



National Investment in Urban Transport

Towards People's Cities Through Land Use and Transport Integration

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About Shakti Sustainable Energy Foundation

Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support energy efficiency and renewable energy.

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Abbreviations

AMDA – Association of Municipalities and Development Authorities
ASI – Avoid Shift Improve
BAU – Business as usual
BHLS – Bus of High Level of Service
BRT – Bus rapid transit
CDP – Comprehensive Development Plan
CMP – Comprehensive Mobility Plan
CSE – Center for Science and the Environment
CSMC – Central Sanctioning & Monitoring Committee
DPR – Detail Project Report
GDP – Gross Domestic Product
GHG – Greenhouse Gases
GRP – Gross Regional Product
IIHS—Indian Institute for Human Settlements
ITDP – Institute for Transportation & Development Policy
IUT – Institute of Urban Transport
JnNURM – Jawaharlal Nehru National Urban Renewal Mission
JS – Joint Secretary
KPI – Key Performance Indicator
MoF – Ministry of Finance
MoUD – Ministry of Urban Development
MRV – Monitoring Reporting and Verification
NMT – Non-Motorized Transport (Walking and Bicycling)
NUTP – National Urban Transport Policy
PPHPD – Passengers per hour per direction
PWD – Central Public Works Department
SUT – Sustainable Urban Transport
TERI – The Energy Research Institute
ULB – Urban Local Body (Municipal Corporation)
USD – United States Dollars
VKT – Vehicle kilometers traveled
WBCSD – World Business Council on Sustainable Development
WHO – World Health Organization

1 Executive Summary

Between 2005 and 2012, India's Jawaharlal Nehru National Urban Renewal Mission (JnNURM) has invested US\$20billion in urban infrastructure (including transport) and basic services to the urban poor. JnNURM is a very important advance, as it helps the cities with policies and funding for moving people, not vehicles. Nevertheless, it has not sufficiently shifted investment in the urban transport sector from road widening and road expansion to sustainable transport.

Based on interviews with several stakeholders, a literature review on the first Jawaharlal Nehru National Urban Renewal Mission (JnNURM), and consideration of the urban characteristics and transport needs of Indian cities, this report concludes four key improvements are needed for the preparation of the 12th five year plan:

1. Reinforce the link between land use and transport in the urban transport policy vision. This will allow the preservation of People's Cities in the existing urban areas and development of new accessible, dense and mixed used developments.
2. Advance the preparation and implementation of the Comprehensive Mobility Plans (CMPs) as a required part Master Plans and align with the JnNURM budget allocations, to transform the CMPs from simple lists of projects and good will, to effective planning and monitoring instruments.
3. Introduce performance measurement of key transport indicators at the city wide level: people served, modal share, travel time, traffic fatalities and transport tailpipe emissions.
4. Develop capacity building programs for project planning and delivery at the city level and for evaluation and monitoring at the state and national level.¹
5. Improve program implementation by providing requiring clear rationale for projects, improving deliverability and ensuring local support for projects.

This document includes an assessment of and suggestions for national investment policies in urban transport. The first chapter provides [a background on Indian urban transport characteristics and trends](#). Currently Indian cities have high density (more than 200 people per hectare inside the cities' administrative boundaries) and mixed use in most areas. They also exhibit a reasonable distribution of travel across different transport modes – close to 1/3 walking and biking, 1/3 in public transport and 1/3 in individual motor vehicles. Nevertheless, all cities are experiencing sprawl, and individual motor vehicle trips are rapidly eroding the share of walking, biking and public transport trips. Indian cities need to preserve the existing mode shares to avoid a future with increasing energy consumption, chronic congestion, longer travel times, increasing traffic fatalities and unaffordable transport choices for the poor.

¹ The MoUD, with the support of IUT, has advanced a program to enhance capacity at all levels of government. This initiative needs continuity and support.

The second chapter includes an assessment of the urban transport component of JnNURM. Stakeholders interviewed for the preparation of this report indicated that this mission has been very valuable in advancing the idea of moving people, not vehicles. But they also suggested areas of potential improvement, including making the CMPs effective planning tools, not just lists of projects. The need to improve capacity at the local, state and national levels was also highlighted. These ideas are also supported by published evaluations of JnNURM. Recommendations for improving the current policies are diverse, and a selection of them informing the suggestions in this report.

The third chapter details a vision for People’s Cities through integrated land use and transport planning. This vision is summarized with the Avoid-Shift-Improve framework², and articulates differentiated actions for the existing built environment and expected urban fringe developments:

Table 1: Avoid-Shift-Improve framework applied to existing and new urban developments in India

	Existing Built Environment	Green Field Development
Avoid long and unnecessary travel	<ul style="list-style-type: none"> • Preserve density and mixed use • Encourage mixed use where it is absent 	<ul style="list-style-type: none"> • Zone for good density and mixed use inclusive of low income housing
Prevent Shift from walking and biking to individual motor vehicles	<ul style="list-style-type: none"> • Improve/create safe walking and biking environments • Provide good quality and affordable public transport • Optimize public transport operations • Enhance intermediate public transport • Price ownership/use of private motor vehicles 	
Improve transport system technologies	<ul style="list-style-type: none"> • Enhance basic and intermediate public transport operations • Implement intelligent transportation system technologies • Encourage clean fuel and vehicle technologies • Establish vehicle emission standards 	

It is suggested that measuring citywide impacts becomes standard practice, to focus on results rather than infrastructure supply (i.e. kilometers of infrastructure, number of buses) or funding disbursement. Simple indicators (i.e. people served, mode share, travel time, traffic fatalities and tailpipe emissions) are recommended which can be monitored with data collected through low-cost surveys, police and health records, and simplified models.

² Avoid-Shift-Improve is an internationally accepted framework for understanding and evaluating policies and measures to reduce greenhouse gas emissions from the transport sector (Dalkmann, Brannigan, 2007; Dalkmann, Sakamoto, 2011).

The fourth chapter includes specific recommendations for improving the CMPs. Expert interviews and the literature review indicate that CMPs have been a positive concept for advancing the transport planning process, but have typically been prepared with insufficient time and resources. As a result CMPs are typically a simple list of projects, rather than a holistic planning strategy. Improvements to the CMP structure are offered, including monitoring, reporting and verification of key indicators (defined above), risk assessment and clear financing sources.

A results-oriented approach will encourage adequate actions beyond the sanctioned projects under the national program by:

- Developing detailed guidelines for data collection, modeling and analysis
- Training for people involved in estimation, monitoring, reporting and verification
- Upgrading the national standards and guidelines on procedures, parameters and reporting requirements
- Creating incentives for overall city performance (key indicators), such as a phased disbursement of national funding conditioned on achieving planned goals

In the final chapter, recommendations for program Implementation are formulated based on international best practices adapted to the Indian context. The authors drawn from experiences of 13 countries with national programs to support urban transport recommends for specific operational actions under three pillars:

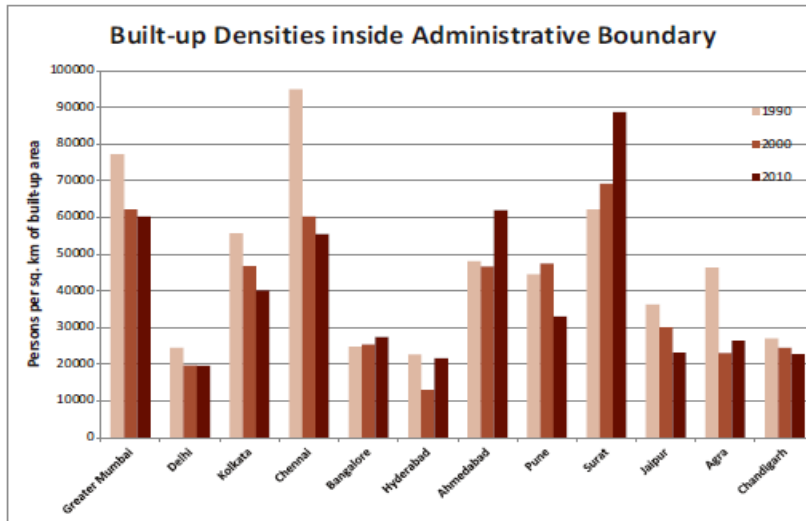
- **Define project rationale.** A proposed project should result from a clear definition of need and comparison of alternative strategies. It should also be appropriately scaled to solve the problem at hand, with costs and benefits compared. The technical evaluation process should be transparent and free of political influence.
- **Ensure deliverability.** A proposed project should not have significant outstanding risks that could threaten its successful implementation. Also, the project sponsor should have adequate capacity to implement the project – which depends on access to technical support from the national government and other institutions with public transport expertise.
- **Facilitate local buy-in.** A proposed project should be a priority for the local agencies that will implement and operate it. Local governments should therefore lead project planning and development and help to fund project implementation. Funded projects should also be consistent with – and ideally derived from – CMPs.

The assessment provided here coincides with several reviews and opinions. There seems to be a broad support in the technical community to the type of recommendations included in this report. Nevertheless, actions to solve the issues indicated here are only happening at a limited scale. Change in paradigms is needed and capacity building will play a big role, along stronger regulations. Improvements in the new national program are expected, and this report is intended to help in that process.

2 Background on Indian Urban Transport Trends

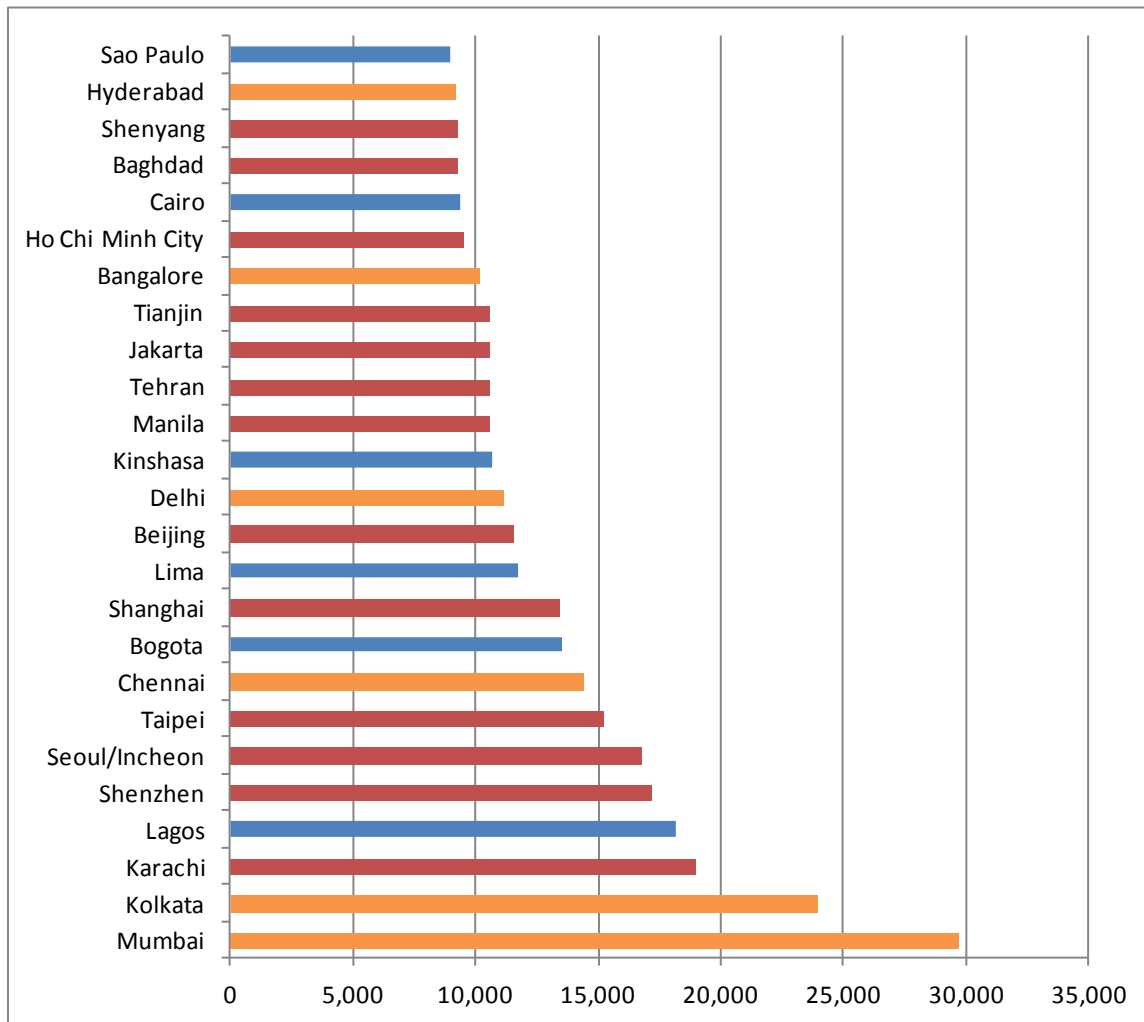
India is rapidly urbanizing. Between 1991 and 2011 urban population increased by more than 70%, from 217 million to 377 million (MoUD and NIUA, 2011). Another 75 million are expected to live in cities by 2031. Many existing urban areas in Indian cities are mixed use, including residential uses adjacent to commercial ones. Indian cities are already dense with 200 - 900 people per hectare within the city administrative boundary (Figure 1). Indian cities' densities are very high compared with urban areas in the rest of the world. There are 6 Indian cities in the top 25 cities by density (Figure 2). It is important to note that 19 of the top 25 cities by density are in Asia - 32% in India and 32% in China, with Mumbai 1st and Kolkata 2nd.

Figure 1: Changing urban densities in Indian cities



Source: IHS, 2011

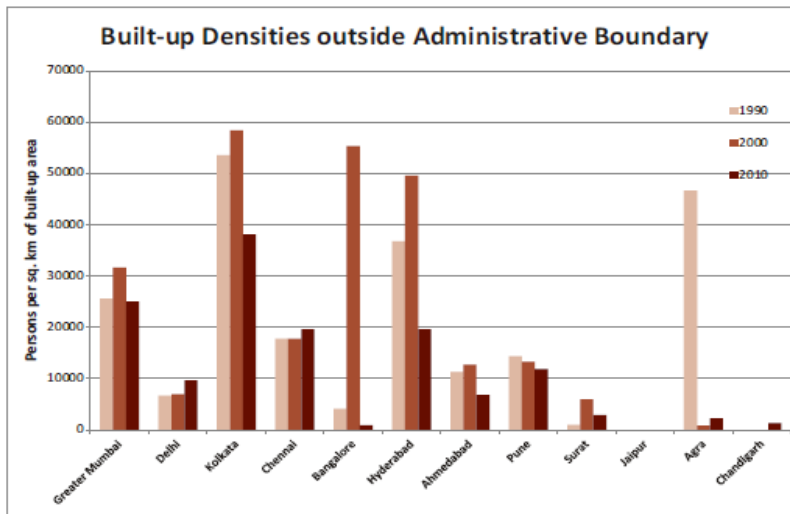
Figure 2: Top 25 Cities in the World by Density (people/km²)



Source: City Mayors, 2007

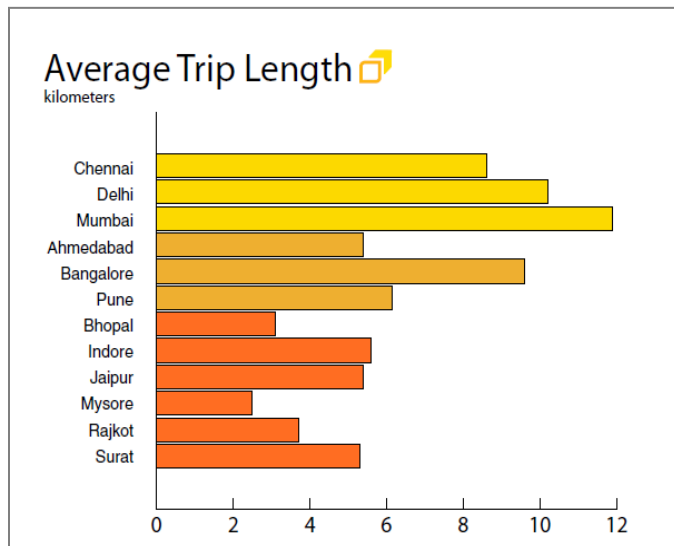
Nevertheless, low-density sprawl (less than 40 people/ha) is occurring in all India cities (Figure 3). This sprawl is extending the trip lengths, which are still a reasonable 2-12km per trip in many cities (Figure 4).

Figure 3: Urban sprawl trends in Indian Cities



Source: IIHS, 2011

Figure 4: Average trip length in Indian cities

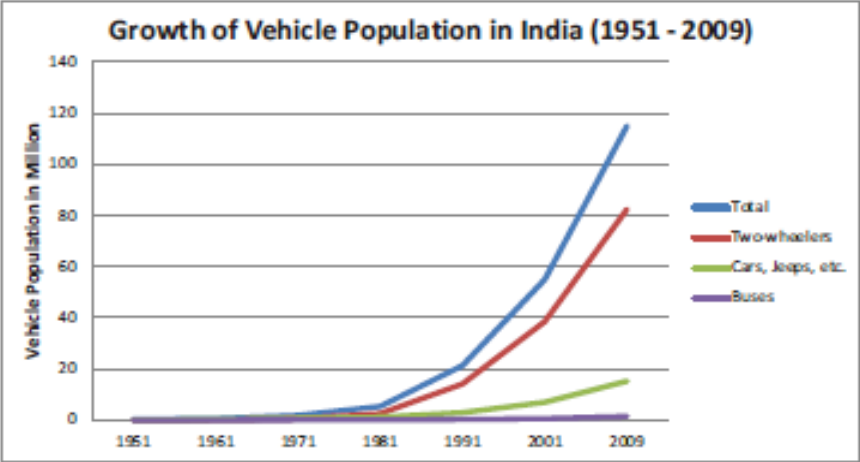


Source: Pai, 2010, based on CMPs 2006-2007

Indian cities currently have a reasonable distribution of travel activity across different transport modes. In 2008 walking and cycling constituted 38% of trips in urban areas, public transport and intermediate public transport 33% and private vehicles another 29% (IIHS, 2011; Pai, 2010). This is a modal split that many developed cities aim to achieve (or recapture) and it's the status quo in many Indian cities. The challenge for Indian cities will be to preserve these modal shares under the current pressures of increasing motorization (Figure 5) and sprawling urbanization.

