

National Environmentally Sustainable Transport (EST) Strategy for Nepal

FIRST DRAFT

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Annex-1

National Environmentally Sustainable Transport (EST) Strategy for Nepal

1. Introduction

1.1. Background

Rapid urbanization and increasing economical activities in cities have dramatically increased vehicle ownership and usage in urban areas of Nepal. The current patterns of motorization adversely affect traffic congestion, air and noise pollution, and traffic accidents and injuries. The unsustainable trends in transport sector as presently observed would further worsen social equity, lower energy security, increase greenhouse gas (GHG) emissions, and destroy natural habitats and ecosystem, which ultimately have adverse impacts on national productivity and human development. At the same time, frequent natural disasters such as floods, earthquakes and landslides are on the rise across Nepal. These natural catastrophes cause the losses of a human life and immense damage to public transport infrastructure each year. To make Nepal's transport system more productive, resilience, and sustainable, it is important to strike a balance among economic progress, social equity, a healthy and protective environment and people-friendly infrastructural development. The Environmentally Sustainable Transport (EST) concept calls for all these essential elements to be integrated at the level of policy formulation, plan preparation, infrastructure building and transport service operation.

With an aim to create a new paradigm in transport practices and to build a common understanding across Asia on the need for EST integrated into overall policy, planning and development, the Asian EST Initiative was jointly launched by the United Nations Centre for Regional Development (UNCRD) and Ministry of the Environment of the Government of Japan (MoE-J) in 2004. The main objective of the EST Initiative in Asia is to integrate EST in the overall policy, planning and development, by sensitizing the local and national governments, private sectors and civil society. As a key component of the Asian EST initiative, UNCRD provides technical assistance to developing countries for the formulation of National EST Strategy. It aims to promote the EST in Asia to build a sustainable society through the effective use of safe, reliable, socially inclusive, economically viable, environmentally protective, people-friendly, and seamless transport system for the benefit of all. The EST initiative is build on the objectives of the *Bangkok 2020 Declaration*-Sustainable Transport Goals for 2010-2020 and *Bali Declaration* on Vision Three Zeros-Zero Congestion, Zero Pollution and Zero Accidents towards Next Generation Transport Systems in Asia, and the Rio+20 outcome -*The Future We Want*.

With the technical support from UNCRD, Government of Nepal, Ministry of Physical Infrastructure and Transport is taking a lead to prepare the National EST Strategy for Nepal in collaboration with other related government ministries.

1.2. Environmentally Sustainable Transport (EST) and relevance for Nepal

In order to judge on the sustainability of a transport system, relevant indicators are used. Table 1 lists such indicators under different dimensions of sustainable transport, namely economic, environmental and social. Both direct and indirect indicators are lumped together in the table for the sake of simplicity. Also some indicators may be common to all dimensions. For example, higher mode share of public transport is an indicator that simultaneously serves the purpose of economic efficiency (lower operating cost per pass-km), environmental sustainability (lower emissions per pass-km) and socially equitable and safe.

The most critical challenge for policy makers is that they may need to go for a trade-off between different dimensions of sustainability. There is a concern that improving environmental sustainability of the transport system may undermine economic efficiency. However, there is good scope of avoiding such a trade-off and achieve a win-win solution. For this, it is important to focus on the indicators that serve the underlying objectives across different sustainability dimensions. Public transport for passenger mobility and intermodal freight transport are policy options, which can produce win-win solutions.

Table 1: Common indicators for sustainable transport

<i>Economic aspects</i>	<i>Environmental aspects</i>	<i>Social aspects</i>
<ul style="list-style-type: none"> • Degree of accessibility • Transport costs • Productivity • Efficiency • Congestion • Mobility • Employment • Comfortability • Profitability • Energy efficiency • Public subsidy • Load factor • System reliability • Multimodality 	<ul style="list-style-type: none"> • Local emissions • GHG emissions • Pass-km per capita • Fuel consumption • Fuel quality • Ecological impacts • Soil/water pollution • Noise and wastes • Transport use of arable land • Per capita travel • Transit mode share • Natural resource exploitation • Climate resiliency 	<ul style="list-style-type: none"> • Traffic safety • Accessibility • Inclusiveness • Affordability • Gender • Universal access • Resettlement • Poverty reduction • Road use parity • Participatory • Impact on heritage • Security • Fitness/health • Livability • Spatial separation

In Nepal, environmental issues related to transport sector are addressed through several mitigative or project level instruments (such as emission mitigation, EIA,

accident reduction etc). Broader meaning of Environmental Sustainability demands better integration of sustainability concerns into the sectoral policy. National EST Strategy is expected to serve as an important policy guide to formulate environmentally sustainable transport policies.



Figure 1: framework for formulation of EST strategy

1.3. Framework of strategy formulation

Figure 1 shows the framework for the formulation of national EST strategy for Nepal. First a vision statement is articulated that encompasses key principles of sustainable transport. Relevant objectives and target are then set which support the realization of the Vision. However, perusing the objectives and achieving the targets is a quite daunting task. Intuitive policy instruments may not work effectively as the transport system itself constitutes a complex system, and for a long run vision, we have to deal with strategic challenges. In order to correctly pin down the challenges and opportunities (if any), it is important to examine the major trends and issues related to the different components of transport system. Also examined is the factors that drive the future scenario of transport sector in Nepal. After identifying key challenges and opportunities along with some defining features of Nepal's transport sector, an insight is drawn about strategic perspective, which would help to tailor strategies and actions to Nepal's context. Strategic components are then identified based on their relevance to address the key issues overcoming the challenges and reaping the opportunities. Finally, specific actions are proposed under each strategic component.

2. Vision

The vision statement for National EST Strategy (2015-2040) for Nepal is set as

“Developing a transport system that is efficient, accessible, people-centric, affordable, reliable, safe, inclusive, and environmental friendly”.

This vision is based on the following principles:

Efficient: Economic efficiency is the core element of sustainability that directly contributes to other aspects too. For example, efficiency requires low energy intensity and better operational performance, which automatically translate to lower emission and lower cost of operation making the service more affordable.

Accessible: Accessibility of transport system relates to the concept of both physical and social accessibility. Physical accessibility is about proximity of transport infrastructure and facilities for prospective users, where as social accessibility is about the possibility of use by all section of society. Well-developed road system in the absence of public transport system would not provide accessibility to users without private vehicles.

People-centric: Transport system includes infrastructure, vehicles and terminals, stations and transfer facilities. There is the movement of both vehicle (with passenger) and pedestrians, but the performance of transport system is judged on the basis of services rendered to the users, in-vehicle or pedestrians. The transport system should therefore be designed and operated to make it people-centric (comfortable for people) rather than vehicle-centric (convenience for drivers).

