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A FRAMEWORK FOR URBAN TRANSPORT BENCHMARKING



DFID Department for
International
Development



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The Transport Research Support program is a joint World Bank/ DFID initiative focusing on emerging issues in the transport sector. Its goal is to generate knowledge in high priority areas of the transport sector and to disseminate to practitioners and decision-makers in transition and developing countries.

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ACKNOWLEDGEMENTS

This report presents the results of a research project on benchmarking of urban transport in transition and developing countries, with focus on public transport. The research project (the study) was undertaken by a team from the Transport Research Centre of the University of Auckland, New Zealand, led by Dr. Theuns Henning (Research Project Manager) and comprising Wanhua Annie Feng and Professor Avi Ceder. The World Bank team included Mohammed Dalil Essakali (Team Leader), Jung Eun Oh, and Christopher Bennett. The study team would like to thank the peer reviewers Ajay Kumar and Om Prakash Agarwal (World Bank) for their comments and suggestions.

This research project would not have been possible without input from the pilot study areas. A special word of gratitude is expressed to those who have provided data for this project including: Mariana Miclaus, Head of International Relations, Metrorex Bucharest, Romania; Ying Liu, Hao Liu and Hui Zhao, Transport research Department, Beijing Transportation Research Centre; Prof. Romano Del Mistro, Convenor: Urban Infrastructure Design and Management post graduate program, University of Cape Town; Udaya Nishantha Mallawaarachchi, National Roads Sri Lanka; and Yanan Li and Emmanuel Py (World Bank) for the coordination of data collection in Beijing.

EXECUTIVE SUMMARY

Why benchmarking?

Many world cities have managed to build on their well performing urban transport to increase competitiveness and attractiveness. Their urban transport systems provide citizens with good access to economic and social opportunities and enhanced quality of life, and enable businesses to efficiently access labor and markets. These cities offer valuable lessons for transition and developing countries.

Cities in transition and developing countries are experiencing simultaneous growth of urban population, income, and private vehicle ownership, which, combined with resource constraints, creates a challenging environment for their urban transport systems. Policymakers in these cities must be able to quickly design and implement performance enhancing measures for their urban transport systems that are commensurate with the challenges they face. This entails the ability to conduct self assessments, learn from good practice elsewhere, and identify the areas and scale of potential improvement. The institutionalization of this *benchmarking* provides policymakers with tools to continuously seek enhanced performance for their urban transport.

Benchmarking, in the context of urban transport, provides comparative information and management tools that enable: (i) governments to assess, monitor, and fine-tune urban transport policies and to better exercise their regulatory role; (ii) citizens to hold governments and service providers accountable through better information; (iii) urban transport service providers to identify performance gaps and set targets and measures to fill them; and (iv) international development and financial institutions to design targeted and result-based development programs and to draw and share lessons from the experience of better performing cities.

The emerging environmental sustainability and climate change agenda has further motivated many professionals and practitioners in the field to carry out benchmarking. In this particular context, a benchmarking exercise provides a framework to monitor and assess effectiveness of climate change policy measures, and allows policymakers to learn about those relatively untested policy measures.

Developing, implementing and maintaining an urban transport benchmarking initiative for the benefit of cities in transition and developing countries has the following benefits: (i) providing consistent and comparable performance data; (ii) fast-tracking the performance improvement process by learning from

others with superior performance; (iii) identifying good practices and implementing changes; (iv) providing cities and organizations with continuous performance improvement; (v) establishing a forum for cities and organizations to share their experiences and exchange information; it allows for an incremental development process that may start simple but can develop more as more and better data becomes available; and (vii) building a knowledge network mechanism to encourage development in the urban transport sector for development countries.

This report summarizes the findings of a study aimed at exploring key elements of a benchmarking framework for urban transport. Unlike many industries where benchmarking has proven to be successful and straightforward, the multitude of the actors and interactions involved in urban transport systems may make benchmarking a complex endeavor. It was therefore important to analyze what has been done so far, propose basic benchmarking elements and test them, and identify lessons for a simple and sustainable urban transport benchmarking framework. A major component of this study was to investigate (a) the availability of data for benchmarking and (b) the value of benchmarking on the basis of limited data.

The study therefore proposes a benchmarking framework for urban transport, focusing on the performance of *public* transport. Because the design of a benchmarking framework depends on the objectives sought from it, the study focused on the performance of public transport systems from the policymaker's perspective. The study included pilot application of the proposed framework in five cities from three continents—Beijing, Bucharest, Cape Town, Colombo, and Singapore. The pilot application and comparative analysis helped gauge applicability and practicality of the proposed framework.

What and how to benchmark?

The study proposes thirteen core indicators that measure the performance of public transport in five categories—uptake of public transport, travel efficiency, accessibility, affordability, and quality of travel experience. Selected indicators satisfy five key principles of performance measurement: they are (i) specific, covering concisely one aspect of the activity; (ii) measureable, constituting objective and quantifiable measures and avoiding subjective measures such as rating or ranking scale; (iii) achievable, using data that are commonly obtainable under normal circumstances and not too sophisticated requiring cutting-edge technology for collection; (iv) relevant, relevant to the objectives and activities that are being considered; and (v) time-bound, with obtained data within similar timeframe.

Each of the five categories consists of a few key performance indicators (KPI). Uptake of public transport is measured by modal share (percentage of trips

made by private cars, public transport, bike, and walking), annual public transport passenger-kilometer travelled, and annual public transport patronage (number of passengers). Under travel efficiency category, various aspects of public transport service quality and efficiency are measured. KPIs include average and variance of public transport speed of home-based work trips, average and variance of public transport travel time of home-based work trips, public transport departure and arrival time reliability, and vehicle fuel consumption. Accessibility category covers how well the patrons are served by public transport services. It is measured by distance and/or walking time from public transport stops to outer rim of patron dwellings (i.e., catchment areas). Affordability is measured by average cost of home-based work trips. Quality of travel experience concerns safety, security and comfort of trips. They are measured by road safety KPIs—annual road accident fatalities, and those involving public transport vehicles—and personal security KPIs—annual number of crimes occurred on public transport vehicles and at stations and percentage of people feeling safe when using public transport.

In order to draw on meaningful findings and policy implications from benchmarking, one needs to contextualize physical and socio-economic characteristics of a city, to which travel patterns and use of public transport are attributed, and peer it with right benchmarks. Hence, this study also sets out contextual indicators that would characterize a city's demography, infrastructure endowment, and economic development. Included as contextual indicators are available modes of public transport, land area, population and population density, vehicle ownership, road length, public transport route length (by mode), public transport capacity (e.g., in terms of fleet size), public transport vehicle-kilometers, gross domestic product, and personal income. In addition to these characteristics, use of public resources for transport affects the performance of public transport; hence, public expenditure related measurements are also included as contextual indicators. They are public transport spending as percentage of GDP, overall transport spending as percentage of GDP, and subsidies to public transport.

The study recommends that the benchmarking follow a five-stage process, particularly in the context of initiatives driven by the public sector (e.g., metropolitan public transport authority): initiating, planning, information gathering, analysis, and implementation for impact. First at initiating stage, broader policy objectives should be defined and a working group or steering committee should be established. Second at planning stage, the benchmarking framework is refined in light of specific policy objectives that the benchmarking exercise aims to achieve. Following is the information gathering stage, at which performance indicators are clearly defined, methodology specified, and available performance data collected, collated, and verified. In the fourth stage, performance information is compiled and analyzed to identify performance gaps. In-depth review of case studies should

help identify good practices. Finally, an action plan should be devised based on the identified performance gaps and good practices. The action plan then should be implemented and its results should be regularly monitored. When properly instituted, the result of performance monitoring will feed back into and update the performance database (i.e., Stage 3 – information gathering), followed by periodic repetition of Stages 3-5. Broader policy objectives and benchmarking framework defined at earlier two stages will be revisited as necessary.

Pilot Study Findings

The objectives of the pilot study were firstly to demonstrate the value of benchmarking using a small sample of KPIs and a limited number of study areas, and secondly to investigate practical and data-related aspects of the benchmarking process. The five selected cities—Beijing, Bucharest, Cape Town, Colombo, and Singapore—are characterized with distinctive historical backgrounds of urban development, infrastructure endowment, and varying levels of economic development.

In all cases, an increase in private car ownership goes hand in hand with a decrease in public transport patronage, both of which are correlated with income growth with the exception of Singapore, where restrictions are imposed on car ownership and use. There is generally a positive correlation between the population density and the share of trips by public transport. For example, Bucharest has the highest public transport uptake despite its very high private car ownership and relatively high cost of public transport trips (as percentage of income). This seems to be attributed to its highest population density, travel time of public transport trips that is on average superior to that of car trips, and lack of parking spaces in the city center. In Beijing, per capita bus patronage is highest among all cities, which is likely related to the cheapest fare as percentage of income thanks to government subsidies.

Public transport uptake is closely related with patterns of urban development and infrastructure endowment. In case of Cape Town, despite relatively high population density and modest vehicle ownership, public transport patronage is low: only quarter that of Bucharest and one third that of Beijing. This is largely to do with the low-density development of residential areas in the outskirts of the city, poor condition of infrastructure in many parts of the city, and low quality of public transport. In all cities, road safety indicators have improved over time, especially those that had higher per capita fatality rates some years ago have dropped more dramatically.

The pilot study showed how a simple benchmarking framework using readily available information and data can provide policymakers and professionals with useful insight about their city's performance relative to peers and about possible means to reach higher performance. The pilot study also revealed

important issues related to the relevance of indicators and the methodological issues related to data availability and comparability.

Remaining challenges, yet, recommendations for informed urban transport decision-making

Several factors and, often, combinations of them make the process of benchmarking urban transport difficult. To name a few: the sophisticated nature of the exercise, lack of willingness, lack of resources, and definition problems. First of all, benchmarking urban transport is not merely about collecting trip data and carrying out quantitative comparisons. Rather, it is an intellectual process of identifying strengths and weaknesses of a system in comparison with peers that are facing similar challenges; of giving an indication of what can be achieved under favorable circumstances; and of revealing underlying economic and physical factors that determine urban transport performance. Normally, these findings are not immediately apparent from the quantifiable information about urban transport performance; and hence benchmarking process requires skilled eyes to put things into right context.

Moreover, benchmarking urban transport initiatives often failed to secure sustaining support. For example the Urban Transport Benchmarking Initiative by the European Commission lasted through only two rounds of data collection. An ambitious initiative that had started with 45 cities in Europe in 2006 was reduced to a much smaller program mostly for medium-sized cities in three years, before the initiative ceased. If lack of willingness is one notable barrier in some high-income cities, lack of resources is one of the great constraints in case of the cities in transition and developing countries. Institutions in those cities often lack the capacity and resources to collect basic data and to monitor performance of their systems. In one of the pilot cities in this study, the majority of the performance related data was unavailable and some of the basic contextual data was only partly obtainable.

Benchmarking practices also often face with several definition problems, notably with respect to the correct boundary of an urban transport system, which often include not only the subjective city but also its surrounding suburbs. When the geographical boundary encompasses more than one jurisdictional unit, data collection and collation becomes more complicated. Non-standardized definitions of performance data and indicators are also a frequent source of confusion.

Notwithstanding these difficulties, benchmarking is one of the most effective tools that enable informed decision-making for urban transport issues, which are very complex and multi-faceted in nature. A few recommendations in this report would help tackling the challenges. First, benchmarking practice should

be considered as a continuous and evolving process; and the current lack of data should not discourage the decision makers from initiating the effort. As found in the case study, the benchmarking process can start with a small number of key performance indicators as long as they align with the policy objectives and can reveal underlying factors that affect urban transport performance. As the benefits of benchmarking practices are felt and experience accumulated, the scope of the benchmarking process can be broadened, supported by larger data collection. Second, as the tested approach that only focused on home-based work trip suggests, limiting the scope of analysis to something that is concrete and easy to measure is a practical approach that minimizes effort for data collection and analysis while obtaining meaningful results. Third, institutions should consider using the recent advancement of information and communication technologies wisely, for cheaper traffic and trip data collection. Growing prevalence of mobile phones and GPS equipment in many transition and developing countries opens up the possibility for technology-driven low-cost traffic and trip data collection. With supportive institution and modest investment, these resources can be tapped on relatively easily.

In the long-term, the process of benchmarking should be instituted as part of broader strategic planning and performance monitoring of urban transport, institutionalizing data collection and availing financial and human resources. This means urban transport policy that is based on (i) clear strategic objectives, (ii) full understanding of status quo (i.e., current performance), (iii) well defined targets (i.e., future performance), and (iv) good understanding of how other cities succeeded or failed and why. This combination will maximize the likelihood of effective and successful implementation of urban transport solutions.

Finally, the increasing focus on results by governments and international development institutions requires that initiatives targeting the improvement of urban transport should be supported by sufficient information. The benchmarking concept studied under this research project could be a useful tool to support this drive for results. The global reach of development and international financial institutions allows effective dissemination of knowledge and would suggest that such a benchmarking initiative should be initiated as part of their development work. It is therefore recommended that a gradual full-scale development/implementation of a simple benchmarking initiative for urban transport in transition and developing countries be implemented.

1 OBJECTIVE AND SCOPE OF THE STUDY

Transition and developing countries are experiencing simultaneous growth of population, income, and private vehicle ownership, which significantly affects urban transport environment and poses challenges to policymakers and urban transport professionals. Experience shows that the performance of urban transport service delivery in many transition and developing countries is low; policymakers have incomplete information to make decisions; and managers and professionals rarely have a clear picture of their operational performance, best practices elsewhere, or the desired performance level of their service provision. The poor performance of urban transport can become a major impediment to achieving access and mobility objectives.

1.1 OBJECTIVE OF THE STUDY

The primary objective of the study was to develop and test a simple benchmarking framework for urban transport, focusing primarily on public transport, using selected key performance indicators and taking into account the most significant constraints faced in transition and developing countries. To achieve its objective, the study attempts to answer the following questions:

- How is benchmarking relevant to policymakers seeking to improve the performance of urban transport?
- Do the required information and data exist to make such a benchmarking exercise worthwhile?
- Does the comparative analysis provide useful information?
- How are the benchmark levels established?

Benchmarking provides policymakers and managers with information on relative performance and guides them through a process of performance enhancement. Benchmarking in the context of infrastructure service delivery has proven to be useful in encouraging competition, and in enhancing technical and economic regulation.

The main immediate benefits from this study is enhanced knowledge of urban transport performance in the World Bank and the broader urban transport community in international development and financial institutions, by drawing lessons from the experience of world cities. This will allow better targeting and design of result-based development programs.

In addition to the immediate benefits to the development community, benchmarking, in the context of urban transport, provides comparative information and management tools that enable: (i) governments to assess, monitor, and fine-tune urban transport policies and to better exercise their regulatory role; (ii) citizens to hold governments and service providers accountable through better information; and (iii) urban transport service providers to identify performance gaps and set targets and measures to fill them.

1.2 SCOPE OF THE STUDY

The scope of this study was limited to the overall performance of *urban public transport services*. This study was aware that embarking on a comprehensive benchmarking exercise for urban transport as a whole from the onset can quickly become a complex endeavor. While the scope of the study was limited, the approach of the study was designed to provide lessons that can be used to customize benchmarking to the specific needs of the wider organization. In addition, in order to better understand these services, it is necessary to include public transport performance within the context of the wider urban transport system and issues. The data analysis should also be contextualized within some demographic statistics which are included in this study.

In broader terms, one can conceive as many benchmarking frameworks as the numerous perspectives from which urban transport performance can be studied. For example, the interests of the city mayor or city policymakers are different from those of a private operator providing public transport services, although they can be collectively working to achieve ultimate city goals. The policymakers would want to benchmark the performance of urban transport in their city to that of other peer cities. They would more probably be interested in the impact of transport on the quality of life of citizens, the share of public transport in the overall transport market, the efficiency of public funding for urban transport, the reliability and accountability of the various service providers, or the overall governance environment of the urban transport sector. Service providers would likely be interested in benchmarking their operational, technical, and financial performance against that of peers in the city or elsewhere focusing on how to enhance their productivity while meeting their commitments in terms of service delivery levels.

Notwithstanding these various perspectives, some useful benchmarking frameworks can be developed according to the following mapping of urban transport issues:

- Overall urban transport governance, covering policy matters, industry and market structure, institutional organization, administrative structures, sector funding, and regulatory matters.
- Administrative and corporate governance, which is relevant to urban transport because very often urban transport services are provided by administrative structures, state or municipally-owned enterprises, or corporations.
- Overall management performance of urban transport service provision along managerial, technical, operational, and financial dimensions.