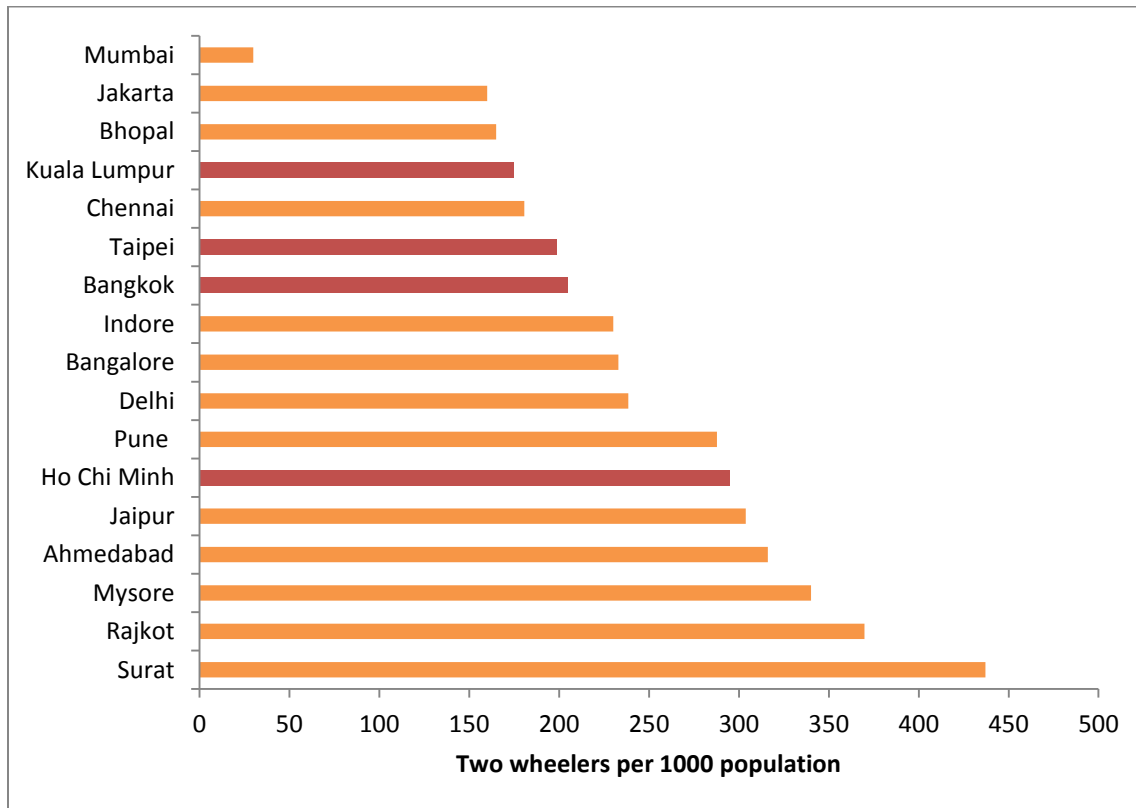
Preserving the well-balanced mode shares will be difficult given the dramatic increase in the population of 2-wheelers and automobiles in India. It is important to note that many Indian cities have levels of 2-wheeler ownership higher than other Asian cities like Ho Chi Minh, Taipei and Bangkok (Figure 6). As Indian cities lose non-motorized transport and public/shared transport mode shares to 2-wheelers and automobiles, vehicle kilometers travelled increase. The potential for this trend to continue is high, as Indian median income continues to grow.

Figure 5: Increasing Motorization in India



Source: IIHS, 2011

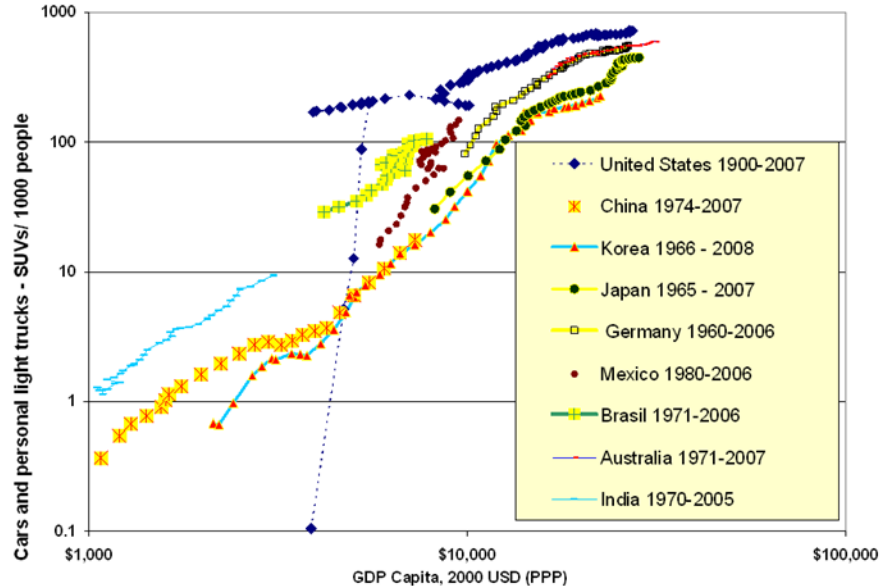
Figure 6: Indian Two Wheeler Motorization Rates



Source: Pai, 2010, based on CMPs 2006-2007 and international data.

As Figure 7 illustrates, many developed and developing countries around the world have shown increased motorization with increased GDP (Schipper, 2009). But not all countries stabilize their motorization at the same level – USA 600-750 light duty motor vehicles per 1,000 population, Germany 500-550 light motor vehicles per 1,000 population, Japan 400-450 light motor vehicles per 1,000 population (Millard-Ball and Schipper, 2010). It is unclear where India’s motorization rate will level off.

Figure 7: Per capita vehicle ownership and GDP in various countries

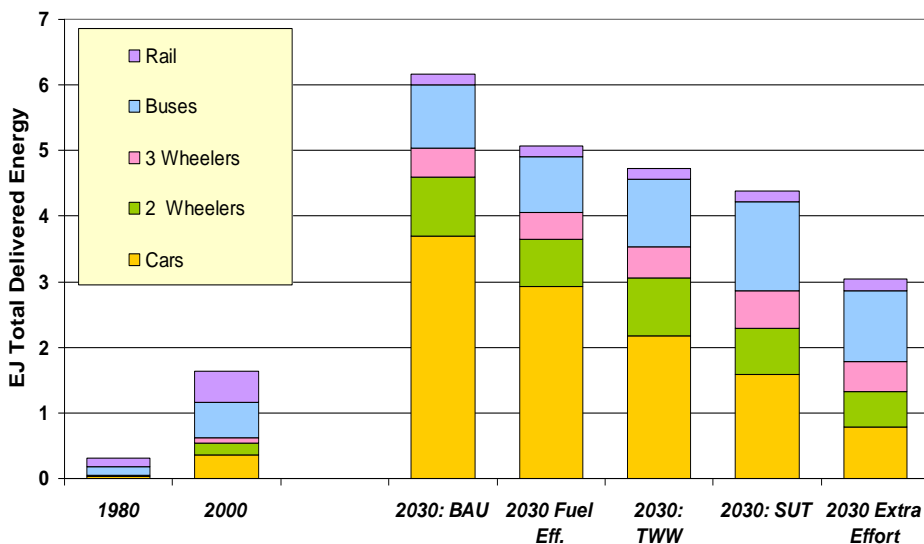


Source: Schipper, University of California at Berkeley, 2009. GDP: Gross Domestic Product; USD; United States Dollars; PPP: Purchase Power Parity; SUV: Standard Utility Vehicle.

Indian cities need to preserve their existing mode shares by discouraging shifts to automobile and 2-wheeler trips. If not, Indian cities will face a future with increasing energy consumption, longer travel times, increasing traffic fatalities and unaffordable transport choices for the poor. For instance as illustrated in Figure 8, Schipper, Banerjee and Ng project that energy consumption in Indian urban transport will grow from 1.6 EJ in 2000 to 6.1 EJ in 2030 if current trends towards auto-mobility prevail. They also indicate that more than 25% of the energy could be saved if Indian cities shift their trajectory to a more sustainable pattern (as compared with a business as usual [BAU] scenario)³.

³ Schipper, Banerjee and Ng consider five development scenarios for Indian cities through 2030 including business as usual (BAU), a fuel efficiency scenario that reflects policy focus on oil saving and renewable fuels in all modes and assumes higher fuel prices and taxes; two and three-wheeler world (TWW) scenario based on small clean vehicles; sustainable urban transport (SUT) scenario reflecting travel demand management policies and implementation of mass transit as the backbone of clean mobility; and an extra effort scenario which includes additional measures to shift motorized trips from private vehicles to public transit and improve energy efficiency of all modes.

Figure 8: India 2030 Mobility Scenarios: Total Energy Consumed by Mode



Source: Schipper, Banerjee and Ng, 2009; EJ: Exajoule; BAU; Business as Usual; Eff: Efficiency; TWW: Two Wheeler World; SUT: Sustainable Urban Transport.

3 Assessment of the Current JnNURM

In 2005, the Government of India created the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) to invest over US\$20 billion in urban infrastructure improvements and basic services to the urban poor in 65 mission cities over the course of seven years (MoUD, 2005; Pai & Hidalgo, 2009). The transport sector has received 11 percent of the total JnNURM investment (IIHS, 2011). Currently 138 urban transport projects have been approved, with the majority (80%) in Category A cities with populations at least 4 million.

In order to assess how well the current JnNURM has performed, EMBARQ conducted interviews with 28 urban transport and planning experts in India, including Central, State and Municipal government officials, civil service officials, consultants, academics and representatives of NGOs between November and December 2011. A broad set of expert interviewees were selected to ensure feedback about the current program was as holistic as possible. Experts include representatives from the different levels of government involved in planning, evaluating, approving and implementing JnNURM projects and reforms. Stakeholders from academia, civil society and the private sector familiar with the JnNURM program were also interviewed.

The interviews focused on different aspects of the JnNURM program, from the overall program structure to the comprehensive planning required of cities. The expert interviews discussed the project

selection or decision-making process, local buy-in for JnNURM projects, capacity constraints and project delivery.

These personal interviews were supplemented with a literature review of existing assessments and evaluations of JnNURM, the Comprehensive Mobility Planning process and individual cities' project implementation. Finally, EMBARQ reflected on its own experience working with 11 India cities⁴ over the course of the past five years. These different inputs shaped a broad perspective on what has been done well under the current JnNURM and what could be improved.

3.1 Summary of Expert Interviews

The experts' responses included some similar assessments of JnNURM, diverse recommendations on the way forward as well as suggestions beyond the scope of this report. Analyzing and collating the responses revealed the more common opinions and recommendations. Where relevant, these frequent responses informed the recommendations laid out in this report. Some selected responses regarding areas that need improvement are listed in Table 2.

One of the conclusions from the discussions with experts was that JnNURM and the National Urban Transport Policy (NUTP) are significant advances. They recognize growing urbanization and the need to provide adequate support from the national level to cities. They also entail a valuable principle: investment for moving people not vehicles. Several respondents highlighted successes and positive developments under JnNURM, including:

- Requiring Comprehensive Mobility Plans (CMPs) is a significant reform that is encouraging cities to think about mobility in a more holistic way. Several cities are implementing projects that follow the general principle of “moving people not cars” embedded in the NUTP.
- Varying the funding contributions (i.e. percent contribution from central, state and local governments) by region recognizes that financial resources of Municipal Corporations vary dramatically.
- Checks and balances are there in principle, but are not implemented well.
- Guidelines have been issued and some support for preparation and implementation exist.

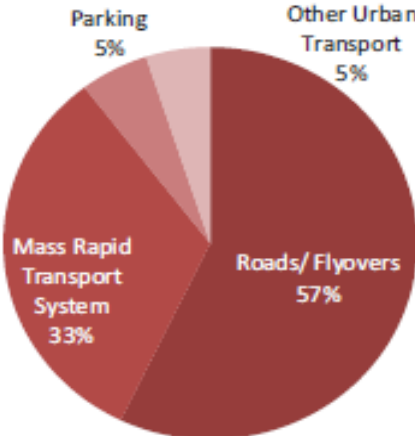
⁴ Through 2012, EMBARQ India has supported projects in Ahmedabad, Bangalore, Delhi, Hubli Dharwad, Indore, Jaipur, Mumbai, Naya Raipur, Pune, Rajkot and Surat.

Table 2: Expert interviews revealed opportunities for improving JnNURM

Category	Opportunity for Improvement
Project Planning Quality	<ul style="list-style-type: none"> • Comprehensive Mobility Plans are collections of projects, not comprehensive and strategic plans • Low-quality CMPs are the result of cities’ inexperience with and lack of knowledge about comprehensive planning – rushed preparation with insufficient funding was common. • There is no incentive for a city to do a thorough CMP if they’ll receive the JnNURM funding regardless of the document’s quality. • Cities need to develop mobility solutions that are locally appropriate, and internalized by local bodies.
Project Approval/Funding Process	<ul style="list-style-type: none"> • CMPs are not adequately linked with other planning instruments (Comprehensive Development Plans CDPs and Master Plans), and they are not linked with the local budgeting process. • Rushed deadlines for Detailed Project Reports encourage cities to use outdated transport demand data and project costs. This contributes to cost overruns. • Lack of rigorous and transparent decision making is JnNURM’s biggest weakness. • JnNURM lacks objective criteria for cities to evaluate their project priorities, and guidelines/criteria for project selection by the state and central government. • The current JnNURM is too top down, lacking local buy-in. • Focus of JnNURM has been on sanctioning projects and disbursing money, not on delivering projects.
Project Implementation and Evaluation Capacity	<ul style="list-style-type: none"> • The scale of India’s transport planning and infrastructure capacity needs is enormous. • Capacity needs to be built within MoUD and State governments to evaluate projects and monitor their advance and performance. • Capacity building is needed at all levels of government, inclusive of decision makers and staff in charge of developing and overseeing project implementation and operations • The ability to deliver projects under JnNURM is India’s biggest weakness. • JnNURM sanctioned too many projects too quickly and there is insufficient capacity to implement and supervise them all.

Some recommendations on the way forward were quite diverse as experts offered innovative solutions to particular challenges. For instance, some respondents favor more power to the cities and states to define their own priorities, while others found the national participation in project sanctioning and supervision valuable. In addition some interviewees suggested specialization of civil service officers through the formation of an urban transport cadre early in the service, while others indicated their preference for specialization in urban issues mid-career. The authors assessed which of these suggestions were most relevant and potentially most effective, and incorporated those ideas into the report. In some cases, interviewees’ suggestions for how to improve JnNURM were beyond the scope of this study. For instance, some experts highlighted issues with other sectors besides urban transport which is the focus of this report. Some suggested reforms address governance or institutional issues that are broader than the JnNURM program. These outlying recommendations were not incorporated into this report. A full summary of what interviewees suggested be improved about JnNURM is included in Appendix 10.1.

Figure 9: Distribution of Transportation Projects under JnNURM



Source: IIHS, 2011

3.2 Summary of Other Assessments of JnNURM in Literature

The available assessments of JnNURM generally coincide with the conclusions from the expert interviews. The program is regarded as a very positive initiative, requiring improvements in its instruments and large capacity building efforts (Sivaramakrishnan, 2011; CSE, 2011; Swamy, 2011; MoUD, 2011). As the expert interviews emphasized, JnNURM has been more focused on disbursing funding than delivering sustainable transport projects. In fact, only 35% of sanctioned projects have been completed (CSE, 2011). Moreover, the assigned funds are concentrated in road infrastructure, favoring general traffic and not necessarily sustainable transport investments. According to analysis by Center for Science and the Environment (CSE), 70% of JnNURM transport investment has funded roads and flyovers, while only 15% has been allocated to mass transit (CSE, 2011). IIHS reports that 57% of

transport-related funding was allocated to roads and flyovers and 33% to mass rapid transit and other public transport (IIHS, 2011) (Figure 9). All sizes of cities have more JnNURM-funded road and flyover projects than other types of projects (CSE, 2011).

Further analysis of cities' budgets reveal which modes are given priority, beyond JnNURM-funded projects. In Pune, for example, although the CMP sets out goals of achieving 50% mode share from non-motorized transport and 40% from public transport, they allocated 61% of their 2011-2012 budget to motor vehicle-related projects (Parisar, 2011). Only 18% of Pune's budget was allocated to public transport projects and 9% to non-motorized transport.

4 A Vision for People's Cities Through Land Use & Transport Integration

Transport is at the heart of urban development and economic activity. However the current urban transport paradigms, which favor auto-mobility generate multiple social, economic and environmental impacts, are not sustainable (Dalkmann and Sakamoto, 2011). India's NUTP recognizes this and recommends the focus be moving people not vehicles (MoUD, 2006). NUTP incorporates several elements that support achieving that goal. The policy and supporting funding from JnNURM have promoted investment in public transit and non-motorized transport and have encouraged cities to complete comprehensive planning (MoUD, 2005). Nevertheless, the impact has been limited, as Indian states and local municipal bodies still favor road expansion as the primary tool to address transport needs.⁵

As a result, more emphasis is needed in the policy instruments to shift business as usual (auto-mobility) paradigms. For the reasons laid out below, the NUTP should be enhanced by establishing a vision of integrated land use and transport planning as the paradigm for the policy instruments and funding. The current policy mentions the need for land use and transport integration as one of many components. The idea is to make that connection the keystone of the new urban transport policy in India. This approach is intended to provide for the accessibility needs of the majority of the population, not just the privileged using individual motor vehicles.⁶

4.1 The negative impacts of auto-mobility development patterns

The prevalence of investments in other countries that favor auto-mobility has resulted in air pollution (local and global), fossil fuel dependence, inequitable access, neighborhood disruption, and mounting congestion, which erodes economic growth and quality of life. Auto-mobility is an important social determinant of negative impacts on health: reduced physical activity, noise and air pollution, and traffic

⁵As reported by several interviewees during the expert interview/data collection phase of this research. This preference is a natural result of prevailing paradigms, which favor predict and provide approaches to solve mobility needs.

⁶ While owning a motor vehicle is an aspiration, it is nevertheless important to recognize that unabated use of individual motor vehicles results in large negative impacts for the society as a whole as indicated in this section.

accidents, which result in illness and premature death (WHO, 2011).

Expanding road capacity is not a solution to traffic congestion, because of induced travel. In California between 1973 and 1990, every 10% increase in highway lane-kilometers led to a 9% increase in vehicle kilometers travel (VKT) within a four year period (Cervero, 1998). Usually it is a matter of time before newly improved roads become congested again, a phenomenon known as “the rebound effect”. Numerous empirical studies and analysis of real world case studies have shown that new road capacity usually induces traffic in direct proportion to the amount of new road space, with traffic growing by 0.4 to 1.0 as much as new capacity in the long run (ITDP and EMBARQ, 2012). Different studies have shown that a large portion (50-100%) of the new roadway capacity is absorbed by induced traffic after three years of operation (Noland and Len, 2000).

Traffic congestion is a bottleneck to economic growth, lowering gross regional product (GRP) by 3.5-6% due to lost time, uncertainty, and wasted energy. In congested environments, the cost of air pollution and accidents can rise to 5.5-13% of GRP (Cervero, 2010). Similar estimates by the World Business Council on Sustainable Development attribute 5.7-10% of social costs of road transport to cities in the developing world to externalities (WBCSD, 2001).

The current auto-mobility trends need to be slowed or reversed, and high public transport and non-motorized transport mode shares need to be preserved or Indian cities will face a future of high energy consumption, poor air quality, chronic congestion, high road fatalities and unaffordable transport choices for the poor.