Affordable: The transport service should be affordable to various section of the society. For the economically weaker section, government may need to make provision of cross-subsidy or direct public subsidy. But the best option would be to bring down the cost through better productivity and efficiency.

Reliable: Service reliability is another important attribute of transport system. It is about high degree of predictability of service availability and travel time. Unreliable service may require extra time to be allocated to the trip in order to hedge possible uncertainties in service availability and travel time.

Safe: Transport infrastructure, vehicles and operating and maintenance system should ensure adequate safety for the users.

Inclusive: Transport system should not exclude or impose any sort of discrimination to any section of society (specially children, elderly, physically challenged, and other marginalized peoples) particularly in terms of accessibility and ease of usage. There

should not be any physical or institutional barrier to use transport infrastructure and services.

Environmental friendly: Building of transport infrastructure involves use of and some degree of damage to natural resources. In addition, service operation produces emissions. Utmost care should therefore be taken to make the transport system environmental friendly.

3. Objectives and Targets

The vision envisages sustainability in environmental, economic and social aspects. In order to deliver the vision effectively, it should be supported by relevant objectives. Appropriate targets need to be set to guide the process of formulating strategies and actions and monitor the progress of achieving the objectives. While setting objectives and targets, past trend and current situation along with strategic directions as reflected in various policy papers of the Government of Nepal have been taken into account. Targets are expressed either in the form of numerical target (subject to be confirmed in the final version of the document) or broad strategic directions of related indicators.

Key objectives and associated targets are listed below clustering under different aspects of sustainability (viz economic, environmental and social). Also indicated is the related transport subsector, namely intercity transport (ICT), urban transport (UT) and rural transport (RT) where applicable (if not specifically indicated, the item is for all transport subsectors).

Table 2: Objectives and Targets of National EST Strategies for Nepal

<i>Objectives</i>	<i>Target/indicators</i>
<i>Economic dimension</i>	
1. Efficiency in investment and service operation	<ul style="list-style-type: none"> • Resonable IRR and profitability • Operating cost per vehicle km • Energy consumption per pass-km
2. Improved accessibility	<ul style="list-style-type: none"> • Minimize time to road head (ICT, RT); • % Coverage of public transport (with 15 minute walk) (UT)
3. Secure higher mobility	<ul style="list-style-type: none"> • Average travel speed in city area (30 km/hr) (UT) • Average travel speed for ICT (general highway 50 km/hr; Exp ways 80 km/hr; railway ###km/hr)
4. Ensuring affordable transport services	<ul style="list-style-type: none"> • ICT/RT- fare per Km as % of per capita income • UT- daily commuting cost as % of per capita income

5. Provision of reliable transport services	<ul style="list-style-type: none"> • Provision of schedule services (% of delay)
6. Leveraging transport for poverty reduction	<ul style="list-style-type: none"> • Degree of labor intensive technology • % of investment in backward areas
<i>Environmental dimension</i>	
7. Ensuring sustainability in the use of natural resources and nature conservation	<ul style="list-style-type: none"> • Minimize use of arable land for infrastructure • Minimize impacts on ecological resources (ICT, RT)
8. Minimize local pollution and noise effects (UT)	<ul style="list-style-type: none"> • Minimize car/motor cycle ownership (#/population) • Mode share of public transport (#%)
9. Minimize CO2 emissions from transport	<ul style="list-style-type: none"> • Per capita CO2 from transport sector • CO2 emission per pass-km (## g CO2)
10. Increase climate resiliency of transport infrastructure	<ul style="list-style-type: none"> • Reduced incidence of infrastructure damage by climate related disasters
<i>Social dimension</i>	
11. Improve transport safety and security	<ul style="list-style-type: none"> • Reduced traffic accidents (# per vehicle, # per vehicle-km) • Reduced incidence of travel related crimes
12. Ensure inclusiveness of transport system	<ul style="list-style-type: none"> • % of public transport coverage; % of barrier-free vehicles
13. Ensure gender equity in transport services	<ul style="list-style-type: none"> • % of all-women public transport vehicles; % seats for women
14. Minimize social impacts of transport development	<ul style="list-style-type: none"> • Minimize degree of community separation due to transport routes
15. Integrate transport and public health	<ul style="list-style-type: none"> • Minimize local pollution • Share of NMT modes in total trips
ICT: Intercity Transport; UT: Urban Transport; RT: Rural Transport	

4. Key Challenges and Opportunities

The vision, objectives and targets set above basically reflect the desirable path that the Nepal's transport development should follow. However, in a developing country like Nepal, there is a wider discrepancy between the business-as-usual and desirable paths. There is a range of factors that may act as barrier in perusing identified objectives and achieving of intended targets. It is important to clearly understand such key challenges in order to formulate effective strategies and actions. In addition, some of

the defining features of Nepal may also offer unique opportunities to achieve the objectives of EST. This section first summarizes the review of key trends and issues on various components of transport sector (Annex-1) and identifies key factors driving the future trends. Based on such a review, key challenges and opportunities for developing environmentally sustainable transport system in Nepal are identified.

4.1. Major Trends and Issues

Table 3 shows major trends and associated issues related to the different components (sub-sectors) of transport sector of Nepal.

Table 3: Key trends and issues related to various components of transport system

<i>Components</i>	<i>Trends and Issues</i>
Intercity Transport	<ul style="list-style-type: none"> • Road transport- always a priority investment in five-year plans • Two districts yet to be connected to Strategic Road Network (SRN) • SRN standard- basic mobility • Only 47% of SRN is paved road • Recent initiatives for higher grade roads eg KTFT and KKHT • East-West Railway- DPR under preparation • Poor condition of bus services in intercity routes • Haphazard settlement along national highway routes (ribbon-type settlement) • Growing concern for ecological damage from new road/rail construction • Increased landslide vulnerability due to road construction in hilly areas
Urban Transport	<ul style="list-style-type: none"> • Lower urbanization rate (17 %) • Higher growth rate of urban population (3.16%) • Problem of urban primacy- Kathmandu valley 2.5 million population • Rapid motorization (growth of cars and motorcycles) • Over 2008-13, annual rate of growth for four-wheel light vehicle was 8.4 % • Over 2008-13, annual rate of growth for motorcycles was 8.4 % • Car (includes van, jeeps) ownership rate in Kathmandu- 34 per 1000 pop • Over 2008-13, petrol consumption increased by 2.2 times • Total road length in Kathmandu valley 1,595 km

