



## Development of a Transport Module for Multi-topic Household Surveys

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## **ABSTRACT**

This paper is aimed at providing guidance on transport issues for those involved in designing multitopic household surveys such as the Living Standards Measurement Studies (LSMS) surveys. The inclusion of a few key questions can provide critical information for better designing transport programs and policies aimed at improving access, affordability and quality services. Questions on transport access, quality, mode, distance, time, and cost can help to understand the constraints that the population may face in accessing jobs, markets, schools, health clinics and other social services. All of this can be broken down by subgroups such as income, geographic area, gender, employment, etc. further strengthening the relevance of the analysis and contribution to policy decisions. The paper covers background on transport and multitopic household surveys, key transport policy concerns and data needs, approaches to analysis, issues of survey design, and prototype questions that could be included in existing surveys.

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# DEVELOPMENT OF A TRANSPORT MODULE FOR MULTITOPIC HOUSEHOLD SURVEYS

## 1 INTRODUCTION

Multitopic household surveys are now carried out in a large number of developing countries to analyze a range of economic and social issues, and in some cases on a frequent basis. These surveys have been effectively used for policy analysis, planning, poverty monitoring, assessing the distributional aspects of policy, and for sector specific analysis. Key transport issues such as access, quality, safety and affordability can also be covered in multitopic surveys, sometimes with the addition of a minimal number of key questions. This can be particularly important in better tailoring transport programs and policies to meet the needs of the poor by understanding their travel needs and travel behavior. Relevant information includes descriptive statistics on travel patterns and time use, access to jobs, schools, services, travel demand, travel conditions, affordability, and the incidence and coverage of government programs. All of this can be broken down by subgroups such as income, geographic area, gender, employment, etc., further strengthening the relevance of the analysis and contribution to policy decisions.

This paper presents the tools for developing a country-specific transport module to be included in a household survey, particularly the LSMS surveys. Producing a "standard" transport module for household surveys can be challenging, as with all standard survey modules, as each application is sufficiently different. Nevertheless experience provides lessons and this paper suggests a survey approach and standard survey module for transport, along with further notes to allow each practitioner to adapt the example to the specific policy and planning issues to be explored. Section 1 provides this introduction; Section 2 covers transport and multitopic household surveys, Section 3 reviews policy concerns and data needs; Section 4, approaches to analysis; Section 5 discusses issues of survey design; and Section 6 presents sample questions that could be included using the sample modules.

## 2 TRANSPORT AND MULTITOPIC HOUSEHOLD SURVEYS

In order to design and analyze results from household surveys, transport practitioners need to understand the context in which household surveys are created and administered. Generally household surveys have been undertaken through a national statistical agency, often with support from international organizations and donors. These surveys can be for strategic purposes; analytical work, poverty reduction strategy papers, country assistance strategies, monitoring and evaluation, etc., but also for routine purposes; price indices, labor force estimates, national accounts, etc. Other surveys are also carried out to support special purpose and project related surveys, which may or may not be household based.

The Living Standards Measurement Study (LSMS) household surveys have been in use by World Bank client countries since the 1980s. They are national probability sample surveys conducted irregularly as required, ideally every three to six years. Their focus is to administer a relatively complex questionnaire to a moderate size of sample (2,000 to 3,000 households). The questionnaire is divided into sections referred to as "modules" covering a single sub-topic. Anywhere from eight to twelve modules may be combined to form the complete questionnaire. Some modules, such as the Household Roster, Education, Health, and Economic Status, are almost always used. Annex Two provides a listing of the standard modules, a short description of their contents, and illustrates how transport relevant information can be extracted from the existing modules.

Substantial LSMS survey resources are devoted to quality control, and the tradeoff between sampling and non-sampling errors since the focus is not purely on the measurement of an indicator, but instead on understanding the causes of observed outcomes. This requires a focus on ensuring

within questionnaire consistency more so than in a larger sample survey,<sup>1</sup> ensuring the quality of response of the complex questionnaire rather than the quantity of responses. The goal is to explore in detail the relationships of individuals and their households to determinants of poverty. The use of careful sampling ensures that the results can be generalized to the national level for strategic policy goals. The sample design permits disaggregation of results for ethnic groups or to the rural-urban level.<sup>2</sup>

The LSMS surveys have evolved considerably over time. In the last five years more attention has been paid to issues of infrastructure and its related services and most recently service levels and quality. An additional survey instrument, the Community Questionnaire or Population Point Questionnaire, is also used to capture information from outside households but relevant to the households of a single sampling location. This generally covers the territory of a village or neighborhood. It is administered to a small set of informed local inhabitants (such as community leaders) and is an extremely useful extension of the LSMS methods for transport purposes.