4.2 Integrating land use and transport: the Avoid-Shift-Improve framework

The main principles of the NUTP should be strengthened under the new policies for a second urban renewal mission to prioritize public transport and non-motorized transport, and integrate transport and land use. One way to effectively communicate these goals is with the Avoid-Shift-Improve (ASI) framework (Dalkmann and Brannigan 2007):

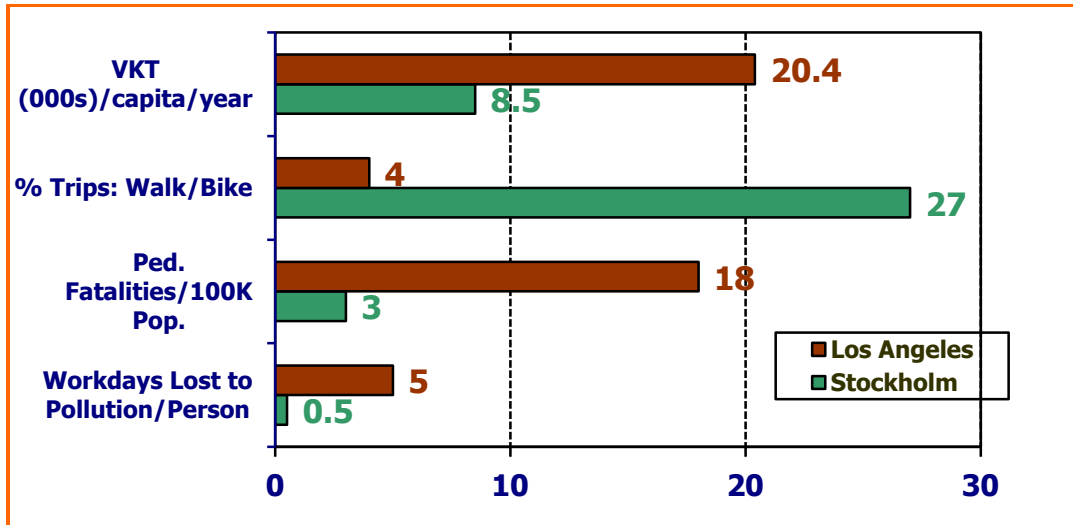
- **Avoid** or reduce the growth in unnecessary travel while maintaining or enhancing economic and social opportunities for interaction through better land use planning
- Prevent the **shift** of trips from non-motorized transport and public transport to individual motorized modes; and
- **Improve** the operations and energy and carbon efficiency of each mode.

Most cities in India are at an initial stage of development with a growing economy, regional economy, and a dense and vibrant built environment. They have the great opportunity to integrate their transport systems and land use in a manner consistent with the ASI principles. If so, they will not need major and much more expensive changes later on, as is the case of industrialized nations.

A comparison of Los Angeles and Stockholm shows sharp differences in the way the people move and the impacts on fatalities and health. In Stockholm, the vehicle kilometers traveled are less than half and

the walking and bicycling trips almost seven times higher than in Los Angeles. Furthermore, Stockholm experiences one sixth the pedestrian fatalities and loses one tenth the workdays to exposure to pollution (Figure 10).

Figure 10: Mobility indicators, pedestrian fatalities and health from Los Angeles and Stockholm



Source: Cervero, 2010: VKT: Vehicle Kilometers Traveled, Ped: Pedestrians; Pop: Population

It is important to recognize that integrating land use and transport policy is not easy. Land use and transport policies are usually under the purview of different agencies and funded from different sources. There are relatively few cities around the world that have been able to develop joint policies for transport and land use, with the most remarkable examples being northern European cities (Copenhagen, Stockholm, Amsterdam, among others). Strong land use and transport integration is also happening in recognized cities like Singapore and Curitiba, where clear leadership has been in place, accompanied by evolved institutions, well prepared technical staff, and adequate levels of funding.

4.3 Specific actions to implement the ASI framework

Applying the ASI framework to the Indian context requires coordinated urban planning (land use, urban form and access) and transport infrastructure and services (safe, affordable, comfortable and convenient transport). The ASI policy framework can be implemented in both existing built urban environments as well as in new, green-field developments.

Table 3: Avoid-Shift-Improve framework applied to existing and new urban developments in India

	Existing Built Environment	Green Field Development
Avoid long and unnecessary travel	<ul style="list-style-type: none"> • Preserve density and mixed use • Encourage mixed use where it is absent 	<ul style="list-style-type: none"> • Zone for good density and mixed use inclusive of low income housing
Prevent Shift from walking and biking to individual motor vehicles	<ul style="list-style-type: none"> • Improve/create safe walking and biking environments • Provide good quality and affordable public transport • Optimize public transport operations • Enhance intermediate public transport • Price ownership/use of private motor vehicles 	
Improve transport system technologies	<ul style="list-style-type: none"> • Enhance basic and intermediate public transport operations • Implement intelligent transportation system technologies • Encourage clean fuel and vehicle technologies • Establish vehicle emission standards 	

In existing urban areas, land use and development strategies should preserve densities and a mixture of uses or encourage them where they are missing. While in new greenfield developments, master plans should zone for good densities and mixed uses, especially around new public transport stations. This shall help in preserving open spaces and producing affordable housing, with good connectivity to area jobs and areas of major activity.

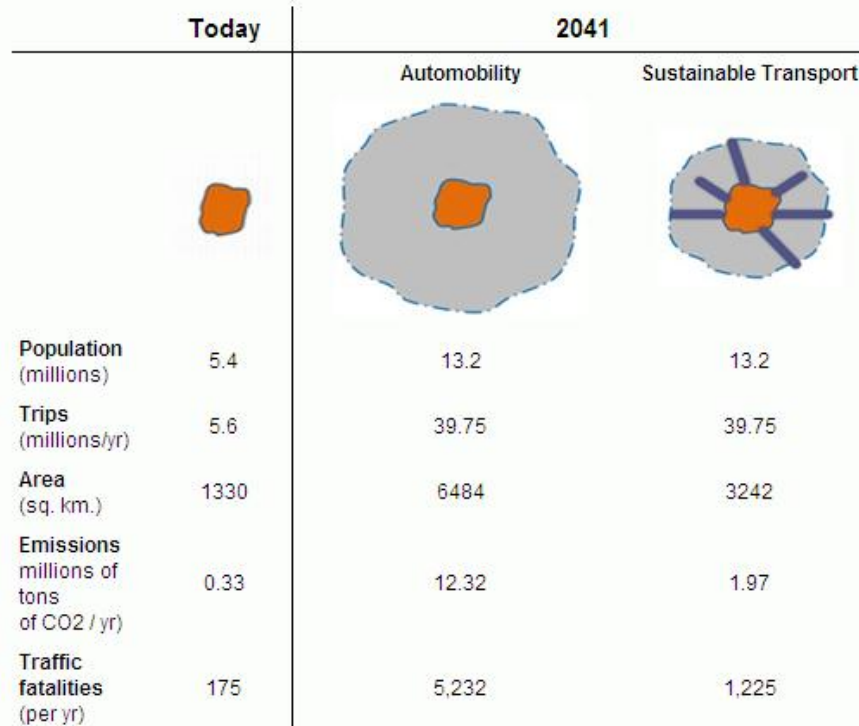
In existing and new urban developments, public transport and non-motorized modes should be prioritized. Flexible bus based services for transit should be considered; bus of high level of service (BHLS) and bus rapid transit (BRT) are excellent options for medium to high capacity corridors – 5,000 to 15,000 passengers per hour per direction (pphd) for a single lane BRT, and 15,000 to 45,000 pphpd for BRT with passing lanes at stations (Thredbo, 2012).⁷ Metro lines can be considered for corridors above 15,000 pphpd.⁸ High quality pedestrian and bicycle infrastructure should be built to complement the mass transit corridor and provide last kilometer accessibility.

⁷ The working group of the MoUD for the 12th year plan recommends BRT up to 20,000 pphpd as a result of an expert discussion. The values indicated here, 15,000 – 45,000 pphpd have been observed in bus systems in Latin America.

⁸ In any case, selection of transport mode for mass transit facilities should be accompanied by a cost effectiveness analysis.

Finally, the efficiency of public transport and IPT operations should be optimized. New technologies such as transit signal priority, centralized dispatch and control, automatic fare collection and real time information systems are appropriate to enhance transport operations. Policies should also encourage the adoption of low emissions vehicle and fuel technologies.

Figure 11: 2041 Urban Development Scenarios for Ahmedabad, India



Source: EMBARQ India, <http://www.indiatogether.org/2012/jan/eco-compact.htm>

Note: The 2041 scenarios assume the same trip rate per capita and that people are able to make the trips they want to make. Therefore the scenarios are only addressing mode choice, not travel activity.

4.4 Measuring the Impacts

For a typical Indian city the difference between business-as-usual (auto-mobility) and sustainable urban development and transport is significant. For instance the city of Ahmedabad is expected to grow to 13.2 million inhabitants in 2041, from its current population of 5.4 million people. If it grows according to auto-mobility patterns it will expand to a built area of 6,484 square kilometers.⁹ If its development adheres to the ASI framework, by 2041 the city will be on only have this area. Estimated CO₂ emissions will be about 10 times higher and road fatalities five times higher in the auto-mobility scenario as opposed to an integrated planning scenario (Figure 11).

⁹ This is the expected growth of the area under the management of the Urban Development Authority if density is half of the current density.

These differences between automobile-oriented development and more sustainable development are also evident when comparing urban patterns in cities of other regions of the world. For instance in Latin America, where the urbanization is fairly advanced, and average incomes are twice those in India, cities with higher automobile use have the highest levels of traffic fatalities and pollutant emissions (see Appendix 10.3).

In order to monitor progress towards the sustainable transport development scenario, Indian cities should measure the citywide impacts of their transport investment and land development choices with a few key performance indicators:

- Tracking **people served** puts the emphasis on impacting people not just sanctioning funding. This helps to ensure the mobility projects serve the majority of the population and particularly the poorest. Since the majority of urban residents in India are from the lowest income categories, the best way for cities to meet the people served goal is to serve the poorest residents.¹⁰
- **Travel mode shares** are a high level indicator of the overall sustainability of the transport system and urban development patterns. High levels of walking and biking and public transport use are usually correlated with lower emissions and traffic fatalities (CAF-OMU, 2010). Cities ranked as the most sustainable and livable places have low shares of individual motorized transport, even if auto ownership is high.¹¹
- **Average trip time** (minutes per person per day) indicates the efficiency of the transport system. As transport demand is derived from the need to travel to work, study, leisure, shopping, etc., the shorter the travel time, the higher the system efficiency.
- **Traffic fatalities** (people killed as a result of traffic incidents per year) capture the main direct health impact of transport¹². Cities ought to adopt a zero tolerance policy to people being injured or killed as a result of traffic incidents and should work systematically to reduce risks. Sustainable transport and urban development are part of a comprehensive traffic safety agenda.
- **Emissions** (total tons of CO₂eq and the main criteria pollutants CO, NO_x, SO_x, HCs and PM_{2.5}) indicate the levels of local and global pollution. These emissions mainly the result of the use of fossil fuels in internal combustion engines or power plants providing energy to electric vehicles. Criteria pollutants¹³ are those commonly found in the atmosphere that create health risks such as pulmonary, cardiac, vascular, and neurological impairments.

¹⁰ This approach does not mean the needs of the minority of car users shall be totally ignored; it indicates that the needs of the majority of the population shall receive priority.

¹¹ Copenhagen, Curitiba, Barcelona, Stockholm, Vancouver, Paris, San Francisco, New York, London and Tokyo, for example, as listed at <http://www.triplepundit.com/2011/06/top-10-globally-resilient-cities/>

¹² Other health impacts of transport include lack of physical activity, exposure to air pollution and noise.

¹³ CO, HC, NO_x, SO₂, and Particulate Matter directly or through photochemical and meteorological processes, generate health risks. See for example <http://www.epa.gov/apti/course422/ap5.html>

These key performance indicators can be tracked with fairly simple yearly surveys as inputs to simplified impact models. Modal shares and average trip time can be measured citywide with random household samples of about 3,500-4,000 surveys stratified by income and housing location¹⁴. The household survey should also include questions to estimate the trip rates and trip lengths per household. With trip rate data and census information, total trips in the city can be estimated. Trip lengths combined with modal shares and secondary data on the vehicle fleet characteristics and emission factors allows the estimation of emissions from road transport. Traffic fatalities may be obtained from police and hospitals reports.¹⁵ Fatality data should include people injured in traffic accidents die as a result of those injuries within a window of time (i.e. 60 days) after the traffic incident. Tailpipe emissions can be estimated using simplified models involving activity (from trip rates and trip lengths), modal shares, and emission factors (from the literature or low-cost sampling).¹⁶

This type of performance indicators adequately complements the Service Level Benchmarks issued by the Ministry of Urban Development (MoUD, 2010). These service level benchmarks rate the different cities according to supply side indicators on the availability of different type of facilities, considered important in the development of transport systems in Indian cities.

4.5 Policy recommendations

As illustrated by the Ahmedabad 2041 scenarios (Figure 11), the impacts of integrating land use and transport planning in order to prioritize development that avoids the need for travel, and prioritizes public transport and non-motorized transport when travel is necessary are significant. This should be reflected in new policies for the urban renewal mission by:

- **Funding public transport** investments to provide high quality, high capacity transport infrastructure in existing urban areas and structure greenfield developments.
- **Integrating intermediate public transport** into the mobility service delivery with mechanisms to improve connectivity at public transport nodes, business models, service delivery and safety (Mani et al, 2012).
- **Requiring city development plans integrate land use and transport** infrastructure to preserve and prioritize density, mixed uses, and good quality access nodes for pedestrians, bicycles and intermediate public transport around mass transit stations.
- **Monitoring citywide impacts of investments and policies** through key indicators people served, modal split, travel time, road fatalities and emissions.

¹⁴ It is important to collect 300-400 random samples from each income strata and residential area. But here, the overall sample size does not influence the confidence interval of the result.

¹⁵ See for example Transport for London

<http://www.tfl.gov.uk/assets/downloads/ReportingLevelsMatchingStats19andHospitalDataFullReport.pdf>

¹⁶ See for example <http://www.adb.org/Documents/Evaluation/Knowledge-Briefs/REG/EKB-REG-2010-16/methodology.pdf>

5 Comprehensive Mobility Plans – Implementing the ASI Framework

The Comprehensive Mobility Plans are a critical link between the theoretical ASI framework and the practical implementation of the concepts in Indian cities. This chapter includes an assessment of the current CMPs developed under JnNURM based on interviews and other studies, and specific recommendations on how to improve CMPs to address the main concerns.

5.1 Assessment of the CMPs under JnNURM

The requirement for CMPs as a funding requirement of JnNURM has been a very important advance in the way transport is planned with a focus on moving people not vehicles. According to the Association of Municipalities and Development Authorities (AMDA), through December 2010, 25 cities completed CMPs and 10 had plans under preparation; many of them were completing the planning exercise for the first time (Chotani, 2010).

CMP preparation guidelines were released by the central government, and many municipalities used these guidelines in advancing their plans directly, or with the help of consultants. As a result, an enormous quantity of municipal transport data was made available and initial engagement between transport and land use planning took place.¹⁷ Nevertheless, according to some experts interviewed for this report, the preparation of CMPs was rushed and funding for advancing them very limited. The CMPs identified several local initiatives to improve mobility, and emphasized lists of projects rather than holistic planning approaches (Chotani, 2010).

Other critiques of the CMPs by AMDA include:

- Slums & the informal sector not addressed in CMPs;
- Mixed land use development not taken into consideration;
- Road widening projects were advanced mainly at the expense of pedestrian space;
- Broad changes in urban form not well reflected in CMPs;
- Cost estimates and funding requests were not rational;
- Only a few CMPs have taken regional approach, most were confined to city areas only;
- Legal and administrative issues not elaborated;
- Cost benefit analysis not done;
- Poor public participation and stakeholder consultation

A second review by TERI comes to similar conclusions about the planning process, plan preparation, and implementation including (TERI, 2011):

- Inadequate stakeholder engagement in plan preparation process;

¹⁷ These data made possible, for example, the compilation of transport indicators by M. Pai
<http://www.embarq.org/en/india-transport-indicators>

- Lack of clarity in definition of terms like vision, goal, objective, strategy;
- Gaps in translation of plan recommendations into specific projects;
- Lack of clarity on formal linkages between CMP with statutory plans like Master Plan and Comprehensive Development Plan CDP;
- Lack of clear implementation strategy in many plans;
- Lack of a well-defined framework of targets and performance indicators;
- Lack of identification of capacity building requirements;
- Lack of recommendations to establish a mechanism for periodic revision and updating CMPs;
- No proper communication strategy to build public support for projects to be implemented.

In principle CMPs are a beneficial requirement, but improvements are required to make them more effective instruments for achieving the national transport policy vision. Recommendations for improving the CMP structure presented in subsequent sections are informed by local transport and urban development needs in India as well as international experience. While it may be worthwhile to reevaluate the institutional roles and responsibilities related to the CMPS, these recommendations focus on improving the CMP, regardless of which institution is responsible for developing and enforcing it.

5.2 Improving the CMP Structure – A results oriented approach

The proposed restructured CMP includes six elements:

- Policy Objective
- Projects & Initiatives
- Impacts
- Risk Analysis
- Financing
- Monitoring, Reporting and Verification

5.2.1 Policy Objective

The policy objective is a declaration of the city’s expected development outcomes, or aspirations for the city under the CMP. These policy-level objectives could include such elements as safety, environmental sustainability, economic viability, equity, multimodal systems. The success of the CMP and JnNURM funded projects to meet these objectives is assessed through the key performance indicators described in Section 0: people served, modal share, travel time, traffic fatalities and emissions. Additional objectives such as universal accessibility or more public space could also be included.

5.2.2 Projects & Initiatives

The CMP should include a description of different projects, policies and initiatives to be developed or implemented under different scenarios (i.e. dynamic baseline/business as usual, low, medium and high investment levels), and how these projects will contribute to achieving the CMP’s overall objective. Suggested categories and types of policies are listed in Table 4.