	<ul style="list-style-type: none"> • Average road area ratio in urban area of Kathmandu valley is only 6 % • Road expansion lagging behind the pace of motorization causes congestion • Evening peak average speed in five busiest route is 8.8 km per hour • Poor condition of infrastructure for NMT- walk ways and bicycle lanes • Disparity in road space allocation in Kathmandu- expanded road mostly for vehicle movement • NMT share decreased to 40.7% (in 2011 from 53.1 % (in 1991) • Public transport mode share decreased to 47.8 (in 2011) in motorized trips • Weak regulatory provision is reinforcing syndicates in public transport • Initiatives are under way to improve urban transport in Kathmandu • In smaller cities, limited provision of public transport; NMT plays a role • Ten market towns (50,000 population) are being planned along the mid-hill highway- road infrastructure is the key element of the plan • Need of better public transport and NMT provisions in cities and towns that are popular tourist destination (eg Pokhara, Janakpur etc)
<p>Rural Transport</p>	<ul style="list-style-type: none"> • Rural road initiatives since 1970s under IRDP • DoLIDAR for rural roads since 1997 • Low cost, labor-intensive and non-engineered rural roads <ul style="list-style-type: none"> ○ Ecological damages ○ Land-slide hazards ○ Road safety hazards ○ Poor service and maintenance problems • Exemplary initiatives for green roads and bio-engineering • Transport service through formal/informal paratransits • Rapid growth in motorcycle use (replacing bicycle)
<p>GHG emissions and local pollution</p>	<ul style="list-style-type: none"> • Per capita CO₂ emission from fuel combustion is low (133 kg) • Growth rate of CO₂ emission from fuel combustion is higher • Share of transport sector in total CO₂ in Nepal is 45%- higher in the world • For given per capita income, Nepal's transport CO₂ is still at the bottom

	<ul style="list-style-type: none"> • Good prospect of developing low-carbon transport • Vehicular pollution is an issue in Kathmandu valley • Average PM10 concentration is higher than national standards • Important policy initiatives were taken in the past to control vehicle emissions • EURO III standard was enforced in 2012
Transport safety	<ul style="list-style-type: none"> • Road traffic accidents are in rise (in Kathmandu and at the national level) • Fatalities trend is on rapid increase at the national level (may be because of rapid expansion of sub-standard roads) • Increasing trend of accidents involving intercity bus- supposed to be safer • Government of Nepal formulated road safety action plan (2013)
Transport Management	<ul style="list-style-type: none"> • Weak regulation is promoting syndicates of operators • Problem of monopoly- barrier for service improvement • Ad-hoc route permits causes inefficient operation of public transport • Domination of small public transport vehicles- inefficient road use • Initiatives underway to improve public transport service in Kathmandu • Plan to replace small public transport vehicles by higher capacity buses • Plan for regulatory reform • Draft National Strategy for Transport Management- emphasis on efficient public transport, transit oriented development (TOD) and demand management.

4.2. Future driving factors for transport sector in Nepal

4.2.1. Higher economic growth and economic restructuring

4.2.2. Significant change in the pattern of spatial development

4.2.3. Rapid urbanization

4.2.4. Increasing demand for transport (all purpose)

4.2.5. Increasing demand for fossil fuel

4.2.6. Climate change agenda (emissions from transport and vulnerability of transport system due to disasters from climate change)

4.2.7. Introduction of new technology in transport sector

4.3. Key challenges

- 4.3.1. *Making adequate investment for transport infrastructure*
- 4.3.2. *Overcoming technical constraints for infrastructure building*
- 4.3.3. *Decoupling economic growth and motorization (cars and motorcycles)*
- 4.3.4. *Haphazard urban development and settlement patterns*
- 4.3.5. *Maintaining environmental and safety standards in low-cost rural roads*
- 4.3.6. *Shifting from road to railway mode (after railways development)*
- 4.3.7. *Promoting non-motorized modes (NMT)*
- 4.3.8. *Enhancing institutional capacity- regulation, database and research*

4.4. Opportunities

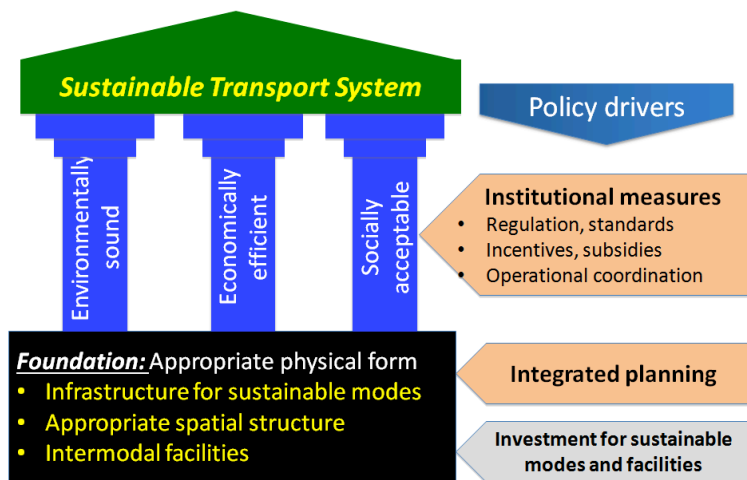
- 4.4.1. *Possibility of achieving more appropriate physical form- Physical structure of transport and spatial system still evolving*
- 4.4.2. *Real prospect of developing a comprehensively integrated transport system*
- 4.4.3. *Public transport is still dominant mode- just need to keep it*
- 4.4.4. *Good prospect for commercial viability of public transport due to higher population density in urban area*
- 4.4.5. *Possibility of corridor development and appropriateness of rail-based intercity transport*
- 4.4.6. *Real prospect of zero emission public transport because of hydropower generated electricity*
- 4.4.7. *Possibility of synergy rather than trade-off between environmental and economic dimensions.*

5. Strategic Perspective for EST strategy in Nepal

Nepal, a least developing country, is featured with some special characteristics, which may demand specific perspective while formulating EST strategy. Transport infrastructure and other physical system are at the very preliminary stage of

development in Nepal. This offers an important opportunity of better integrating transport and land use at the national and urban level. The concept of integrated transport has recently been broadened to achieve integration at different level, such as integration at the planning level, at the investment level, at the operation level and also integration between transport and other sector (such as health). As the overall physical and spatial structure in a developing economy like Nepal is just evolving, it is possible to go for comprehensive integration.