Income and expenditure surveys (also known as household budget surveys) are more commonly available than the LSMS. In most countries they are carried out infrequently, every 5-10 years, though in FSU, Europe and North America, they are done annually (with data often being provided on a quarterly basis). The Income and Expenditure surveys generally do not cover personal and intra-household socio-economic situation and relationships to the same extent as the LSMS, though they can provide income and expenditure data (including transport expenditures), and some socio-demographic material (economic status, highest education).<sup>3</sup> Sample sizes vary from country to country, and in some regions, such as Latin America, data are collected for urban areas only.

Other surveys which also measure aspects of living conditions include the Demographic and Health Surveys (DHS), the Multiple Indicator Cluster Survey (MICS) the Core Welfare Indicators Questionnaire (CWIQ), and censuses. These surveys are highly standardized as they are used for international comparisons. It is generally not possible to measure welfare in monetary terms, nor do they typically include questions on transport. Including a few key transport questions, however, could provide an opportunity for

broader coverage and analysis of transport issues.

Survey research is a part of an investigative process which develops over time. Results from one step will change the approach used in a later step. It will include use of qualitative methods and non-household surveys that are not discussed here. In transportation other common types of survey work include (among others): classified traffic counts, vehicle occupancy counts, vehicle intercept surveys, origin-destination surveys, license plate surveys, and enterprise surveys of infrastructure providers, transport service providers, and transport users.

Information relevant for transport can be obtained through the LSMS approach by editing existing survey modules to add or change questions, and by modifying the coding of responses received to include more transport relevant possibilities. Transport information can also come from an additional survey module specifically on transport use. Changes to the questionnaire will require complementary changes to the survey administration, in particular the interview guide which provides instructions to the interviewer, especially on how to probe for more meaningful responses. To date, there are only a few existing examples of surveys that have incorporated extensive transport modules. Among these are Vietnam LSMS (repeated), Guatemala LSMS (2000), Azerbaijan (Sigma, 2000). These surveys have generated new analysis and contribute to a small, but growing body of literature on transport using household survey data.

A second approach is to carry out a Transport Survey, incorporating some of the core modules from multi-topic surveys. Using this approach, it is important to ensure that the approaches for core information such as location, household demographics, and income and expenditure are designed to be comparable to similar sample design and questionnaire design formats in the country. Including questions on other infrastructure sectors (water, communications, energy, housing) can provide the basis for analysis of multi-sectoral urban, rural development, and infrastructure projects at a relatively small marginal cost. Where up-to-date poverty analysis is available transport research should make use of the already established welfare aggregate methodology and the Bank-accepted poverty line estimates. For maximum relevance to broader poverty work, transport

surveys should incorporate the questions needed to calculate an acceptable welfare aggregate.

Household surveys can be supplemented by qualitative approaches which provide important information from respondents that may not come across in a coded response. Qualitative approaches include techniques such as focus groups and open ended interviews, and generally use small sample sizes. This includes subjective data on the attitudes and reasons which underlie travel behavior and public transport use. Ideally, a study methodology would include both a statistically representative household survey, and a smaller number of qualitative surveys from the same sample.

### **3 POLICY CONCERNS AND DATA NEEDS**

Transport plays a central role in development and poverty reduction. The role of transport in poverty reduction is linked in several ways. First, it impacts directly through providing poor people better access to jobs, markets, schools, health clinics, and other social services. Second it contributes to economic growth by lowering transaction costs, promoting economies of scale, widening opportunities and extending connection to rural hinterlands, expanding trade, integrating markets, and strengthening effective competition. Third, it facilitates empowerment by providing access to meeting places and town centers, and by allowing for the flow of information. Finally, a reliable transportation system can enhance security by helping a country respond to economic and natural shocks, such as transporting food during famines, or moving people or medicines during medical emergencies.