Table 4: Categories and examples of CMP projects & initiatives

Category of Projects, Initiatives	Examples	ASI Framework		
		Avoid	Shift	Improve
Land use management	<ul style="list-style-type: none"> • Mixed use zoning • Densification • Growth management 	✓		
Transportation demand management measures	<ul style="list-style-type: none"> • Parking fees • Congestion pricing • Vehicle restrictions 		✓	
Active transport	<ul style="list-style-type: none"> • Pedestrian and bicycle facilities and programs 		✓	
Public transport interventions	<ul style="list-style-type: none"> • Rail, bus rapid transit • Bus network optimization • Transit system integration 		✓	
Clean fuels & vehicles	<ul style="list-style-type: none"> • Emissions & efficiency standards • Vehicle emission inspection • Vehicle scrapping programs • Alternative technologies 			✓
Fiscal policy	<ul style="list-style-type: none"> • Taxes on less efficient modes • Targeted subsidies for public and active transport 		✓	
	<ul style="list-style-type: none"> • Financial incentives for alternative fuels and vehicles 			✓
Capacity building	<ul style="list-style-type: none"> • Improved ability to plan, measure, supervise, control transport activities 		✓	
Operational management improvements	<ul style="list-style-type: none"> • Passenger information systems • Real-time incident management • Traffic/transit operations centers 		✓	

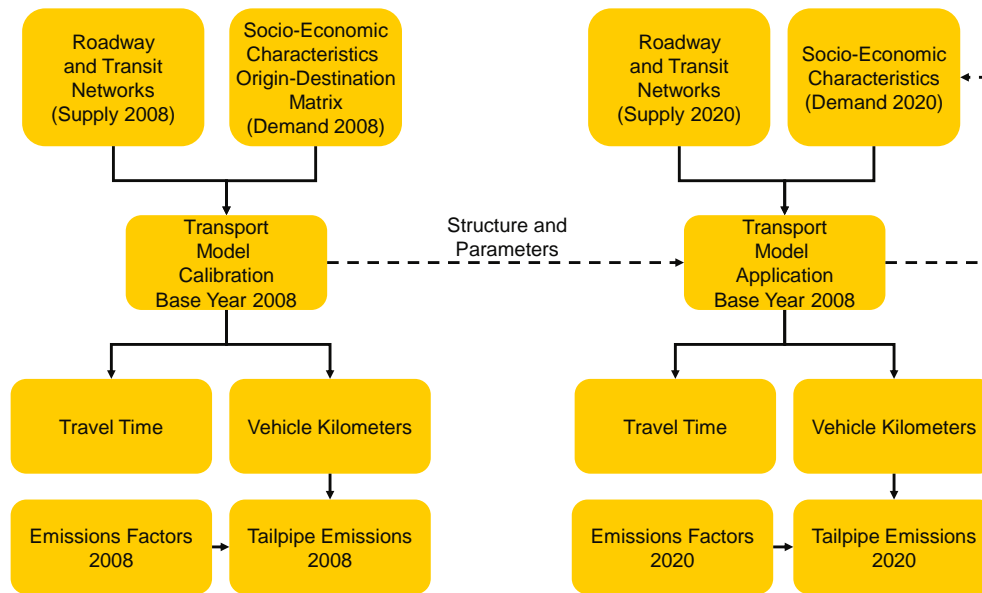
A critical aspect on the estimation of goals is the selection of the baseline (business as usual) scenario. It is recommended to avoid “do-nothing” scenarios as baselines as they do not reflect the fact that local and state administrations continuously invest in the transport infrastructure. The baseline should reflect the historic trends in investment in the transport sector. One option for baseline definition is projecting the investments that have been already committed, according to the current financial capacity.

5.2.3 Impacts

The projected impact of the projects and initiatives under the CMP as indicated by the metrics people served, travel time, model share, fatalities and emissions, should be described. These impacts are expected to be achieved as a result of cutbacks in the number and length of personal motorized trips due to densification (avoid), reduction of the total motorized vehicle-kilometers as the participation of public and active transport increases (shift), and enhanced efficiency of the vehicle fleet (improve). A quantitative definition of the expected impacts as compared with a baseline (projected) scenario should be included.

People served shall be derived from forecast farebox revenue for the public transport systems and forecast traffic counts for other types of investments (walkways, bikeways, and other infrastructure facilities). The framework indicated in Figure 12 can be used to estimate transport emissions.

Figure 12: Framework for Estimating Transport Emissions



Source: EMBARQ 2010

Once the projects and initiatives are completed, their individual impacts will be monitored and reported using the KPIs, as will the citywide impacts of the CMP. In the future, global standards such as the Greenhouse Gas Protocol¹⁸ could be utilized to monitor how the CMP contributes to changes in citywide emissions.

¹⁸ See Greenhouse Gas Protocol, City GHG Accounting. <http://www.ghgprotocol.org/city-accounting>

5.2.4 Risk Analysis

A clear definition of risks and mitigation actions thereof should be detailed in the CMP. For instance comprehensive plans are subject to implementation risks. Plans may be affected by local political agendas, changes in administration and resistance by affected parties (i.e. small vehicle operators, land owners, private vehicle owners). Providing information about the CMP and its projects and initiatives to the local community and facilitating stakeholders' participation in the planning process can help to ensure local buy-in and mitigate some of these risks.¹⁹

Likewise, implementation of the development plan may depend on funding availability so the CMP should identify sustainable revenue streams to fund the necessary infrastructure investment, and opportunities to apply innovative financing mechanisms.

In addition, monitoring and reporting the CMP is also subject to risk. There could be problems with data collection, and lack of technical expertise to analyze and interpret the data. This risk can be mitigated by enhancing the technical capacity of local, state and national bodies. Through contracts or partnerships the private sector could provide the monitoring and reporting services where local institutions lack the capacity.

5.2.5 Financing

CMPs should be fiscally constrained and identify specific, confirmed, available funding for projects and initiatives in the first two years of the plan. For medium and longer term initiatives, funding plans should be realistic in their identification of available sources of financing. Sources of funding to be considered include:

- Local and state revenue from taxes, public-private partnerships and urban transport funds. This may include land value capture, parking fees and congestion pricing.
- Contribution from Union Government
- Programmatic loans/grants from development banks
- Climate finance which constitute a broad array of technology funds, not limited to clean, low carbon fuels and vehicles (Binsted et al, 2011).
- Private sector investment

5.2.6 Monitoring, Reporting and Verification

Monitoring, reporting and verifying (MRV) the progress of the CMP against its objective is as important as developing it in the first place. The only way to manage the impact of the CMP is to measure the results of the projects and policies implemented under the CMP. For instance, the CMP may include goals and targets for modal share and fatalities, but the city's expenditure may be completely

¹⁹ According to one reviewer, the basic requirement to reduce risk is good planning, resolution of conflicts by an empowered body and quick decision making.

misaligned. See for example an analysis by Parisar of the 2011-2012 transport budgets in Pune (Menon, 2011). Including goals or KPIs in the CMP is not sufficient – an MRV system is necessary to understand whether the goals are being achieved. Otherwise the CMP has no weight and remains just a box to check. A CMP with adequate MRV can guide transport priorities and investment.

Monitoring does not need to be complicated or expensive; a simplified approach can be taken in which the key indicators are monitored. The data inputs required for these indicators are:

- Population [number], from census sources
- Trips per person per day [number], from local traffic engineering studies
- Primary mode of travel (walking, biking, public transport, private vehicle, auto-rickshaw, motorcycle), from a simplified annual survey (see below)
- Average distance per trip per mode of travel [km], from a simplified annual survey (see below)
- Average travel time per mode of travel [minutes], from a simplified annual survey (see below)
- Total deaths from traffic accidents [fatalities/year], from police reports and hospital records
- Emission factors per kilometer per mode of travel, from the literature or low-cost sampling
 - GHGs (CO₂, CH₄, N₂O) [gm CO₂eq/km]
 - Tailpipe emissions (CO, HC, NO_x, SO_x, PM_{2.5}) [gm/km]

Collecting a set of control variables to check consistency is also recommended:

- Aggregated fuel sales (associated with transport) [liters/year]
- Air quality indicators (ambient concentrations and number of events above standards, extracted from air quality monitoring network) [average daily parts per million]

Transport activity can be monitored with a citywide survey. To assure adequate representation, a categorized random survey with a 5% error and a 95% confidence interval should be used.

Recommended categories include main trip purpose (work, study, other), gender (male, female) and income level (high, medium, low). The suggested error and confidence level require around 300 random surveys per category, for a total of 5,400 surveys²⁰. Approximate cost per survey is US\$4-6, for a total cost of US\$21,600 - 27,000, including analysis and reporting. This is a fraction of the cost of a detailed transport planning study, often in the range of US\$0.5 to 1.0 million dollars.

The results of the survey (modal share, trip distance, trip time) allow direct estimation of average modal share and trip time, and indirect estimation of emissions (using trip distances and emission factors from the literature).

²⁰ This number of surveys provides a good level of confidence and error size regardless of the city size if there is a random selection within each category. The suggested number can be adjusted for local conditions and requires the consideration of expansion of the urban area over time.

5.3 CMP Conclusions and Recommendations

A results-oriented CMP will encourage actions and policies beyond the JnNURM-sanctioned projects that advance sustainable transport and development. By measuring the citywide impacts, not just the isolated projects, the plan will result in sustainable outcomes and improved city efficiency and safety, as indicated by modal share, travel time, fatalities and tailpipe emissions.

Measuring and monitoring does not require very expensive and complicated mechanisms. A well planned annual survey can be a simple and low cost mechanism to collect the key data and indicate the actual results of the CMP. This type of approach is being used in Latin America by the CAF (Latin American Development Bank) and the independent program “Como Vamos” (How are we doing), supported by the private sector and major media outlets.

This results-oriented approach can be implemented by:

- Developing detailed guidelines for data collection, modeling and analysis
- Training for people involved in estimation, monitoring, reporting and verification
- Upgrading the national standards/guidelines on procedures, parameters and reporting requirements

6 Recommendations for JnNURM Implementation: Adapting international best practices to the Indian context

Through a review of national transit investment programs from 13 countries, EMBARQ identified a framework for effective decision-making about which urban transport projects are worthy of and ready to receive funding²¹. Since final decisions about funding mass transit projects are almost always political in nature, any transit investment program should support informed decisions by identifying all significant benefits, costs and risks of each project, as well as the level of local support, for decision-makers’ consideration. This perspective frames the principles described below, as well as the identification of examples of good practice. The most critical principles for effective decision-making fall under three primary “pillars”:

- **Define project rationale.** A proposed project should result from a clear definition of need and comparison of alternative strategies. It should also be appropriately scaled to solve the problem at hand, with costs and benefits compared. The technical evaluation process should be transparent and free of political influence.

²¹ This section is an adaptation of Owen, B., Carrigan, A. and Hidalgo, D. 2012. “Evaluate, Enable, Engage: Principles to Support Effective Decision-Making in Mass Transit Investment Programs.” EMBARQ. Washington, D.C.

- **Ensure deliverability.** A proposed project should not have significant outstanding risks that could threaten its successful implementation. Also, the project sponsor should have adequate capacity to implement the project – which depends on access to technical support from the national government and other institutions with mass transit expertise.
- **Facilitate local buy-in.** A proposed project should be a priority for the local agencies that will implement and operate it. Local governments should therefore lead project planning and development and help to fund project implementation. Projects should also be consistent with – and ideally derive from – existing local transport and development plans.

Assuming that a national transit investment program is backed by and consistent with, a strong and clearly articulated urban development policy/vision, this framework will help to ensure the implementation of the investment decisions is robust, consistent and transparent. The three pillars are interdependent, so the new improved JnNURM should aim to incorporate all three:

- The **rationale** for a project depends on **deliverability** considerations: risks can affect the costs and benefits of a project, potentially making it unjustifiable. In order to assess the rationale for a project, Urban Local Bodies must be capable of conducting (sometimes rigorous) technical analyses. Rationale also depends on **local buy-in**: a project’s anticipated costs and benefits are often sensitive to how the project is integrated with local transport and development plans.
- **Deliverability** depends on the analysis of project **rationale**, as desirable project alternatives may carry unique implications in terms of project management and risk. Deliverability also relies on **local buy-in**, in terms of adequate resources – financial and otherwise – to implement the project, as well as sufficient political and public support for implementation.
- **Local buy-in** requires practices to ensure project **deliverability**: municipal governments may need capacity-building assistance to propose and develop quality projects. Local buy-in also requires a process for the state and national government to assess **rationale** that is both achievable and transparent, as local governments may otherwise be dissuaded from proposing projects.

The following sections describe the three pillars in more detail, illustrate areas where JnNURM can be improved and provide examples of good practices from other national programs.

6.1 Pillar 1: Define Project Rationale

A key element of a strong mass transit investment program is a well-defined, transparent process by which the rationale for a project is evaluated. The new improved JnNURM should consider the following principles to guide assessments of rationale for particular projects:

- **Identify project need and analyze alternatives.** Proposed projects should result from a thorough examination of the transport problem at hand and an assessment of alternative investments and policies, including lower-cost options that address the same problem. This should include not only capital investments, but also operational improvements. The process should encourage consideration of policy and regulatory changes to ensure the sustainability of the project and lessen the need for future investments.

- **Compare project costs and benefits** to assess whether proposed projects represent a good use of limited resources and are reasonably scaled to solve the problem at hand. For transparency's sake, the comparison should include non-monetizable reasons for pursuing a project in addition to socioeconomic factors. Guidance to project sponsors should clearly indicate how the national government will measure and present evaluation criteria for decision-makers' consideration, including the procedures for analyses of costs and benefits that sponsors must conduct.
- **Keep politics out of technical evaluations** to facilitate transparency in the development of the case for a project. Separation of the individuals that conduct technical analyses from those making funding decisions needs to be clear, such that the latter cannot intervene in analyses.

6.1.1 Identify project need and evaluate alternatives

Under the current JnNURM, alternatives analysis is required for major projects with cost greater than or equal to Rs 500 crores, but voluntary for less costly projects. The CMP guidelines recommend development of an urban mobility plan which includes preparation of a mass rapid transit development plan. Generic advantages and disadvantages of three modes – bus rapid transit, light rail transit and metro – and guidance on which mode to choose are presented in the guidelines. This process favors choosing a mode too early in the transport planning process, based on generic factors, rather than conducting a rigorous assessment of what the most effective and efficient solution for a particular context will be.

An important starting point in formulating any transport project is identifying the problem and the range of solutions that could alleviate it. For instance, to alleviate congestion, solutions might include user charges, changes to land use regulations, improved traffic operations or construction of new infrastructure. Alternatives (or options) analysis is an integral part of the project proposal process that encourages cities to assess mobility problems in depth and contemplate more than one desired solution.

Key questions for alternatives analyses include:

- What is the transport problem? Does it require a large investment to solve?
- Could the implementation of policy or regulatory changes or operational improvements in conjunction with an infrastructure investment improve the solution's effectiveness and sustainability? Could they reduce the need for future investments? Could they solve the problem more effectively than additional infrastructure? Could they avoid or mitigate adverse impacts?
- Do investment alternatives match capacity and demand? Are there less-expensive options that offer similar benefits or that avoid or mitigate adverse impacts?
- Were alternatives omitted from the analysis that might have been reasonable? If so, why?
- Are there minor changes to the proposed project that could improve its effectiveness or mitigate or avoid adverse impacts?

Alternatives analysis is not an opportunity for the national government to impose a particular solution upon a project. Doing so could reduce local political support for projects, which is necessary for a program's success. Rather, the process should eliminate unfeasible alternatives from consideration, highlight changes to a preferred approach that might improve its benefits and lessen its costs, and provide a justification for why a preferred approach was selected. The testing of alternatives is not an add-on to the appraisal but an integral part of the process of determining the preferred option (DfT, 2007). To improve objectivity, the process should be conducted and results reviewed as early in project development as possible.

Alternatives analysis commonly involves the following steps:

1. Diagnosis of the transport problem, including its significance and causes.
2. Identification of alternatives to solve the problem.
3. Establishment of criteria to reduce the list of alternatives to a few especially promising possibilities.
4. Evaluation of the promising possibilities, often using a simplified version of the program's processes for assessing risks and comparing costs and benefits.
5. Advancement of the most promising alternative for further study and development, and ultimately funding consideration.

JnNURM should require alternatives analysis for all urban transport projects. To ensure rigorous analysis and consistency across projects, clear guidance should be provided to cities on how to conduct the analysis, including what alternatives to consider and evaluation criteria to use. The types of alternatives for project sponsors to consider could include:

- Regulatory and policy changes, including approaches to land use planning and pricing for use of transport infrastructure
- Better-use measures, such as travel demand management, information campaigns and deployment of intelligent transportation system technologies
- A range of investments, including different modes (public transport or otherwise), routings, implementation timeframes and phasing, investment amounts, and commercial options

England, for example, specifies the alternatives that should be considered for public transport and road infrastructure projects. For public transport projects, alternatives should include different technologies, such as alternative bus-based scheme; or lower cost alternatives, such as bus lanes or shorter length busways compared to fully segregated busways. Light rail project alternatives should include bus-based alternatives. Similarly, highway projects should consider different design alternatives as well as public transport services, and demand management policies. Robust evidence is required if the project sponsor concludes that additional road infrastructure is the preferred alternative.

A "baseline," or reference, alternative must be selected along with the preferred alternative. Since the baseline represents the scenario against which costs and benefits of the project will be compared, it needs to be realistic. The baseline alternative is rarely a no-investment ("do-nothing") scenario that would lead to deteriorating conditions (Mackie & Nellthorp, 2001). The baseline alternative can be

defined as an optimal version of the current situation that would occur without the project, or consist of investments needed to sustain current conditions along with projects that have funding commitments. *France's* national program notes the unavoidability of limited investments and suggests selection of the most probable scenario in light of transport policies and potential changes in pricing, intermodal competition and the economic environment (MEEDDM, 2010). *Chile's* program suggests a cost threshold for the baseline alternative: sponsors should consider reformulating the baseline alternative if its cost exceeds 20 percent of the average cost of the project alternatives under consideration (Comision de Transporte Urbano [CTU], 1988).

The alternatives should be reviewed with project sponsors, and funding should be contingent upon thorough and rigorous analysis. In the new improved JnNURM, the State Level Nodal Agency should review the need for the project and proposed alternatives and only recommend a project to MoUD if the alternatives analysis meets specified standards²². This approach would be consistent with other national transit investment programs. For instance, in *England*, the national government may decline to fund a project if the alternatives analysis is inadequate or a preferable alternative was excluded (DfT, 2007). English project sponsors are required to provide a clear description of the alternatives analysis with their project bid, which explains how the project was identified as the preferred solution for the identified mobility problem, including:

- All alternatives considered
- Reasons why some were rejected
- Description of any analysis completed to inform the selection of preferred alternative
- Shortlisted options
- Description of the process to identify preferred option
- Any stakeholders consulted in the process

6.1.2 Compare project costs and benefits

JnNURM requires projects whose cost exceeds 1 billion rupees to complete a cost-benefit analysis (MoUD, 2006). This criterion should be preserved in the new JnNURM program design, so that the level of required analysis is scaled to the project costs. What is missing from JnNURM is clear guidance on how to conduct the cost-benefit analysis. Many of the stakeholders interviewed for this research highlighted the need for more detailed and consistent guidance from MoUD to project sponsors. The new improved JnNURM should provide clear instructions regarding the cost benefit analysis to ensure high-quality analysis that is consistent between all high-cost projects.

6.1.2.1 Critical Improvement: Provide thorough cost-benefit analysis guidance

India's program suggests a variety of costs and benefits for project sponsors to include in the cost-benefit analysis. Instead, the program should specify precisely which costs and benefits to include and

²² The State Level Nodal Agency (SLNA) invites project proposals, appraises them, and manages and monitors the JnNURM. See Section 10.1 for more details about the JnNURM structure.

how to measure and monetize each. As a reference, Table 5 shows the range of costs and benefits and their treatment in ten national transit investment programs.