The simple framework that is the subject of this study reflects the perspective of policymakers. In terms of the data included in the study, the aim is to utilize as much existing data as possible from the selected study areas. For this reason, only work-based trips are considered as they normally constitute the majority of trips made by people on a daily basis. There are also different dynamics involved with private trips and they would therefore warrant a separate study. Transition and developing

countries often have an active “informal” public transport, which is defined as operations that are not associated with a large organization or officially recognized by governance structures. Good examples of these are private people who transport passengers on motorcycles (and even cars and vans) without any formal registration or recognition of a business.

2 BENCHMARKING: LESSONS AND GOOD PRACTICES

2.1 BENCHMARKING FOR PERFORMANCE IMPROVEMENT

Performance management of any network or sectors can utilize a number of techniques, with one of these being benchmarking. The term benchmark originates from land surveying and was later widely used in scientific management practices to present an efficiency standard to which a job could be performed (Dattakumar and Jagadeesh, 2003). In the simplest terms, benchmarking has been defined as “learning from the pros” (ASTD, 1992). The process of benchmarking is about comparing an organization’s performance or process on a number of measures in relation to a carefully selected benchmark (e.g. a successful peer organization), providing information on the areas and scale of potential improvement, and identifying good practices for implementing changes that effect improvement. The main objectives of benchmarking are to learn from top performers and adopt best practices for effective performance improvement.

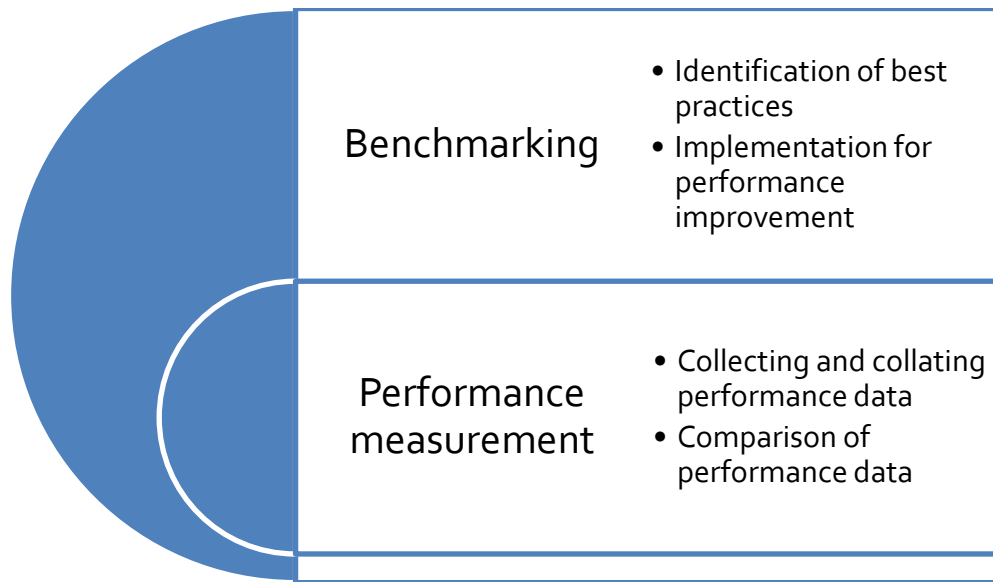
The benchmarking process has many defining features. It is different from performance measurement, which is about collecting and comparing performance data that tells an organization where it stands in relation to the past. Performance measurement, therefore, has a past and present focus. Benchmarking, however, has a present and future focus and encompasses the key elements of performance measurement. The key themes include performance measurement, comparison, identification of best practices and adopting these good practices and processes for improvement (Geerlings et al., 2006; Dattakumar and Jagadeesh, 2003). Figure 2.1 illustrates the relationship between benchmarking and performance measurement.

The benchmarking process was pioneered by the Xerox Corporation in the United States in order to meet the Japanese competitive market in the 1970s. Following Xerox’s success story, benchmarking has been extensively applied in private sector organizations to achieve competitive advantages. Nowadays, it is also used in public sector organizations to improve asset performance and service delivery.

2.2 SUMMARY OF BENCHMARKING INITIATIVES

The primary objective of this section is to assess international and regional approaches towards techniques of transport benchmarking and to narrow the focus to the most recent good practice initiatives. The projects outlined in Table 2.1 are some of the best known benchmarking initiatives in urban transport. Some of the KPIs used in these projects are summarized in Table 2.2. These indicators are highly relevant to this study.

FIGURE 2.1: BENCHMARKING VERSUS PERFORMANCE MEASUREMENT



BOX 1: USING KEY PERFORMANCE INDICATORS (KPIs) IN PERFORMANCE MANAGEMENT AND BENCHMARKING

KPIs are used in both performance management and benchmarking. However, in performance management KPIs will mostly relate to the organization itself. In benchmarking, the KPI of the organization is compared to the performance of other organizations with the aim of establishing a realistic target for the organization. For example:

If an organization knows what performance is expected from it, for example through consultation with stakeholders, it will only need its own KPIs to monitor performance towards these targets. A good example of these includes the safety performance of road networks. Policymakers can set a goal of reducing by 20% serious vehicle crashes caused by road conditions.

If the desired future performance is not clear on appropriate and specific targets, benchmarking uses KPIs from other organizations to assist in defining appropriate targets for the organization. If, for example, a city council receives feedback from users that it needs to improve its performance regarding the punctuality of public transport, the main question would be the appropriate target level of punctuality as it may have significant cost implications. In establishing the appropriate KPI level; the city council may look at the performance of a comparable city that it believes is targeting the right KPI levels in order to clarify the appropriateness of its own KPI target levels. In this example, the city council may decide to have no public transport provider being later than say five minutes as it has learned through benchmarking that this level is (a) achievable; (b) affordable; and (c) practical in its own circumstances.

TABLE 2.1: SUMMARY OF BENCHMARK INITIATIVES

Project Title/Reference	Brief Description	Relevance to this study
1. CoMET (the Community of Metros)/Nova	<p>The CoMET (the Community of Metros) benchmarking program began in 1994 with an aim to exchange performance data and investigate best practice amongst large-sized metro systems. The aim was to improve the metro operation and more specifically to improve service levels (Anderson, 2006). Following the success of CoMET project, Nova project was set up in 1998 for medium-sized metros. The CoMET/Nova project uses 32 key performance indicators (KPIs), which measure the performance of the organization through five categories, namely growth and learning, customer, internal processes, safety and security, and financial performance. Currently it has evolved to comprise a consortium of large metro systems from around the world, including Beijing, Berlin, Hong Kong, London, Mexico City, Madrid, Moscow, New York, Paris, Santiago, Shanghai and Sao Paulo.</p> <p>The CoMET/Nova benchmarking study is undertaken every year. The process involves collecting and analyzing data for indicators to standard definitions and undertaking case studies/workshops for in-depth analysis of the performance results. For the last 15 years, this benchmarking process has delivered tangible benefits to the participant metros. For example, New York metro yielded a 6% increase in capacity by adopting the results of a line capacity study between London and Hong Kong.</p>	<p>The framework for developing a benchmarking initiative;</p> <p>The value of a long-term benchmarking process is noted and should be aimed for in this study.</p>
2. Scandinavian BEST (Benchmarking in European Service of public Transport)	The Scandinavian BEST (Benchmarking in European Service of Public Transport) Survey has been running since 1999 (BEST, 2006). This benchmarking survey developed 10 KPIs to score the performance of over 10 European cities in the public transport sector to identify positive improvements in cities with best scores. The score was based on survey results and therefore was not quantitative in its approach.	<p>Defining key performance measures.</p> <p>The value of a long-term benchmarking process is noted.</p>
3. The European Commission launched BEST – Benchmarking European Sustainable Transport	The European Commission launched BEST – Benchmarking European Sustainable Transport in 2000 (BEST, 2003). The objective was to bring together European transport policymakers and other stakeholders to learn about benchmarking techniques, and to assess its application as a practical tool to improve the performance and sustainability in a number of transport sectors in Europe. Four independent projects were set up as the BEST case studies in order to test the recommendations of the BEST network. One was the IATA (International Air Transport Association) benchmarking project. It studied the positions of 57 airports around the world in relation to their strategic goals and regional competitors to better understand the performance level and surveyed over 60,000 passengers on customer satisfaction. The BOB (Benchmarking of Benchmarking) project examined international railway operation. Only a few indicators such as delays, punctuality, passenger growth and rail infrastructure were selected for the study to allow accelerated progress of the project. The third case study was the Metis-Conseil Benchmarking, which was undertaken in the Emilia-Romagna region of Italy with a focus on the performance of public bus and train transport modes. The NATCYP (National Cycling Policies) benchmarking initiative was another BEST case study on a national level comparison of cycling policies among the Czech Republic, England, Finland, the Netherlands and Scotland.	<p>The framework for developing a benchmarking initiative;</p> <p>Defining key performance measures.</p>
4. Mobility in City Database by the International Association of Public Transport	The Mobility in City Database project compiled and compared the data on urban transport of over 100 cities around the world for the year 2001 (UITP, 2006). The project was initiated by UITP (International Association of Public Transport) with a primary focus on sustainability and public transport. Over 200 indicators relating to passenger transport, emissions and energy and demand management were	<p>Defining key performance measures;</p> <p>Some data for this study.</p>

	reported.	
5. Urban Transport Benchmarking Initiative by the European Commission	The Urban Transport Benchmarking Initiative by the European Commission was a three-year project completed in 2006 (Taylor, 2006). The project group benchmarked 45 participating European cities' transport systems, explored and compared best practice examples among the participants, providing better understanding of how to improve urban transport strategies effectively.	The framework of developing a benchmarking initiative; Defining key performance measures; Some data for this study.
6. NZTA Benchmarking Initiative by the New Zealand Transport Agency	The New Zealand Transport Agency launched a benchmarking project during 2007 aimed at promoting sustainability in the transport sector. The project's main objective was to establish a benchmarking process that would assist local authorities in promoting alternative transport options within the context of an urban area's geographical and socio-economic backdrop.	The framework of developing a benchmarking initiative; Defining key performance measures; Some data for this study.
7. Benchmarking Efficiency of Sustainable Urban Transport in Chinese cities by the China Ministry of Transport	More recently, the China Ministry of Transport, in conjunction with the China Academy of Transportation Science completed a project on benchmarking efficiency of sustainable urban transport in Chinese cities in 2008 (Wu, 2009). The project identified seven challenges and five strategic priorities for major Chinese cities.	Defining key performance measures; Some data for this study.

TABLE 2.2: SUMMARY OF KEY PERFORMANCE INDICATORS

Indicator Group	Key Performance Indicators	Target Area
Background	Network size Operated capacity km Car kilometers Population density Urban area GDP Car ownership Job density in urban centre	Contextual information Comparability of urban areas
Asset utilization	Passenger journeys Passenger km/Capacity km Proportion of car use in peak hour Travel mode Vehicle occupancy Public transport (PT) place occupancy Annual PT journey km	Transport system performance
Safety	Road accident fatality and injury Passenger transport fatality and injury Travel personal security	Social Safety and security
Reliability	Traffic congestion Average peak-hour speeds of PT/car Average distance/travel time of a PT trip Average distance/travel time of a car trip PT delays	PT system performance
Financial	Cost of travel Total commercial revenue/operating cost Fare revenue PT investment expenditure in % of GDP Road network expenditure in % of GDP	Transport cost Affordability of PT
Environment	Vehicle fuel consumption Average age of bus fleets Vehicle harmful emission Euro rating of bus fleets Greenhouse gas emission	Public health Environmental sustainability

2.3 LESSONS LEARNED FROM THE BENCHMARKING INITIATIVES

2.3.1 BENEFITS OF BENCHMARKING IN TRANSPORT SECTOR

The above studies demonstrate how benchmarking can benefit urban transport services. Some of the potential benefits are:

- Providing consistent and comparable performance data;
- Fast-tracking the performance improvement process by learning from others with superior performance;
- Identifying good practices and implementing changes;
- Providing organizations with continuous performance improvement;
- Establishing a forum for organizations to share their experiences and exchange information; and
- Building a knowledge network mechanism to encourage development in the urban transport sector for transition and developing countries.

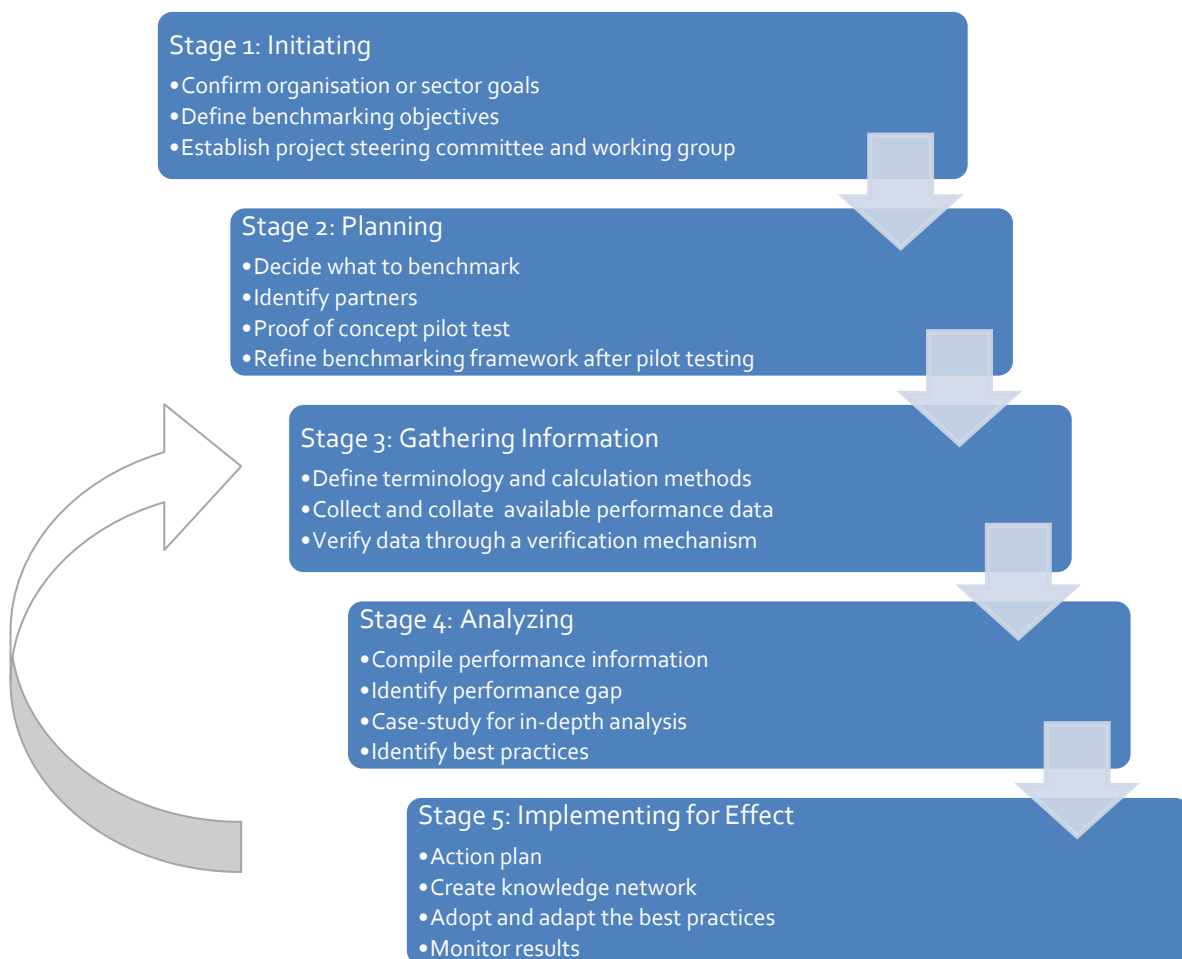
2.3.2 GOOD APPROACHES TO INITIATING BENCHMARKING EXERCISE

Key Stages in Benchmarking

From the above benchmarking initiatives and literature reviewed in the general benchmarking approaches, the following stages are deemed to be most useful for this study.

As noted in Figure 2.2, stages 3 (Gathering Information), 4 (Analyzing), and 5 (Implementing for Effect) form a cyclic process which may take place for example, once a year. This process is important to the continuous improvement in the benchmarking process.

FIGURE 2.2: KEY STAGES IN A BENCHMARKING PROCESS



Key Performance Indicator Framework

A KPI framework should be designed in the initial stage of the benchmarking process. Some of the benchmarking initiatives in the literature have over 100 performance indicators. The vast number of indicators requires an extensive amount of human resources and financial input, which may not be feasible for a long-term process, particularly for the case of transition and developing countries. Some of the important features in the indicator framework are discussed below:

- KPIs must relate to the sector or organization's goals or policies;
- It is best to limit the number of KPIs to ensure that the benchmarking process remains focused and can deliver results;
- The KPIs should be comprehensive enough so as to represent all the different parts of the system/operation, yet concise enough to be able to be used effectively by an organization;
- The framework should spell out clearly the definitions of each KPI so that the data set behind the indicators is collected to standard definitions for consistency and comparability;
- Data availability and accuracy are important considerations in deciding which KPIs to include in the framework;
- The framework may be updated over time to reflect major changes in the organization's policy or strategic directions;
- The literature review reveals that the three common threads running through various transport performance indicator frameworks are:
 - Environment – e.g. fuel consumption and emissions;
 - Economy – e.g. affordability and modal split; and
 - Social – e.g. road safety and accessibility.

