they have to be made maintainable. A dedicated Road Maintenance Management Unit may be set up in each State and made responsible to develop a sound and rational Maintenance Management System for the entire rural road network.

8.10.2.6 For planning and prioritization of maintenance interventions, the model to be developed should be simple and demanding of only a few essential parameters so that it is robust and once developed, it is sustainable in the long run. It is now quite convenient to set up data base on GIS platform or such other IT-related software. What is essential is to formulate an Annual Maintenance Plan (AMP) for the entire rural road network based on network condition and importance of road taking into consideration the Budget allocation. A system of working out the replacement value of the rural road assets at the end of each financial year should also be introduced and put on website.

## **8.11 Human Resource Development Policy for Rural Road Sector**

8.11.1 The first task in the Human Resource Development is **training needs assessment** for different levels of engineers, based on the tasks to be performed by them. The training needs assessment should not be confined to the departmental engineers alone but need to be extended to the engineers of contractors, who are constantly involved in the construction of roads. The next stage is planning for training by identified suitable institutions both at the National Level and the Regional Level. The National Level Institutes may include Indian Academy for Highway Engineers (formerly NITHE); Central Road Research Institute, New Delhi; National Academy for Construction; Hyderabad and IITs, NITs and other academic institutions may be entrusted for training at the Regional Level. Quality Assurance, riding surface profiles, pavement performance functionalities of different layers of construction should also be included to properly train engineers.

8.11.2 The possibility of road safety designs at critical locations with training on safety audits should be imparted so that the impact of geometrics, land use, traffic islands, road markings and signage should be properly located in the design process.

## **8.12 Research and Development needs for Rural Road Sector**

8.12.1 Research and Development (R&D) in the Rural Roads should be a continuous activity laid on planning, designing, and management of roads. The purpose of R&D in Rural Roads is to adopt and popularize the innovative technologies to achieve one or more of the following

advantages (a) Cost Effectiveness; (b) Pace of construction; (c) Longevity; (d) Better Performance; and (e) Research leading to evolving new standards, etc. The Departments implementing Rural Roads either under PMGSY or in other programmes may adopt any of the technologies accredited by the Indian Roads Congress.

8.12.2 R&D is an important phase in the rural sector which should cover Planning – The alignment of the road should be mapped with GPS based transect walk, where the obligatory points like land, green bodies, terrain conditions, visual soil profiles can be mapped for identifying the possibility of change of alignment. During the planning process special attention should be accorded to the following: (i) Mapping of strength characteristics of locally available material; (ii) Rural Roads normally carry low volume of traffic. Therefore, use of locally available materials is to be explored, even if they have marginally lower strength but meet specifications; (iii) Technology of fast construction of bridges; and (iv) Utilization of Accelerated Pavement Testing Facility (APTF) to evaluate performance of different pavement compositions.

### **8.13 Use of modern techniques like GIS, GPS enabled equipment for codification of Core Network, assessment of quality on real time basis for PMGSY as well as other.**

8.13.1 The Geo-Fenced map display system is essential because of the following reasons: To identify the progress of PMGSY and other roads with reference to access and connectivity pattern for overall development of the rural areas; To locate the habitations of different ranges be it Geo-referenced, which would be helpful in policy making and connecting habitations over a time frame; To avoid multi-connectivity among the habitations so that the basic objective of PMGSY scheme can be achieved; To identify rural growth corridors and track density of roads constructed per block / constituency/ district/ State which may be helpful in planning; To overlay the land use, terrain conditions and other obligatory aspects, a Geo- reference of map display system will be helpful for scientific and engineering design.

### **8.14 Environment & Social Management Framework and Road Safety:**

8.14.1 To avoid, minimize and mitigate the environmental, social and vulnerability issues that are likely to arise during the planning, design and implementation of project, Environmental and Social Management Framework (ESMF) has been prepared for Rural Roads. It comprises four volumes:

- an ESMF, provides an overview on the approach and institutional arrangements for managing environment and social issues in the project;
- an Environmental Codes of Practice (ECoPs),
- a Social Management Framework, providing guidance on handling land uptake, resettlement and stakeholder participation related issues; and
- a Vulnerability Framework to address the needs of the vulnerable population and to enable measures for promoting distributional equity among the Project Affected Persons (PAPs) in a culturally sensitive manner. These four documents together are referred to as ESMF in the various project documents.