Interventions in the transport sector include a range of policy reforms and physical investments which may vary in rural and urban areas and across countries depending on need. These might include physical construction of highways, rural roads, or ports, or institutional reforms such as with rail systems, road maintenance, or road safety programs.

Table 1 summarizes areas of concern in transport strategy and policy. Many of these issues are not best or solely addressed through household survey based research. The areas that are most relevant are related to the links between poverty and transport, in particular with regard to access and mobility, affordability, and quality and are discussed

below. Travel forecasting or transport service/facility design is difficult with household surveys because the sample sizes are too small for forecasting purposes.

#### **3.1 Access and Mobility**

A fundamental role of transport is in providing physical access by the population to jobs, markets, education, health, and other services. Assessing the travel behavior of individuals and households is thus key to understanding patterns of access and mobility in both rural and urban areas. This is particularly important for the poor, as the lack of access can deprive them of job opportunities, the accumulation of human capital, and markets for trading their goods. With an understanding of specific travel patterns for by mode, travel time, travel cost, and reliability, appropriate policies can be designed to address the needs of the poor, and other subgroups which have traditionally been excluded to access such as the elderly and disabled.

#### **3.2 Affordability**

Beyond physical access is whether transport services are affordable to the poor. Fares are often beyond the reach of the poor, making existing services inaccessible. While we actually know relatively little about what households spend on transport, this kind of information is possible to analyze with household survey data. One can quantify existing spending patterns for the household, what is currently spent on transport (in the aggregate and as a percent of total household spending), and simulate the impact of fare increases and reductions on different income groups. This can have a powerful effect on policy decisions about fares and the impact of targeted transport subsidies for the poor.

#### **3.3 Quality**

Access to reliable, safe and secure transport is also critical to effective mobility. Bus services that do not consistently follow their routes, or provide an unsafe environment for women are inadequate to meeting the needs of the population. Issues of quality can be addressed through household surveys by questions on the conditions of existing services, as well as perceptions of these services. This information can be disaggregated by subgroups such as income or gender, further defining the nature and scope of problems. Issues of traffic safety are difficult to capture using household surveys because the incidence in a sample population

is likely to be relatively small, not allowing for statistical significance in analysis. For this kind

of analysis, specialized surveys are generally required.

<b>Table 1. Transport Policy Concerns.</b>		
<b>Policy Area</b>	<b>Policy Goals and Interventions</b>	<b>Relevant for Household Survey Based Analysis</b>
Access and Mobility	<ul style="list-style-type: none"> <li>• Improve physical access to employment, markets, schools, health centers, and other social services</li> <li>• Reduce excessive time spent walking</li> <li>• Promote inclusive access for poor, elderly, disabled, women</li> </ul>	* * *
Affordability	<ul style="list-style-type: none"> <li>• Ensure affordable transport services for the poor through targeted programs</li> <li>• Develop progressive fuel levy schemes for resource mobilization</li> </ul>	* *
Quality	<ul style="list-style-type: none"> <li>• Promote reliable, safe and secure transport services and infrastructure</li> <li>• Support adequate maintenance of existing infrastructure</li> <li>• Implement road safety strategies</li> </ul>	*
Economic and Financial Efficiency and Sustainability	<ul style="list-style-type: none"> <li>• Make transport more cost effective through competitive markets for services and infrastructure, increased efficiency in the provision financing and management of transport infrastructure. Provide adequate compensation if efficiency measures lead to labor redundancies</li> <li>• Ensure an adequate, reliable, and sustainable source of financing for maintenance, including a governance structure with user and private sector representation</li> <li>• Support cost effective, labor intensive approaches where appropriate for constructing and maintaining roads</li> </ul>	*
Environmental Sustainability	<ul style="list-style-type: none"> <li>• Reduce threats to life and health from congestion and pollution.</li> <li>• Promote an environmentally sensitive framework with standards for the provision of non-motorized transport, urban mass rapid transit, and road user charges that reflect externalities.</li> </ul>	
Institutional Development	<ul style="list-style-type: none"> <li>• Introduce innovative financial and management techniques in the provision of transport services</li> <li>• Build capacity in the public and private sectors to enable both to perform their respective roles effectively and to encourage partnerships</li> <li>• Develop participatory mechanisms for stakeholders such as users and the private sector and users in monitoring and planning</li> </ul>	