In the new JnNURM, cost-benefit guidance should at a minimum prescribe:

- The **monetizable benefits and costs** to be included in and excluded from analyses. Cost-benefit analysis is typically restricted to direct costs and benefits of a project, such as travel time savings, reductions in operational costs, emissions reductions and investment costs. Initially, the new JnNURM could exclude certain direct impacts that are difficult to value such as environmental factors (Mackie & Nellthorp, 2001; DfT, 2011d). Although, as described in Section 7.1.1.2, non-monetizable costs and benefits should eventually be added once the capacity for cost benefit analysis in India matures.
- **Necessary data and how to collect it**, including on travel behavior and travel times. In metropolitan areas with established travel forecasting procedures, transport modeling programs may generate much of the necessary information. For other cities, JnNURM should guide municipalities to conduct travel surveys of existing transit riders to yield the data needed to assess user benefits.
- **Prices** to use in valuing benefits. Program materials from *Chile, England* and *Poland* indicate the values to be used in monetizing many factors, such as the value of time (DfT, 2011d; CTU, 1988; JASPERS, 2008).
- **Discount rate**, the factor by which future costs and benefits are discounted to reflect their diminished value relative to those occurring now (Small, 1999). This also reflects the opportunity cost of investing public funds in projects. JnNURM guidance suggests that the opportunity cost of capital be used, but no specific discount rate is specified. *Chile's* guidance specifies a social discount rate of 6% (MIDEPLAN 2011c).
- **Period of appraisal** over which the costs and benefits are projected to accrue. *Australia's* appraisals for significant infrastructure investments typically use a 30 year timeframe (IA, 2010).
- **Assumptions for projecting "baseline" conditions** into the future. Since the costs and benefits of a project are assessed relative to a future situation without the project, the latter must reflect how society would be expected to fare were current conditions to persist. To ensure comparisons can be made among projects, MoUD should provide clear guidance about what data and assumptions should be used in projecting costs and benefits into future years.

Given the complexity of cost benefit analysis, the results must be scrutinized during the project review process to ensure that analyses were performed correctly and in line with guidance. Additional capacity may be needed in the State Level Nodal Agency and Central Sanctioning & Monitoring Committee for this detailed review (see Section 6.2.2 for further discussion on capacity building)²³.

²³ The Central Sanctioning and Monitoring Committee supports the National Steering Group by appraising and sanctioning proposals. At the state level, the JNNURM is coordinated by the State Level Steering Committees with support from the State Level Nodal Agency (SLNA) which invites project proposals, appraises them, and manages and monitors the JNNURM. See Section 10.1 Appendix 1: JnNURM for more discussion.

6.1.3 Present results of technical analysis clearly to decision-makers

Rigorous alternatives analyses and comparisons of costs and benefits support objective, transparent decision-making by providing political decision-makers with complete information about projects' merits. While politics may help to shape the evaluation criteria employed by a particular program, they should not cloud the technical analysis. A decision-making process that separates political decisions from technical analyses ensures consistent analytical requirements across projects, which can help foster local political buy-in. The new improved JnNURM should maintain the separation between technical evaluators of projects, the Institute of Urban Transport, and funding decision makers, the Central Sanctioning & Monitoring Committee.

It is also important that the State Level Nodal Agency presents the outcomes of technical evaluations clearly and succinctly to the Central Sanctioning & Monitoring Committee for funding decisions. Projects may be rated or evaluation outcomes can simply be presented in clear and concise formats. This can help facilitate quick but thorough review of project's impacts and justifications even in large committee meetings. Good examples of this are *England's* and *Australia's* Appraisal Summary Tables (see Appendix 10.4 and 10.5) which summarize each project's performance under all evaluation criteria in a single table for ministers' consideration.

This type of approach differs from the common practice of advancing a solution without adequate analysis of alternatives. Promoters of projects are seldom interested in reviewing options, as many times they are already committed to a given course of action; but alternatives analysis is very important in defining the use of limited resources and should be encouraged.

Table 5: Cost-benefit analysis factors by country

Country	Users			Producers		Society					Construction-phase impacts	Other factors
	Travel time	Travel cost	Travel quality	Implementation costs	Operating costs	Collisions	Noise	Air quality	CO ₂ emissions	Gov't costs		
Australia ^a	+	+	+	+	+	+	+	+	+	+	+	(1)
Chile ^b	++	++	0	0	0	0	0	0	0	+	+	(2)
Colombia ^c	+	0	0	+	+	+	0	+	0	+	0	
England ^d	+++	+++	0	++	++	+++	+++	0	+++	++	+++	
France ^e	++	+	0	+	+	++	++	++	0	+	0	(3)
India ^f	+	+	+	0	+	+	0	+	+	+	+	(4)
Mexico ^g	+	+	0	+	+	+	0	+	+	+	+	(5)
Netherlands ^h	+++	0	+++	++	++	+++	+++	+++	+++	++	+	(6)
New Zealand ⁱ	+++	+++	+++	++	++	+++	+++	+++	+++	++	+++	(7)
Poland ^j	+++	+++	0	++	++	+++	0	+++	+++	++	+	(8)

LEGEND: 0 = not mentioned or specifically excluded + = listed as a possible or common item
 ++ = measurement or valuation guidance provided +++ = measurement and valuation guidance provided

- (1) Crowding on vehicles and at stations, amenities on-board & at stations, health and physical fitness, road network congestion reduction, decommissioning/rehab costs.
- (2) Analysis factors are from guidance for urban road and bus lane projects. Social and environmental factors are considered in a complementary analysis (see Table 5). Other costs include opportunity costs associated with future investments necessitated by the project and legal costs associated with expropriation.
- (3) Changes in earnings among operators, competitors and up/downstream firms; opportunity cost factor applied to portion of project cost to be funded by government.
- (4) Access, employment, coverage, supply continuity or disruptions, quality of life, haphazard development, other environmental impacts.
- (5) Improved energy efficiency, reduced road maintenance costs, real estate income, value of use of the right-of-way.
- (6) Changes in government revenues due to less motoring, costs of investments avoided due to project.
- (7) Road traffic reduction, agglomeration (if applicable), access security (if applicable), option values (if applicable), cost offsets for future road construction avoided.
- (8) Changes in comfort and travel safety, if directly related to project objectives and monetizable.

SOURCES:

- ^a IA 2010
- ^b CTU 1988, MIDEPLAN 2011b, MIDEPLAN 2011c
- ^c Based on typical factors in appraisals of approved projects. DNP 2003b, DNP 2003c, DNP 2004a, DNP 2004b
- ^d DfT 2011l
- ^e MEEDDM 2010
- ^f MoUD 2006
- ^g FONDO 2009b
- ^h RWS 2010b, Bakker and Zwaneveld 2009, RWS 2011
- ⁱ NZTA 2010a, NZTA 2010b
- ^j JASPERS 2008

6.2 Pillar 2: Ensure Deliverability

Another critical component to effective funding decisions is assurance that proposed projects are deliverable – that is, that they can be implemented according to their respective scopes, schedules and budgets. As of 2011, only 35% of urban transport projects sanctioned under JnNURM have been implemented yet (CSE, 2011). This record of poor project deliverability was cited by most of the interviewees as one of the critical issues a new JnNURM program should address.

The new JnNURM should evaluate and augment proposed projects' deliverability by:

- **Assessing risks** to projects' costs, scopes and schedules and ensuring that sponsors adopt risk and impact mitigation procedures. Many types of risk can complicate project implementation, including shortcomings in project management procedures. JnNURM can take several steps to reduce risks, including assessing the reasonability of project management plans and viability of project designs. It can also incorporate quantifiable risks into capital cost estimates. Risks can be tracked through multiple evaluations of projects' scopes, schedules, costs and benefits during project development. By identifying and seeking to mitigate or avoid adverse impacts on users, communities, and the environment, project sponsors can avoid political backlash that can be a source of project delay.
- **Increasing the capacity** of project sponsors to develop, implement and operate projects. This is especially important when Indian cities may have limited experience in mass transit development, or when new institutions must be created to manage projects. The State and central government must also be equipped with the knowledge to administer the programs effectively, evaluate projects and provide assistance to cities on critical project development matters.
- **Assuring coordination** of the several agencies normally involved in project preparation, implementation and review.

6.2.1 Assess deliverability risks

Many types of risk, from the mundane to the catastrophic, can impact projects' capital costs, scopes and schedules. These may include (Owen et al, 2012; Hidalgo & Carrigan, 2010; Flyvbjerg et al., 2003):

- Changes in national, state and local policy and legislation, such as delays in approval of legislation needed to implement a project
- Changes in economic conditions and cost of inputs (i.e. labor and materials)
- Construction issues such as unexpected and difficult utility relocation, unanticipated terrain challenges, weather conditions and contractor deficiencies
- Design features of the project, such as the complexity of engineering and technology
- Sensitivity of the natural environment and the extent of mitigation measures
- Population resettlements and land acquisition
- Inter-institutional coordination, particularly when different local agencies are involved (i.e., public service companies)
- Natural disasters

- Funding disbursement delays
- Willful underestimation of construction costs
- Public opposition to the project

Risks also include operational factors, such as variations in demand, revenue and service levels relative to projections (DfT, 2011e). Overarching all of these risks is project sponsors' capabilities to plan, manage and implement their projects; good project management capacities can help to mitigate risks.

While JnNURM currently requires project sponsors to identify risks, and document at least a limited range of project management procedures, it does not specify standards or assessment procedures for the documentation. Through clear guidance to sponsors and rigorous project evaluations, JnNURM should identify, treat and minimize risks by:

- Assessing project sponsors' capabilities to manage their projects, including risks, and prescribe remedial actions to ensure deliverability.
- Including quantifiable risks in cost estimates.
- Evaluating projects at multiple points before and during construction to track changes in costs, benefits and sponsors' management capacities.

Additional steps that could be taken to monitor and mitigate project deliverability risks include:

- Identifying common areas of discrepancy between projected and actual project performance through ex-post evaluations, and incorporate the results into future project planning.
- Implementing mechanisms to limit access to additional funding for cost overruns.

Table 6: Project management plan and risk assessment requirements by program

Country	Organizational information (structure, governance, procedures)	Roles in project development and implementation	Contracting procedures	Communication procedures	Quality assurance and control procedures	Key milestones	Risk identification and mitigation	Description of how materials are assessed
Australia ^a	+	+	+			+	+	+
Brazil ^b			+		+	+		+
Chile ^c			+	+		+		
Colombia ^d	+	+	+	+	+	+	+	
England ^e	+	+	+	+	+	+	+	+
France ^f						+	+	
India ^g	+	+	+			+	+	
Mexico ^h	+	+	+	+		+	+	+
Netherlands ⁱ	+	+	+	+		+	+	+
New Zealand ^j	+		+	+	+		+	
Poland ^k			+				+	
South Africa ^l	+		+	+	+	+	+	
United States ^m	+	+	+	+	+	+	+	+

LEGEND: + = required

SOURCES:

^a IA 2010, IA 2011

^b MdC 2011d

^c MIDEPLAN 2011a, MIDEPLAN 2011d

^d DNP 2002, DNP 2003a, DNP 2006

^e DfT 2007, DfT 2011e, DfT 2011j, DfT 2011k

^f MEEDDM 2010

^g MoUD 2005b, MoUD 2005c, MoUD 2006

^h SHCP 2008, FONDO 2009a, FONDO 2009b

ⁱ VenW 2009, VenW 2004a

^j NZTA 2009

^k JASPERS 2008, MI 2011

^l I. Seedat, personal communication, October 5, 2011

^m FTA 2002, FTA 2010a, FTA 2010b

6.2.1.1 Assess sponsors' project and risk management capabilities

Public transport investments are complex and require close coordination between a range of groups – project sponsors, engineering firms, construction contractors, vehicle suppliers, other government agencies and the public, to name a few. JnNURM should not only require project sponsors to develop project management plans, but also assess those plans to make sure that they are reasonable. The range of considerations related to project management is broad (Hidalgo & Carrigan, 2010):

- Are adequate financial resources and staff available for project preparation, implementation and operation? What is the structure of the organization(s) that will be responsible for these activities?
- Is the community engaged in the project, both in terms of input toward its development and education on how to use it?
- How are other units of government and existing public transport operators involved in project development? If the project proposal will likely produce adverse impacts on the environment, communities, or housing, are appropriate resource agencies involved in planning for impact avoidance and mitigation?
- Does the implementing agency have all the required legal authority to implement the proposed project? What is the timetable for permitting the project?
- Will proposed fare policies and operations contracting procedures allow the project to meet operating cost and subsidy projections?
- Will the sponsor be able to ensure that the design and construction of the project are consistent with the overall project proposal? For instance, will the design and components allow the project to serve anticipated demand? Are assumptions about future maintenance costs reasonable?
- Is implementation of the project likely to worsen traffic congestion (at least in the short-term) or create other issues that might lead to public opposition?
- Is the implementation schedule realistic (i.e., developed around the time needed to construct the project rather than election cycles)?

As shown in Table 6, JnNURM is similar to other national programs in requiring project sponsors to submit some information about project management plans including organizational structure and governance, as well as responsibilities in project planning and implementation. However, JnNURM's ability to assess project management capabilities could be strengthened by requiring more detailed information from project sponsors such as:

- Contracting procedures, such as the proposed implementation approach and how construction risks will be distributed between parties
- Communication procedures, including with the public and other external stakeholders
- Quality assurance and control procedures, including processes for reviewing and accepting project documents and designs from contractors

JnNURM could require specific risks (including and beyond those related to project management) and proposed mitigation measures to be listed in the DPRs. Examples of other national programs that specify the types of risk to be considered and how they should be treated include the following:

- In *Colombia*, economic, social and environmental risks should be drawn from risk management sections of land use plans (DNP, 2006).
- In the *Netherlands*, macroeconomic risks are addressed by adding a risk premium (typically 3%) to the discount rate (VenW, 2004b).
- In *England*, guidance identifies several categories of risk and recommends using evidence from prior projects to estimate their impact and likelihood (DfT, 2011e).
- In *New Zealand*, guidance includes a detailed checklist of common risks and circumstances under which each risk might be classified as “low” or “high,” based on prior experience (see Appendix 3) (NZTA, 2010a, p. A13-6). For identified high risks, additional information about the nature of the risk, the risk’s consequences for decisions and possible treatment strategies must be provided.

To achieve this, there must be capacity within the state or central government to review project risk management plans and provide feedback to project sponsors (see 6.2.2 on Capacity Building). JnNURM should also withhold project approval and funding until project risks and management plans meet specific standards. Examples of this being done in other countries include:

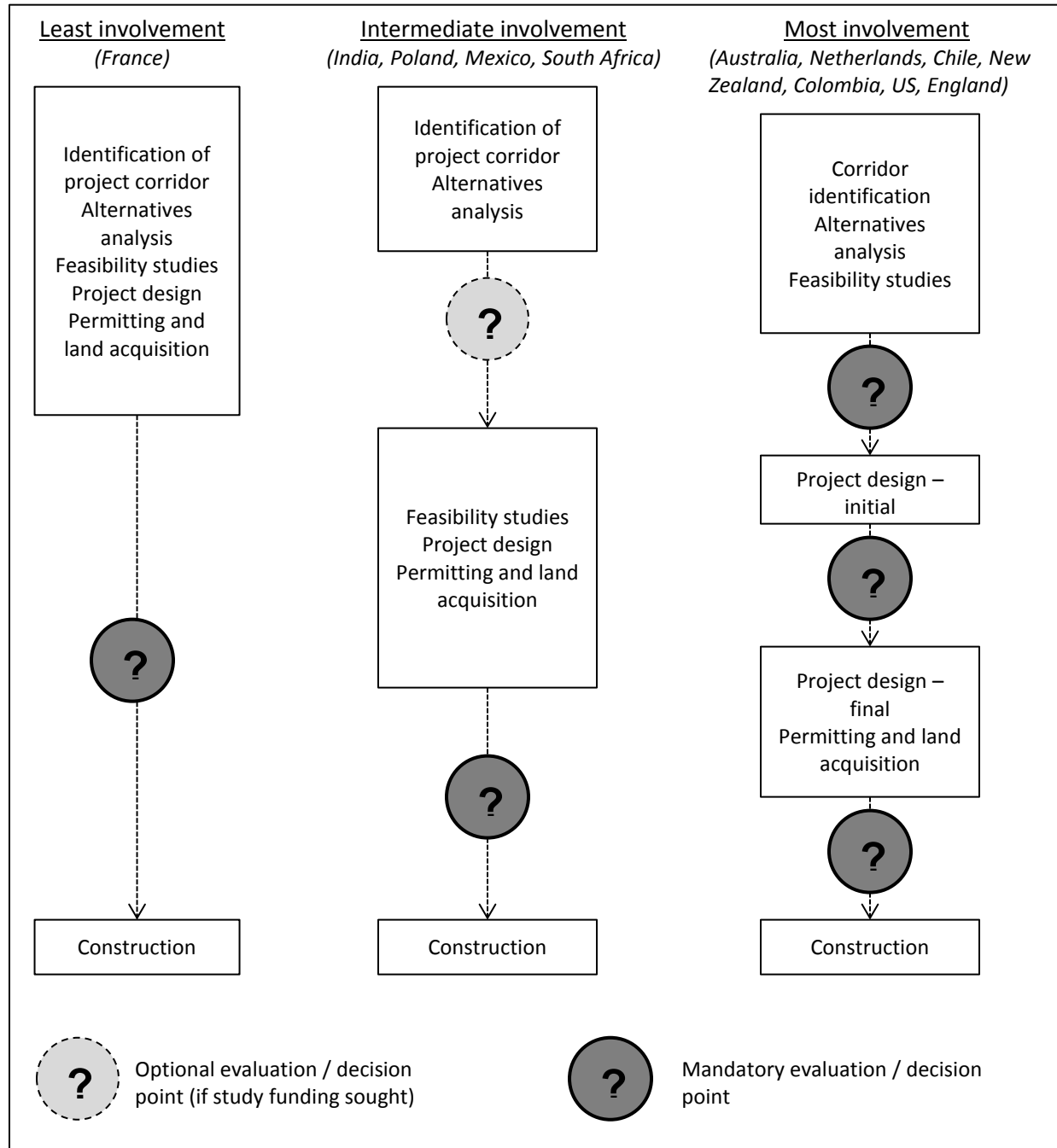
- In *South Africa*, project sponsors deliver in-person budget request presentations that include discussions of project management approaches (B. Stanway, personal communication, June 29, 2011).
- In *England* and the *United States*, independent consultants that work for the respective national governments provide feedback on project management approaches to the sponsors of higher-cost projects, with the reviews coinciding with project evaluation points (DfT, 2007; FTA, 2011b).
- In the *Netherlands*, guidance specifies the project and risk management steps that must be taken during each stage of project development and the standards for each approval point (VenW, 2009).

The assessment of sponsor's project and risk management capabilities can be improved if an expert team visits and interacts with city officials and makes an assessment.

