EVALUATION AND MODIFICATION OF SERVICE LEVEL BENCHMARK FOR SUSTAINABLE URBAN TRANSPORT IN INDIA

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Abstract: **In this paper, we evaluate and revise the to assess how well cities are doing in meeting the targets set by the United Nations Sustainable Development Goals, we utilize the service level benchmarks adopted by the Ministry of Urban Development (now the Ministry of Housing and Urban Affairs), Government of India in 2009, and we create a composite Sustainable Urban Transport Index. In order to identify the many ways in which the MoUD SLBs, 2009 fall short of their potential as a useful instrument for measuring city performance in achieving the goals of the NUTP, 2006, an in-depth study was conducted using these documents as a starting point. To fine-tune the SLBs and their indicators and to assign weights to different indicators and benchmarks, a two-stage poll of experts and stakeholders was conducted using the Delphi technique. The Ministry of the Interior and the Urban Mass Transit Corporation and the Institute of Urban Transport conducted the research and the Centre for Engineering Planning and Technology (CEPT, 2013), and the results were utilized to do an effect study with secondary data from those same 13 cities.**

The study's main conclusion is that significant changes need to be made to the MoUD SLBs, 2009 in order to achieve a more all-encompassing vision for sustainable urban transportation. Among the modifications are the addition of Intermediate Para transit as a new benchmark (now called a Performance area), the inclusion of new indicators for public transportation, pedestrian infrastructure, and road safety, the reorganization of existing indicators within the respective performance areas, and the adjustment of the relative importance of existing indicators. In addition, statistical analysis and a survey of the relevant parties were conducted & have resulted in the assignment of varying weights to various indicators and performance areas.

Keywords: **Socio-Equity, Urban Transport, Policies, SUTI**

INTRODUCTION

India is urbanizing at a rapid pace. In the last decade, for the first time in the history, the growth of urban population is more than the growth in rural population (census 2011). However, our cities, which are engines of economic growth, are under great strain to meet the growing demands and aspirations of their people. Cities contribute to about 60% of Gross Domestic Product (GDP) presently and are expected to contribute to 70% of GDP by 2030 (National Transport Development Policy Committee (NTDPC) report, 2014; http://planningcommission.nic.in/). The focus, traditionally, has been only on creation of piecemeal infrastructure and that too without comprehensive planning and linking it to outputs and / or outcomes.

For this purpose, in 2006 a comprehensive National Urban Transport Policy (NUTP, 2006) (www.mohua.gov.in) was adopted by Government of India as the vision for achieving the sustainable urban transport in cities. Since large amount of funds were being committed/ invested by GOI under the mission for improving urban transport services in cities there was an urgency to have some service level benchmarks for urban transport so that the investments in urban transport by GOI and State Governments/ Urban Local Bodies result in critical reforms in the urban transport sector and also corresponding improvements in levels of service delivery. It was the first such exercise ever being undertaken especially at country level. It is limited to a mode generally and that too the performance outputs/ outcomes of that mode. As such it becomes difficult to make comparison across various cities of different sizes / types. Aim was to hit the road as fast as possible and improve later on, where required, based on the experience gained and further works in future. The deadlines did not permit a detailed work based on academic research.

Accordingly, an exercise of benchmarking of urban transport was started in 2007 for which a core group was formed under the chairmanship of the author who was heading the urban transport wing in the ministry. Through an in-house work by the author along with the core group from conceptualization to finalization in a time bound manner, the exercise was completed in 2009 with the Ministry of Urban Development (MoUD) (presently renamed as Ministry of Housing and Urban Affairs (MoHUA)), Government of India, finally adopting Service Level Benchmarks (SLBs) for urban

transport (MoUD SLBs, 2009) with ten benchmarks along with their respective indicators and levels of service (www.mohua.gov.in) after consultation with states and other stakeholders.
However there has been no exercise at that time to develop a composite index for Sustainable Urban Transport for a city as a whole to have an overall rating of that city in achieving the desirable standards. The MoUD SLBs (2009) being first of its kind, required a comprehensive review and analysis to study the gaps and also understanding the viewpoints of wider stakeholders towards various focus areas / benchmarks and indicators so as to develop comprehensive Service Level Benchmarks for Sustainable Urban Transport in India duly aligned with the goals/ objectives of NUTP, 2006.