High population density and inadequate road infrastructure is another defining feature of Nepal. The road space or the reserved right-of-way in major metropolitan area is much inadequate to serve the rapid trend of motorization. Because of land scarcity, land acquisition for roads is now a thorny issue even in non-urban areas. On the other hand, the current national road network in Nepal is just for very basic accessibility. The transport service has to be speeded up to cater a high-growth economy. Such a condition in Nepal demands that public transport be fully utilized for mobility to make efficient use of limited road space. In addition, railway may offer even better option given the future scenario of large-scale demand for both urban and intercity transport. Higher population density at the national and urban level further provides an opportunity to run public transport services on commercial basis.



Source: Adapted from Morichi and Acharya (2013)

Source: Adapted from Morichi and Acharya (2013)

Figure 2: Foundation and Pillars of Sustainable Transport

In developed economies, EST strategies normally involve institutional, regulatory or technological solutions. New investment for infrastructure or facilities is rarely applicable since infrastructure and facilities are already there. However, in a developing country like Nepal, transport infrastructure and facilities are grossly inadequate. Under such circumstances, only institutional or regulatory (so-called

software) instruments may not be that much effective. Hence, in Nepal, it is important to adopt a strategic perspective that places equal emphasis on both hardware (infrastructure and facilities) and software (institutional) aspects. In a way, integrated development of infrastructure and facilities provides a sound foundation on which soft policy measures can more effectively work (Figure 2). In addition, appropriate physical structure (involving transport infrastructure and spatial patterns) would make it possible to achieve a synergy rather than trade-off between environmental and economic objective.

6. Strategic Components

The issues, challenges, opportunities and the strategic perspective discussed above lead to few strategic components that require priority focus in the future in order to deliver the articulated vision of EST in Nepal. Commonly discussed strategic components in the literature include so-called Avoid, Shift and Improve (ASI) strategies. Here, Avoid means avoiding excessive travel, Shift is about moving from environmentally damaging to environmentally friend modes, and Improve means improving various aspects of transport system. Though these strategic components are quite relevant for the developed countries' case, it may be incomplete or inappropriate for developing countries. For example, in developing countries, investment for new infrastructure or adoption of new technology (which may be just a conventional technology in the developed world) might be more important than they are in developed countries.

Key strategic components for developing Environmentally Sustainable Transport (EST) system in Nepal are listed below. A brief discussion including intended issues to be addressed under each component is also included.

6.1. Investment for essential and sustainable transport infrastructure

Because of grossly inadequate transport infrastructure, higher degree of infrastructure investment is urgently needed for intercity transport, urban transport and rural transport. Priority should be laid first for essential infrastructure for basic accessibility, such as general roads. Later, priority should be shifted to more sustainable infrastructure, such as intercity railway and urban mass transit (BRT or MRT). The issues to be addressed by this strategic components includes: Provision of high-quality public transport; expansion of road capacity and easing of congestion; expanded coverage of public transport; better connectivity of regions and local cities; improved accessibility and mobility; reduced emissions due to sustainable modes (railways).

6.2. Planning and development of integrated transport system

The core element of sustainability is to make the best use of transport infrastructure and facilities developed with scarce capital resources. For this, it is important to plan, develop and operate transport infrastructure to produce a truly integrated transport system. Such an integrated system allows making the best use of each mode offering flexible and high-quality transport services to the users. It is important to achieve integration at the level of physical infrastructure (including land-use and transport coordination), intermodal and network coordination, service operation (coordinated scheduling and fare integration) and regulatory integration (level-playing field for competition between different modes). The issues to be addressed by this strategic component include: Transit oriented development; Seamless public transport; competitive public transport; Transport efficiency; higher mode share of public transport and NMT.

6.3. Introduction of technology for efficiency and sustainability

Since Nepal is a backward country in terms of use of modern transport technology, there is good prospect of serving EST objectives through technological options. These involve improved vehicle engine, improved fuel quality, introduction of low-emission fuel such as biofuel, introduction of mass transit technology (BRT, MRT), and high speed railways, introduction of ITS, use of bio engineering etc. The issues to be addressed by this strategic component include: energy efficiency, vehicular emissions, quality of transport service, congestion in urban roads, road safety, erosion and land slide hazards.

6.4. Priority for improving public transport and non-motorized transport

The dynamics of modal competition normally works in favor of private mode mainly because of unfavorable cost dynamics for public transport and users' preference for private mode as income grows. Because of such phenomena, just a provision of good public transport facilities is not enough to attract users. Some kind of public support (not necessarily a subsidy) may be necessary to maintain competitiveness of public transport. Also important is to give priority for NMT on its own merit and also as supporting factor of promoting public transport. The issues to be addressed by this strategic component include: improving mode share of public transport; transport safety; lower transport emission; inclusive transport; improve public health.

6.5. Travel demand management (TDM)

Travel demand management is about reducing need of travel, shortening the trip length, shifting to or maintaining share of public transport modes, and scheduling trip time to avoid congestion. The issues to be addressed by this

strategic component include: lower transport emissions per capita; public transport mode share.

6.6. Environmental and social safeguards

This component includes environmental and social impact assessment for transport projects. Because of vulnerable topographical, geological and seismic condition of Nepal, transport infrastructure projects should be carefully assessed to minimize ecological damage and landslide and other hazards. The issues to be addressed by this strategic component include: ecological impacts of intercity and rural roads; Landslide hazards due to low-cost rural roads; separation of community by high-speed transport routes.

6.7. Enhance institutional capacity and undertake reform

In order to make all above components more effective, institutional capacity of Nepal’s transport sector needs to be significantly enhanced. Also necessary is to undertake reform to be responsive to emerging challenges. The issues to be addressed by this strategic component include: public transport regulation; data-base and research; organizational coordination

7. Strategic Actions

This section presents a list of strategic actions under each strategic components discussed above. At this stage of draft document, the actions are just identified and yet to be put in the format of action plan showing a clear time line. This part will be completed after the consultative meetings with the related government agencies. Table 4 shows relevant actions for achieving the objectives and thereby delivering the vision.