6.2.1.2 Include quantifiable risks in cost estimates

JnNURM should require project cost estimates to reflect identified risks. Underestimation of capital costs is common in large transport projects: in a study of 258 large transport projects constructed over several decades, overruns occurred in nine of every ten projects, with the average overrun ranging from 20 percent for road projects to 45 percent for rail projects (Flyvbjerg et al., 2003). In addition to not accounting for risks, sponsors may willfully understate costs to bias alternatives analysis and ensure that preferred projects qualify for competitive national funding (Flyvbjerg et al., 2003).

Figure 13: Examples of Project Development Structures and Evaluation Points



SOURCES: IA 2011; MdC 2011a; MIDEPLAN 2011a; DNP 2006; DfT 2011h; MEEDDM 2010; MoUD 2005a; FONDO 2009a; VenW 2009; NZTA 2009; MI 2011; I. Seedat, personal communication, October 5, 2011; SAFETEA-LU 2008

Developing cost estimate for DPRs should involve three primary steps:

- Development of **base cost estimates**, using figures from comparable projects, historical experience and construction bids. As one example, project sponsors in the *United States* can use a database of actual costs from completed projects to develop cost estimates (http://www.fta.dot.gov/12305_11951.html).
- **Adjustment of the base cost estimates for risk.** In *England, New Zealand* and the *United States*, a probabilistic range of cost estimates for each project is then developed based on the costs and likelihood of risks (DfT, 2011e; NZTA, 2009; FTA, 2010). In *England*, the expected value (average) of these costs is taken as the risk-adjusted cost.
- **Adjustment of cost for unquantifiable but likely cost increases.** In *England*, cost estimates are inflated to account for estimation errors and sponsors' intentional underestimation (DfT, 2011e). The amount of the "optimism bias uplift" depends on the transport mode and development phase of the project (DfT, 2011e, p. 21). For most mass transit projects, the recommended inflation percentage is 44 to 66 percent for the initial estimate, falling to three to six percent at the point of approval of construction funds.

6.2.1.3 Evaluate projects at multiple points before construction

Evaluating projects at multiple points during planning and construction would allow the state and national government to monitor changes in costs, benefits, scopes and schedules. This would also enable the state and central government to track sponsors' development of their project management capabilities and provide technical advice where needed. In addition, clearly defined evaluation points ensure that projects are assessed at comparable stages of development, thus facilitating relevant comparisons of rationale and deliverability. Ideally these evaluations would precede the four JnNURM funding installments and the disbursements would be contingent upon a satisfactory evaluation. Seven countries employ multiple evaluation points, with the initial evaluation occurring around the time of the alternatives analysis process. In these programs, evaluations function as "a sieve, rather than a funnel" of milestones that must simply be passed (VenW, 2009, p. 9, "een zeef, in plaats van een trechter" in original).

6.2.1.4 Require ex-post monitoring, reporting and evaluation

Ex-post evaluations compare projects' performance against their intended objectives and projected benefits, costs and schedules. The variance between actual and projected costs and implementation schedule should be reported in order to highlight the inaccuracy of project cost and performance projections and the reasons for discrepancies. Based on this feedback, MoUD could take appropriate steps to further refine program procedures and guidance.

JnNURM should also require ex-post evaluation of funded projects to assess whether estimated key performance indicators (people served, mode share, travel time, fatalities and emissions) have been

met. This ex-post evaluation will complement the required monitoring, reporting and verification of the CMP. The completed JnNURM projects will be evaluated for their performance against the estimated KPIs submitted with the DPR and funding request – the same citywide KPIs included in the CMPs. If individual projects are meeting their stated performance goals, then the city should be making progress towards the citywide targets laid out in the CMP.

Several national programs require ex-post evaluations of projects after they begin operations. In *Chile*, simplified ex-post evaluations that focus on project costs and implementation schedules are performed on all projects (MIDEPLAN, 2011a). In *France*, on the other hand, the full range of benefits and costs – including benefits to users, mode shifts to transit, socioeconomic returns, profitability, environmental impacts and land use impacts – must be examined for all projects within five years of completion (MEEDDM, 2010).

6.2.2 Increase capacities to develop, evaluate and implement projects

A rigorous decision-making framework that incorporates deliverability and readiness considerations will matter little unless project sponsors have the capacity to develop and manage complex projects, and state and national government agencies have the capacity to assess project proposals. Capacity building at all levels of government was highlighted in many expert interviews as a critical limitation of JnNURM²⁴.

Examples of other national programs' approaches to capacity building include:

- In *Australia* and *New Zealand* for example, independent consultants provide a level of scrutiny beyond that of the agencies that administer the programs (IA, 2011; NZTA, 2009).
- *South Africa's* Department of Transport offers to provide technical assistance to sponsors to guide the transition to increased municipal coordination of services, which is one of the requirements to receive funding for mass transit projects (DoT, 2011). Assistance may take the form of workshops or site visits.
- *Colombia's* National Department of Planning has implemented a capacity-building program for the new companies that oversee implementation and operation of mass transit projects (DNP, 2002; DNP, 2003b). The program addresses key roles and processes of the agencies, as well as ways that the companies can generate ancillary income. The department also facilitates information exchanges between cities that are developing projects.
- The *New Zealand* Transport Agency provides guidance to project sponsors on program policies and procedures, good practices in project management and aspects of their proposals that require improvement (NZTA, 2009). Guidance articulates several areas in which the agency will be involved for each stage of project development.

²⁴ This limitation has received attention at the highest level in the Government and MOUD has already launched an ambitious program for capacity building in urban transport. The program, under development in 2012, is funded by UNDP and the World Bank, and is helping to advance this critical aspect.

- *England's* Department for Transport encourages contact from sponsors early in the project development process, particularly with respect to technical matters such as data collection and travel forecasting (DfT, 2007). Assistance may include informal reviews of draft project submittals.

Currently under JnNURM, only 2 percent of total project costs can be utilized for project planning. There is an additional scheme whereby MoUD will reimburse up to 80% of the cost of preparing the Comprehensive Mobility Plans or Detailed Project Reports for public transport or non-motorized transport. To help facilitate local capacity building and increase the quality of project plans, JnNURM could provide more dedicated upfront grant funding for alternatives analysis and preparation of DPRs. Delaying the deadline for funding proposals in the next round of JnNURM by two years would allow cities to complete current projects and then devote more time to project planning for new projects which should help to improve project development. Alternatively, a longer preparation period could be granted for the more complex, integrated transport projects, so that they are planned properly.

Mechanisms for providing technical assistance to cities on project planning and implementation, and to state and national agencies on project evaluation and monitoring should be built into JnNURM. This can include leveraging resources outside of government – including multilateral development banks, non-governmental organizations, local universities and private-sector entities. Public-private partnerships could be effective ways to enhance project planning and implementation capacity. Likewise JnNURM could short-list consultants as a resource for urban transport projects (as was done for urban infrastructure) and could require that projects using international consultants also include local partners for knowledge transfer.

Finally, capacity building efforts should also aim to improve communications and outreach skills of project staff at all levels of government. Vital to the success of public transportation projects is government agencies' ability to effectively communicate to internal and external stakeholders. This includes proactively communicating with the Indian media about the priorities under JnNURM and funded projects; promoting the features and benefits of new transit systems to users; and informing the public about construction schedules, traffic disruptions and alternate routes (Weber et al, 2011). Workshops, trainings and study tours could be effective in improving communication and outreach capacity.

6.3 Pillar 3: Facilitate Local Buy-in

The decision-making process for India's national mass transit investments ought to consider the interests of State governments and Urban Local Bodies. The success of urban and metropolitan mass transit projects depends on strong local interest, as state agencies typically operate transport and local governments make the land use decisions that influence projects' effectiveness. JnNURM already requires the ULBs to develop Detailed Project Reports which contributes to the local government having more interest in the project development. Furthermore requiring state and local funding shares (for all

but the lowest income states) helps ensure local governments are more committed to the projects than if the projects were fully funded by the central government.

Like India, many national transit programs, require or strongly encourage consistency between proposed projects and transportation planning processes. In many cases, the requirement to produce the plans is independent of the mass transit investment program or the plans serve a broader purpose beyond qualifying sponsors to receive mass transit funds. The legal contexts of these comprehensive planning requirements differ by country:

- In *New Zealand*, projects that are advanced for funding consideration typically derive from short-term plans developed by regional transport planning bodies (NZTA, 2009). The plans in turn serve as the implementing mechanism for higher-level, long-term regional transport strategies, which are developed in consideration of regional conditions and national transport policies.
- In *England*, projects are derived from and must support the objectives of local transport plans (DfT, 2007). The plans, which are required by law, are expected to contribute to national transportation goals that include economic growth, reduced carbon emissions, enhanced travel safety and public health, and improved quality of life (DfT, 2009c).
- In *France*, any city with over 100,000 inhabitants must produce an urban mobility plan (PDU), and smaller cities are encouraged to do so as well (Hylén & Pharoah, 2002; ELTIS, 2011). PDUs must prioritize development of public transport and non-motorized modes, specify measures to reduce use of automobiles and provide timelines for implementing proposed strategies (ELTIS, 2011). Proposed projects are expected to be consistent with PDUs, or in smaller cities, with policies articulated in local or regional development plans (MEEDDM, 2010).

One opportunity for JnNURM to increase local buy-in would be to strengthen the link between the proposed project and locally driven urban/transport planning processes. Cities are meeting the rote JnNURM requirements for completing Comprehensive Mobility Plans, but with low-quality results. CMPs should clarify the project's role in the local transport network, including its relationship to existing public transport services and other modes. Detailed Project Reports should demonstrate that existing and proposed development will support the project, and vice versa. Beyond requiring that existing local transport or development plans describe proposed projects in detail, which may bias the alternatives analysis, JnNURM should require that proposed projects address a key mobility problem identified in the CMP and CDP.

Establishing a State Urban Transport Policy could be one additional instrument through which to build local buy-in for the National program. If projects funded under JnNURM are aligned with key development priorities of the State Urban Transport Policy, it may be more likely for State-level agencies to facilitate their implementation.

Under JnNURM, consistency with local development plans should be a criterion for project approval. State Level Nodal Agencies should only recommend to MoUD projects that are prioritized in the CMP, ensuring the project will be consistent with the objective and goals of the local development plan. This approach has been adopted by other countries:

- In *England*, projects' consistency with land use policies and plans at the local, regional and national levels is assessed, in particular whether the project furthers or hinders plans and policies (DfT, 2003e).
- In *France*, projects are assessed for consistency with local development plans, as well as their spatial relationships with major destinations and areas of planned development (MEEDDM, 2010). The assessment also considers whether zoning changes are planned that would accommodate the project.
- In *New Zealand*, one evaluation criterion considers the integration of proposed projects with land use and other infrastructure (NZTA, 2009). The national government's policy for transport planning encourages coordination with land use planning, including with respect to locating new development near public transport and increasing urban development densities (NZTA, 2009).
- In the *United States*, projects' consistency with existing and planned land use is assessed through two criteria. One criterion focuses on existing conditions, including the quantity and character of development, extent of pedestrian facilities and parking supply (FTA, 2011a). Under this criterion, projects' ratings are primarily based on quantitative elements, such as population and employment densities near stations (FTA, 2004). The other criterion centers on the degree to which land use plans and policies support transit oriented development and are consistent with a mass transit project, as well as past performance of the locality in implementing such plans and policies (FTA, 2011a). Guidance indicates the conditions that warrant certain ratings and how these conditions should be measured (FTA, 2011a; FTA, 2004).

7 Longer-term Improvements for Subsequent Phases

In addition to the recommendations presented in preceding sections, there are opportunities to further improving JnNURM in subsequent phases. These additional recommendations would help strengthen the project selection rationale and improve project deliverability.

7.1.1 Pillar 1: Define Project Rationale

7.1.1.1 *Require sensitivity analysis*

In addition to providing clear guidance on how to conduct cost-benefit analysis, JnNURM could require project sponsors to include sensitivity analysis to assess how the projected costs and benefits may change under different assumptions. This would indicate the uncertainty associated with the estimates of project impacts. Clear guidance to project sponsors should specify which factors to apply the sensitivity analysis to, such as:

- The **discount rate**, the factor by which future costs and benefits are discounted to reflect their diminished value relative to those occurring now (Small, 1999). For instance, *Australia's* program requires sponsors to assess their projects under three discount rates: 4%, 7% and 10% (IA, 2010) as a form of sensitivity analysis.
- **Anticipated benefits and costs.** Over-prediction of demand and underestimation of costs are common to large infrastructure projects (Flyvbjerg, Bruzelius & Rothengatter, 2003). This has been a problem in Indian urban transport projects as well²⁵. To address this, *Poland's* guidance specifies that sensitivity analysis should consider 15% reduction in passenger demand and 25% increase in capital costs (JASPERS 2008). Guidance *Chile* specifies ranges of variation for key variables (CTU, 1988). *England's* program requires cost estimates to incorporate risks as well as inflation factors to account for chronic underestimation of project costs (DfT, 2011e). Population and economic growth, including development patterns around mass transit projects, constitute another area of uncertainty (DfT, 2011d; IA, 2010; RWS, 2010a).
- **Prices to use in valuation**, for instance to account for fluctuations in global oil prices or the value of carbon (Mackie & Nellthorp, 2001; IA, 2010; DfT, 2011f).

7.1.1.2 Account for non-monetized costs and benefits

In subsequent revisions to JnNURM, project evaluation may be expanded to include quantitative and qualitative factors that cannot be monetized but are still important to consider in project funding decisions. These non-monetized factors could be directly linked to objectives set forth in NUTP. This approach is taken in several other national programs. In *England*, projects are rated based upon their cost-benefit analysis results, and this rating may be adjusted based on the inclusion of significant non-monetizable costs and benefits in the analysis (DfT, 2011h). In *New Zealand*, cost-benefit analysis results account for approximately one-third of a project's overall rating while two qualitative criteria that encompass strategic and policy factors account for two-thirds of the rating (NZTA, 2009).

Many costs and benefits of mass transit investments are not included in cost-benefit analysis because they cannot be monetized or are strategic in nature. Such costs and benefits – which include quantitative, qualitative and distributional factors – may constitute an important part of the rationale for a project and so should be included in project evaluations. As with cost-benefit analysis, guidance for assessing non-monetized costs and benefits should be clear, specifying how the factors are measured and assessed in the overall project evaluation process.

JnNURM could be revised to recommend the Detailed Project Reports consider several quantitative and qualitative factors, including:

²⁵ Approved costs of the Rajkot BRTS system were Rs 110 crores while the actual costs exceed Rs 165 crores. The original cost estimate of the Delhi Metro as Rs 4,860 crores and the actual costs are about Rs 11,000 crores. Ridership reports from the metro indicate the system is only operating at 30-50% capacity (K.C. Sivaramakrishnan, 2011)

- **Economic factors** including indirect economic benefits. Such benefits result from the correction of imperfect land, labor or goods markets through creation of economies of scale, substantial travel time reductions, major employment shifts or significant changes in land prices (Mackie & Nellthorp, 2001, p. 168; VenW, 2008). The benefits are challenging to measure, and even where they can be monetized, their value is typically small relative to direct benefits (Mackie & Nellthorp, 2001). Programs in *England*, *Australia*, the Netherlands and *New Zealand* require evaluation of indirect economic benefits for larger projects or in cases where imperfect markets may exist (DfT, 2009a; IA, 2010; VenW, 2008; NZTA, 2010a; NZTA, 2010b).
- **Environmental factors** include impacts that are difficult to monetize or quantify, including impacts on air and water quality, heritage sites, landscapes and habitats. Where the impacts can be quantified, they may be reported in terms of the amount of land affected, or the changes in the volume of pollutant that would be generated (e.g., RWS, 2010a; MEEDDM, 2010). Alternatively, impacts can be described qualitatively or rated on a scale of magnitude (e.g., DfT, 2003b; DfT, 2004a; IA, 2010).
- **Service quality factors** include impacts on travel time reliability and the overall quality of the public transport service. Reliability may be quantified, in terms of the likelihood and potential magnitude of delays (DfT, 2009b). Travel quality, on the other hand, may be described qualitatively or rated on a scale, based on changes to the atmosphere and aesthetics aboard vehicles and at stations (DfT, 2003c; DfT, 2003d).
- **Policy and strategic consistency factors** include alignment with national objectives. For example, in *Colombia*, metropolitan areas that receive mass transit funding must increase their control over local public transport services, including coordination of connecting routes to support the project (DNP, 2003b). Under JnNURM cities and states must already commit to governance reforms (including public participation, taxation and accessibility of government services) as a condition of receiving funds (MoUD, 2005b). But in new versions of JnNURM, proposed projects could be rated for strategic consistency, such as how well they align with MoUD's Avoid-Shift-Improve vision. Projects with better strategic alignment would be prioritized for funding. This is done in *New Zealand* where the potential "strategic fit" of the project concept with national surface transport objectives is rated (NZTA, 2009, p. B4-12).

7.1.1.3 Require distributional analysis

Distributional analysis identifies a project's impacts on particular social groups or geographies. As results of socioeconomic analyses do not provide these details, future versions of JnNURM could consider requiring parallel evaluations of projects' distributional impacts of costs and benefits. Analysis may extend across a range of groups or focus on disadvantaged groups. In *Chile*, project sponsors must assess impacts on a range of groups, including users of different travel modes, transport operators, construction firms and the government (CTU, 1988). In the *United States*, one evaluation criterion assesses the share of a project's travel time benefits accruing to "transit-dependent" populations relative to their concentration in the region (FTA, 2011a, p. 19). The precise definition of "transit-dependent" varies by metropolitan area, but generally encompasses households that do not own motor vehicles or fall into the lowest income group (FTA, 2011a). In *England*, project sponsors must consider

how a project's benefits and externalities would be borne by low-income or "vulnerable" populations, such as the elderly, minorities and people that do not own personal vehicles (DfT, 2011g).

7.1.2 Pillar 2: Ensure Deliverability

7.1.2.1 Provide incentives for delivering projects

JnNURM could develop financial incentives for cities to complete projects on time and budget. For instance, subsequent projects could only be sanctioned once the current is successfully completed, or cities could be reimbursed a percentage of their funding share if the project is completed on time. Cities who demonstrate a track record for implementing high-quality projects could be given preferential funding in subsequent rounds.

7.1.2.2 Limit access to additional funding in the case of cost overruns

Future versions of JnNURM could incentivize accurate cost estimates by capping additional national funding in case of project cost overruns. For instance, in *New Zealand*, the national government will only support cost overruns in proportion to its funding share in the original agreement, provided that risks have been properly distributed between project sponsors and contractors (NZTA, 2009). For *Chile* to fund more than 110 percent of the agreed upon project costs, sponsors must prepare a detailed justification of the cost overrun and an economic reevaluation of the project (Ministerio de Planificación [MIDEPLAN], 2011a); the overruns may not be caused by changes in the scope of the project. *England* and the *United States* assign all cost overruns to the project sponsor (DfT, 2011i; FTA, 2011b)²⁶, but this approach may not be appropriate in India where project delivery experience is low. JnNURM should aim to limit project risk and cover some but not all cost overruns.