### 3.4 Data Needs

The data that are needed for analyzing the issues raised above range from existing information on household and individual welfare and gender to questions that are less

commonly found on transport use, mode, travel time, cost, and quality. The following matrix in Table 2 provides an overview of the type of data needed for selected transport policy issues. Specific questions are discussed in section 6.

**Table 2. Data Needs for Transport Policy Analysis.**

Policy Area	Data needs	
	Household Questionnaires	Community Questionnaires
Access and Mobility	<ul style="list-style-type: none"> <li>Individual transport use to job, school, health, market, road, water, fuel, other business transport use (including transport of agricultural and other products), for each: <ul style="list-style-type: none"> <li>- frequency of trip</li> <li>- modes</li> <li>- travel time/distance</li> </ul> </li> <li>Household vehicle ownership</li> </ul>	<ul style="list-style-type: none"> <li>Physical access to all services by: <ul style="list-style-type: none"> <li>- mode</li> <li>- travel time/distance</li> </ul> </li> </ul>
Affordability	<ul style="list-style-type: none"> <li>Travel expenditures per trip (individual and business)</li> <li>Transport services in kind</li> <li>Participation in subsidy programs</li> <li>Travel expenditures as a proportion of total expenditures</li> </ul>	<ul style="list-style-type: none"> <li>Costs by mode/service</li> <li>Subsidy programs availability</li> </ul>
Quality	<ul style="list-style-type: none"> <li>Frequency/reliability of service</li> <li>Conditions of infrastructure (roads, closures due to flooding)</li> <li>Perceptions of quality (e.g. reliability, safety, security and comfort)</li> </ul>	<ul style="list-style-type: none"> <li>Frequency/reliability of services</li> <li>Condition of infrastructure</li> <li>Perceptions of quality (e.g., reliability, safety, security, comfort)</li> </ul>

## 4 DATA ANALYSIS FOR TRANSPORT

### 4.1 Core Analysis

Different types of analysis can be carried out for the above issues using household data. Since much of the work is focused on the distributional aspects of transport policies, the analysis usually begins with the construction of a welfare aggregate.<sup>4</sup>

The welfare aggregate is normally constructed from information on a household's patterns of consumption rather than income. Constructing a consumption-based measure of individual welfare typically requires three steps: (i) aggregation of different components of household consumption to construct a nominal consumption aggregate, (ii) construction of price indices to adjust for differences in prices faced by households, and (iii) adjustment of the real consumption aggregate for differences in household composition. Household surveys

which are to be used in poverty analysis must obtain the data required for each step described above. A standard reference for more information on welfare aggregates of is "Guidelines for Constructing Consumption Aggregates for Welfare Analysis", Angus Deaton and Salman Zaidi, LSMS Working Paper No. 135, May 2002. An excerpt from this publication summarizing some of the considerations in constructing a welfare aggregate is provided as Annex Two.

Descriptive analysis is used to characterize individuals and households, and group them according to their socio-economic situation. Quintiles or deciles are often used rather than poor and non-poor groupings to allow for distributional analysis. Cross tabulations can then link subgroups with the transport variables of interest. Comparisons can be made between groups of individuals or households and, if more than one survey is available, over time. For example,

rural/urban or regional breakdowns might be particularly useful for transport analysis. Comparing changes in access and travel mode by the poor over time might be another type of analysis relevant for transport policy.

The household survey data can also feed into more sophisticated analysis to "decompose" poverty and examine poverty correlates using regression and inequality analysis. Regression analysis can quantify the effect of specific household or individual characteristics on poverty while holding constant all other characteristics. Transport variables may shed light on the linkages between transport issues (e.g. access) and poverty. Models of travel demand and residential location choice can be used to assess the value that individuals

and households put on reductions in time and money costs, by income group.