8.14.2 Land acquisition is not financed under the PMGSY but provided by the States - mostly through voluntary donations. However, in some project States – land is purchased besides voluntary donation, and this represents an important shift in the land transfer modalities under

the PMGSY, one that will mitigate potential social challenges associated with voluntary transfers.

## **8.15 Road Safety**

8.15.1 Road safety in rural sector is multidimensional because of the socio-economic background of the road users, infrastructure geometrics, road user behaviour and dominance of slow moving vehicles on different roads get connected to the higher order roads. The treatment at junctions is essential to be face lifted with engineering geometrics generated by simulating vehicle turning path, weaving length template, acceleration, deceleration lanes, site triangle, peripheral vision and glare recovery, etc. The Safety audit on all the roads approaching to junctions and the road of higher demand should be properly audited for suggesting optimal locations for signals, signage, markings, island treatment etc. In the road safety issue, Safety aspects should be inbuilt in the DPRs and related cases needs to be computed and duly included.

## **8.16 Reducing Carbon Footprints**

8.16.1 Carbon Foot print is a measure which measures impact of climatic change relating to deforestation, soil erosion, water retention and spices loss, due to emission of more carbon content in the environment. In order to assess the energy requirement for reducing the Carbon Footprint, a scientific approach is essential to develop. In rural road planning, one perspective is to promote carbon free roads with proper care on geometric alignment by considering the terrain, soil and land use practice into account. Secondly, the road design should be compatible to vehicle mobility with reference to fewer emissions. The three dimensional terrain modelling is essential to develop for fixing the alignment, optimal locations of CD works and CC drains. The tracking effort, engine condition and driver ability will also contribute for lower emission of the carbon content. In order to assess the energy requirement for countering the carbon footprint, absorbers like green bodies all along the road and geometric profile convenient to the vehicle mobility shall be planned. Principal Component Analysis, multi criteria evaluation and Regression Modelling or some Index Approach is also required to be developed as R&D base to assess the calculation of Carbon Footprint. This is with the objective of quantifying the CO emission getting related to the influencing factors.

## **8.17 Recommendations:**

### **8.17.1 Interfacing of Rural Roads**

8.17.1.1 The functionality of Rural Road should be correctly identified as it keeps on changing over a time frame. Accordingly, extension of network connectivity for an effective socio-economic networking in rural areas should be assessed.

8.17.1.2 Following a need based approach, Rural Roads should be classified with reference to road utility, terrain / topography, climatic conditions, traffic intensity, population coverage, prevailing socio – economic status etc. The classification of Rural Roads will be dynamic which will change over a period of time.

8.17.1.3 Interfacing roads like Major District Roads should be given proper attention by the concerned departments which will improve overall connectivity in rural sector. It will improve mobility patronages, road safety, environment sustenance and economic interactions.

8.17.1.4 Rural growth corridors can also be identified if overall connectivity is achieved among market centres, community places and/ district/ Block/ Panchayat headquarters with interface of MDRs and Other Collateral roads, etc.

### **8.17.2 Network Analysis**

8.17.2.1 Development of road user preferred paths and link/ node overlap size should be evolved to facilitate the identification of roads for Public Private Partnership mode of operation and for identification of through routes which are dynamically changing over a time and space in the planned period.

8.17.2.2 The Core Network showing the details of habitations, existing roads and roads required to be constructed should be put in place through GIS which will help the policy planner decide the priority for construction of new roads and maintenance of existing roads.

### **8.17.3 Dispensations for LWE Affected (IAP Districts).**

8.17.3.1 Some dispensations have been given to accelerate the pace of implementation of PMGSY roads in LWE Affected Areas/ IAP districts. These dispensations should be reviewed from time to time and may be extended for other categories of roads.