Pilot Study

Most successful benchmarking begins with a focused area (field testing) under a pilot study. A pilot study uses a subset of the KPIs (four for example) for limited study areas. This not only serves as a starting point for the benchmarking project, but also captures several potential benefits, including:

- The pilot study provides quick evidence on whether benchmarking will fulfill the objectives set for the benchmarking project;
- The development of a KPI framework is an iterative process. Experience demonstrates that a pilot study provides valuable information for the improvement of the framework as well as the whole benchmarking process;
- The pilot study provides potential for cost-saving by identifying some of the pitfalls that may occur during a full-scale implementation of the benchmarking process; and

- The early engagement of stakeholders in the pilot study ensures their buy-in to the benchmarking approach by giving them a first taste of the potential benefits as well as instilling a sense of ownership.

Once a performance gap has been identified, case studies will provide an in-depth analysis of the processes and management practices that other organizations have used to achieve their superior performance. The case studies help with:

- Providing a thorough understanding of the organization's strategy, policies and operation behind the performance data;
- Identifying good practices in both operations and management that other organizations can adopt to improve their performance; and
- Offering information to support better dialogue between the policymaker and managers in charge of service delivery.

2.4 BENCHMARKING AS A CONTINUOUS PERFORMANCE IMPROVEMENT PROGRAM

Benchmarking should be developed as a long-term process and not a one-off exercise. A long-term approach to benchmarking delivers tangible benefits to participating organizations because:

- It can take many years and iterative cycles to achieve benchmarking indicators that are comparable and reported on a consistent basis (Anderson, 2006). One-off benchmarking studies are rarely successful for this reason;
- The value to any policymaker, or related stakeholder, is the results which are extracted over time. Ongoing benchmarking allows performance trends to be identified through time series analysis. Trends provide more conclusive findings than any one-off snapshot; and
- Performance trends help monitor the effectiveness of good practice on performance improvements.

3 THE DEVELOPMENT OF THE KEY PERFORMANCE MEASUREMENT FRAMEWORK

3.1 BACKGROUND TO PERFORMANCE MEASURES/INDICATORS

Performance measures/indicators are used in both performance measurement and benchmarking. Benchmarking is a technique used to compare an organization's performance relative to a peer organization with similar contextual characteristics based on the activity under consideration (Henning et al., 2010). Performance measurement is normally an internally focused process where an organization measures its current performance against historical performance. The performance measures are normally a quantitative measure or index that numerically expresses a specific activity. In the context of this study, reference is made to key performance indicators (KPIs), as the aim is not to measure a complete set of performance measures, but rather focus on some key ones that will provide a sufficient understanding of relative comparison in the benchmarking process.

The challenge in defining KPIs is to select the appropriate ones that will give a sufficient understanding of overall performance. The KPIs should also be practical in terms of data availability and understandable to the audience. Useful KPIs can normally be associated with the SMART principle (NAMS, 2007):

- **Specific** – A KPI must cover concisely one aspect of the activity;
- **Measurable** – KPIs must be quantifiable as subjective measures, e.g. a rating scale, could lead to distorted comparisons;
- **Achievable** – Available data and common items normally measured must be used for KPIs. It would not be useful to develop sophisticated KPIs for which data are unobtainable;
- **Relevant** – The KPI must be relevant to the activity being considered. Sometimes a different KPI is used to indicate or estimate a different activity. For example, one can use fuel consumption as a surrogate of CO₂ emission if no actual emission data exist; and
- **Timebound** – KPIs of similar timeframes need to be used in order to be an effective comparison tool for benchmarking. Therefore, the data need to be date-stamped.

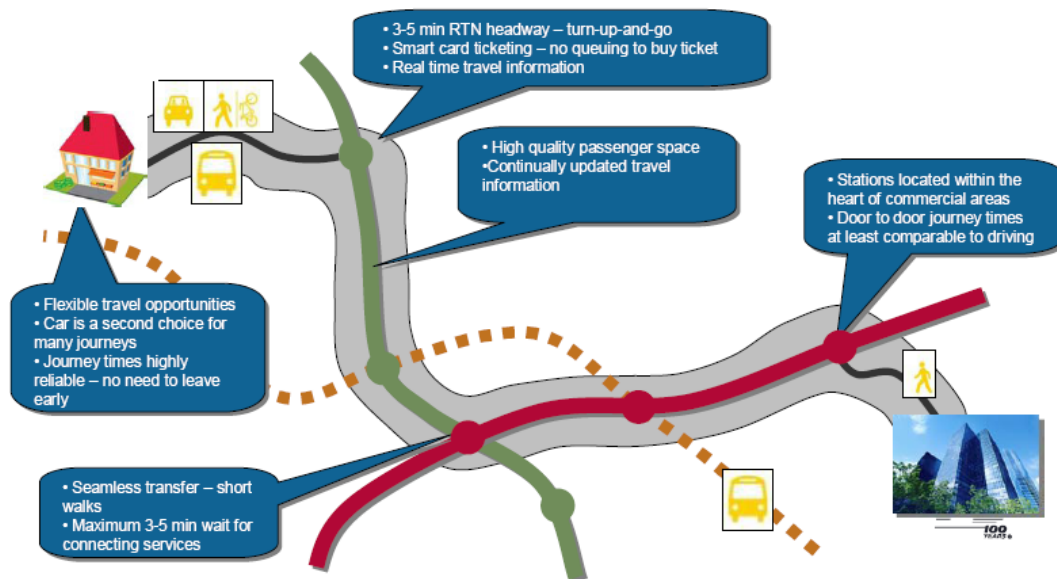
3.2 THE PERFORMANCE AREAS TARGETED THROUGH THIS BENCHMARKING EXERCISE

As explained in Section 1.1 the aim of this benchmarking study is to provide a framework that includes a tool to measure and compare the effectiveness of public transport systems. This tool could be used by decision makers to target their efforts into areas that will improve the public transport system and as a result increase the

uptake of this transport mode. Ultimately, the KPIs have to be able to quantify the quality of the public transport service within the context of its operating environment. For example Figure 3.1 illustrates some of the main items highlighted as quality services for a public transport strategy developed by the Auckland Regional Council (ARC, 2009).

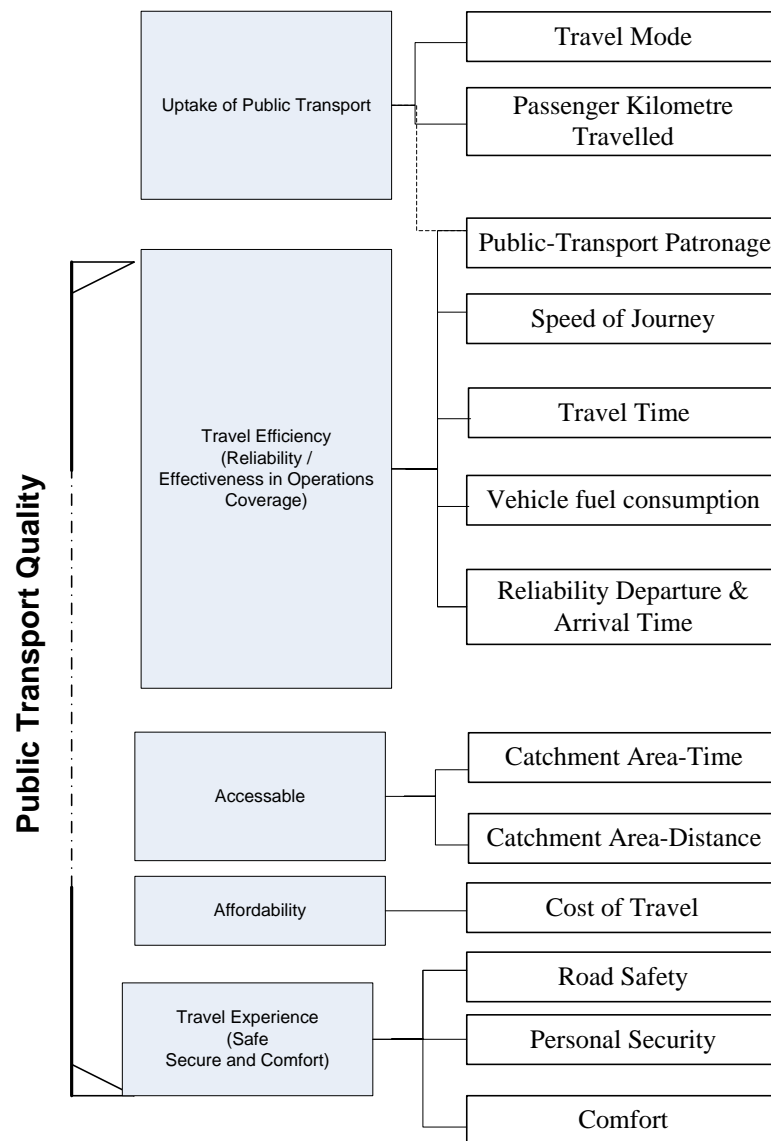
The areas of measurement of the quality of public transport services are discussed in subsequent sections. The overall proposed KPI framework is depicted in Figure 3.2, with discussions on the respective KPIs in subsequent sections. A full list of KPIs is presented in Appendix A.

FIGURE 3.1: THE MAIN ISSUES RELATED TO AN EFFECTIVE PUBLIC TRANSPORT SYSTEM



(Reference: ARC, 2009)

FIGURE 3.2: PROPOSED KPI FRAMEWORK FOR BENCHMARKING PUBLIC TRANSPORT



3.2.1 UPTAKE OF PUBLIC TRANSPORT

The first and most obvious performance area for public transport relates to the portion of travelers using the services. Although it is not a direct measure of the quality of a public transport system it is a definite indicator of its popularity or in some cases the patron's dependency on it for essential travel. Useful KPIs will need to explore information on the following:

- The modal composition and patronage share for each¹;
- The passenger distance travelled; and
- The public transport patronage.

¹ Note that for simplicity only work-based trips are considered in this framework

Linkage between public transport uptake and quality of the services should be handled with care as there may not be a direct relationship. Especially in transition and developing countries public transport has to be viewed in the context of the socio-economic background. For example, in some countries people use public transport simply because they don't have any other means of travelling to work. For that reason, public transport uptake has to be viewed against the background of the contextual data and quality of the service data.

3.2.2 TRAVEL EFFICIENCY

There is never a single factor that will determine why someone uses public transport as a means of travel. For example, affordability and accessibility are often paramount reasons why people use public transport. If a person has difficulty in using alternative means of travel, by default this person will use public transport.

However, if the use of public transport pivots on the free choice of a person, travel efficiency will be one of the most important factors determining the uptake of this service. Travel efficiency is governed by three main factors including reliability, effectiveness of operations and coverage of the service. Many publications such as Ceder (2007) list a large number of performance measures that could be used to measure the efficiency of public transport services. For benchmarking purposes a select number of KPIs have to be chosen to cover the most critical aspects of public transport. These include:

- Speed of the journey;
- Travel time;
- Vehicle fuel consumption; and
- Reliability in both departure and arrival times.

It can be seen from this list that the overall journey time and certainty around the journey time is one of the main considerations for travel efficiency. This efficiency is however a complex activity as there are other factors that impact on it, including trip make-up (e.g. the use of multi-modal services such as ferries and buses in one trip), connectivity between services, and the layout and efficiency of transfer facilities such as train and bus stops. Data on all these factors are not always readily available and for that reason focus has been placed on overall trip duration (travel time) and speed of the journey (distance covered/travel time) to moderate the overall performance of this activity.

The only issue associated with travel time is that it is not always within the control of the public transport operation. For example in congested networks, public transport can offer a more effective alternative if access preference is provided through dedicated bus lanes. In other circumstances, public transport would be subjected to the same congestion issues as other travelling modes. In order to obtain a better understanding of operational effectiveness, the functionality of arrival and departure times are tested in addition to travel time.

The next area considers the efficiency of energy use for the overall transport system. By understanding the overall energy use for the travelling public, one can obtain an understanding of not only the energy use per trips made, but also an indication of emission issues. The latter need a significant amount of research for accurate estimates as they are strongly related to vehicle type and age. However, there are some crude estimation models available that could give a reasonable indication of emission levels based on fuel consumption levels.

3.2.3 ACCESSIBILITY

There are normally two aspects to the accessibility of public transport: accessibility for all travelling public and provisions for people with limited mobility. This study focuses on the overall access for all patrons.

Accessibility in this project is defined in terms of the distance from the most remote location within a catchment area to the transport facility. In addition, the walking time from the most remote location to the transport facility needs to be incorporated. Neither time nor distance measures, in isolation, can give a sufficient view on the ease of access to the transport facility.

3.2.4 AFFORDABILITY

Affordability is one of the primary drivers of public transport patronage in transition and developing countries. As expected, one needs to normalize this KPI to the socio-economic backdrop of the city in order for this KPI to provide a sensible comparison between different areas.

3.2.5 TRAVELLING EXPERIENCE

In terms of travelling experience, this study seeks more information on the following three characteristics:

- How safe is the journey in terms of road safety;
- How secure are the facilities including terminals and public transport mode; and
- How comfortable is the transport mode to the users?

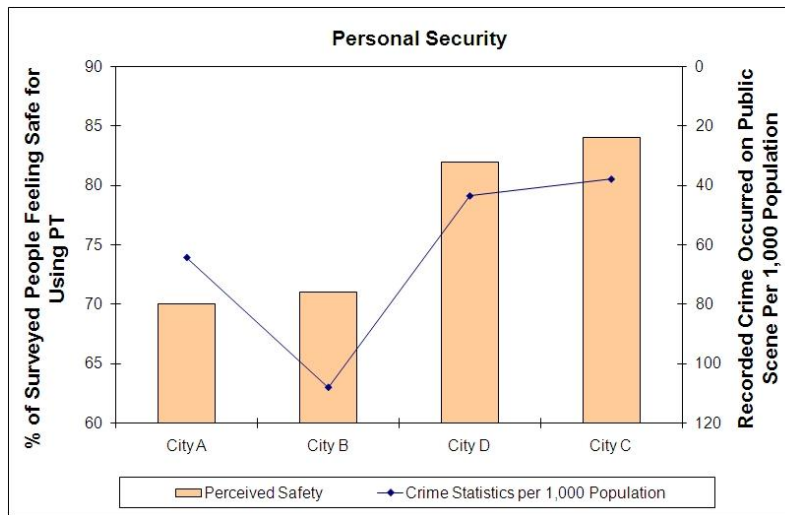
Road safety data are normally readily available and in most cases it is possible to split the public transport component from the remaining crash information. This measure also needs to be normalized to the appropriate contextual data such as person/vehicle-km travelled.

Security data can include both actual crime statistics associated with public transport and perceived security from patrons. Henning et al. (2010) demonstrated that there was normally (but not in all cases) a good correlation between perceived security and actual crime statistics. Figure 3.3 illustrates the output from a benchmarking process in New Zealand. The graph shows both the actual and perceived security aspects relating to public transport. It can be seen that there is not always a direct relationship between actual and perceived security. The report highlighted factors such as the media having

a significant impact on the perceived security. It is believed though that actual crime statistics are a more objective measurement of the security aspects of public transport.

The comfort of public transport services would be a challenging KPI to measure, but it needs to be part of the overall assessment of the activity. It is suggested that it would seek out percentages of patrons being satisfied or dissatisfied with the comfort of the public transport service, rather than having a complicated three or five point rating scale assessing the comfort level in detail.

FIGURE 3.3: PERSONAL SECURITY ON PUBLIC TRANSPORT



Source: Henning et al., 2011

4 PILOT STUDY DETAILS

4.1 THE OBJECTIVE OF THE PILOT STUDY

The main objective of the pilot study was to demonstrate the value and feasibility of the benchmarking process using a small sample of KPIs and a limited number of study areas. Secondary objectives include the investigation into the practical and data-related aspects of the benchmarking process. It would be risky to embark on a full-scale benchmarking process without testing the conceptual framework and data availability. Experience has shown that in most cases it is difficult to obtain consistent data from all participants due to a variety of factors, including:

- The purposes of data collection are different between countries thus resulting in completely different data collection strategies;
- The level of data collection varies significantly given different drivers and available resources for the data collection; and
- The contextual background to each country varies significantly, requiring sufficient understanding of the background and avoiding data reporting without appropriate normalization.