The example in Table 3 looks at the determinants of household spending levels in Cote d'Ivoire. Specific to transport, it indicates that access to roads has substantial predictive power – households located in villages that are nearer to both paved roads and public markets are better off, as are households located in areas with higher wage levels. This points to the importance of rural roads in helping families out of poverty. It also indicates that education plays a different role in urban and rural areas (where it does not seem to significantly influence consumption), as do different types of assets. This raises policy questions about the quality of education in rural areas.<sup>5</sup>

<b>Variable</b>	<b>Urban</b>	<b>Rural</b>
Distance to the nearest:		
Paved road	-	-0.04 (-2.9)
Market	-	-0.09 (-3.3)
Education level of most educated male		
Elementary	.38 (5.3)	0.04 (0.6)
Junior Secondary	.62 (8.6)	0.08 (0.9)
Senior Secondary	.80 (9.6)	0.05 (0.4)
University	.93 (9.4)	-
Education level of most educated female		
Elementary	.11 (1.7)	0.07 (1.0)
Junior Secondary	.24 (3.1)	0.27 (2.2)
Senior Secondary	.34 (3.4)	-
University	.52 (4.1)	-
Value of selected household assts		
Home	.06 (5.3)	-
Business assets	.04 (3.3)	0.16 (4.9)
Savings	.08 (4.7)	-
Hectares of agricultural land		
Cocoa trees	-	0.17 (4.3)
Coffee trees	-	0.04 (1.3)
Unskilled wages (males)	-	0.37 (6.4)

- Not applicable.

Note: T statistics are in parenthesis

Sources: Poverty Reduction Sourcebook, Chapter 1, and Grosh and Munoz, 1996 (p.169) .

Among the subgroups that can be used for analysis, depending on the objective of the research, are: location, gender, age,

ethnicity, education level, household size, family composition, migration status, employment, sources of income, quintile,

education outcomes, health outcomes and social outcomes (participation, access to information, social contacts).

The potentially relevant transport variables include: mode(s) used, trip rates, average travel distance, average travel time, variability of travel time, out-of-pocket costs, etc. and can then be compared relative to group averages from within the transport survey (including by welfare/income group) and to examples or norms established with reference to other work.

In surveys, it is important to develop questions and ways of coding responses that capture poverty related behavior, usually specific to the country or society. Trip purpose is often classified as; school-related, work-related, social-related, and other personal business-related. Better understanding will result from distinguishing travel undertaken for household use (e.g. getting water, getting fuel, child-care trips), and economic purposes (e.g. sales of home production goods, obtaining of inputs to home production, looking for work). It is also important to identify when trips are taken by combinations of individuals and why, and the presence of cargo and how it is transported.

Mode of travel needs to be recorded using as broad as possible a list of responses in order to capture the full range of coping mechanisms employed by the poor in transport. Rather than looking at travel mode as a physical characteristic it should be thought of as "how is the trip accomplished" which includes a broader consideration of the means employed. For example, travel by "automobile" may be further broken down by "passenger in an automobile" and "auto driver". In measuring travel costs, it is important to capture information per trip, and by mode.

Travel time and travel distance are measures of "transport difficulty" or "transport effort". There is not a clear consensus in the literature which measure is most accurately collected in a household survey. There is reference to the problems of accuracy of recall or estimation varying

by mode of travel used, by purpose of trip, and by time of travel. Additionally, estimates of distance and time are likely to be skewed, particularly in rural areas where people may not be accustomed to wearing watches, and the estimates do not account for terrain. A pilot has been initiated in Albania by the World Bank to explore measurement comparing perceptions of time and distance with objective measures. This research has used pedometers and timers by respondents, though thus far the results are inconclusive. This is an area requiring additional research. Surveys should generally include both measures so that later analysis can cross-check the results to eliminate gross discrepancies and use the best (consistent, reasonable) results as required. Adding the use of GPS by enumerators who can measure the coordinates of particular places, particularly for the community surveys, is an effective solution for measuring distance (use of GPS discussed in next section).