Table 4: Strategic Actions under each strategic component

7.1. Investment for essential and sustainable transport infrastructure	
Intercity transport	<ul style="list-style-type: none"> • Completion and upgrading of Strategic Road Network (SRN) • Construction of KTFT and KKHT roads • Acquire right-of-way for by-pass roads in towns along national highways • Construct service stations on national highways • Construction of Mechi-Mahakali-Kathmandu-Pokhara electric railways • Study for Kathmandu-Hetauda high-speed railway (HSR)
Urban transport	<ul style="list-style-type: none"> • Expand road network in Kathmandu Valley

	<ul style="list-style-type: none"> • Designate the road hierarchy and complete missing links in Kathmandu • Improvement of major intersection in Kathmandu valley • Improvement of traffic management system in Kathmandu valley • Planning and implementation of outer ring-road in Kathmandu valley • Make provision of mass transit in Kathmandu (high capacity bus, LRT) • Invest for pedestrian and NMT infrastructure in Kathmandu and other cities • Make provisions for bus terminals, bus stops, and transfer facilities • Make provision of parking facilities in Kathmandu • Undertake road network planning in secondary/tertiary cities
Rural Transport	<ul style="list-style-type: none"> • Upgrade the design standard of rural roads
7.2. Planning and development of integrated transport system	
Intercity Transport	<ul style="list-style-type: none"> • Achieve integration between national transport network and regional development plan • Match transport hierarchy with city hierarchy • Coordinate railway development with regional development and local town development plans • Physical integration of highways, railways and airports with the provisions of intermodal (transfer) facilities • Coordinate the development of road-side service station with the function of market for local agricultural and other productions • Balancing social cost and benefits of different intercity modes through subsidies and taxes
Urban Transport	<ul style="list-style-type: none"> • Coordinate land-use and transport development • Promote transit oriented development (TOD) in big and small cities • Promote high-density and compact city development (minimize travel) • Plan for future Mass Rapid Transit (MRT) routes and locate the high-density housing (such as apartments) along the MRT routes • Make adequate provision of transfer facilities (connecting different modes) • Make provision of parking for introducing park-and-ride system • Enforce integrated fare system (eg distance-based) for public transport • Seek balance between the cost of private mode and public transport fare • Recognize walk and NMT modes as the means of improving public health

Rural Transport	<ul style="list-style-type: none"> • Undertake settlement planning/restructuring in the rural area before planning for the rural roads • Integrate rural roads with rural economic activities
7.3. Introduction of technology for efficiency and sustainability	
General	<ul style="list-style-type: none"> • Improved standard for vehicle energy efficiency • Upgraded emission standards • Use of alternative and low-emission fuels • Electrification of transport vehicles
Intercity Transport	<ul style="list-style-type: none"> • Consideration for possible use of high-speed rail (HSR) in future for the proposed East-West railways routes (civil structure to be designed for HSR)
Urban Transport	<ul style="list-style-type: none"> • Introduction of trolley buses or electric buses in Kathmandu • Provision of high-quality buses (with bus info system, WiFi) • Barrier free public transport vehicles (eg low floor buses)
Rural Transport	<ul style="list-style-type: none"> • Use of green road technology and bio-engineering to minimize ecological impacts and landslide hazards due to construction of rural roads
7.4. Priority for improving public transport and non-motorized transport	
General	<ul style="list-style-type: none"> • Taxing private modes (vehicle tax and fuel tax) and provide subsidy to public transport from the collected revenue • Improve service level of public transport (speed, vehicles standard, reliability, safety)
Intercity Transport	<ul style="list-style-type: none"> • Planning for bus lane in newly constructed intercity expressway routes • Pedestrian way and NMT lane along national highway
Urban Transport	<ul style="list-style-type: none"> • Make provision of bus lane during peak hour • Setting standards for pedestrian way and NMT lanes in urban areas • Study for possible restriction of motorcycles and cars (during peak hour) on the busiest routes in Kathmandu valley • Provision of public transport (electric vehicles) and NMT facilities in cities/towns that are popular tourist destination
Rural Transport	<ul style="list-style-type: none"> • Promote bicycles use in rural areas • Bicycle club targeting rural tourists
7.5. Travel demand management (TDM)	
Intercity Transport	<ul style="list-style-type: none"> • Plan for regional economic zones and transport connectivity to minimize intercity travel

Urban Transport	<ul style="list-style-type: none"> • Reduce travel demand by <ul style="list-style-type: none"> ○ Land-use and transport coordination ○ Pricing transport to reflect real social cost • Arrange staggered working/school hours • Promote tele-commuting • Promote modal shift (from private to public) <ul style="list-style-type: none"> ○ Raising public awareness on the benefits of public transport ○ Imposing higher cost on private modes ('push' factor) ○ Making public transport attractive ('pull' factor)
7.6. Environmental and social safeguards	
General	<ul style="list-style-type: none"> • Reviewing guidelines for environmental and social assessment • Provision of considering positive environmental benefits of railways in EIA guidelines • Regulation on aging vehicles • Provision of safety audit for infrastructure and vehicles • Checking drivers' condition
Intercity transport	<ul style="list-style-type: none"> • Provision of service lanes on national highways • Provision of over/under pass on national highway and railways
Urban Transport	<ul style="list-style-type: none"> • Up scaling vehicle emissions standards in Kathmandu valley • Strict monitoring of compliance of vehicle emission standard
Rural Transport	<ul style="list-style-type: none"> • Upgrading engineering and environmental standards of rural roads
7.7. Enhance institutional capacity and undertake reform	
General	<ul style="list-style-type: none"> • Building capacity of government institutions • Upgrade technical capacity of private firms involved in infrastructure design and construction (consultants and contractors) • Start courses on railway planning, engineering, and management in public engineering campus • Establish railway training institute • Building capacity for transport policy research <ul style="list-style-type: none"> ○ Establish in-house think-tank within government agencies ○ Establish long-run collaboration for transport policy

	<p>research with some research center of public university</p> <ul style="list-style-type: none"> • Maintain data-base of basic transport data • Restructure transport regulatory institutions and reform regulatory provisions for transport services.
Intercity Transport	<ul style="list-style-type: none"> • Improve/enforce regulation for axle loads of heavy vehicles plying on the national highways
Urban Transport	<ul style="list-style-type: none"> • Regulate use of motorcycle on some busiest routes (as a pilot project) • Conduct periodic personal trip survey for Kathmandu valley • Design public transport routes and franchising policy based on scientific analysis

Annex-1

Major trends and developments in the transport sector and its impacts

In order to provide a broad picture on themes potentially related to EST, this section describes major trends related to the sub-sectors of transport and some cross-cutting themes (namely emissions and safety).

1. Intercity transport (national transport network)

- In the beginning First Five Year Plan (1956-61), Nepal had only 624 Km of roads and 59 km of railways. The planning for East-West highway and North-South routes were conceived during the Second Five year Plan period. Review of past plans reveals that successive plans placed policy priorities in expanding road network to provide basic access and connectivity. However, the pace of investment for transport infrastructure and physical achievement is not so much impressive. Two of the district head quarters are still not connected to national road network. Only 47 % of the Strategic Road Network (SRN)- which is basically intercity road network- has paved surface, and the rest is just earthen and gravel (Figure 1-1).