SUSTAINABLE URBAN TRANSPORT POLICY COMPONENTS

Considering environmental sustainability, economic viability, and social equity, Figure 1 illustrates the hierarchy of sustainable transportation goals. These goals can be further subdivided into global and local or regional goals for sustainable urban

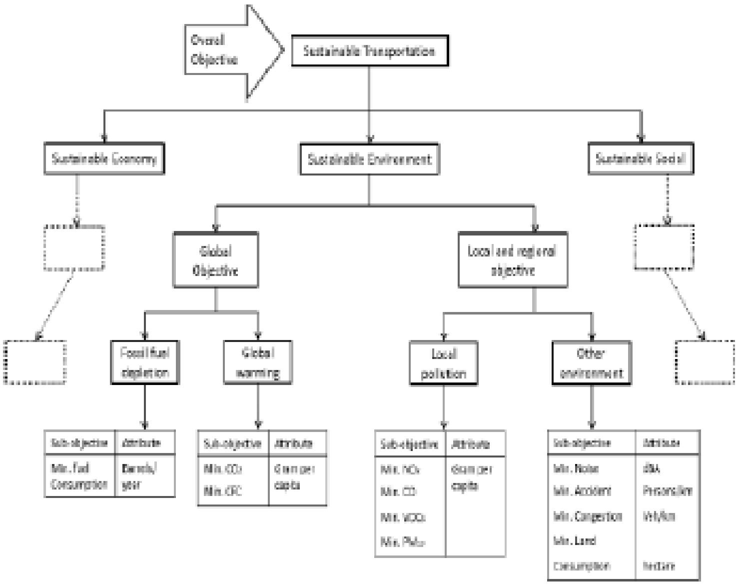

Figure 1: Hierarchical diagram for sustainable transportation

While the global objective focus is on reduction of fuel consumption or its depletion by minimizing fuel consumption through technology and or saving it through fuel efficiency measures the local/ regional objectives focus on global and local pollution by minimizing CO2 and CFC emissions along with NOx, CO, VOC, and PM10. It can be measured in grams per capita and other environmental sub-objectives, such as minimizing noise, accidents, and congestion (ibid.).
Aftabuzzaman and Mazloumi (2011), Figueroa and Ribeiro (2013) and Newman et al. (2013); Newman and Kenworthy, (2011) have highlighted 3 strategies to combat the transport distress era after the peak oil production globally. A landmark study by Banister (2007) suggests that the existing paradigm of transport planning and sustainability can be flexible, that requires actions to reduce the total number of trips in total, to encourage modal shift for greener modes, and also to reduce the need to travel longer along with greater efficiency of the transport system.
Alberti (1996) argues the urgent need of aligning the global and local perspectives to help build the common perspectives and determine information requirements and different levels of monitoring. This shall in turn harmonize the urban transport indicators and its various variables data collection worldwide. The local urban bodies shall be helped in selecting the community based indicators measures and support their participation in selecting a comprehensive set of urban indicators through public forums, expert panels and policy maker groups.
Urban transport challenges can be divided into two broad categories, firstly those which are mainly in the transportation sector, such as congestion, accidents, injuries related to road traffic and pollution (generally referred as "manifestation problems"); and secondly those which have their origins primarily outside the transport sector, such as poor land-use control, rapid increase in migration of population to cities and decreasing costs of acquiring motor vehicles (alternatively referred to as ''root cause problems'') (Dimitriou, 1992). The study recommended framework that incorporates four principal concepts (institutional, social, economic and environmental) and twelve strategy dimensions (in the form of goals) which are supportive of a sustainable urban development with a clear role for transport within it, such as:
a) Enhancing economic growth, productivity and employment; investment and ensure cost recovery; equity and affordability;
b) Addressing the special needs of the disadvantaged;
c) Reducing traffic accidents; air pollution; noise pollution;

d) Conserving energy consumption;
e) Promoting and protecting cultural heritage; participation and consultation;
f) Improving institutional development and delivery.