#### 4.2 A Transport and Poverty Profile

To determine how the transport sector can best help to reduce poverty, it is first necessary to assess the needs of poor people and how much the poor require transport to meet those needs. Household surveys are ideal for generating such information. Descriptive analysis can provide a snapshot of access by the poor to essential services, by mode, cost, travel time, and select measures and perceptions of quality. Information can be collected on the availability, frequency, and usage of public transport services, travel conditions, expenditures, costs of services, and vehicle ownership.

In preparation of the Guatemala Poverty Assessment (GUAPA), World Bank, 2003, and extensive transport module was included in the 2000 Guatemala LSMS.<sup>6</sup> With this data, a transport and poverty profile was generated and included as a core part of the study. The results were then included as a fundamental part of the poverty reduction strategy. The specific objectives of the transport-poverty profile were:

**Measuring** the extent to which access to basic services is already *available* in Guatemala. This includes obtaining a geographical, demographic and spatial overview of the extent of physical access to critical services or 'merit goods' such as health and education;

**Determining** the *linkages* between provision of transport infrastructure and services and poverty, vulnerability and exclusion;

**Measuring** the extent to which physical basic access is a *limitation* in getting access to services in Guatemala;

**Recommending** a set of *policy instruments* for the Government of Guatemala for increased provision."

Among the main issues identified in the study were that road quality was found to be a critical bottleneck for economic progress in Guatemala, impacting access to markets, employment and merit services (Table 4). The complex topography and inadequate road network contributed to the geographic isolation of the rural poor. This analysis was subsequently fed into the design of a rural roads project which addressed the major findings of the analysis.

Quintiles	Surfaced	Unsurfaced but motorable	Non-motorable track	Paths	Overall (non-motorable)
1 (poorest)	21	70	43	86	22
2	30	72	44	78	16
3	37	74	40	61	11
4	48	71	34	52	9
5 (richest)	61	62	29	38	9

Source: World Bank, Guatemala Poverty Assessment, 2003

### 4.3 Monitoring and Evaluation

With the increased focus on measuring and monitoring results, there is a need to develop better approaches to monitoring and evaluating transport interventions. Household surveys can provide the basis for specific kinds of indicators, as well as the basis for evaluating the impact a project may have on beneficiaries.

An extensive list of performance measures in transport has been developed by the World Bank and is attached in Annex 2. Of this list, several can be captured using household surveys. The key is to ensure that these data are collected on a periodic basis to measure changes over time.

Monitoring at the project level is difficult with household surveys because data are

often not collected with sufficient frequency, and may not be at a level sufficiently disaggregated to allow for capturing changes specifically related to a project. Some work in transport has been done on evaluating project impact, with most focusing on the impacts of rural road construction.

Impact evaluation relies on household and community survey data, and measures impact looking at direct and indirect effects. The direct effects relate to changes in travel time (to work, schools, etc.), savings in fuel and other direct transport costs, and changes in seasonal or other weather related road closures. Indirect effects consist of increases in income and other dimensions of well being such as health, education social interaction and political participation brought about by the

infrastructure. Carrying out this work requires a carefully designed sample to account for 'treatment' groups which received the intervention, and 'control' groups which did not. Methods are discussed in Grootaert, "Socioeconomic Impact of Rural Roads: Methodology and Questionnaires", 2002 and in Baker, 'Evaluating the Impact of Development Projects on Poverty,' 2000.<sup>7</sup> Among the examples are studies in Peru, Vietnam, Morocco, Brazil and Tanzania. Impact analysis for transport can present substantial methodological challenges and thus careful design in designing such work is necessary.

#### 4.4 Rural Transport Problems, Lack Of Basic Access And Mobility

Rural welfare is strongly influenced by transport. Key features of rural poverty

include the lack of income generating opportunities outside of agriculture and inadequate access to economic and social services. In many cases the character and extent of these problems are largely a function of the inadequate provision of rural travel and transport infrastructure and services, especially at the village and community level.<sup>8</sup>

Survey research is used to understand the time and effort spent on transport in the context of overall household labor allocation and of the outputs achieved from the inputs to transport. This can mean accessing supplies and getting goods to market in a timely and cost-efficient manner. Research from Azerbaijan examines local level rural transport as a factor and constraint in agricultural development and in the use of essential services (Table 5).