This part of the study was therefore primarily aimed at developing the concept. As such it is not an in-depth research into public transport issues and initiatives in the selected pilot cities. It also involves the development of processes and techniques to normalize the data so that these provide meaningful comparisons. The pilot testing process of this study is summarized in the subsequent sections.

4.2 SELECTED KEY PERFORMANCE MEASURES

The KPIs proposed for the pilot study allow for performance measurement and benchmarking in the following main areas (refer to Figure 3.2):

- Uptake of public transport;
- Travel efficiency including reliability, effectiveness in operation and coverage;
- Accessibility;
- Affordability; and
- Travel experience including safety and comfort.

The KPI and data items requested in these main areas are summarized in Table 4.1 and more details are provided in Appendix A.

TABLE 4.1: PERFORMANCE DATA REQUESTED FROM PILOT AREAS

Performance Area	Key Performance Indicator	Description
Uptake of public transport	Travel mode	The number of work-based trips per modal type
Uptake of public transport/ Travel efficiency	Public transport patronage	Number of boarding passengers transported
Travel efficiency	Travel time	Average and variance of travel time for work-based trips
Accessibility	Catchment area	Distance and/or walking time between public transport stop or station to outer rim of patron dwellings
Affordability	Cost of travel	Average fare for travelling by car/public transport
Travel experience	Road safety	Road-accident fatalities involving public-transport vehicles
Supporting information	Contextual data	Land surface area Population Population Urban surface area Annual vehicle kilometers Total number of cars Population Monthly personal income Public transport expenditure Transport expenditure GDP

4.3 SELECTED PILOT AREAS

4.3.1 BASIS OF SELECTION

The selection of the pilot areas included the following considerations:

- First, areas were selected where known work had been completed in the performance area of public transport;
- Second, preference was given to areas where a strong working relationship existed between the city officials and World Bank urban transport staff; and
- Last, during initial correspondence it was confirmed that the selected cities possessed data that could be utilized in this project.

The selected pilot areas are discussed in subsequent sections.

4.3.2 BUCHAREST – ROMANIA

Bucharest is the capital and the industrial, cultural and financial center of Romania. Its population reached two million in 2009 and population density is over 8,000 persons/km². These figures are higher than other Central and Eastern European cities such as Warsaw and Budapest. The flat topography of the city and its high population density offer excellent conditions for the development of a transport network as well as passenger transport. The city's present road network features a ring-like characteristic.

Expansion of the urban area is evident from the growth of suburban centers and development of low-density housing along the outer ring road.

Urban transport is a pressing concern in Bucharest. Some of the transport problems in Bucharest are (Beldean et al., 2002; J.I.C.A., 2000):

- Increase in vehicle ownership: The reforms of the political system together with economic growth have changed people's consumption patterns. Private vehicle ownership is expected to reach 259 per 1,000 persons in 2015, which is 1.4 times more than what it was in 1998. As a result, the number of personal trips is expected to increase. This increased travel demand will add pressure to transport infrastructure and services;
- Growing traffic congestion: Traffic congestion already occurs at major intersections and trunk roads in the central area during peak times. Since there are more people living in the surrounding areas than in the central area, which remains the centre of commercial and business activities, daily commuting into the central area is increasing;
- Decrease of public transport usage: The rapid increase in private cars is only one of the main factors contributing to a decrease in public transport usage. There are two main public transport operators in Bucharest: METROREX (metro) and RATB (surface transport). The two operators use different ticking systems and so passenger transfer cannot be made using one ticket. At the same time, public transport is also provided by several private companies authorised by the Municipality of Bucharest. While duplicated and complicated routes are common on trunk roads, due to the lack of cooperation and coordination between the different providers there is inadequate coverage on low-demand areas. The transfer between different modes is often inconvenient. These factors combined reduce the attractiveness of public transport;
- Discontinuity in road network: Studies have shown that there are missing links in the ring roads and some of the district roads are not well integrated into the main network; and
- Insufficient parking supply in the central area: The central area of Bucharest was built up in 1930s and is fairly compact. The parking spaces are unable to cope with the increasing demand for parking. Also, enforcement of parking regulations is not so strict. Therefore, it is common to see vehicles illegally parked on roads, causing traffic congestion and accidents. This is also inconvenient for pedestrians.

4.3.3 BEIJING – CHINA

The municipality of Beijing had a population of 17.6 million in 2009 and a population density of 1,069 persons/km². The urban centre of Beijing had a population density as high as 30,574 persons/km² in 2000 (Ahmed et al., 2008). The urban transport system in

Beijing is mainly road based. During the last 10 years car ownership in Beijing has rapidly increased. Compounded with a 1.7-fold increase in the urban area from 1997 to 2004, an increasingly diversified urban population due to the influx of a migrant work force and the change in urban land use patterns, Beijing is experiencing tremendous pressure on urban transport travel demand. Some of these problems are (Ahmed et al., 2008; Creutzig and He, 2009; Darido et al., 2009):

- Increasing vehicle ownership: Automobile ownership in Beijing is growing at an annual rate of 20.5%. This contributes to an increasing travel demand. The average number of trips per person per day in 2003 increased by nearly 75% compared with 1986 figures;
- Traffic congestion: On average it takes over an hour to commute to work in Beijing. A recent survey revealed that Beijing residents take the longest time to travel to work compared with all major cities in China. Vehicle speed declined from 45 km/hr in 1994 to less than 10 km/hr in 2005 on major ring roads in Beijing and this is now extending to outer ring roads and major radial and arterial roads;
- Declining public transport usage: The public transport system in Beijing is very well developed, but the usage is declining due to a combination of the following reasons. Automobile-oriented policies lead to rapid motorization and urbanization. Increasing urban sprawl and the relocation of urban dwellers to suburban development increase travel distance and the time to reach the workplace. Increasing wealth has brought a desire for choices and flexibility. Increasing numbers of cars on the road reduce bus speeds substantially;
- Greenhouse gas emissions: Rapid motorization directly relates to an increase in energy use and therefore greenhouse gas emissions; and
- Air pollution: Vehicle emissions have become the main source of air pollution in Beijing.

4.3.4 SINGAPORE

Singapore, as an island country, has limited land supply for land transport development. On-going land reclamation projects have expanded the land area from 581.5 km² in the 1960s to 710 km² in 2009.

Singapore's land transport approach of controlled motorization and public transit development has made it an example of success of how the two modes of transport can be facilitated in parallel. Its transport planning and management policy recognizes the importance of the demand for private car usage as well as the need to provide public transport (Han, 2009). Transition and developing countries may be able to learn from the Singapore experience. In this study, Singapore is considered a high level benchmark.

4.3.5 CAPE TOWN – SOUTH AFRICA

In terms of transport infrastructure, South Africa is among the best in Africa, supporting both domestic and regional needs. Cape Town is the second most populous cities and one of the four advanced economic centers in South Africa. The population of Cape Town was close to 3.5 million in 2007, with a population density of about 1,400 persons/km².

Cape Town's urban transport issues are dictated by two factors. Firstly, the legacy from the old apartheid governance structure resulted in large settlements of the workforce living far distances from the CBD in low density dwellings. Although the urban form generates large movement numbers, mass transport has limited access due to distances to terminus. As a result there has been a significant uptake in informal and less effective public transport options such as minibus taxis. Secondly, South Africa has significant socio-economic challenges with a large portion of the population having high levels of poverty, inadequate housing and basic services. (Haskins, 2006). Since 1994 the government has been focusing on addressing some of the poverty issues but with the high demands infrastructure development has not kept up with the growth in population and travel demand. As a result some of the transport issues faced by a city such as Cape Town include (Haskins, 2006):

- Outdated transport network-focused on private car use & 'traditional' destinations (e.g. CBD);
- Current urban form generates large amounts of movement with great financial, social & environmental cost to city; and
- Life inconvenient & expensive for those who cannot afford a car. Poor have little access to economic/social opportunities with the public transport system inefficient:
 - difficult to switch from one mode to another
 - some parts of city inaccessible.

An integrated rapid-transit (IRT) system has been proposed to be a part of the solutions to the transport issues in Cape Town. The project includes a priority rail plan, a bus rapid-transit system, improvements to conventional bus and minibus operations, urban space upgrades to provide safer cycling and walking experience and park-and ride facilities. The construction of the first phase of the IRT system began in 2009 and it will take the next ten to fifteen years to complete the project. Once completed the IRT system will provide the Cape Town residents a safe, efficient and quality public transit.

4.3.6 COLOMBO – SRI LANKA

Colombo is the economic and political centre of Sri Lanka. The population of Colombo reached 2.3 million in 2001 and the city centre has a population density of over 3,300 people/km². Public transport (buses) is the main transport mode. The number of vehicles is about 97 vehicles/1,000 population. Studies have shown that only a fraction

of the vehicles are privately owned, the rest being owned by companies and various levels of government.

The transport problems in Colombo are discussed in the World Bank (2001) report. Some of the main problems are:

- Low-quality and unsafe public transport service: Bus is the dominant public transport mode and is operated by both public and private operators. Despite an extensive bus service network and an overloading of buses on street, the buses are poorly maintained, overcrowded and uncomfortable. Services in off-peak and on low-demand routes are poorer than at peak hours in terms of frequency and punctuality. It has been identified that the key factor contributing to the low-quality service is an incoherent public transport policy in the regulation and financing of the public transport sector;
- Underdeveloped road infrastructure: Roads show an abundance of cracks and potholes due to poor drainage and neglected maintenance work. The road network lacks orbital links and secondary roads;
- Chaotic and unsafe traffic conditions: Roadways are undivided and narrow. They are shared by mixed types of vehicles including buses, truck motorcycles, cars, 3-wheelers and bicycles, and pedestrians as well. Motorcycles, 3-wheelers and bicycles have the highest accident rates;
- Congestion: Travel speed is only 10–15 km/hr in peak hours on main arterial roads. Some of the busiest roads have a speed as low as 5 km/hr; and
- Unregulated parking: Traffic lanes get blocked by double parking. Vehicles park illegally on walkways and entrances.

4.4 APPLICABILITY OF PILOT AREAS

It is difficult to undertake any international study on the basis of limited countries. However in the case of this study with its current objectives it is reasonable to expect that the five countries and cities selected can provide a balanced view of the potential value of a benchmarking process. The benchmarking also includes cities in high-income countries such as New Zealand, Australia, and Canada.

5 PILOT STUDY DATA SUMMARIZATION AND COMPARATIVE ANALYSIS

5.1 AVAILABILITY OF KPI AND BACKGROUND DATA

As noted earlier, data availability is a key success factor in completing a benchmarking study. Due to differences in indicator definition and collection methodologies between cities, it is difficult to obtain consistent and complete data sets. Furthermore, this study aims to make use of the existing data collected by transport agencies or research institutions in the pilot cities. Some of the KPI data, for example data relating to travel time and catchment area are not of immediate interest to some cities and consequently were not available.

The performance data were compiled to represent the KPIs following the definitions provided in Appendix A. Supporting information was also put together to give a context to the background information of the pilot cities. Table 5.1 below summarizes the data availability in the pilot cities.

In addition to a snapshot description of the pilot areas in Section 4.3, the following tables provide a summary of some background data for these areas. These examples also illustrate issues of comparability and consistency of data definition.

Transport mode definition issues. The types of public transport service modes provided in the cities are presented in Table 5.2. It shows that buses, taxis and metros are to be found in most of the cities but trams and trains are not so widely used.

Reference period issues. The reference year of the data provided in Table 5.3 (demographic data) varies from city to city. For Bucharest, Beijing and Singapore the data reference year is 2008, except for Bucharest's per capita GDP which is based on 2007 data. Colombo's population is based on 2001 data and its per capita GDP is for 2009. Cape Town's population and GDP are based on 2007 data.

The reference year of the transport supply data also varies. The data for Bucharest, Beijing, Cape Town and Singapore are for 2009, except for Beijing's bus route figure, which is based on 2008 data. Transport supply data specific to the Colombo area are not available. The data provided for this study for Sri Lanka are for 2007, except the vehicle numbers which are based on 2008 data.

Completeness of data issues. Bus services in Sri Lanka are largely in the hands of private operators, who take 45% of the market share of public transport. The state-operated bus service has just 23% of the market share. There are over 17,000 buses run by private operators, which is significantly large when compared with the state bus number reported in Table 5.4. The data relating to Colombo are for state-operated public transport services only, since private operation data are not available.

TABLE 5.1: PERFORMANCE DATA AVAILABILITY

KPIs	Bucharest	Beijing	Cape Town	Colombo	Singapore
Travel mode	Available	Available	Available	Partially available	Available
Public transport patronage	Available	Available	Available	Missing	Available
Travel time	Available	Partially available	Not available	Missing	Available
Catchment area	Available	Not available	Available	Missing	Not available
Cost of travel	Available	Partially available	Not available	Partially available	Available
Road safety	Available	Partially available	Available	Available for entire country	Available
Contextual data	Available	Partially available	Partially available	Partially available	Available

TABLE 5.2: PUBLIC TRANSPORT SERVICE MODES

City	Bus/Trolleybus	Metro	Tram/Light Rail	Train	Taxi
Bucharest	✓	✓	✓	✗	✓
Beijing	✓	✓	✗	✗	✓
Colombo	✓	✗	✗	✓	✓
Cape Town	✓	✗	✗	✓	✓ ¹
Singapore	✓	✓	✓	✗	✓

Notes: 1. Including minibuses that are privately operated.

TABLE 5.3: AREA, POPULATION AND GDP DATA

City	Population	Land Area (km ²)	Population Density (persons/km ²)	Per Capita GDP (USD)
Bucharest	1,943,981	238	8,168	\$18,196
Beijing	16,950,000	16,410	1,069	\$9,987
Colombo	2,251,247	676	3,330	\$2,052
Cape Town	3,497,097	2,500	1,399	\$4,647
Singapore	4,839,000	710	6,815	\$38,952

TABLE 5.4: TRANSPORT SUPPLY DATA

City	No. of Vehicles	No. Of Buses	Road Length (km)	Bus Route (km)	Metro Route (km)	Tram/Light Rail Route (km)
Bucharest	1,080,000	878	1,821	1,544	66.9	243
Beijing	4,019,000	21,716	7,188	146,617	228	0
Colombo	3,390,993	4,668	missing	305	0	0
Cape Town	1,023,000	1,160 (7,467) ¹	8,020	missing	0	5812
Singapore	925,518	3,393	3,355	missing	118.9	28.8

Note: 1. Refers to minibus number. 2. Refers to train route length.

5.2 TRAVEL MODE

Modal split of work-based trips provides a good overview of how people travel in a city. Figure 5.1 below shows a comparison among the selected pilot cities and with cities in New Zealand, Australia, and Canada. The data of cities presented in the figure are from 2006 statistics, data from Cape Town, Colombo and Singapore statistics are based on 2005 data. Non-motorized transport includes cycling and walking.

The indicator shows that public transport is the dominant means of work-based travel in the five pilot cities, with Beijing and Cape Town having over 40% of these trips made by public transport, Singapore over 50%, Bucharest close to 70% and Colombo over 70%. For Cape Town, the public transport share includes privately operated minibus, which accounts for more than 10% of the work-based trips. Cycling still plays an important role in Beijing's transport, as close to 30% of the trips were made by bike in 2006. Cape Town has about 48% of the work-based trips made by private vehicles and the number drops to less than 40% in Singapore. Around 30% of the work-based trips in Beijing and Bucharest are made by private vehicles and the share drops to 20% in Colombo. It seems however that non-motorized transport might be under-reported in Colombo. These pilot cities have a very different travel mode makeup from the selected cities in high-income countries as shown in Figure 5.1, where private vehicle is the dominant means of travel. However, as indicated in Section 4.3, some of the transition and developing countries have a significant increase in private motor ownership which will have a negative impact on public transport.

There are three main types of public transport modes in Beijing and Singapore—bus/trolley bus, metro and taxi. In addition to these modes, tram also plays an important role in transporting the public in Bucharest. In Colombo and Cape Town, bus, train and privately operated minibus are the main means of public transport.