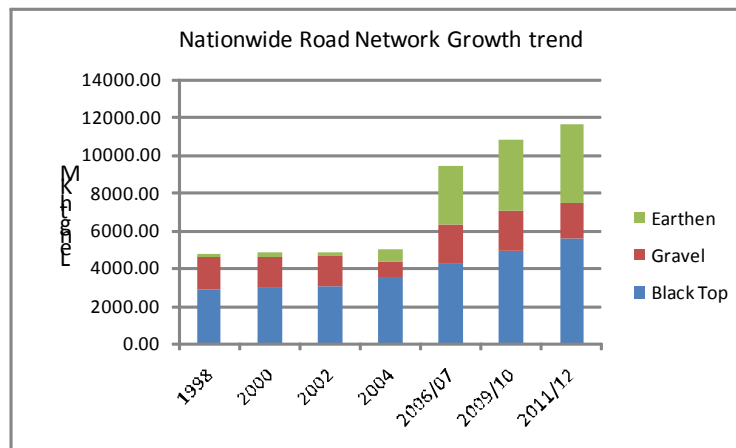


Figure 1-1: Trend of Strategic Road (national roads) Network

- Recent major policy initiatives for road sector include construction of Kathmandu-Tarai Fast-Track (KTFT), Kathmandu-Kulekhani-Hetauda Tunnel (KKHT) Highway, and Mid Hill Highway. The track-opening work of KTFT is already completed. Likewise, KKHT Highway is under construction through Public-Private Partnership. Missing links of Mid Hill Highways are under construction. There are attempts for some innovative approaches in these road projects in terms of mobilizing private sector financing or planned land development along the road corridor. For example, ten towns are being

planned (each for 50,000 to 100,000 population) at the major nodal points along the Mid-Hill Highway. Likewise, KKHT project is planning to develop land around the highway for possible townships involving local people.

- In recent years, Nepal government has given priority for nation-wide electric railway network. Feasibility study for Mechi-Mahakali and Kathmandu Pokhara routes have already been completed (total 1318 Km). The total estimated cost for these routes is US\$ 6.54 billion. Detailed project report (DPR) for Berdibas-Simara Section of Mechi-Mahakali route has already been completed while DPR for other sections is under preparation.
- Other major mode for intercity transport is civil aviation. Because, of longer travel time by road, air transport has been preferred for time-sensitive passenger. Other passenger segment that has to rely on air transport is from remote areas, where road access is either unavailable or not reliable. Currently, 39 Airports are under operation, of which one is of international level, four are of regional level, and rest are of local level. International airports in Nijgarh and Pokhara are under planning stage.

2. Urban transport

Urbanization trend

- According to 2011 Census (CBC 2012), urbanization rate in Nepal is relatively lower at 17 % with average annual growth rate of urban population over 2001-2011 as 3.16 %. Urban population is distributed among 58 municipalities across the country. Kathmandu valley comprising three districts, namely Kathmandu, Lalitpur and Bhaktapur with total land area of 899 sq km has a population of 2.5 million. The urban core of the valley consists of five urban administrative units with total population of 1.4 million. Kathmandu Metropolitan city is the largest urban unit with a population of 975,453. Greater Kathmandu with an approximate radius of 12 km now function as a single contiguous urban area. Pokhara, the second largest city is home to 255,465 people. As the city rank goes down city population gets smaller. Population of the smallest municipality, Dhulikhel, is only 14,283. As the government is about to embark on a path of high economic growth, a rapid urban growth is expected in the future.

Motorization

- Lately, Nepal has witnessed rapid growth of motorized vehicles. In 2013, total vehicle number adds to 1,557,478, large proportion (78 %) of which included motorcycle. Over 2008-2013, national level average annual growth rate for motorcycle and 4-wheel light vehicles (car, jeep, van) remained as 19.5 % and 8.4 % respectively. Total vehicle population in Bagmati zone for the year 2013

accounts for 647,895 that is 41.6 % of the national figure. Vehicles registered in Bagmati zone basically are plying on the roads in Kathmandu valley. From 2008 to 2013, average annual growth figure for motorcycle and light vehicles in Bagmati zone recorded as 12.4 % and 7.9 % respectively (DTM 2014). Figure 1-2 shows the trend of motorcycle and light vehicle population in Bagmati zone. Car ownership rate (include jeep and van) for Kathmandu valley is approximately 34 per thousand populations.

- One of the direct impacts of increasing vehicle population is in rapid increase in motor fuel (diesel and petrol). From 2008 to 2013, annual Diesel consumption increased by 2.36 times to 716,747 KL. Likewise, over the same period, annual petrol consumption increased by 2.2 times to 221, 676 KL (NOC 2014). This trend of fuel consumption obviously has serious