8.17.3.2 Some relaxations in PMGSY norms such as number of CD Works, adequate length of CC drains, suitable road way width, changes in pavement design, addressing of higher cost due to transportation, and mapping for effective drainage system should be considered for the North-Eastern States. Such dispensations may also be given, if required, for other roads as well.

### **8.17.4 Technology and IT Interventions.**

8.17.4.1 GIS supported and GPS enabled transect walk mapping should be carried out to address many obligatory issues in planning, construction, quality assurance and maintenance aspects of Rural Roads.

8.17.4.2 Bridge condition assessment with unmanned technology, traffic volume assessment with latest reliable techniques and quality monitoring with Non Destructive Testing Equipment should be undertaken.

8.17.4.3 GIS interventions with specific modules/ layers additions at Graphical and Non Graphical data like naturally formed drains, socio- economic profiles, changes in land use pattern etc should be accommodated at the main server and the slave servers for constructive use in the Central and the State Governments. These modules will be in addition to the usually digitized data/ base map.

### **8.17.5 Policies on Finance Mobility**

8.17.5.1 The cess on High Speed Diesel (HSD) be made '*ad valorem*' by linking it to the price of HSD, instead of being a specific amount per liter as at present.

8.17.5.2 The States should pool resources like Mandi Tax, electricity duty, royalty of mining, vehicle tax etc. to supplement their efforts for management of Rural Roads.

8.17.5.3 Rural Roads, where heavy mining vehicles ply, should be identified. These roads need to be designed to bear heavy traffic. Additional cost on account of construction as per modified design and maintenance should be shared between the State Governments and the Mining Agencies.

#### **8.17.6 Assets Management Policy**

8.17.6.1 In order to monitor the construction and maintenance of the vast assets, Geo-fencing of all the rural roads and its interface with other functional roads should be put in place.

8.17.6.2 Maintenance policy should be evolved using audits of different indicators such as surface condition, structural condition, material characterization, traffic intensity, etc. In fact, periodic road health survey should be undertaken and documented by the State Governments using GIS and other advanced technologies.

#### **8.17.7 Lead on Public Private Partnership**

8.17.7.1 Public Private Participation should be undertaken for Pilot Projects to begin with.

8.17.7.2 Pilot Projects of construction, upgradation and maintenance can be taken up for PPP through modified EPC model/ Annuity based model.

#### **8.17.8 Quality Control and Assurance Issues**

8.17.8.1 Three-tier quality monitoring system of PMGSY may be extended for all roads.

8.17.8.2 A single agency for the management of all rural roads including PMGSY roads should be put in place by the State Governments.

8.17.8.3 The advance technologies such as GIS, GPS, GPRS, etc. should be applied for monitoring the quality of roads on line.

#### **8.18 Training Needs- HRD Policy**

8.18.1 An effective Human Resource Development Policy should be put in place for Rural Road Sector.

8.18.2 Needs of training to the engineers and other technical personnel at different levels should be assessed.

8.18.3 Training to engineers should be linked to the need based field conditions and also the advancement in basics of Engineering.

8.18.4 A proper evaluation of performance after training through examination or other means should be carried out to obtain feed backs for further improvement in the training system.

8.18.5 Contractors' Engineers, workers and equipment operators should also be trained for ensuring quality construction and effective maintenance.

8.18.6 Training on DPR preparations should be imparted. DPR preparation needs to be more scientific which may also require IT enabled scrutiny.

### **8.19 Research & Development Issues**

8.19.1 Research should be carried out on the following

- Spatial planning related to connectivity, mobility issues with Core Network and neighbourhood network of the region.
- Material characterization to freeze the characteristics features which are used in the pavement structure and the cost estimates.
- Need based technology to plan, design, construction and maintenance of rural roads.
- Construction of bridges and other hydraulic structures for improving the life of the pavement and facilitating All Weather Connectivity to the rural people.
- Specific areas related to the impact of land slides, heavy snow fall, etc. on rural roads.
- Expeditious construction of bridges.

### **8.20 Environment and Road Safety**

8.20.1 The proposals of rural roads for clearance under forest conservation act should be fast tracked.

8.20.2 Road safety should be given prime importance right from the planning to the construction and the maintenance of Rural Roads.