FIGURE 5.1: TRAVEL MODE COMPARISON

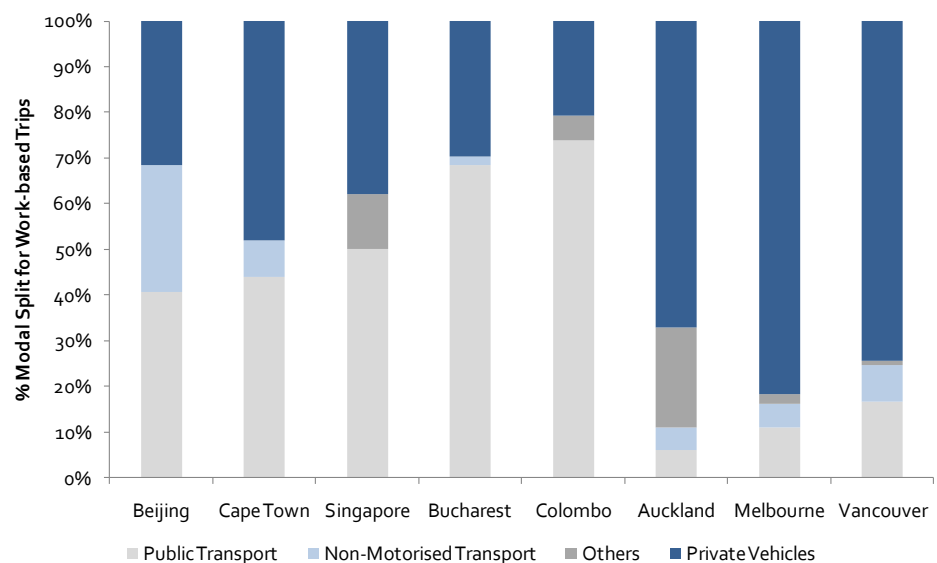
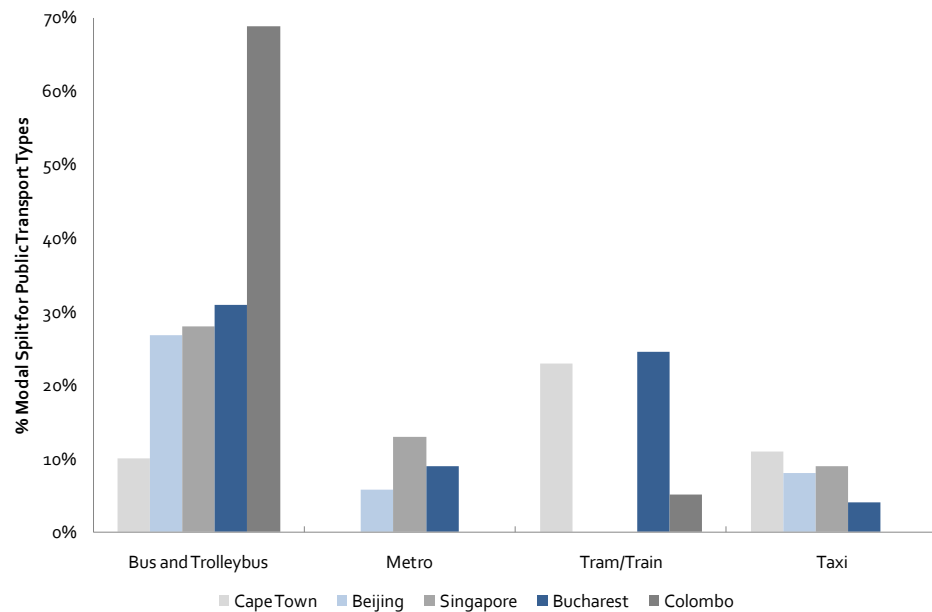


FIGURE 5.2: PUBLIC TRANSPORT MAKEUP IN % MODAL SHARE



As shown in Figure 5.2, bus/trolley bus is the dominant public transport mode for all cities except Cape Town. In Bucharest, trams carry a similarly large proportion of people compared to buses. In Cape Town, the major mode of public transit is train with over 20% share, followed by minibuses (over 10%; shown as Taxi in Figure 5.2).

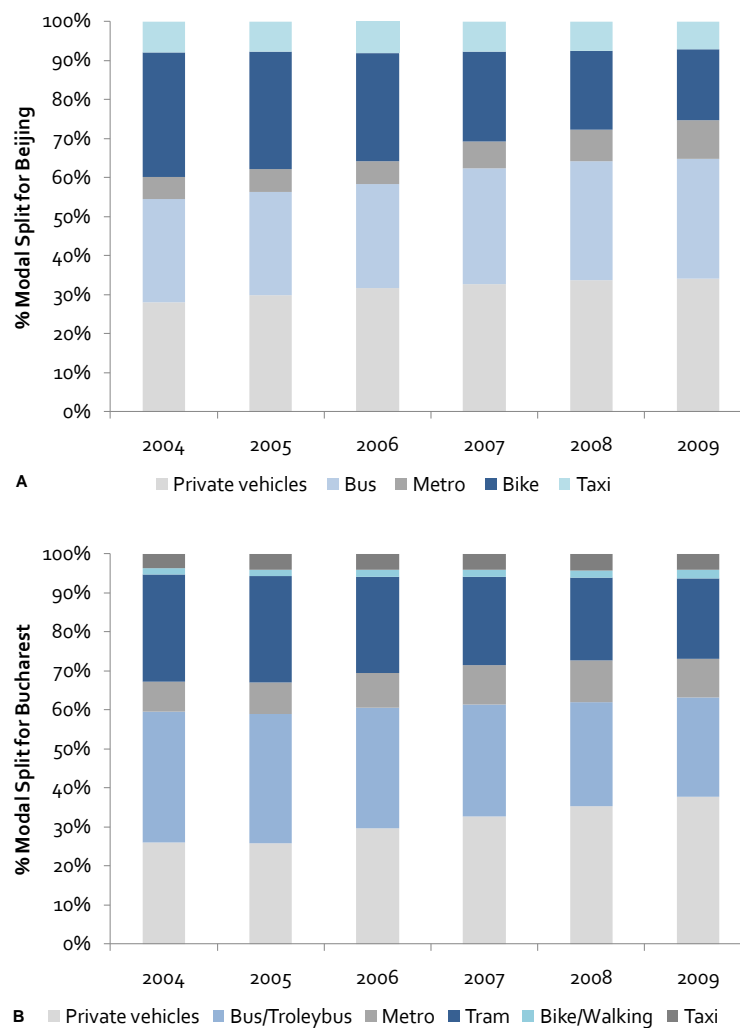
When sufficient data are available, trend analysis of travel mode indicator can show how effective an initiative is or if the city's transport problems, such as congestion, are likely to worsen. For example, Figure 5.3 below shows how the travel mode indicator has evolved in Beijing (A) and Bucharest (B) during the period 2004 to 2009.

Although private vehicle ownership in Beijing is increasing rapidly at an annual rate of 20.5%, the percentage share of private vehicle travel for work-based trips has only increased by 5.9% in the past six years. Beijing has been experiencing severe traffic congestions during peak hours. The city has implemented several initiatives to encourage public transport uptake and has a target to increase public transport mode share to 60%. In 2007 flat travel fares were applied to bus and metro passengers. These actions brought about a substantial increase in bus and metro share.

On the other hand, Bucharest is experiencing a much greater increase (11.9%) from 2004 to 2009 in private vehicle share during peak hours than Beijing. Compared with Beijing, Bucharest's public transport share is in decline, giving way to private vehicle expansion. It is possible to foresee that the existing congestion in the city is likely to worsen in the near future. It is noticeable that an increase in private vehicle use takes place at the expense of bus and tram use while the use of the metro is growing slightly.

In conclusion, a modal split indicator such as the share of public transport in work-based trips (24-hour or peak-hour share) should be one of the core indicators of any urban transport benchmarking exercise. Policymakers around the world increasingly consider promoting public transport usage as a fundamental policy option to develop a sustainable urban environment, and they should be able to monitor its use over time with the objective of increasing it. Once the benchmarking exercise has revealed performance gaps, policymakers can assess the experience of better performing peers and identify locally adaptable solutions that will bring the performance of their cities over time to that of best performers.

FIGURE 5.3: TREND ANALYSIS FOR TRAVEL MODE INDICATOR



5.3 PUBLIC TRANSPORT PATRONAGE

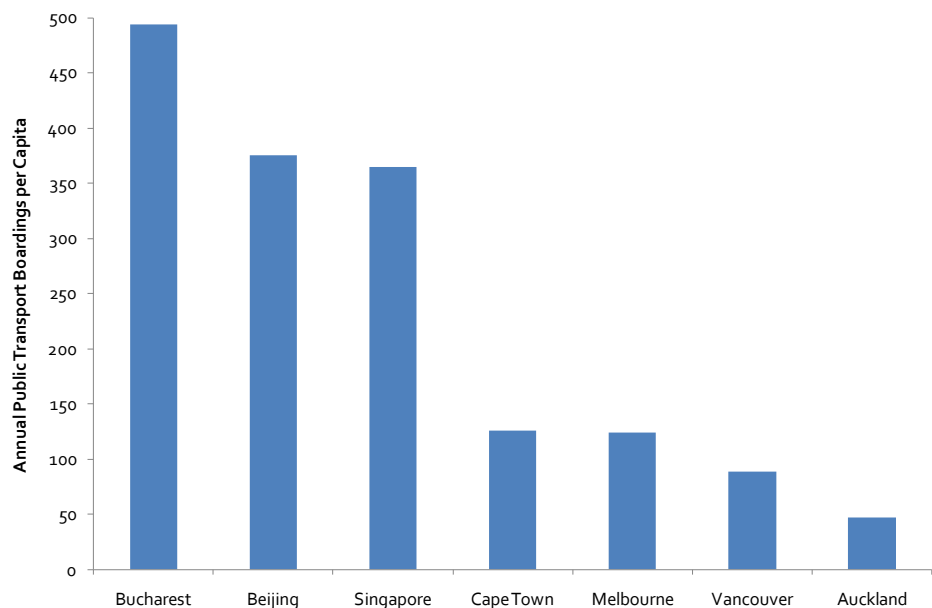
The public transport patronage KPI measures the total number of passengers boarding in a year. For comparison between cities, the number can be normalized to, for example, the city population in order to derive an estimate of the per capita usage of public transport. Figure 5.4 compares the per capita boarding for all public transport modes between the pilot cities and with cities from high-income countries. No patronage data are available for Colombo.

The per capita boarding number in Bucharest is about 32% more than Beijing. This number is consistent with the travel mode shares which show that Bucharest has 28% more public transport trips than Beijing. Beijing and Singapore have similar per capita public transport usage. However, per capita public transport usage, including minibuses, in Cape Town is significantly lower than Bucharest, Beijing and Singapore.

These pilot cities, except Cape Town, show significantly higher per capita patronage than the selected cities in high-income countries. This is expected and consistent with the travel mode makeup shown in Figure 5.1 as private vehicle is the dominant mode of transport in these high-income countries.

It is worth noting that a significantly high patronage number can also relate to a high number of transfers a person needs to make to reach his/her destination. The patronage indicator may be better understood in conjunction with the travel efficiency indicator. The average travel time by bus is similar to car in Bucharest (Figure 5.8). This suggests that the high patronage number is not due to a high number of transfers.

FIGURE 5.4: COMPARISON OF ANNUAL PUBLIC TRANSPORT BOARDING PASSENGERS NORMALIZED TO CITY POPULATION



A comparison of per capita patronage of public transport mode is also made among Bucharest, Beijing, Cape Town and Singapore. Figure 5.5 shows Beijing has the highest per capita bus patronage number and Singapore has the highest per capita metro usage. Bucharest and Beijing share similar per capita metro patronage. Although Beijing has a higher per capita bus patronage than Bucharest, the highly utilized tram services in Bucharest account for a higher public transport boarding number than in Beijing. Minibus usage in Cape Town is 25% more than the bus. This can be explained by the ability of minibuses to service low density urban areas more effectively. It should be noted that minibus usage is included in Cape Town's overall public transport usage.

The analysis also shows that people in Bucharest, Beijing and Singapore use on-street public transport services more frequently than underground metro.

FIGURE 5.5: PER CAPITA PATRONAGE BY PUBLIC TRANSPORT MODE

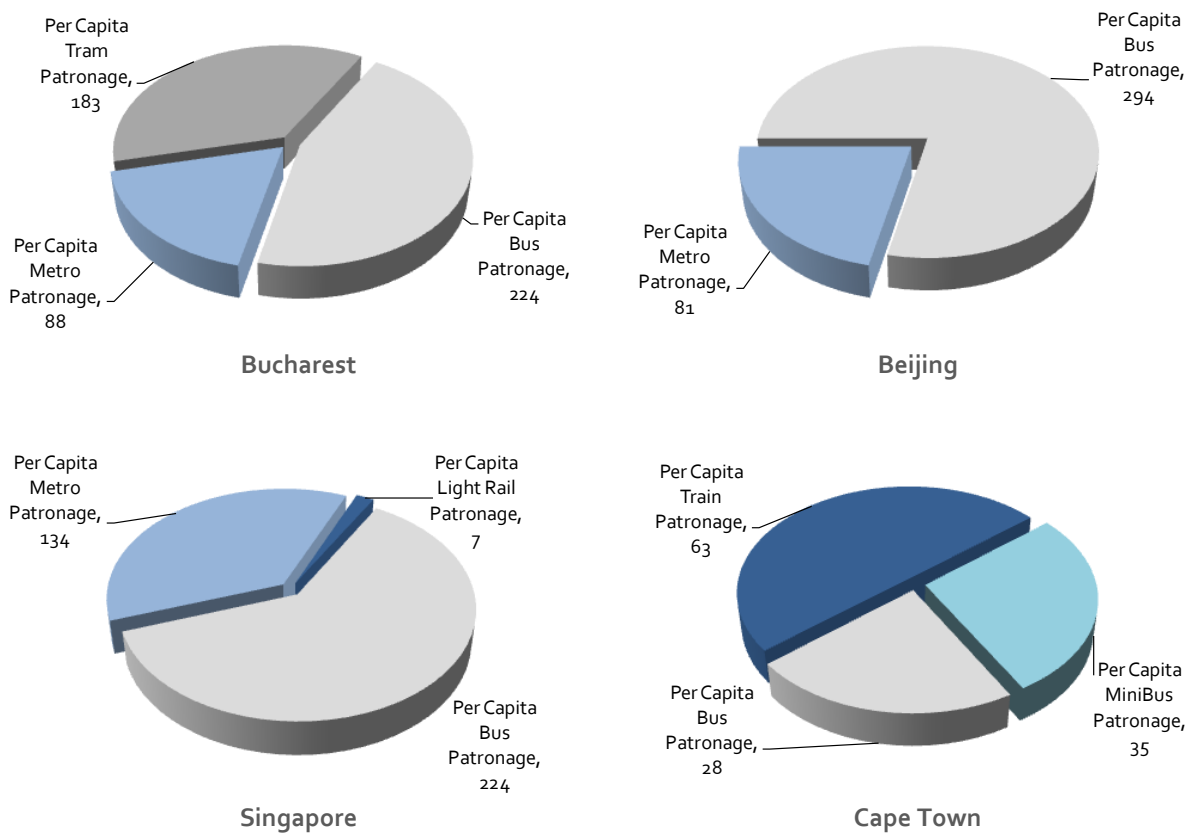
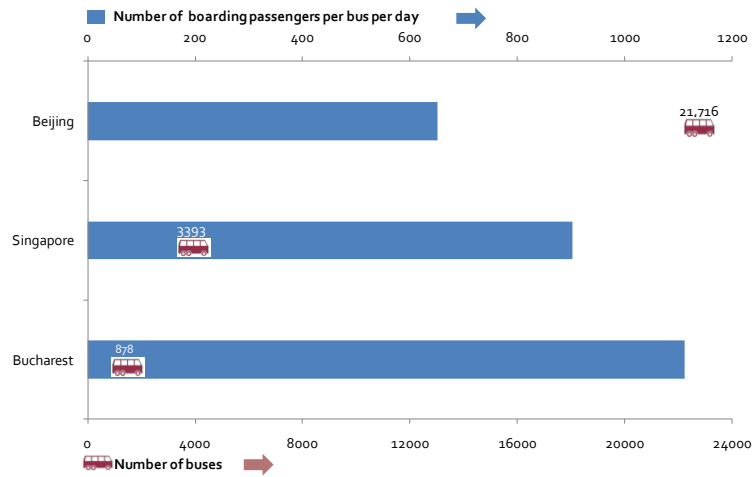


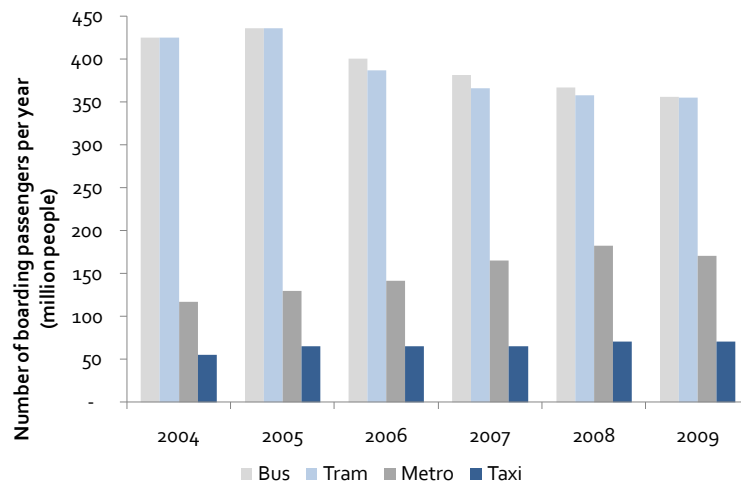
FIGURE 5.6: COMPARISON OF ACTUAL BOARDING PASSENGERS PER BUS AND BUS FLEET NUMBERS



By normalizing the number of bus boarding passengers with the bus fleet number, Figure 5.6 reveals that, on average, a bus in Bucharest carries over 1,100 people per day, which is 70% more than the number carried by a bus in Beijing and 22% more than Singapore. However, the number of buses in Bucharest is just 4% of the bus fleet in Beijing. This information may suggest that buses are much more crowded in Bucharest than Beijing. Or it is possible that buses in Beijing are running under capacity. The latter is suggested by the number of buses in Beijing being reduced by 15% from 25,409 in 2006 to 21,716 in 2009.