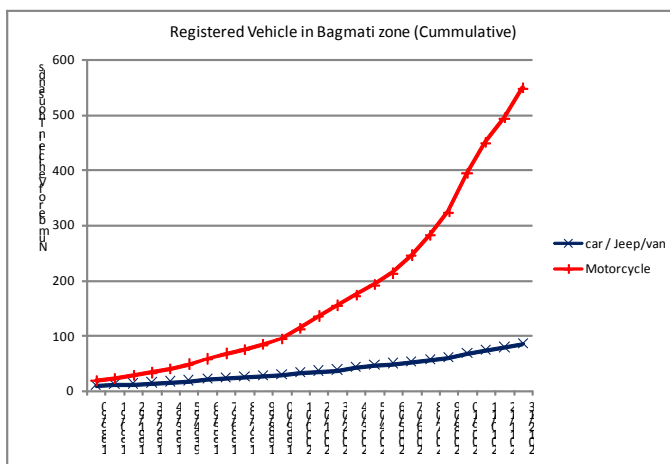


Figure 1-2: Trend of vehicle (cars and motorcycles) in Bagmati Zone

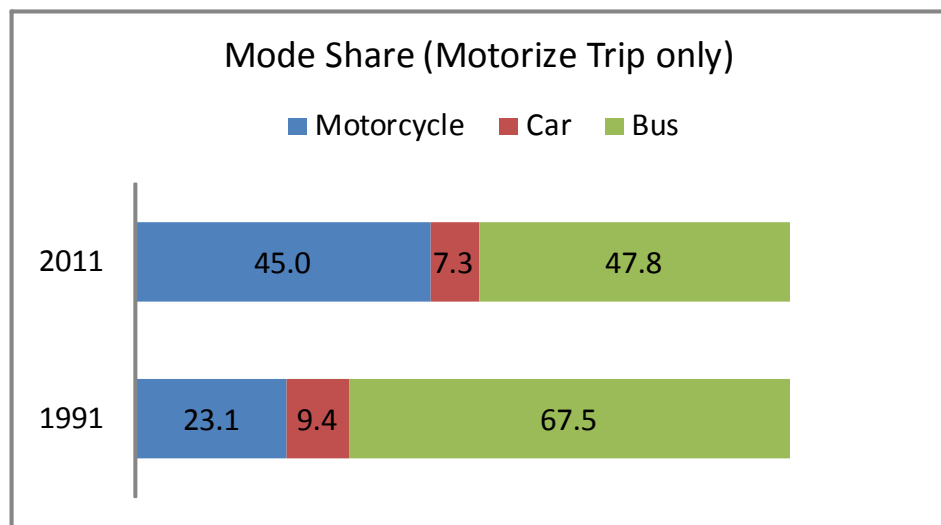
implications for climate change concerns.

Urban transport infrastructure and services

- Urban areas in Nepal depend on road and non-motorized modes for mobility. There is no urban rail system in Nepal. Road infrastructure is inadequate and the network is with inefficient hierarchy especially in the largest agglomeration of Kathmandu valley. Road network length in three district of Kathmandu valley totals to 1,595 Km, out of 555 km road is managed by DOR and rest is by local government units. Average road area ratio in five urban administrative units (metropolitan city and municipalities) of Kathmandu Valley is around 6 % of total urban area (Panta 2010). Such figure for the road ratio falls in the lower bound range even by the standards in developing countries. There are continuous efforts to improve road network by constructing new roads, namely strategic missing links and roads along the river corridors. Recently, government also implemented road-widening projects in urban areas of Kathmandu valley. Despite such efforts, the pace of road network expansion and improvement lags far behind the speed of

motorization. As a result, road traffic in Kathmandu valley is facing severe congestion particularly during peak hours. JICA (2012) reports that average traffic speed within the ring road is less than 20 km/hr. In the top 5 busiest routes, evening peak average speed is 8.78 km/hr.

- Expansions of metropolitan area and increasing motorization have direct impact on the share of different travel modes. JICA (2012), including both motorized and non-motorized modes, reports that between 1991 and 2011, share of walk decreased from 53.1 % to 40.7 % while share of motorcycle increased significantly. Figure 1-3 shows mode share pattern considering only motorized trips. Motorcycle share in 2011 reached 45 % from 23 % in 1991 largely at the cost of decreasing mode share of bus.



Data Source: JICA (2012)

Figure 1-3: Trend of mode share in Kathmandu

- With assistance of ADB, Nepal government is currently undertaken Kathmandu Sustainable Urban Transport Project (KSUTP) with the aim of improving urban transport situation in Kathmandu Valley. The project involves four distinct components, viz public transport improvement through investment and management, improvement in traffic management, pedestrianization of heritage areas, and capacity building for emission monitoring and inspection. All of the project components have direct bearing on the various EST components.
- In smaller size municipalities outside Kathmandu Valley, there is no provision of public transport services. Proper planning for pedestrian space is also lacking. Non-motorized three wheelers, known as Rikshwa, service as important public transport mode in municipalities in Terai region. There is increasing trend of motorized three wheelers replacing Rikshwa. Bicycle use, which was most common in the past, has now now been replaced by motorcycle use.

3. Rural Transport

Rural roads

- Nepal's rural areas traditionally faced lack of access to road transport. Because of limited budgetary resources, priority was given to complete the basic national road network. The adverse topography and geology also posed challenges to rural road construction. In the 1970s, some efforts were made to construct rural roads under the auspices of Integrated Rural Development Projects. Provision of direct block grant to VDCs initiated in 1995 provided an impetus to construct rural roads mainly with people's participation. In 1997 a new department called Department of Local Infrastructure Development and Agricultural Road (DoLIDAR) was established to better plan and implement rural roads. DoLIDAR has issued guidelines for the District Transport Master Plan (DTMP). Following DTMP, each district prepares District Road Core Network (DRCN), which connects VDCs with the district head quarter or Strategic Road Network (SRN) (DoLIDAR 2010).
- However, because of low cost and labor-intensive approach combined with local urge of quick completion of complete route, proper engineering standards are grossly lacking in rural roads. Large proportion of the rural road stock is just earthen or gravel roads, which is not usable by vehicle especially during rainy season. In addition, in hilly areas, non-engineered rural roads are causing ecological damage including erosion and landslide hazards (Upadhyaya 2002).

Green roads and bioengineering

- To address the issue of possible environmental damage by road construction particularly in hilly regions, innovative approaches have been promoted by various agencies. Green road and bioengineering approach has been successfully applied to rural road construction in various hilly districts (GTZ/SDC 1999). This approach is about constructing roads with minimum disturbance of natural earth based on labor-based technology (without using heavy equipment), balanced cut-and-fill, and use of locally available materials. Bio-engineering and balanced cut-and-fill techniques were also used in JICA assisted Banaepa-Sindhuli road project.

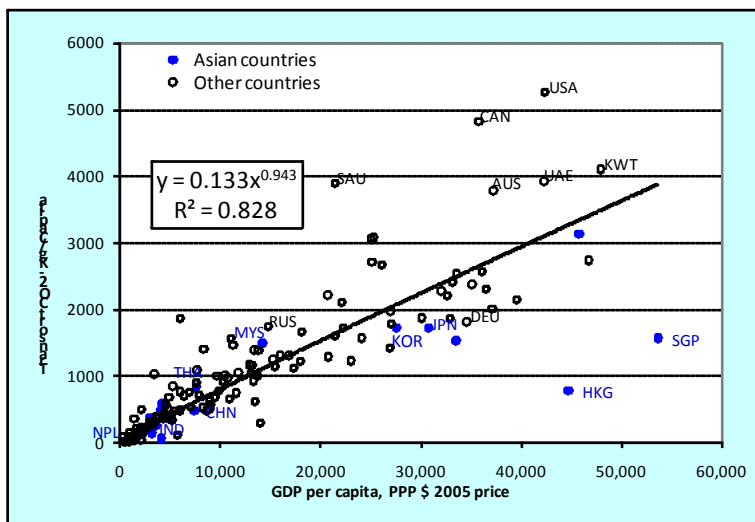
Rural transport services

- Informal para-transit (jeeps, three-wheelers and vans) is the primary public transport in rural areas. However, rural populations face low coverage, monopoly behavior of operators, and very poor quality of service including

safety risks. This has caused rapid growth of motorcycles in rural areas. Motorcycle has replaced bicycle, a popular non-motorized mode until recent years in the rural area of Terai region. Increasing motorcycle use has resulted in more accidents.