8 Conclusions and Recommendations

8.1 Summary of JnNURM Recommendations

This report provides key recommendations for improving the 12th five year plan:

- Reinforce the NUPT by utilizing the utilizing the Avoid-Shift-Improve framework to guide land use and transport planning.
- Advance the preparation and implementation of the Comprehensive Mobility Plans (CMPs) as a required part of the Master Plan and align with JnNURM budget allocations, to transform them from simple lists of projects and good will, to effective planning and monitoring instruments.
- Introduce performance measurement of key transport indicators at the city wide level to focus on results rather than infrastructure supply or funding disbursement. Key performance

²⁶ In *England*, the maximum contribution is based on the optimism bias-adjusted initial estimate; in the *United States*, the contribution is specified in the construction grant agreement.

indicators ought to include people served, modal share, travel time, traffic fatalities and transport tailpipe emissions.

- Improve the JnNURM program administration and implementation.
 - **Define project rationale.** A proposed project should result from a clear definition of need and comparison of alternative strategies. It should also be appropriately scaled to solve the problem at hand, with costs and benefits compared. The technical evaluation process should be transparent and free of political influence.
 - **Identify project need and analyze alternatives.** Proposed projects should result from a thorough examination of the transport problem at hand and an assessment of alternative investments and policies, including lower-cost options that address the same problem. This should include not only capital investments, but also operational improvements. The process should encourage consideration of policy and regulatory changes to ensure the sustainability of the project and lessen the need for future investments.
 - **Compare project costs and benefits** to assess whether proposed projects represent a good use of limited resources and are reasonably scaled to solve the problem at hand. For transparency's sake, the comparison should include non-monetizable reasons for pursuing a project in addition to socioeconomic factors. Guidance to project sponsors should clearly indicate how the national government will measure and present evaluation criteria for decision-makers' consideration, including the procedures for analyses of costs and benefits that sponsors must conduct.
 - **Keep politics out of technical evaluations** to facilitate transparency in the development of the case for a project. Separation of the individuals that conduct technical analyses from those making funding decisions needs to be clear, such that the latter cannot intervene in analyses.
 - **Ensure deliverability.** A proposed project should not have significant outstanding risks that could threaten its successful implementation. Also, the project sponsor should have adequate capacity to implement the project – which depends on access to technical support from the national government and other institutions with mass transit expertise.
 - **Assess risks** to projects' costs, scopes and schedules and ensuring that sponsors adopt risk and impact mitigation procedures. JnNURM can take several steps to reduce risks, including assessing the reasonability of project management plans and viability of project designs. It can also incorporate quantifiable risks into capital cost estimates. Risks can be tracked through multiple evaluations of projects' scopes, schedules, costs and benefits during project development. Ex-post monitoring, reporting and evaluation of projects to compare projects' performance against their intended objectives and projected benefits, costs and schedules.

- **Increase the capacity** of project sponsors to develop, implement and operate projects. The State and central government must also be equipped with the knowledge to administer the programs effectively, evaluate projects and provide assistance to cities on critical project development matters.
- **Facilitate local buy-in.** A proposed project should be a priority for the local agencies that will implement and operate it. Local governments should therefore lead project planning and development and help to fund project implementation. Projects should also be consistent with – and ideally derive from – existing local transport and development plans. Under JnNURM, consistency between DPRs and CMPs should be a criterion for project approval.
- Further suggestions for improving program administration and implementation for future consideration:
 - Require sensitivity analysis of projected costs and benefits
 - Require accounting of non-monetized costs and benefits
 - Require distributional impact analysis
 - Provide incentives for delivering projects on schedule and budget
 - Limit access to additional funding in the case of cost overruns

8.2 For Further Study

There are several aspects of JnNURM and NUTP that may be improved with further analysis.

8.2.1 Capacity Building

This report would be enhanced by a further study of capacity building programs. It would be useful to examine successful project planning, evaluation and implementation capacity building programs from other countries' national transit investment programs, development banks, academic institutions and NGOs. In addition, it would be helpful to examine why capacity building efforts under JnNURM have been unsuccessful, in order to develop more effective capacity building programs. This study concludes that there is a clear need for additional capacity at the national, state and city level, but more information is needed to develop effective capacity building programs.

8.2.2 Comprehensive Mobility Plans

Further research efforts should focus on identifying international examples of high quality comprehensive mobility planning, and clarify what a high-quality CMP ought to include. Existing CMP preparation guidelines could be improved to clarify:

- How to prepare a CMP
- Who the target audience is
- What it's geographic coverage should be
- Who has responsibility for approving and implementing the CMP?
- What level of sanctity and legal backing does it have?

As this report discusses, it is important for the CMPs to include measurements of key performance indicators to track the city's progress towards desired outcomes. Establishing the baseline, or current, performance for each of the indicators is a critical first step for monitoring and reporting progress. Detailed guidance for cities on how to conduct this baseline analysis should be provided, as well as how to conduct periodic data collection and analysis to monitor progress.

If the CMP specifies that the city's key performance indicators include travel time savings, the budget should include investment in policies and projects that demonstrate potential travel time savings. Guidance should be provided to cities on how to evaluate which policies and projects are most aligned with the vision and outcomes detailed in the CMP.

8.2.3 Integrated Land Use and Transport Planning

This report recommends integrating land use and transport planning, relying on the Avoid-Shift-Improve framework to guide planning and policy choices. JnNURM could be further strengthened with specific guidance on integrated land use and transport planning. Drawing from international best practice and relevant Indian examples, a methodology should be developed that explains how to complete land use and transport planning. The institutional arrangements for successfully integrating urban spatial planning with transport should also be clearly defined.

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10 Appendices

10.1 Appendix 1: JnNURM Background

Jawaharlal Nehru National Urban Renewal Mission (JnNURM) is an urban renewal scheme that was inaugurated on 3 December 2005. This 7 year mission aims to encourage reforms and fast track planned development of identified cities with focus on efficiency in urban infrastructure and service delivery mechanisms, community participation, and accountability of Urban Local Body (ULBs) / parastatal agencies towards citizens.

Under JnNURM, the central government provides financial assistance to the ULBs and parastatal agencies which could deploy these funds for implementing the projects themselves or through the special purpose vehicles (SPVs) that may be expected to be set up. This financial assistance provided by Central Government comes as 100 percent central grant to the implementing agencies.

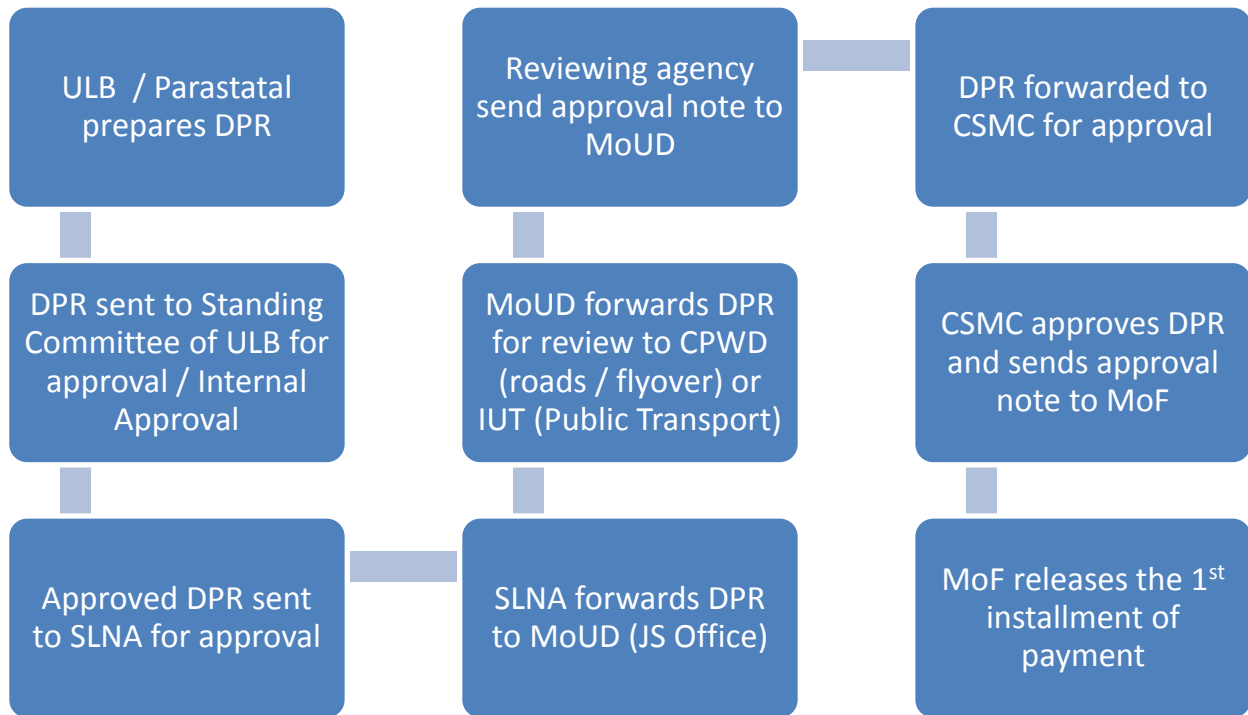
JnNURM involves investment of over US\$20 billion over a seven year period in two sub-missions, namely:

- Sub-Mission for Urban Infrastructure and Governance that focuses on water supply and sanitation, solid waste management, road network, urban transport and redevelopment of old city areas. This sub mission is administered by the Ministry of Urban Development (MoUD)
- Sub-Mission for Basic Services to the Urban Poor (BSUP) that focuses on integrated development of slums. This submission is administered by the Ministry of Housing and Urban Poverty Alleviation (MHUPA)

The JnNURM functions under the overall guidance and supervision of a National Steering Group (NSG) which is chaired by the Minister of Urban Development and co-chaired by the Minister of State for Urban Employment and Poverty Alleviation respectively. The NSG sets up policies for implementation, monitor and review progress, and suggests correctives measures where necessary. The NSG is supported by a Technical Advisory Group (TAG) whose task is to appraise proposals, and a Central Sanctioning and Monitoring Committee (CSMC) responsible for further appraising and sanctioning proposals. At the state level, the JnNURM is coordinated by the State Level Steering Committees and is headed by the Chief Minister. The State Level Steering Committee reviews and prioritizes proposals for inclusion in the JnNURM. The State Level Committee is supported by State Level Nodal Agency (SLNA) which invites project proposals, appraises them, and manages and monitors the JNNURM.

Every city is expected to formulate a City Development Plan (CDP) indicating policies, programs and strategies, and financing plans. The CDP would include identification of projects leading to the formulation of Detailed Project Reports (DPRs). In case of Transportation Projects, the cities also need to prepare a Comprehensive Mobility Plan that addresses long term mobility needs to the city. The Urban Local Bodies (ULBs) / Parastatal agencies have to prepare DPRs for undertaking projects in the identified spheres.

Figure 14: JnNURM Project Approval Framework for Urban Transport Projects



Legend:

- ULB – Urban Local Body (Municipal Corporation)
- MoUD – Ministry of Urban Development
- DPR – Detail Project Report
- CSMC – Central Sanctioning & Monitoring Committee
- PWD – Central Public Works Department
- IUT – Institute of Urban Transport
- JS – Joint Secretary
- MoF – Ministry of Finance

10.2 Appendix 2: Summary of Expert Interview Responses

Dimension	Opportunities for Improvement
Program structure	<ul style="list-style-type: none"> • Central government should categorize cities by size/need and contribute more or less % of project costs based on that categorization. • National government should develop generic guidelines for the country, while allowing some localization. • Disbursed JnNURM funding has not altered behavior/trends.
Comprehensive Planning	<ul style="list-style-type: none"> • Low-carbon development should be a cross-sectoral priority. • Planning policies need to complement each other and support a common goal • Cities lack unified vision for their urban plans partly because of weak institutions and lack of capacity in those institutions. • There is currently no long term planning • Government of India is trying to standardize the entire country’s urban transport design, when they should be helping cities develop comprehensive visions and plans for the city. • Rapid urbanization is the most urgent problem facing Indian cities, more so than any other development problem • India hasn’t given sufficient thought to the relationship between urban transport and urban form. • There is no incentive for a city to do a thorough CMP if they’ll receive the funding regardless of the quality of the CMP. • Rushed deadlines for Detailed Project Reports lead to cities using outdated transport data and project costs. • Weaker CMPs are the result of inexperience, lack of knowledge • CMPs are collections of projects, not comprehensive and strategic plans • Cities are allowed to cherry pick the CMP. For instance the CMP may include a BRT, the city says they’re doing a BRT but only widen the road for BRT and never build the BRT • With a lack of templates and guidelines, cities are creating CMPs from scratch
Decision-making	<ul style="list-style-type: none"> • Decision making is JnNURM’s biggest weakness. • Administrative reform is needed to streamline decision making • JnNURM should select projects for funding based on alternatives analysis instead of the list of projects in CMPs/CDPs • Establishing Key Performance Indicators for cities/projects would be incredibly useful. KPIs would help to standardize project evaluation and help focus people on the right impacts (mobility, travel time savings etc) and

	<p>make long-term planning more of a priority.</p> <ul style="list-style-type: none"> • JnNURM lacks objective criteria for cities to prioritize their projects, or for project selection by the state and central government. • More in-depth and rigorous project review is needed. • For the most part the Indian transport models are garbage and lack rigorous baselines and household surveys. JnNURM should fund rigorous baselines that assess all modes • During project selection/evaluation, decision makers should consider the degree of coordination the project requires. How many agencies are involved? Are legislative changes needed? Has the project been tried before?
Local/political buy-in	<ul style="list-style-type: none"> • JnNURM needs to empower cities while also holding them accountable. e • There is currently no mechanism for stakeholders to provide input on projects • Local buy-in requires openness and transparency, which is currently lacking • Cities need to develop solutions that are locally appropriate, and internalized by local bodies • The current JnNURM is too top down, and lacks local buy-in • There is limited local buy-in because the process is driven by the state, since the stats, not the cities, have the funding.
Capacity building	<ul style="list-style-type: none"> • The scale of India’s capacity needs is enormous. • Need to build capacity within MoUD and State governments to evaluate projects. • State Missions also need advisory capacity to help cities understand what options/alternatives could be considered. • Cities are meeting the rote JnNURM requirements but with low quality outputs because of capacity constraints. • Cities don’t have the capacity to spend the money – there’s a lack of “absorption capacity” • India needs to not only build internal capacity, but also the capacity of external, private consultants. • Capacity building is not institutionalized yet
Deliverability	<ul style="list-style-type: none"> • Focus of JnNURM has been on dispersing money, not on delivering projects • The ability to deliver projects under JnNURM is India’s biggest weakness. • JnNURM sanctioned too many projects too quickly and there is insufficient capacity to implement them all. • There are insufficient conditions on funds disbursement (i.e. stakeholder consultation, project quality). • Guidance documents exist, but they are not used so there is a general lack of understanding about how to prepare project documents. • Under the current program, there are many potential sources of project delivery delay. • Cost overruns are common

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| | <ul style="list-style-type: none">• Project changes and cost overruns often occur because of inexperience with new technologies/concepts, and lack of required level of integrated/multidisciplinary teams need for planning & implementation• Delayed funding disbursements are common and can contribute to project delays and cost overruns.• Overlapping authority is a deliverability challenge. Development Authorities control land in cities, but the Municipal Corporation (ULB) is expected to deliver transport projects with no funding mechanism only property tax. |
|--|--|

10.3 Appendix 3: Auto-mobility and Sustainable Transport in Latin American Cities

As India continues to urbanize, it may be possible to draw lessons from Latin America and the Caribbean, a developing region of the world that has already achieved significant levels of urbanization. Between 1972 and 2000 urban population in this region grew from 176 million to 391 million (59% to 75% of the total population).²⁷ Not all the cities in the region followed similar patterns as indicated by Figure 15. While some cities became dense (Bogota, Caracas, Rio de Janeiro and Lima, with more than 10,000 people per square kilometer), other cities became sparse (Buenos Aires and San Jose, with less than 5,000 people per square kilometer). At the same time, with the notable exception of Buenos Aires which became auto-dependent, the Latin American cities kept most of the trips in sustainable modes – walking, biking and public transportation share 70% or more of the total trips (Figure 16).

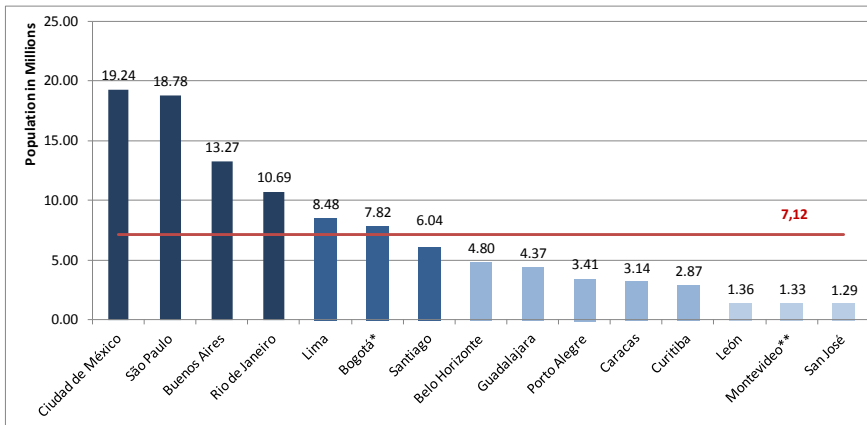
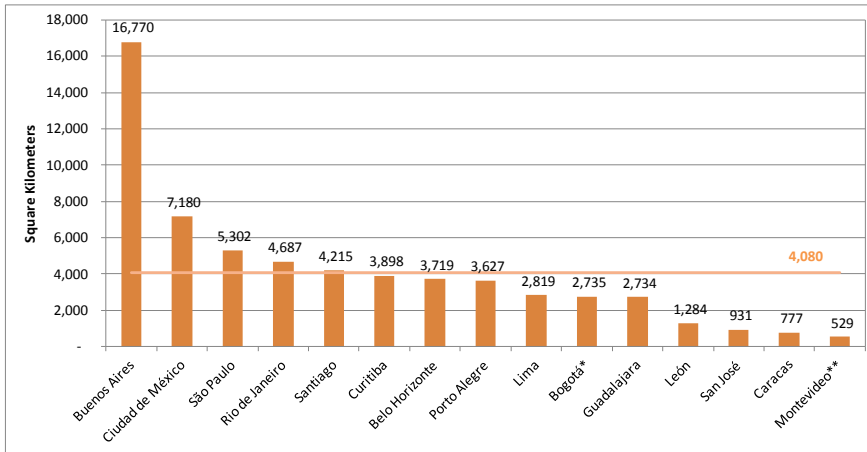
One remarkable observation for the Latin American countries is that density has a high correlation with modal share. As indicated in Figure 17, the higher the density the higher the share of sustainable transport modes –walking, biking and public transportation. About half of the variability in modal share among cities is explained by density alone.²⁸

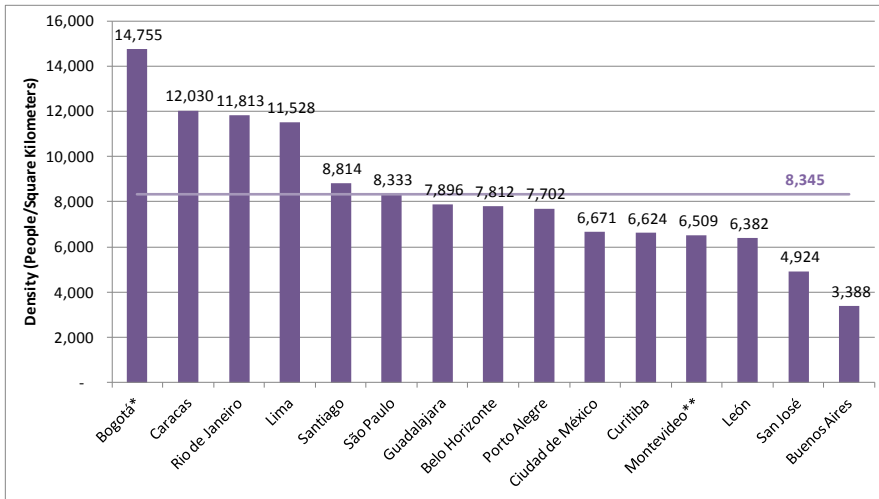
The impact of such development patterns (density) and modal shares can be measured in key sustainability impacts. For instance travel time (indicator of economic efficiency), traffic fatalities (indicator of social impacts), and emissions (indicator of environmental impacts). Figure 18 shows the data for selected Latin American cities. It is significant to note that the Latin American data shows that the higher the automobile use, the larger the impact on traffic fatalities and emissions (Figure 19). In other words, traffic fatalities and emissions are correlated with auto-mobility. However, the increase in automobiles does not result in reductions in travel time. Despite the fact that automobiles can move faster than people on foot, bike or buses, the increase in vehicles on the road causes congestion.