Trend analysis of the patronage of each public transport mode is also performed for Bucharest as shown in Figure 5.7. Again, the trend analysis depicts a similar picture to Figure 5.3 showing that public transport usage is in decline, except for the metro which is steadily growing.

FIGURE 5.7: TREND ANALYSIS OF BOARDING PASSENGERS IN BUCHAREST



5.4 TRAVEL TIME

The travel time indicator measures the efficiency of an overall transport system. Figure 5.8 compares the average travel time of journey-to-work trips by car, bus and metro for Beijing, Bucharest and Singapore. Colombo and Cape Town data are not available.

The average travel time is significantly less in Bucharest compared with Beijing and Singapore. In Bucharest, travelling by car and bus take a similar amount of time, suggesting that bus travelling is as efficient as car travel. However this is not the case in Beijing. A survey in 2005 showed that the average journey time to work in Beijing was more than an hour by public transport modes, which were much slower than using cars. The most recent Commuter Pain Survey conducted by IBM revealed that commuters in Beijing had the worst experience in getting to and from work each day and Beijing topped the commuter pain index among the 20 cities surveyed. The two main issues addressed by the index were commuting time and time stuck in traffic.

Trend analysis of travel time in Bucharest also shows that while underground travel has remained fairly constant over the years, the on-street travel time is steadily increasing, suggesting an increase in traffic congestion (Figure 5.9).

Travel time is an important element of any urban transport benchmarking exercise. This indicator should however be well designed so that it permits comparability. In undertaking such a comparison, one should also keep in mind the size of the city.

FIGURE 5.8: AVERAGE TRAVEL TIME COMPARISON

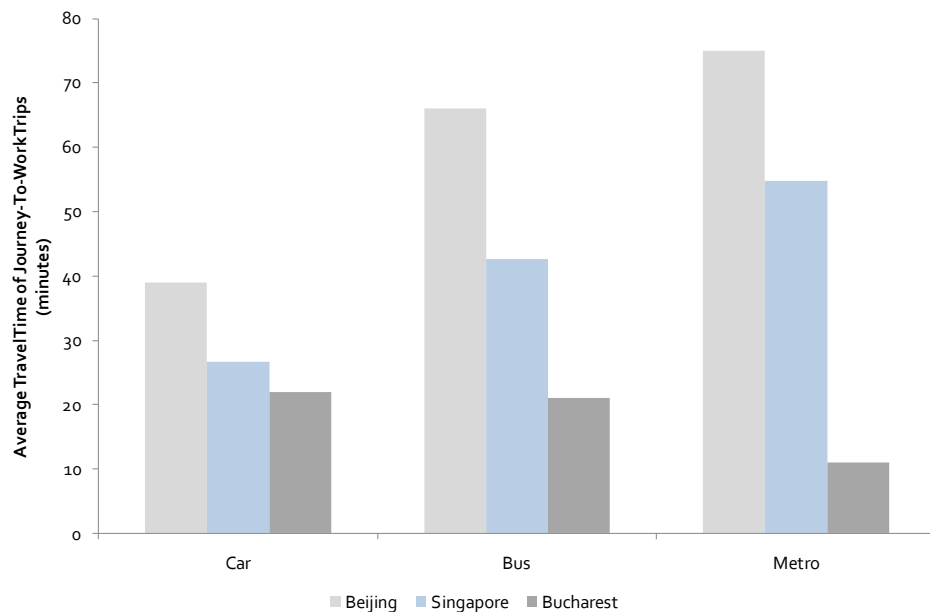
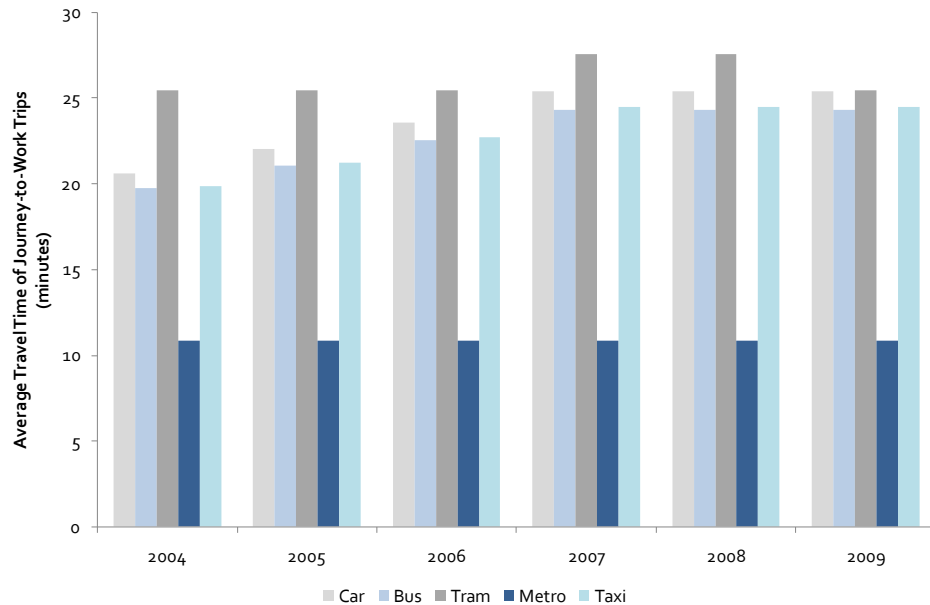


FIGURE 5.9: TREND ANALYSIS OF AVERAGE TRAVEL TIME IN BUCHAREST



5.5 CATCHMENT AREA

The catchment area KPI is a measure of accessibility in terms of the distance and walking time from the outer rim of a catchment area to the public transport stop or station. Analysis of the indicator is not available because the data are not collected in the pilot cities, except for Bucharest. The catchment area measured in terms of walking distance and time in Bucharest is 350 meters and five minutes respectively, and these values have not changed over the past six years.

Catchment area KPI is important information for policymakers and urban transport professionals. This study showed that this is however one of the sophisticated indicators that are not easily available. Such an indicator is usually available in cities where a tradition of urban transport planning and analysis exists or where recent urban transport studies have been completed. Despite this difficulty, it is recommended that a benchmarking exercise should include this KPI with the understanding that its availability will be limited.

5.6 COST OF TRAVEL

The cost of travel KPI measures the affordability of public transport in the city. Bus fare data are available from all the pilot cities except Cape Town and were analyzed by this study. A comparison with the cost of travel by car helps put the bus travelling cost in context. The average cost for travelling by car is however not available for Beijing and Colombo. Figure 5.10 compares the cost of travel by bus between the pilot cities and with selected cities in high-income countries.

The actual cost of an average bus fare in Colombo is low compared to other pilot cities, however this cost as a proportion of per capita income (per capita GDP) is higher in Colombo than in all other pilot cities (refer to Figure 5.10). In comparison with the selected cities in high-income countries, the bus fares in the pilot cities are lower in terms of both actual cost and cost normalized to per capita income.

Beijing has a lower bus fare than Bucharest in terms of both actual cost and cost as a percentage of per capita income, as shown in Figure 5.11. Although the actual cost of travelling by metro in Beijing is relatively low in comparison to other cities, when shown as a proportion of per capita income, it is slightly higher than the cost in Bucharest.

FIGURE 5.10: AVERAGE BUS FARE COMPARISON

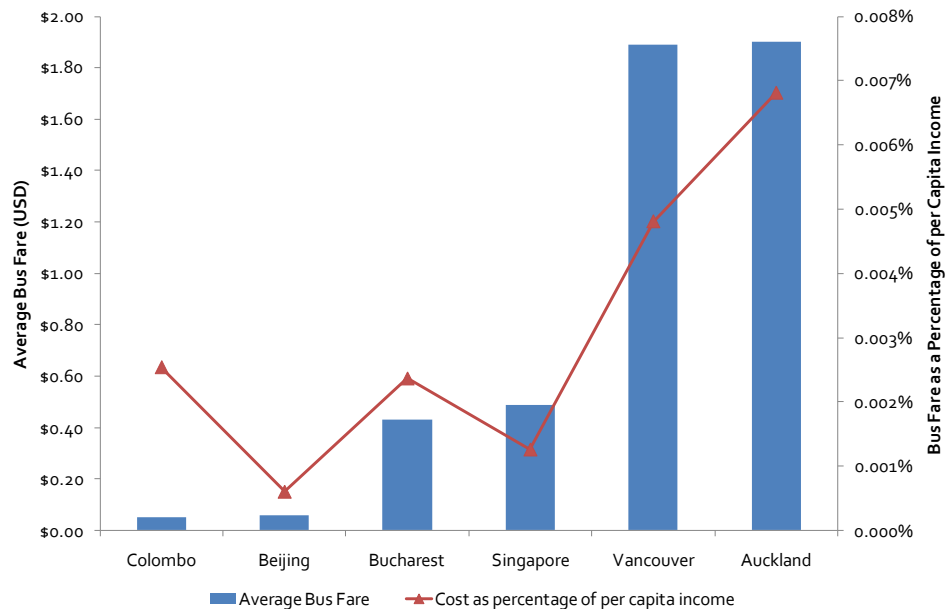
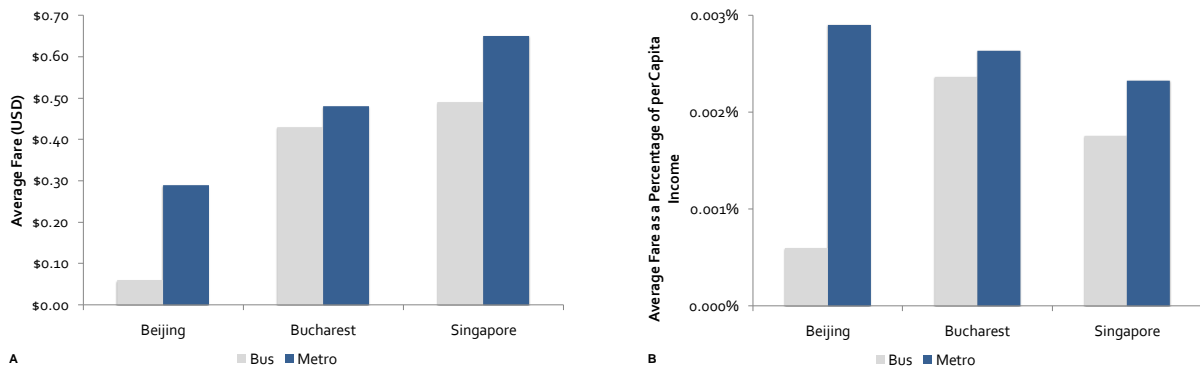


FIGURE 5.11: COST OF TRAVEL COMPARISON BETWEEN BUS AND METRO



5.7 ROAD SAFETY

The road safety indicator measures how safe it is to travel on the road. It is a basic and common indicator collected by countries/cities around the world. It is possible to split the public transport component from the crash information. However these data are not currently available from Beijing and Colombo. Road accident data for Colombo are not available, but are represented by the country data. Figure 5.12 shows an analysis of road-accident fatality data between the pilot cities.

The fatality data are normalized to the number of cars (A) and population (B) in the cities. For Colombo, the data are normalized to the number of cars and population in the country. Colombo has the highest road-accident fatality rate in the pilot cities. While it has more fatalities per 10,000 cars than Bucharest, Beijing has relatively low fatalities per population. Beijing and Singapore have relatively similar level of road fatality rates.

FIGURE 5.12: COMPARISON OF NUMBER OF ROAD FATALITIES

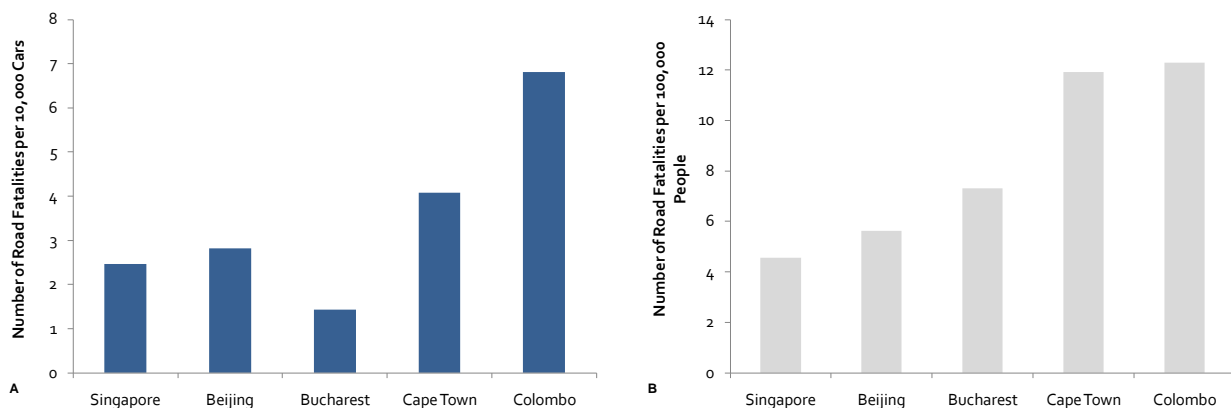
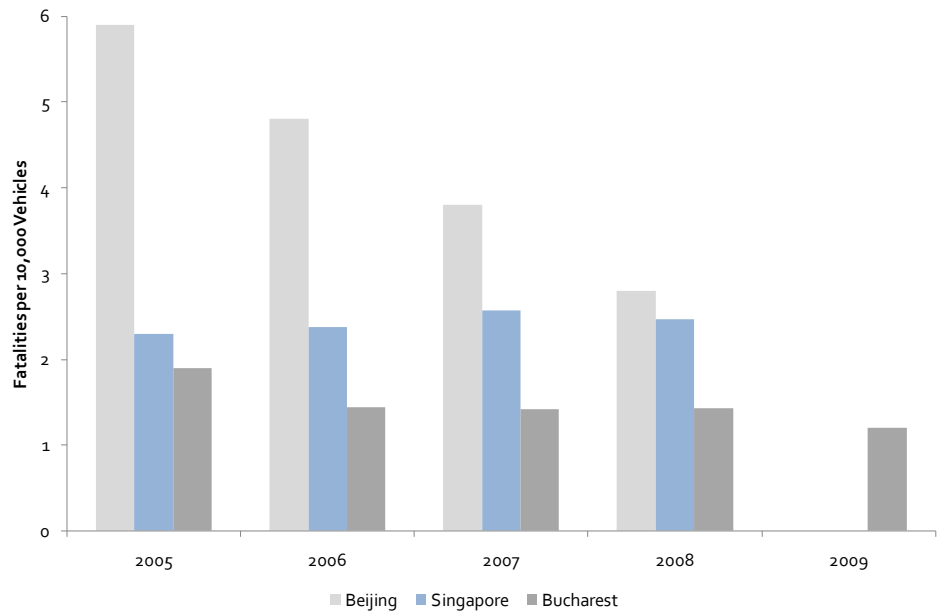


FIGURE 5.13: TREND ANALYSIS OF ROAD SAFETY



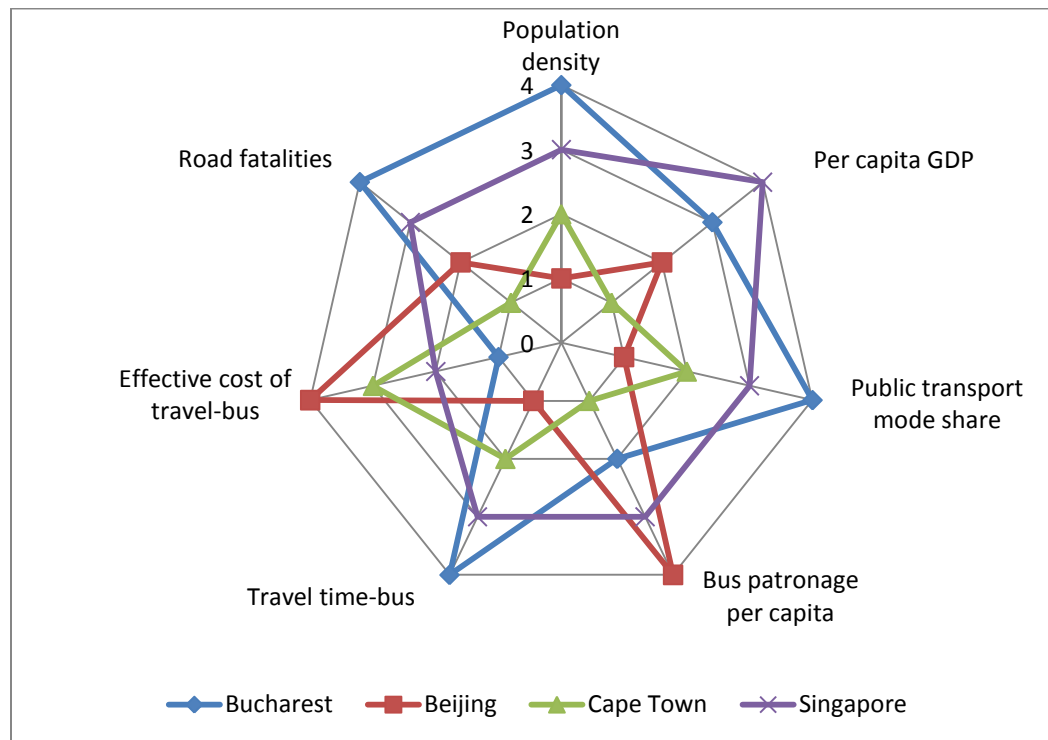
Trend analysis of the road safety data is shown below in Figure 5.13. Beijing has experienced a significant reduction in its road fatality rate over the past years. Improvement in road safety has been a main target adopted by the transport agency in Beijing since 2005 as part of the “New Beijing Transport System” initiative to provide support for the Olympic Games in 2008. This initiative has shown a positive impact on reducing road accidents in Beijing. The number of fatalities in Bucharest has been consistently low and is steadily declining.