GHGs emissions and pollution

- According to IEA (2013), Nepal’s per capita CO2 emissions from fuel consumption in 2011 is only 133 kg against the world average of 4,504 kg per capita. However, growth rate of emissions is among the highest in the world. From 1990 to 2011, CO2 emission from fuel consumption increased by 395 % in Nepal while the average figure for Asia and the world is just 172.5 % and 49.3 % respectively. In 2011, the share of transport sector in the total CO2 emission of the world remained as 24 % while that in Nepal is 45 %. Relatively higher share of transport emissions in Nepal indicates importance of reducing transport emission to address the issue of GHG emissions.



Data Source: IEA (2012)

Figure 1-4: Transport sector CO2 per capita Vs GDP per capita

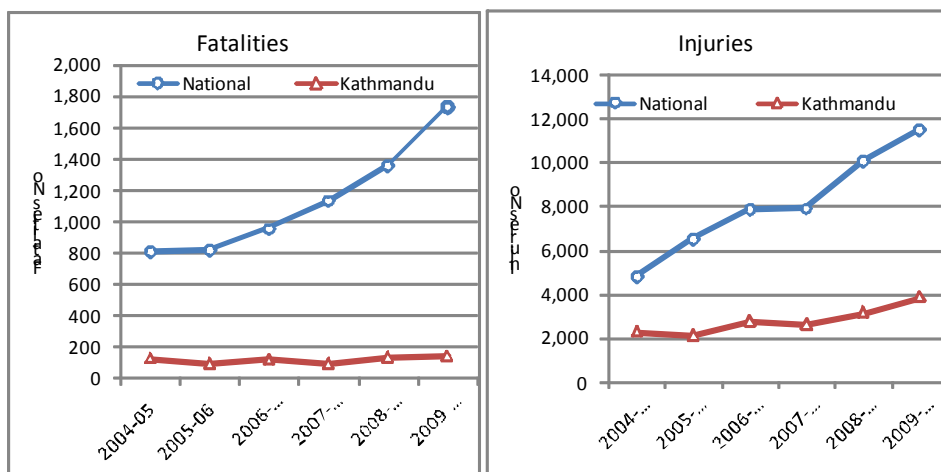
- Figure 1-4 shows plotting of GDP per capita (PPP \$) versus transport CO2 emission per capita across the countries in the world. The trend line has reasonably good fit, and shows that GDP per capita and transport emission per capita are strongly correlated (following a power function with exponent <1). We can see that some countries are above the trend line while others are below it. Per capita transport emissions in developed East Asian countries or region such as Japan, Korea, Singapore and Hong Kong is below the cross-country trend while that in north American and oil producing middle east countries is higher than the cross country trend. Some rapidly growing Asian countries

such as Malaysia and Thailand are also above the trend line. Nepal is just at the bottom of the trend line, but there is a risk of following upper bound trajectory if the country's transport system continues to depend on the road transport with conventional fuel. On the other hand, for Nepal there is real possibility of decoupling the GDP growth and transport emission by adopting low-carbon transport system. Under such scenario Nepal may follow a trajectory leading to a minimum level of CO₂ emission with higher level GDP per capita.

- In the largest urban agglomeration of Kathmandu valley, air pollution caused by vehicular emissions is once of the key public health concern. MoEP (2005) reported that air pollution is responsible for 1600 premature death annually in Kathmandu valley. Aging vehicles, inefficient engines, and poor quality of fuel is primarily responsible for emission of pollutant. Vehicles plying on the roads with poor pavement condition also contribute dust and particulate matters. According to MoEP monitoring data, In 2007, annual average concentration of PM₁₀ in roadside and residential areas recorded as 173 and 115 micro grams per m³ (against the national air quality standard of 120 micro gram per m³ for average annual concentration of PM₁₀).
- Nepal government has taken series of policy initiative to address the problem of vehicular emissions. Table 2 shows the chronological list of major policy initiatives. As a result of the implementation of these policies, the situation of vehicular emissions improved to some extent. For example, in 2003, average annual PM₁₀ concentration in residential area was 149 ug/m³, which dropped down to 115 ug/m³ in 2007. Despite such improvement there is still an upward pressure for worsening pollution because of increasing number of vehicles and road traffic congestion.

Table: 1-1 Chronological list of major policy initiative targeting vehicular emissions

1991: Banned diesel three wheelers registration.
1994: Emission standards for in-use vehicles
1999: Banned three wheelers operated by diesel
1999: Subsidies for electric vehicles.
2000: Nepal Vehicle Mass Emission Standard EURO I.
2000: Stopped two stroke registration
2001: announced for ban of 20 years old vehicle, but not implemented.
2001: National Transport Policy
2003: National Ambient Air Quality Standards
2004: Two stroke three wheelers banned from operation
2009: National indoor air quality standard and implementation guideline
2012: EURO III standard



Data Source: MoPIT (2013)

Figure 1-5: Trend of Road Traffic Accident (Country Total and Kathmandu)

3.1.1. Transport safety

- As the process of motorization gains momentum and passenger mobility is dependent on the motorized modes, the problem of traffic accident is getting further aggravated. In Kathmandu valley, because of poor service quality and lack of accessibility, people have to rely on motorcycles, which characteristically is less safe mode. The mixed traffic involving different types

of vehicles also increases risk of accident. In addition, lack of pedestrian facilities and public awareness about traffic rules and discipline makes pedestrians more vulnerable to traffic accident. Figure 1-5 shows the trend of traffic accident (injury and fatalities) at the national level and in Kathmandu. Fatalities in Kathmandu modestly increasing but there is rapid increase in fatalities at the national level. The key sources of national fatalities is traffic accident involving public transport vehicles such as buses, vans or jeeps operating on intercity routes or regional or district level routes. Inappropriate road geometry and poor road condition particularly in hilly regions are among the major causes. In addition, negligence of drivers and poor quality of vehicles are also the causes of frequent accident on long-distance routes. It is an irony that public transport mode- supposedly a safer mode- is subject to more frequent accidents in Nepal.

- GoN/MPIT (2013) formulated an action plan addressing road safety issues in Nepal. The action plan identifies five strategic pillars, such as road safety management, safer roads and mobility, safer vehicles, safer road users, and post crash response. Activities under each strategic pillar are proposed along with responsible agencies and estimated budget.