The study by Kenworthy and Laube (1996) demonstrates statistical relationships between the land use and transportation variables. Urban density is a critical explanatory variable in car and transit use (increased car use and decrease transit use with decreasing density). Provision of roads, parking, and non-motorized mode usage are all strongly associated with the pattern of car-dependence across cities in US, Europe and Asia. The study suggests a series of measures to meet the goal of increased sustainability for transport and land use in cities such as: High density mixed land use, Private transport restriction (and Public transport and Non-motorized mode focus.

Compact, mixed-use, pedestrian-friendly designs can 'degenerate' vehicle trips, reduce VMT per capita, and encourage non-motorized travel (Cervero and Kockelmen, 1997). Densities exerted the strongest influence on personal business trips. Diversity also had a modest impact on travel demand, though where it was significant, its influences were a bit stronger than that of density. Several specific design elements of the built 30 environment seemed to be particularly relevant to non-work trip-making. However, given the difficulty in measuring diversity and mixed land use, experts feel that their impact on travel (NMT modal share and average travel lengths) is much easier to capture.

RESEARCH METHODOLOGY

This chapter presents the research framework, sampling method for data collection and data analysis method used in the current study research framework. This study combines primary data with data collected through Delphi technique to propose modified SLBs and a composite index for evaluating sustainability of actions taken by cities for improving transport infrastructure. In this study, samples are taken from three different types of professionals (researchers/ experts – both national and international, practitioners/ city officials and consultants working in the field of urban transport), who would use urban transport SLBs, to accumulate views from different stakeholders.

A set of questionnaire was administered to the selected group, in two stages, to solicit their responses, firstly for evaluation and modification of MoUD SLBs (2009) for development of comprehensive service level benchmarks and at second stage a second set of questionnaire to three broad category of groups for evaluating the relative importance and assigning weights to the indicators and the benchmarks / focus areas. The data is then analyzed using statistical tools for drawing conclusions. While the survey and analysis for development of service level benchmarks were being completed, the exercise of collection of primary data of each indicator and benchmark for service level benchmarking, as per MoUD SLBs (2009), was in progress for 13 cities under a study commissioned by MoUD.

These were conducted through Urban Mass Transit Corporation (UMTC) & Institute of urban transport (IUT) for 7 cities; and through Centre for Environment Planning and
Technology (CEPT), for 6 cities. While the terms of reference as per MoUD was to only do the benchmarking of these cities as per MoUD SLBs (2009) and give recommendations, the conclusions of the first stage survey and analysis of present study were made available to CEPT and UMTC with a request by the author if they could collect additional primary data on the additional indicators and focus areas as well (CEPT, 2013; UMTC & IUT, 2013). The additional data was collected by CEPT only, which has been used as secondary data for analysis purposes with proposed SLBs and weights as per this study. The results of this study were also applied to secondary data collected by UMTC to study impact of derived weights. The overall methodology is schematically shown in Figure 2:

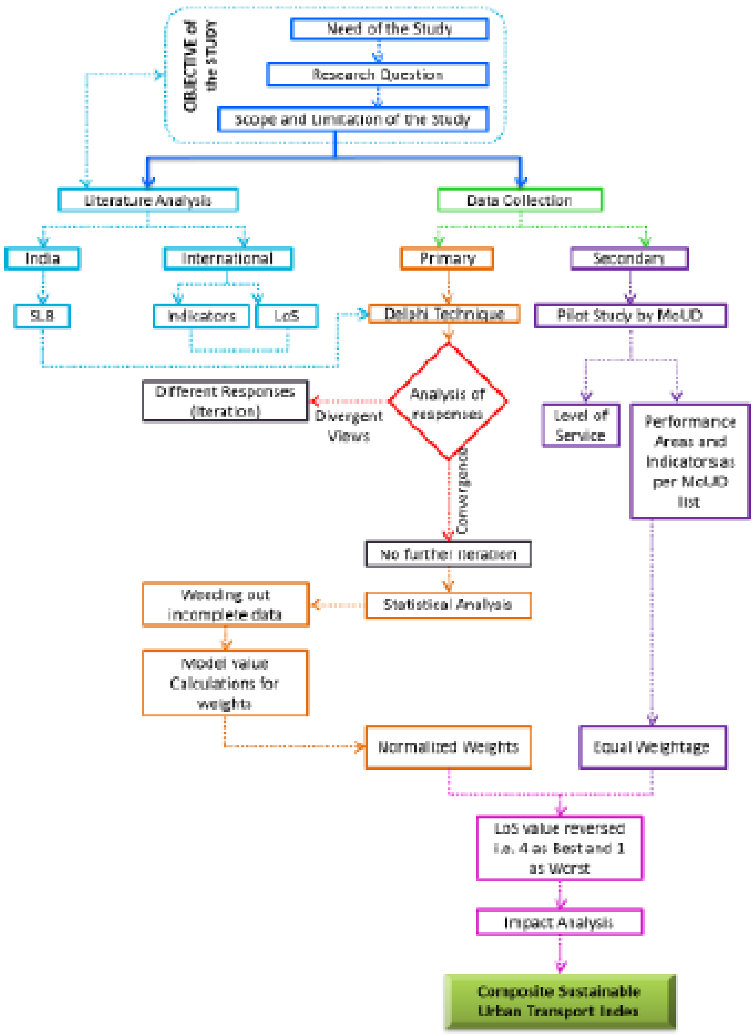

Figure 2: Overall research methodology

However for the present study, AHP is not a suitable method in view of the fact that there are large numbers of indicators making it extremely difficult to make systematic comparison in pairs of two at a time with respect to their impact on an element above them in the hierarchy. Furthermore the present research problem does not include common indicators in different nests. Also Delphi technique can be used well as compared to AHP to bring consensus among various domain experts throughout Indian geographical areas and cities. In view of the above, in this study the approach of a "Decision' Delphi, in two rounds, is used to structure thinking around areas of SLB indicators and their weights, taking MoUD SLBs (2009) as the base, so that consensus can be achieved in respect of a set of urban transport focus areas, their indicators and also weights of each.

PROPOSED SERVICE LEVEL BENCHMARKS

This chapter presents the impact of modified SLBs , which included the normalized weights of each indicator for every Performance area. The exercise of actual calculation of LOS as per MoUD SLBs had never been done in the country for any city before the study carried out by MoUD through CEPT and UMTC in 2013 for a total of 13 cities. These cities along with some of their basic characteristics are tabulated in Table 1. As such to study the change in LOS values as per MoUD SLBs and modified SLBs analysis was done for these 13 cities for which secondary data was available from CEPT and UMTC studies. Furthermore derived weights amongst various Performance areas were also applied to arrive at a comprehensive sustainable urban transport index (SUTI) for each city.

First of all the impact of only the additional indicators was studied without taking into account the relative weights. This was possible only for the six cities surveyed by CEPT (2013) as the secondary data for additional indicators was available for only these cities

UMTC and IUT had not collected data for the additional indicators and additional benchmark for cities surveyed by them. The LOS values of each Performance area with indicators as per MoUD SLBs (2009) and also as per the additional indicators as per present study are listed in Table 5.4.

Analysis of the results listed in Table 5.4 leads to following observations:-

a. For all the PAs where there has been change either in the number of indicators or the method of calculation of LOS as per the study, the LOS values or the Performance rating have decreased in most of the cases with additional indicators and in some cases it has remained same.

b. Maximum fall in LOS values has been noticed for Pedestrian facilities and NMT (cycling) facilities PAs where the method of calculation of LOS values was changed as per the study with the introduction of concept of basic indicator (BI) and additional indicator (AI); and pegging the LOS value of AI to that of BI.

c. While for Public transport facilities PA numbers of additional indicators were added, only three cities showed reduction in the LOS values viz Ahmedabad, Surat and Mysore. This was perhaps on account of the fact that Ahmedabad and Mysore have good public transport system. As far as Surat is concerned, from the analysis of details it was noticed that its LOS was already low at 2 and with the additional indicators also it was just on the cut off for LOS of 2 and 1.