5.8 PRESENTING THE BENCHMARKING ASSESSMENT

It is important that policy and decision makers be presented with the findings of the benchmarking assessment in a transparent and clear manner. It is therefore recommended to limit the indicators as much as possible to metric measurements and avoid constructing “black-box” indicators. It is usually sufficient for policy makers to have a succinct report with adequate graphic presentations to allow for proper discussion.

When comparing the overall position of the city’s urban transport based on multiple indicators, the use of graphs as it is depicted in Figure 5.14 is encouraged. In the case of the pilot cities, the comparison shows the ranking of the pilot cities for the respective KPIs, with a higher ranking meaning higher score for the KPI (For example: 4 - means best performance and 1- means worse performance). Note that Colombo is not included in this comparison due to limited KPI data on the city and two KPI values were assumed for Cape Town.

FIGURE 5.14: OVERALL RANKING COMPARISON OF FOUR PILOT CITY AREAS



0 = worst/lowest and 4 = best/highest. Assumed ranking: Travel time Cape Town (2), Travel cost Cape Town (3)

Observations from the comparison include:

- Bucharest has the highest public transport uptake, highest population density and cost per public transport trip;
- Beijing has the largest share of public transport on busses but also the longest average travel time per trip. It also has the cheapest travel per capita given significant government subsidies;
- Public transport share is potentially correlated to the population density, meaning that higher population density may suggest higher uptake in public transport; and
- There is no apparent trend between cost of bus travel and uptake.

The overall comparison is effective in “telling the complete story” during inter-city comparison. It was especially effective in highlighting apparent trends or lack of apparent trends between certain KPIs.

6 IMPLEMENTATION OF A BENCHMARKING INITIATIVE

6.1 DEVELOPING APPROPRIATE BENCHMARKS

Section 5 presented benchmark values and comparisons between the pilot areas. The next step is to use the comparative analysis and develop appropriate KPIs and benchmarks for a city. Establishing a benchmarking initiative should reflect the desired policy objectives and include only relevant indicators and comparators. This section presents a brief summary of the process for establishing benchmarks based on comparative analysis. Examples are used to illustrate important concepts of this process.

6.1.1 ESTABLISHING THE STATUS QUO

The first step towards any meaningful benchmarking is to have a thorough understanding of the organization's performance. This not only involves comparison with other organizations but also involves an understanding of changes in the organization's internal performance over past years.

In terms of the external comparison, it is important to choose appropriate peer organizations. For example it would be of little value to compare an organization with another that clearly has a worse performance in the areas investigated. In addition, the comparison should be undertaken against organizations/countries/cities with similar contextual background, issues and trends. For example, in this pilot study, both Bucharest and Beijing have similar backgrounds despite obvious differences in size and population density. They both have been through important changes in the last decades, and they have both focused on improving their overall transport efficiency. In addition, both countries face challenges regarding the increase in private motor ownership that could have a negative impact on the efficiency of the transport system as a whole and consequently on public transport. In addition, Romania is a member of the European Union, and it shares many similarities with cities in Central and Eastern Europe. It is therefore logical that the benchmarking of Bucharest would use peer cities in the European Union and in Central and Eastern Europe.

The status quo should cover the full spectrum of the transport efficiency assessment with the primary aim of identifying both the strong and weak points of the urban transport system.

6.1.2 THE NORMALIZATION OF INFORMATION AND DATA

The normalization used in the comparative analysis not only causes a different outcome in the analysis but is also central to the message to be conveyed. Consequently, it is important to ensure that appropriate normalization techniques are employed. For example, Figure 5.10 illustrates the comparison between the bus fares of the pilot areas and those in high-income countries. It has been discussed that although Sri Lanka has

the lowest actual bus fare in real terms, the fare normalized per capita income is the highest of all five pilot areas.

Likewise, Figure 5.12 illustrates a comparison of fatal crashes between the pilot areas. Two different normalization techniques are used: First, the information is normalized on the basis of crashes per vehicle, and secondly they are normalized per population. Although road crashes are normally reported per travelling vehicle in high-income countries, normalizing them to population may be more appropriate for transition and developing countries, especially given the difference in modal split between the two (refer to Figure 5.1), and the difficulty in obtaining vehicle usage (vehicle-km for example) in cities where a tradition of urban transport analysis is weak or does not exist. When dealing with fatalities for comparative purposes, it is important to ensure that the same definition is used: some countries only define fatalities as those which happen at the time of the accident; others those within as much as 30 days of the accident.

6.1.3 DEFINING THE TARGET

Having a specific target sets a clear direction for an organization. For example the decrease in fatal crashes in Beijing can only be attributed to a commitment from the authorities to change the performance towards acceptable levels for the 2008 Beijing Olympics (refer to Figure 5.13). From the pilot data it appears that Bucharest has also achieved a decreasing trend in fatal crashes, but not as drastic as Beijing. Therefore, one of the first steps towards establishing benchmarking targets is to have strong policy commitment and vision in place to guide improvement strategies.

Comparisons with high-income countries may in some cases signal performance trends to be avoided for transition and developing countries. For example, Beijing and Bucharest may want to adopt policies that would help them avoid modal splits similar to Australia or Canada (refer to Figure 5.1). If transport for the majority of people in either Romania or China included such significant travel by private cars, there would be negative consequences such as severe congestion and pollution.

Therefore, the target performance or benchmark level is decided based on a combination of:

- The organization's current performance and its desired position in the future;
- The contextual background in terms of future objectives for public policies regarding urban transport;
- Comparisons with cities/countries to establish some practical levels that would be achievable in terms of an organization's contextual background. Two possible approaches could be used:
 - "We want to be as good as those guys" – where it is believed that someone in similar circumstances has achieved an appropriate performance level. If this also seems achievable for the organization in question, the level is set accordingly;

- The second approach would be to accept either a higher or lower performance level than the peer organization. Reasons for deviating from the peer organization may include resources available to the organization; and in most cases, significant improvements in an organization's performance cannot be achieved in a short time frame. Therefore a future target should be set on the basis of practical incremental improvements.

6.1.4 CONTINUOUS MEASUREMENT AND REPORTING OF PERFORMANCE RELATIVE TO THE BENCHMARK

Benchmarking can only be successful if it becomes a continued process of measurement and reporting against the set targets. Apart from obvious progress monitoring that takes place, it will also ensure that the overall outcomes progress in a desired direction. It is not uncommon for KPIs in a benchmarking progress to be counter reactive. For example, one of the strategies to improve travel time and/or travel speed could be to improve the capacity of a network by increasing the number of motorway lanes. Although this may have the initial desired outcome, it can also encourage patrons to use private vehicles, thus in the long run resulting in a poorer performance of the public transport and overall traffic congestion. However, focused capacity improvement such as dedicated bus lanes could have a long-term return on increasing the effectiveness of public transport and decreasing congestion.

Having continuous measurement and reporting in mind should also help set the expectations in terms of the scope and magnitude of the benchmarking framework. Experience has shown that setting overambitious frameworks from the onset can lead to cumbersome and costly initiatives that cannot be sustained over time. It appears that the best approach would be to start with a simple but meaningful framework and to upgrade it over time while paying particular attention to the marginal benefits and costs of such upgrades.

6.2 LESSONS FROM THE COMPARATIVE ANALYSES

The pilot study involved six KPIs and five study areas from transition and developing countries as well as comparators in high-income countries (New Zealand, Australia, and Canada). Its objectives were to demonstrate the value of benchmarking and obtain a better understanding of the practical and data-related aspects of benchmarking.

The study demonstrated the value of these comparisons in the context of public transport service delivery. The following points are noted:

- Although the study is not an in-depth research of the transport situation in the pilot cities, this simple exercise has already identified a number of good initiatives as well as performance gaps in the study areas. This is a relatively quick demonstration, by using existing data sets provided by the pilot cities, that benchmarking can be an effective tool in identifying areas for improvement;

- A KPI should not be analyzed in isolation. As demonstrated in Figure 5.5, for example, the patronage KPI analysis in Section 5, the KPI is related to other KPIs such as travel mode, travel time and cost. Understanding the interaction between the KPIs will provide a more meaningful and complete picture of the urban transport system;
- Benchmarking should not be viewed as a one-off exercise. Other studies have shown that it takes several iterations to develop an optimal benchmarking initiative. Furthermore, this pilot study has demonstrated that when sufficient data are collected, trend analysis such as in Figure 5.3 can capture the effectiveness of an implemented initiative and also yield meaningful implications for future changes.
- The study also demonstrated that it is difficult to obtain consistent data from all participants, but this should not prevent initiating urban transport benchmarking if it is understood that such an endeavor should start with simple but meaningful steps:
 - The purposes of *existing* data collection programs are different between countries thus resulting in completely different data collection strategies. Also, the constraints in resources and knowledge further limit the type and frequency of performance data collected in transition and developing countries. Making use of simple and commonly used performance data will make benchmarking more effective and attractive;
 - An analysis methodology is essential for consistent and accurate data reporting. For example, the cost of travel needs to be normalized to a commuter's income as in the case of bus fare in Figure 5.10; and
 - The supporting technical tools for a benchmarking initiative should not be underestimated although today's IT environment offers cost effective solutions. For example, development of a database is needed due to the large amount of data involved in the process.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 SUMMARY OF THE PILOT BENCHMARKING STUDY

Benchmarking is a well recognized approach to assess the performance of an organization. In the infrastructure industry, good examples of benchmarking can be found in the water supply area through the International Benchmarking Network for Water and Sanitation Utilities (www.ib-net.org). Little evidence has been found that benchmarking has been used successfully for transition and developing countries in the assessment of urban public transport systems. This report documents a pilot study for implementing a benchmarking initiative for public transport in transition and developing countries, as a first step for a more ambitious initiative for urban transport in general.

The objective of this project was to develop and test a benchmarking framework for public transport services, taking into account the most significant constraints faced in transition and developing countries. This involved the recommendation of key performance indicators (KPIs) to assess the performance of various cities in the area of public transport.

Using these indicators, policymakers and urban transport professionals will be able to identify and implement improvements to public transport in order to achieve a safer, cleaner, and more affordable services. The following questions have been answered through this research project:

- How is benchmarking relevant to policymakers seeking to improve the performance of urban transport?
- Do the required information and data exist to make such a benchmarking exercise worthwhile?
- Does the comparative analysis provide useful information?
- How are the benchmark levels established?

For this study a full set of KPIs were developed as part of the benchmarking framework which covers the main areas of:

- Uptake of public transport
- Travel efficiency
- Accessibility
- Affordability
- Travel experience.

A total of 13 KPIs have been suggested and are supported by a number of contextual indicators quantifying the demographic and socio-economic background of the areas in question. For the purpose of the benchmarking pilot, six KPIs were used to investigate

the performance of five pilot areas: Colombo (Sri-Lanka), Beijing (China), Bucharest (Romania), Cape Town (South Africa), and Singapore.

7.2 FINDINGS FROM THE PILOT STUDY PROJECT

7.2.1 DATA AVAILABILITY

It was encouraging to note that in most cases core data existed in most cities for minimal comparative analysis. It was evident that more data existed for areas where there was a tradition of urban transport planning and analysis or some concerted effort to improve public transport services and the overall efficiency of the transport system. It can be accepted that initially it would be a challenge to obtain all the required data for a benchmarking initiative in a city, but that it is possible to gather the required information during transport studies with little effort. It should be noted that no additional data collection was undertaken as part of this study, and all data were sourced from existing census and transport reports.

7.2.2 VALUE OF THE KPIS AND COMPARATIVE INFORMATION

Useful comparisons were undertaken for the pilot areas. It was noted that the observations from the comparisons were consistent with the development process and initiatives associated with each country. For example, Beijing had targeted specific issues such as encouraging the use of public transport through subsidies and significant investment in safety improvements. Positive trends were observed that confirmed the relevance of some of these initiatives.

The comparative analysis also confirmed that increased private vehicle ownership placed greater pressure on the public transport system and brought about reductions in patronage. For example, this trend was notable in Bucharest where there had been a decrease in both bus and tram patrons. It seems that the Bucharest metro system is now showing increased patronage.

It has been demonstrated that the normalization of KPIs to the appropriate contextual parameters is essential in making KPIs meaningful and appropriate for the transition and developing countries. Examples have demonstrated that the wrong conclusions can be drawn from inappropriate or no normalization (refer to Section 6.1.2). In addition, not all KPIs can necessarily be normalized.

It has been further demonstrated that comparative analysis should also include some examples from high-income countries. This not only gives perspective to some of the results, but also indicates trends that transition and developing countries should avoid, for example, the dependency on private cars.

The overall conclusion is that comparative analysis is essential for a successful benchmarking initiative and useful information can be yielded from the data supplied by the pilot areas.

7.2.3 ESTABLISHING THE BENCHMARK LEVEL

Comparative analysis is an essential component of benchmarking. It assists in giving a relative performance status for the area in question. In addition, it highlights the potential performance levels achievable for respective performance areas. Choosing an appropriate peer comparison city is essential for this, otherwise unrealistic performance targets could be developed. Through comparison with other successful areas a quick insight can be obtained by investigating the successful initiatives that lead to the desired performance outcomes.

Despite the usefulness of comparative analysis, establishing appropriate benchmarks remains a function of policy objectives and commitment to make a change to the current performance. This has been demonstrated by some of the successful aspects highlighted by the Beijing and Bucharest pilot areas.

7.3 RECOMMENDATIONS FOR ADOPTING A BENCHMARKING INITIATIVE AT LOCAL LEVEL

7.3.1 MOTIVATION

Any strategy of improvement needs to be underpinned by a robust process of self-monitoring and external monitoring with peers. Only by knowing one's current performance, in relation to a target, that one can monitor the success of initiatives to address shortcoming within a system. This is especially relevant to the urban public transport. Given that there are many factors that assist in improving uptake of public transport, it is important to know how a study area performs relatively to other cities in order to gauge the effectiveness of certain initiatives.

It is therefore recommended that any agency that is tasked with managing and/or improving public transport systems to start with a benchmark process as a first step. This report provides some guidelines of how the benchmark process should be undertaken. It also demonstrated the value of a benchmark process.