HH Status	Corn	Potato	Livestock	Poultry	Overall
Very poor	93	87	88	43	81
Less poor	71	76	59	62	67
Non poor	71	57	70	66	62

Source: Poverty Assessment and Poverty Alleviation in Azerbaijan's Central Corridor, 2001.

#### 4.5 Urban Transport Problems, Symptoms Versus Cause Of Poverty

Urban poverty may be reduced through the contribution which transport makes to increasing the efficiency of the urban economy and thus to overall economic growth. Urban transport policies can also be focused more specifically on meeting the needs of the poor particularly with regard to helping them access jobs, services and social networks. Sprawling urban development can make the journey to work excessively long and costly, particularly for the poor who often cannot afford the cost of living close to the central business district where work may be available.

The urban poor exhibit a complex trade-off between residential location, travel

distance, and travel mode, in an attempt to minimize the social exclusion associated with low earning potential. The "income poor" may in fact have chosen poorly served peripheral locations precisely because they are the places where their overall welfare (in terms of availability of shelter, access to activities, etc) is best served. High transport cost is then a symptom of their poverty rather than its fundamental cause.

Household survey information is needed to understand this complex set of relationships and activities. Related to this, specific aspects of individual and household behavior in urban areas that have drawn attention include: wide variety of trip rates (trips per capita per time unit) among the poor, wide variation of transport consumption/expenditure in the household

budget (can be zero if walking - to very expensive (25-30% of income) with the upper bound income-constrained), wide variation in travel time to work. There is a need to understand the trade-off between housing cost and transport cost. Finally as overall incomes increase there appears to be a two stage transformation as households progress first from non-motorized to motorized public transport and then from motorized public transport to motorized private transport.

A general constraint with most household surveys with relation to urban areas is the sample size. Data is usually available at a city level or for all urban areas, though cannot be disaggregated to analyze differences within cities. Physical transport improvements (infrastructure, services provided) can be focused on where poor people live and work, with the caveat that improvements can also lead to rising land prices and the exclusion of poor residents. The household characteristics derived from the survey can be used with more comprehensive statistical sources, such as a census, to allow for better poverty mapping of a city. Censuses themselves lack the necessary household consumption information needed to estimate a welfare aggregate. Care must be taken when merging the benefits of multi-topic household surveys and geographically comprehensive census data to prevent errors arising from over-generalization of the results.

## **5 SURVEY DESIGN ISSUES**

There are a number of issues specific to the incorporation of transport questions in the design of household surveys. Among them are sampling, survey administration, travel diaries, and the use of GIS, all discussed below.

### **5.1 Sampling**

Sample design is critical for the usefulness of the survey: if this is done wrong, all other work to ensure data quality is wasted. Sampling is a very technical discipline and unrecoverable errors can easily be made. Proposals for sample designs made by client ministries or consultants should be subject to competent review.

The type of sample design generally recommended for LSMS surveys (a nationally representative random sample of households drawn in two stages) is appropriate for transport applications. In policy related work a whole national sample may be the most appropriate. In project related work a similar sampling design may be used, but focused geographically on only the project area and a suitable non-project control area. A major difficulty in sampling for LSMS-type surveys is having an adequate sample frame (comprehensive, up to date, and relatively error free) from which to draw the sample. The sample frame is a listing of "all" households from which the households to be surveyed are randomly selected. The sample frame is usually divided (stratified) into two or more strata, such as rural and urban. Sampling beyond the basic requirement for overall statistical reliability (oversampling) may be done to ensure specific population groups are adequately covered (e.g regions, ethnic groups, etc.). Countries with a national census within the last three to five years should make use of the census enumeration for the sample frame. Otherwise resources may have to be allocated to generating a sample frame from other sources.

The sample design must be statistically rigorous and specified in the survey documentation with sufficient clarity and detail that the same approach can be used time after time to draw a sample with the same statistical characteristics. A robust and well documented sample design is needed so that post-project impact evaluations can later use the same design and so be statistically comparable.

Sample design must match the needs of the survey. In a country-wide survey such as the LSMS, this is designed to produce a nationally representative sample. In the case of a transport project the sample design must provide for an adequate "with-project" and an adequate "without-project" (or control group) sample. The two samples should be comparable in socio-economic characteristics so that a post-project evaluation can be done with a minimum complexity due to changes in other factors.