²⁷ <http://www.centrogeo.org.mx/unep/documentos/Geo-3/Chapter2urban.pdf>

²⁸ Other factors may be the availability of facilities and services, level of service, public transport user fares, income and cultural issues

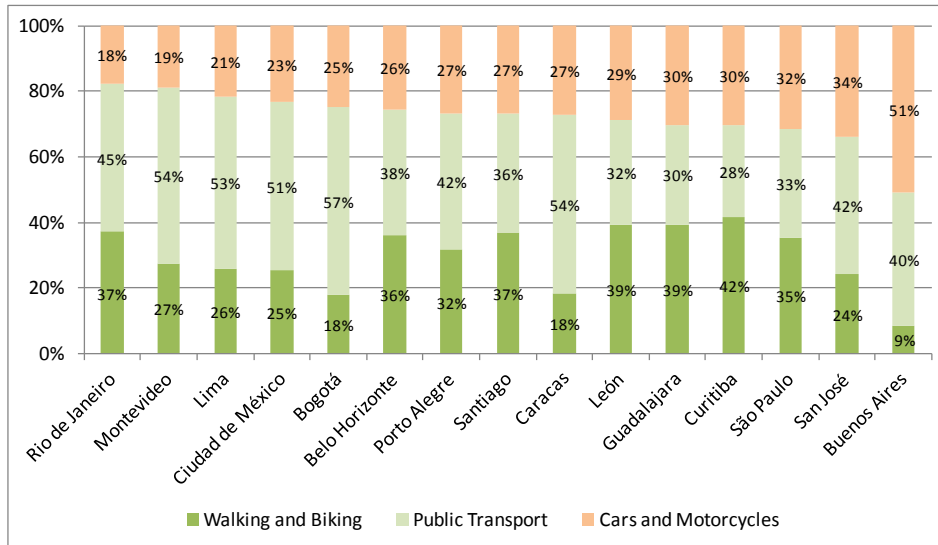
Figure 15: Area, Population and Density in Selected Latin American Cities





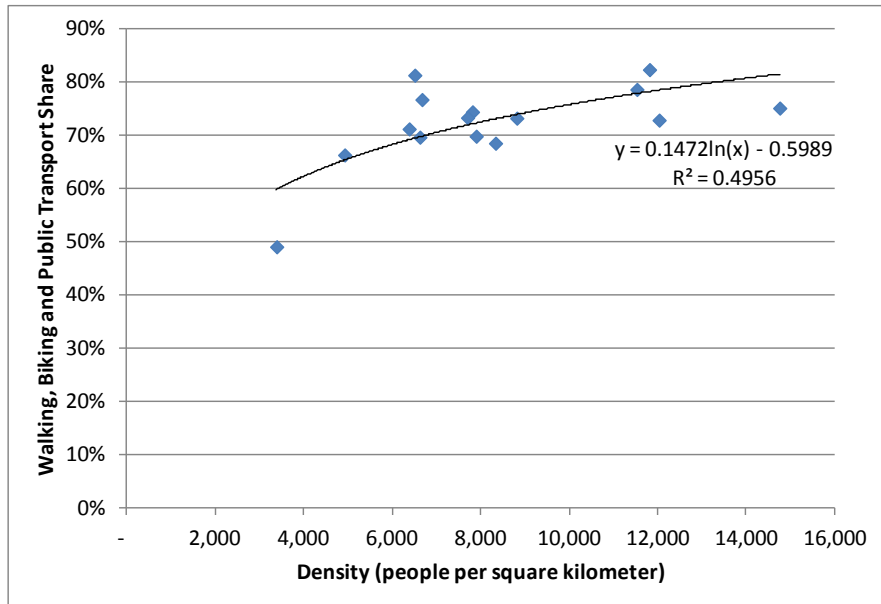
Source: Observatorio Movilidad Urbana CAF Banco de Desarrollo de América Latina <http://omu.caf.com/>, 2007 data.

Figure 16: Modal Split in Selected Latin American Cities



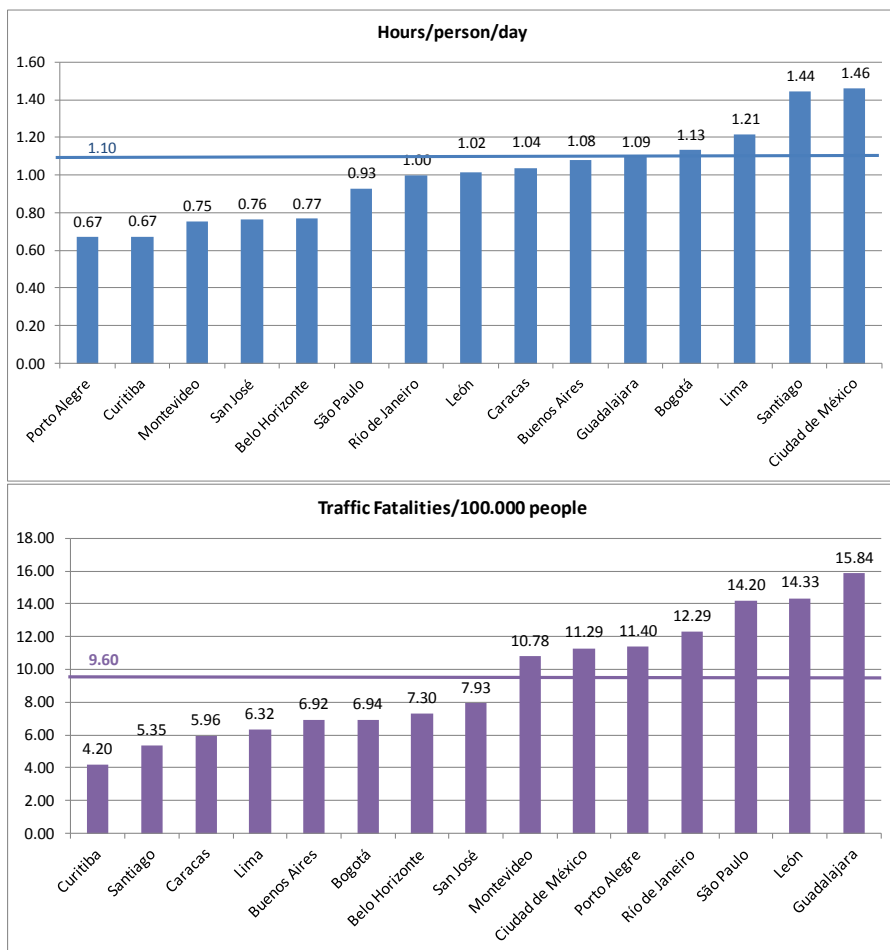
Source: Observatorio Movilidad Urbana CAF Banco de Desarrollo de America Latina <http://omu.caf.com/>, 2007 data.

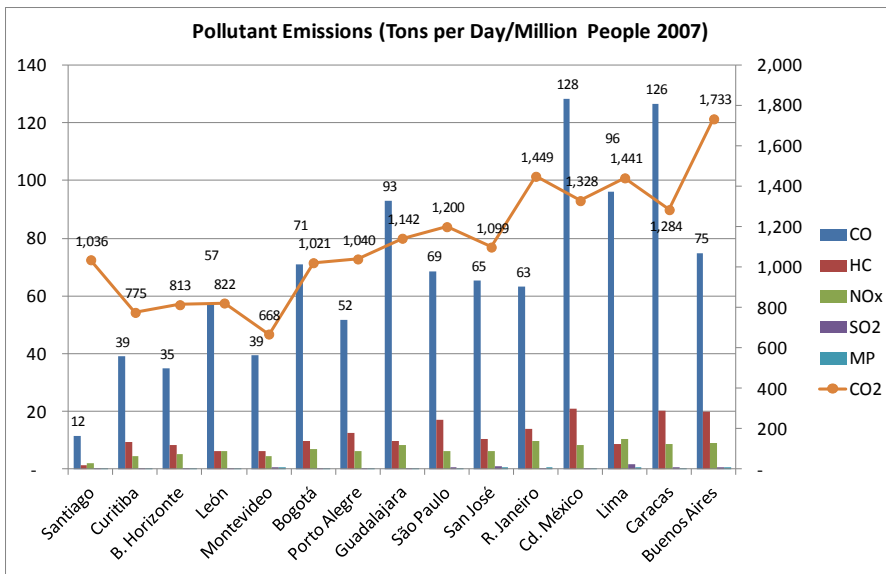
Figure 17: Density vs. Sustainable Modes Modal Share



Source: EMBARQ, with data from OMU CAF <http://omu.caf.com/>

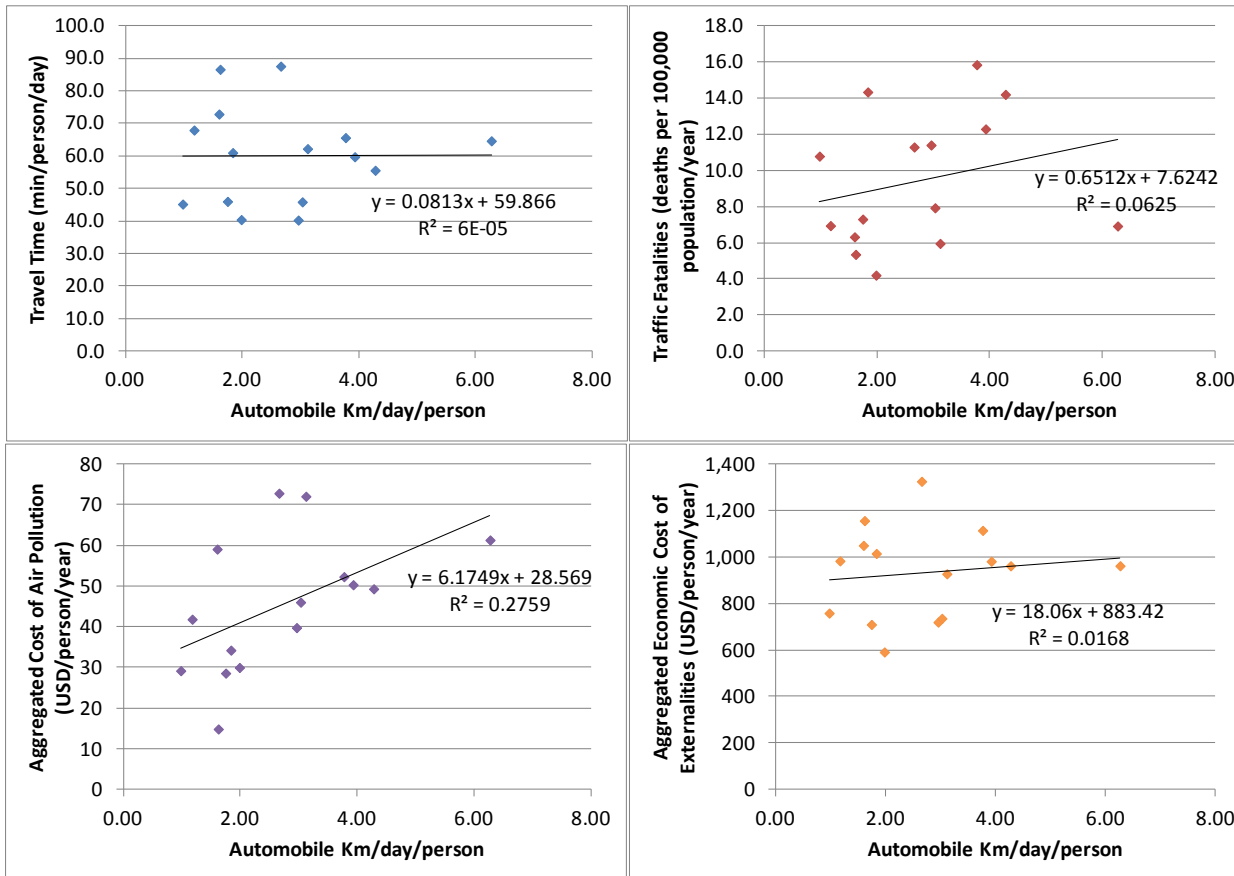
Figure 18: Key Sustainable Mobility Indicators for Selected Latin American Cities: Travel Time, Traffic Fatalities and Emissions





Source: Observatorio Movilidad Urbana CAF Banco de Desarrollo de América Latina <http://omu.caf.com/>, 2007 data.

Figure 19: Auto-mobility vs. Travel Time, Traffic Fatalities, Emissions and Aggregated Economic Cost of Travel Externalities in Selected Latin American Cities



Source: EMBARQ with data from OMU CAF <http://omu.caf.com/>

10.4 Appendix 4: England's Project Appraisal Table

Appraisal Summary Table

Option		Description	Problems	Present Value of Costs to Public Accounts
Objective	Sub-Objective	(a) Qualitative Impacts	(b) Quantitative Impacts	
Environment	Noise			Net properties win / lose NPV fm
	Air Quality			Comes wtd for exposure
	GreenHouse Gases			Tonnes of CO2
	Landscape			Score
	Townscape			Score
	Heritage of Historic Resources			Score
	Biodiversity			Score
	Water Environment			Score
	Physical Fitness			Score
	Journey Ambience			Score
Safety	Accidents			PVB fm
	Security			Score
	Public Accounts		Central Govt PVC, Local Govt PVC	PVC fm
Economy	Business Users and Providers		Users PVB, Providers PVB, Other PVB	PVB fm
	Consumer Users			PVB fm
Accessibility	Reliability			Score
	Wider Economic Impacts			Score
	Option Values			PVB fm
	Severance			Score
Integration	Access to the Transport System			Score
	Transport Interchange			Score
	Land-use Policy			Score
	Other Government Policies			Score

10.5 Appendix 5: Australia’s Project Appraisal Table

1) Appraisal Summary Table 1

Key Assumptions Underpinning the Demand Forecasting and Economic Modelling	
Criteria	Assumptions / Inputs
1. Demand Modelling, Assumptions and Results	Outline the key drivers of demand, and describe the situation “without” the initiative. i.e. the base case, including future works and associated capital, maintenance and operating costs.
2. Land use, population and employment forecasts	<p>Describe and / or list the policy statements and plans which support the land use forecasts and existing commitments regarding any necessary re-zoning; and who undertook the land use forecasts?</p> <p>What is the ABS historical 5 year and 20 year employment and residential growth rate for the area in question?</p> <p>List the low, medium, and high population and employment projections over the period for which forecasts are generated and which was used in the economic appraisal? What are the annual employment and residential growth rates implied by these land use forecasts?</p> <p>If relevant, have specific land use forecasts been undertaken for this initiative? If so, what is the difference in terms of number of jobs and residents compared to the base case land use in the last year the forecasts are produced for? Has there been any redistribution of jobs and residents and if so, what are the assumptions underpinning this redistribution?</p>
3. Demand Modelling Outputs	<p>What demand model was used to generate the forecasts and who undertook the demand modelling?</p> <p>What time period was modelled (for example, a one hour AM peak on an average weekday, 24 hour period on an average weekday, etc). What expansion factor was used to translate the period of the day modelled into a daily observation? (Note – this is not applicable if a 24 hour period was modelled). What sources informed this expansion factor?</p> <p>What expansion factor was used to translate the daily observation into an annual observation? What sources informed this expansion factor and / or what logic underpins it?</p>

	Does the model calculate new or 'generated' trips (as opposed to using a fixed trip matrix)? How does the demand model deal with the issues of induced demand?		
Benefit Cost Analysis Result			
Complete the following table:			
	Real Discount Rate (%)		
	4%	7%	10%
BCR	-	-	-
NPV (\$, 2010) i.e. 'Net Benefit'	-	-	-
NPV / \$	-	-	-
IRR	-	-	-
Monetised Cost and Benefits			
Complete the following table:			
Column 1 – List all cost and benefit elements that have been monetised			
Column 2 – State the \$ value of each cost and benefit element (\$m, real, discounted)			
Column 3 – Include the % contribution of each cost and benefit element – adding to a total of 100% across costs; and 100% across benefits			
Monetised Costs and Benefits	Value		Percentage
Costs (Broken down by element)	-		-
Total	(sum of above) (\$, real, discounted)		100%
Benefits (Broken down by element)	-		-
Total	(sum of above) (\$, real, discounted)		100%

Worksheet A13 – Risk Analysis

Summary of Benefit Risks

A tick (✓) should be placed alongside any risk which is judged to be either 'low' or 'high'. Where detailed information on risks is unavailable for the sub categories, an overall assessment should be given in the shaded row for the risk category as a whole.

Low Rating	Benefit Risks	High Rating
	1. Base Travel Demand	
	1.1 Age of Data Source	
	1.2 Data Scope	
	1.3 Data Quantity and Statistical Reliability	
	1.4 Data Validation	
	1.5 Travel Composition	
	1.6 Other	
	2. Growth Forecasts	
	2.1 High Capacity Population Growth	
	2.2 Development-Related Traffic as Proportion of Scheme Traffic	
	2.3 Time Series Projection	
	2.4 Other	
	3. Assignment	
	3.1 Other Future Activities	
	3.2 Path Derivation Method	
	3.3 Routing Parameters	
	3.4 Supply Relationships	
	3.5 Convergence	
	3.6 Other	
	4. Accidents	
	4.1 Proportion of Benefits Accounted for by Accidents	
	4.2 Observed Accident Sample Size	
	4.3 Judgemental Accident Reduction Risk	
	4.4 Other	