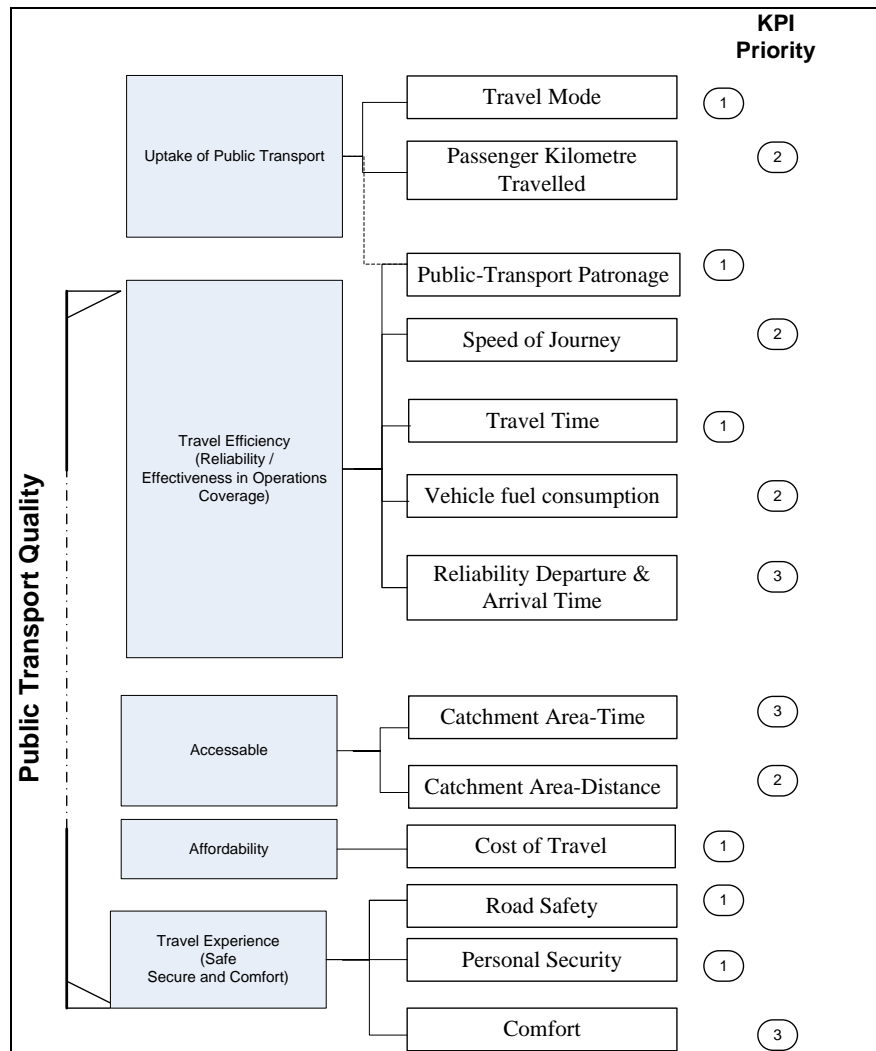
7.3.2 BENCHMARKING FRAMEWORK

A benchmarking framework consisting of 13 key performance measures (excluding contextual measures) was recommended by this study. It is however understood that a full scale benchmarking for urban transport in transition and developing countries would take some years to be fully operational.

For this reason, a stage-wise benchmarking implementation is recommended. Figure 7.1 illustrates the full benchmarking process with priorities assigned to each key performance indicators. The idea is to have representative KPIs for each of the core reporting areas. Therefore as a starting point all the priority 1 KPIs would be regarded as the minimum measures to report for a full representation of the urban public transport performance. These priorities were selected on the basis of the availability and ease of data collection. Priority items 2 and 3 therefore represent more complex and more challenging data items to collect. As a benchmarking process matures over

time these KPI could be incorporated in order to provide a more comprehensive presentation of the status of urban public transport.

FIGURE 7.1: RECOMMENDED PRIORITIES FOR KEY PERFORMANCE INDICATORS



7.3.3 DATA REQUIREMENTS

The data requirements for the KPIs could also follow a stage-wise development process. For example, during the initial stages some data could be sources from special studies or generally available sources such as census data. For more technical type information initial benchmarking may even be based on a sample of the system. As the maturity of the benchmarking process increases, more detail and wider ranging studies and/or data collection could be undertaken.

Ultimately, the benchmarking process has to be effective for its purposes. The data requirements need to be viewed from the perspective of maintaining simplicity and practicality on the one end and accuracy and sophistication on the other end.

7.4 FURTHER WORK - INTERNATIONAL IMPLEMENTATION

The increasing focus on results by governments and international development institutions requires that initiatives targeting the improvement of urban transport should be supported by sufficient information. The benchmarking concept studied under this research project could be a useful tool to support this drive for results. The global reach of development and international financial institutions allows effective dissemination of knowledge and would suggest that such a benchmarking initiative should be initiated as part of their development work.

It is therefore recommended that a gradual full-scale development/implementation of a simple benchmarking initiative for urban transport in transition and developing countries be implemented. This implementation will typically involve the following:

- Refining the definition of the core indicators to take account of the complexity of urban transport;
- Collecting the relevant data for target implementation;
- Developing a web-based benchmark sharing and dissemination platform that includes data analysis;
- Constructing guidelines for the use of urban transport indicators and benchmark indicators for transition and developing countries, and
- Establishing a cooperative mechanism for continuous data collection.

APPENDIX A: FULL LIST OF KEY PERFORMANCE INDICATORS

1. Key Performance Indicators (KPIs) for Work-Based Trips

KPIs	Indicator Target Group	Definition	Method of Measurement	Basic Data Requirement		
				Statistic	Units	Notes
Travel Mode	Public-transport usage	The indicator tracks the usage of available transport modes for work-based trips.	It is expressed as percentage of the total number of daily work trips that are made by various transport modes, including private vehicle, company vehicle, passenger in private vehicle, public transport, motorcycle, walked/jogged, biked and worked at home, etc.	% travel by private vehicle	%	
				% travel by public transport mode	%	
				% by bike	%	
				% by walking	%	
Public Transport Catchment Area	Accessibility	The area served by a public transport facility.	Distance from public transport stop or station to outer rim of patrons dwellings served by this public transport stop or station (m) or Walking time from public transport stop or station to outer rim of patrons dwellings served by this public transport stop or station (minutes)	Distance between public transport stop or station to outer rim of patron dwellings	m	
				Walking time from public transport stop or station to outer rim of patron dwellings	Minutes	
Annual Public-Transport Passenger Kilometer Travelled	Public-transport usage	The indicator is an estimation of the total distance travelled over a year by public-transport passengers.	It is the sum of passenger kilometers travelled by various public transport modes, such as bus, metro and ferry. For example for bus travels, it is the	e.g. Number of boarding passengers transported by bus	Persons	
				e.g. Average distance travelled by each passenger by bus	Kilometer (km)	

			number of passengers transported by bus multiplied by the average number of kilometers travelled by each passenger.		Persons	
					Kilometer (km)	
					Persons	
					Kilometer (km)	
Annual Public-Transport Patronage	Public-transport usage	The indicator shows the total number of passengers transported by public transport modes over a year.	It is the sum of the number of boarding passengers by various public-transport modes, such as bus, metro and ferry.	e.g. Number of boarding passengers transported by bus	Persons	
					Persons	
					Persons	
Average and Variance of Public-Transport Speed of Journey-to-Work Trips	Public-transport reliability	The indicator shows the average and variance of speed for work-based trips by cars and public transport, respectively.	<p>It is the average and variance of public-transport speed (e.g. bus speed) during peak hours.</p> <p>The public transport speed will be compared with car speed.</p> <p>The average speed of each public transport mode may be calculated to give a weighted average value to represent the overall public transport performance. The weight attached to each mode is the share of passenger kilometers travelled by that mode.</p>	Average and variance of speed by car during peak hours	Km/hr	
				e.g. Average and variance of speed by bus during peak hours	Km/hr	
Average and Variance of Travel Time of Journey-to-Work Trips	Public-transport reliability	The indicator shows the average and variance of travel time for work-based trips by cars and public	It is the average and variance of public-transport travel time to work (e.g. travel time by bus) during peak hours.	Average and variance of travel time for work-based trips by car	Minutes	
				e.g. Average and	Minutes	

		transport, respectively.	<p>The travel time by public transport will be compared with travel time by car.</p> <p>The average travel time by each public transport mode may be calculated to give a weighted average value to represent the overall public transport performance. The weight attached to each mode is the share of passenger kilometers travelled by that mode.</p>	<p>variance of travel time for work-based trips by bus</p>		
Public-Transport Departure-time Reliability	Public-transport reliability	The departure-time performance measures reliability for each public transport mode.	<p>The indicator measures the percentage of public transport vehicle (e.g. a bus) that departs within a targeted time (e.g. ± 5 min) relative to scheduled time.</p> <p>The reliability of each public transport mode may be calculated to give a weighted average value to represent the overall public transport performance. The weight attached to each mode is the share of passenger kilometers travelled by that mode.</p>	<p>e.g. % bus departing on schedule</p>	%	Indicate the targeted time
Public-Transport Arrival-time	Public-transport reliability	The arrival-time performance	The indicator measures the percentage of public	e.g. % bus arriving on schedule	%	Indicate the targeted time

Reliability		measures reliability for each public transport mode.	transport vehicle (e.g. a bus) that arrives within a targeted time (e.g. ± 5 min) relative to scheduled time. The reliability of each public transport mode may be calculated to give a weighted average value to represent the overall public transport performance. The weight attached to each mode is the share of passenger kilometers travelled by that mode.			
Average Cost of Travel of Journey-to-Work Trips	Transport affordability	The indicator considers the cost of travel associated with public transport and cars for work-based trips. The focus is on the actual users.	The cost of running a car may include fuel expenditure, vehicle maintenance cost and parking fee, depending on local situations. The average cost for public-transport users can be estimated by dividing annual farebox revenue by the annual passenger kilometers travelled for each public-transport mode.	Average cost of running a car per kilometer	US cents	
				Average distance travelled by car for work-based trips	Km	
				Eg. Annual bus farebox revenue	US cents	
				Eg. Average bus fare for 5km/10km/15km/20 km	US cents	
Road Safety – Overall vs Public Transport	Transport safety	The indicator measures the total number of fatalities resulted from road accidents in the	The annual death tolls resulted from road accidents.	Annual road-accident fatalities	Persons	
				Annual road-accident fatalities involving public-transport	Persons	Data availability varies

		metropolitan area.		vehicles		
Travel Personal Security	Transport safety and security	The indicator refers to the risk of physical assault or theft on public-transport vehicles or at public transport stations.	It is viewed from two perspectives, being the perceived security and the actual crime statistics on public-transport vehicles and stations. The perceived travel security can be obtained from perception survey data and is generally expressed as % people feeling safe or unsafe, for example.	Annual number of crimes occurred on public-transport vehicles and stations	Numbers	
				% people feeling safe when travelling on public-transport vehicles or at waiting areas	%	The combined % of people feeling safe and unsafe should be 100%.
				% people feeling unsafe when travelling on public-transport vehicles or at waiting areas	%	The combined % of people feeling safe and unsafe should be 100%.
Vehicle fuel consumption	Environment and green house gas emission	The indicator measures fuel use for transport purpose.	Fuel consumption can be obtained from fuel use data. The fuel data can be converted to estimate CO ₂ and CH ₄ emission.	Annual transport gasoline volume	Liters	
				Annual transport diesel volume	Liters	
				Annual transport gasoline volume used of public-transport vehicles	Liters	Data availability varies
				Annual transport diesel volume used for public transport	Liters	Data availability varies

2. Contextual Indicators

Contextual Indicator	Definition	Basic Data Requirement		
		Statistics	Units	Notes
Public Transport	Public transport includes both official and unofficial operations. An example of official public transport is the bus operation supported by government through various mechanisms, such as schedule regulation and fare control or subsidies. An example of unofficial public transport is the bus operated by private companies or individual personnel that is not regulated by the government. The modes of public transport vary among cities.	Public transport modes	--	Please state the types of public transport available in the city.
City	The city boundaries are accepted as defined locally by the city administrations. This is consistent with the approach adopted by other urban transport initiatives by the World Bank, and will ensure that the indicators will be compatible spatially with the Bank's data.	--	--	The data should be collected for a city unit. If, in addition, statistical data on a metropolitan area is available, the data should be named the unit as metropolitan area.
City land area	The area of a city's land surface.	Land surface area	Km ²	
Population	The total number of people living in the city.	Population	Persons	
Population density	The ratio between the population and the urbanized surface area.	Population	Persons	
		Urban surface area	Km ²	
Vehicle Kilometers Travelled (VKT)	VKT is the total annual vehicle kilometers travelled in an area.	Annual vehicle kilometers	Vehicle Km	
Vehicle ownership per capita	The number of vehicles per capita inhabited in the metropolitan area.	Total number of cars	Car	
		Population	Persons	
Road length	The total length of all public roads.	Road length	Km	
Public-transport route length	The sum of all individual route lengths of all public-transport modes; in other words, it is the network of routes length by mode of travel.	e.g. Bus route length	Km	
Public-transport capacity	The sum of capacity by public-transport modes. E.g. for buses, the capacity is the number of buses multiplied with the average number	e.g. Number of buses	Number	
		e.g. Average bus capacity	Persons/	

	of people carried by a bus over a day.		day	
Total public -transport vehicle kilometers	The total distance covered by all public-transport vehicles. E.g. for buses, the bus vehicle kilometers is the number of buses multiplied with the average distance travelled by a bus in commercial operation over a day.	e.g. Number of buses	Number	
		e.g. Average distance travelled by a bus in a day	Km/ day	
Total public transport vehicle hour travel	The total time travelled by all public-transport vehicles. E.g. for buses, the bus vehicle travel time is the number of buses multiplied with the average time travelled by a bus in commercial operation over a day.	e.g. Number of buses	Number	
		e.g. Average time travelled by a bus in a day	hours/ day	
GDP	GDP is the area's income earned from production in the area. It represents the area's economic performance.	GDP	US dollar	
Monthly personal income	The average monthly personal earnings in the area.	Monthly personal income	US Dollar	
Public transport expenditure in % of GDP	The annual expenditure the city put into public transport related development normalized to the city's GDP.	Public transport expenditure	US Dollar	
		GDP	US Dollar	
Transport expenditure in % of GDP	The annual expenditure the city put into transport development.	Transport expenditure	US Dollar	
		GDP	US Dollar	
Level of subsidized public-transport fare	Percentage of subsidies applied to public-transport fares.	e.g. % subsidies applied to bus fare	%	

3. Data to be Provided by Participant Cities

Basic Data Requirement		Year						Notes
Statistic	Units	2009	2008	2007	2006	2005	2004	
Public transport mode	--							Please indicate the types of public transport available in the city
% travel by private vehicle	%							
% travel by bus	%							
% travel by metro/train	%							
% travel by taxi	%							
% travel by ferry	%							
% travel by other public transport	%							Please indicate type of public transport
% by bike	%							
% by walking	%							
Distance between public transport stop or station to outer rim of patron dwellings	m							
Walking time from public transport stop or station to outer rim of patron dwellings	Minutes							
e.g. Number of boarding passengers transported by bus	Persons							Please expand to other public transport modes
Average and variance of travel time for work-based trips by car	Minutes							
e.g. Average and variance of travel time for work-based trips by bus	Minutes							Please expand to other public transport modes
Average cost of running a car per kilometer	US cents							
Average distance travelled by car for work-based trips	Km							
e.g. Annual bus farebox revenue	US cents							Please expand to other public transport modes
e.g. Annual bus passenger kilometer travelled	Persons kilometer							Same as above

e.g. Average bus fare for 5km/10km/ 15km/20 km	US cents							Same as above
e.g. Average distance travelled by a passenger by bus	Kilometer (km)							Same as above
Annual road-accident fatalities	Persons							
Annual road-accident fatalities involving public-transport vehicles	Persons							
Land surface area	Km ²							
Population	Persons							
Population Density	Persons							
Urban surface area	Km ²							
Annual vehicle kilometers	Vehicle Km							
Total number of cars	Car							
Population	Persons							
Road length	Km							
e.g. Bus route length	Km							Please expand to other public transport modes
e.g. Number of buses	Number							Same as above
e.g. Average bus capacity	Persons/ day							Same as above
e.g. Average distance travelled by a bus in a day	Km/ day							Same as above
e.g. % subsidies applied to bus fare	%							Same as above
Monthly personal income	US Dollar							
Public transport expenditure	US Dollar							
Transport expenditure	US Dollar							
GDP	US dollar							

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LIST OF ABBREVIATIONS

BEST	Benchmarking European Sustainable Transport
BoB	Benchmarking of Benchmarks
CBD	Central Business District
CoMET	The Community of Metros
GDP	Gross Domestic Product
IATA	International Air Transport Association
IRT	Integrated Rapid Transit
IT	Information Technology
KPI	Key Performance Indicator
NATCYP	National Cycling Policy
NZTA	New Zealand Transport Agency
PT	Public Transport
UITP	International Association of Public Transport



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