d. For Travel speeds along major corridors PA (name modified to Road infrastructure and performance), there was consistent reduction of LOS by 1 level for all the cities. This was on account of poor rating of cities in the additional indicators for this PA.

e. For Road safety PA, only in case of Kohima, the LOS has dropped by one on account of more number of serious accidents and LOS value slipping to lower bandwidth in the aggregation. For all other cities it has remained in the same bandwidth.

f. For Integrated land use and transport system PA, the LOS values have remained same, as the modification was only minor in categorizing the LOS value for one indicator.

Table 1: LOS values of each Performance area (PA) as per MoUD SLBs (2009) and with additional indicators but without weights (6 cities)

S.no	Cities Performance areas		Ahmedabad	Surat	Hubli-Dharwad	Mysore	Bhubaneswar	Kohima
1	*Public transport facilities*	With MOUD indicators	3	2	3	3	3	3
		With additional indicators	3	2	2	3	2	2
2	*Pedestrian infrastructure facilities*	With MOUD indicators	3	3	3	3	3	2
		With additional indicators	1	2	2	2	2	2
3	*Non-Motorized Transport*	With MOUD indicators	3	3	3	2	3	NA
4	*(NMT) facilities*	With additional indicators	1	1	1	1	1	NA
	Level of usage of Intelligent Transport System	With MOUD indicators	2	1	1	2	1	1
		With additional indicators	2	1	1	2	1	1

5	*Travel speed (Motorized and Mass Transit) along major corridors*	With MOUD indicators	4	3	3	4	3	3
		With additional indicators	3	2	2	3	2	2
6	*Availability of parking spaces*	With MOUD indicators	2	3	1	2	1	2
		With additional indicators	2	3	1	2	1	2
7	*Road safety*	With MOUD indicators	2	2	1	2	2	3
		With additional indicators	2	2	1	2	2	2
8	*Pollution levels*	With MOUD indicators	3	4	3	4	3	3
		With additional indicators	3	4	3	3	3	3
9	*Integrated land use transport system*	With MOUD indicators	3	3	2	2	2	2
		With additional indicators	3	3	2	2	2	2
10	*Financial sustainability of public transport*	With MOUD indicators	1	2	2	2	3	2
		With additional indicators	1	2	2	2	3	2
11	*Intermediate Para Transit*	With MOUD indicators	NA	NA	NA	NA	NA	NA
		With additional indicators	2	1	2	2	3	1

Note: 1. Higher the LOS value, better it is
2. Performance areas in italics are those where there has been change either in the number of indicators or the method of calculation of LOS as per the study

g. As far as LOS values or Performance ratings across various PAs for a city is concerned, it was noticed that after additional indicators / modifications as per the study, the best performing areas changed significantly e.g. in case of Ahmedabad, travel speeds along major corridors was the best PA with LOS of 4 followed by public transport facilities, pedestrian infrastructure facilities, NMT facilities, pollution levels and integrated land use transport system, all with LOS of 3.

h. However after modifications as per the study, pedestrian facilities and NMT facilities became the worst PAs with LOS of 1 and the PAs of travel speeds along major corridors, public transport facilities, pollution levels and integrated land use transport system became the best, all with LOS of 3.

Conclusion

In conclusion, the LOS levels of various Performance areas were found to change significantly on application of weights. The changes are more significant on application of additional indicators. On account of the additional indicators, the LOS value for each Performance area became more representative in nature by capturing all relevant aspects. The application of normalized weights to different indicators and calculation of LOS value of a Performance area without second level of aggregation / grouping enabled a better rating system with continuous gradation in LOS values from 1 to 4 thereby making it possible to capture even minor changes and LOS vales being more reflective of the ground reality. Application of normalized weights to the Performance areas made it possible to derive a single composite index for sustainable urban transport for the city (SUTI), which though is aggregation of LOS values of various diverse indicators, yet a powerful policy level tool for higher level policy makers for monitoring, performance measurement, resource allocation and generating friendly competition amongst the cities.

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