## 5.2 Survey Administration

The LSMS-type surveys are based on face-to-face personal interviews that take place in the household over several visits. In most developing countries this is generally the only feasible method (rather than mail-back or telephone based approaches). There is a well developed set of approaches from the LSMS work used to facilitate data collection which is also applicable for transport questions. This includes the design and physical layout of the questionnaire itself, the organization of fieldwork, pre-test, interviewer training, supervision while in the field, data coding, and data cleaning. Because field problems can arise at any time, it is critical to ensure that the interviewers and supervisors are well trained. A key reference is, "A Manual for Planning and Implementing the Living Standards Measurement Survey", Margaret Grosh and Juan Munoz, LSMS Working Paper No. 126, The World Bank, 1996.

In a recent survey of Urban Transport and the Poor in Mumbai, the World Bank used Handheld PDAs to collect the data.<sup>9</sup> Data entry software was designed with the questions and coded responses. Interviewers then recorded the responses directly into the PDAs. This allowed for a high degree of accuracy in the data collection as error messages were built into the software to account for inappropriate or non-coded responses. The data were then downloaded every other day and checked for accuracy. A GPS unit was also attached to the PDA to mark the exact location of the household.

## 5.3 Travel Diaries

Conventional travel questionnaires may collect data on only a portion of individual mobility (work trips, school trips, etc.). Questions related to travel may not be recalled accurately, private motorized trips often underestimate the time taken, public transport trips often overestimate travel time. Also infrequent trips, small unimportant trips, and locations close to home and work may be overlooked. To some extent these problems can be reduced by specifying actual travel from a recently preceding day rather than "usual" travel. Another solution is a travel diary, which provides detailed information about

what an individual does for a given length of time. Three types of diaries are commonly found: (i) travel diaries where only trips are recorded, (ii) activity diaries where mostly out-of-home activities are recorded, and (iii) time-use diaries where most of what is done throughout the day is recorded.

Completing a diary is much more demanding on the respondent and may involve higher non-response rates. Diaries are more difficult to comprehend and require more effort in terms of preparation, pre-testing, and administration. They are also labor intensive in terms of data coding. Diaries are have been criticised on the grounds of panel conditioning, in that as respondents are required to keep log-books of their behaviour, they are made aware of their habits which subsequently may result in a change in those habits.

Despite these costs diaries have become more frequently used in travel research as new forecasting models have focused on activities as opposed to trips. The activity-based approach can consider the substitution of non-travel alternatives, better use of non-motorized modes, and trip-chaining. The focus on activities should also permit the examination of interpersonal dependencies among household members, time constraints related to hours of operation of activities, work schedules, expected activity duration, and multi-day scheduling of activities. To develop such understanding the diaries need to be collected from all household members over several days.

The paper, "Effects of Data Collection Methods in Travel and Activity Research", Ettema, Timmermans, and Veghel, European Institute of Retailing and Services Studies, 1996 provides a good discussion of the trade-offs between conventional travel surveys and travel diaries. Among the rules-of-thumb they develop are (everything else being equal):

- If the aim of the study is to describe activity patterns then a conventional survey questionnaire is sufficient. If the aim is to examine the various inter-dependencies between travel and activities then diary data should be collected.

- Incentives, surveillance in the form of an appointment to pick up the diary or repeated visits, and user-friendly design are essential to successfully collect diary data.
- Use a maximum of a 48 hour diary unless the application (modelling) requires a longer frequency.
- Use a designated day diary (to allow every day of the week to be specified).
- Use a 24 hour recall period for an activity diary and a maximum of a 48 hour recall period for a trip diary.
- Use an open interval diary over a fixed interval diary.
- Include questions about timing, duration, location, and mode. Dependent on the aim of the study include questions about travel/activities companions, motivations, and planned/unplanned nature of activity.
- Be sure the sample is spatially representative.

#### 5.4 Use of GIS

A Geographic Information System (GIS) is a software application that combines a database of statistical information with a database of geographic co-ordinates so that the statistical information can be further processed in spatial ways and can be viewed through various types spatial displays, including maps. In order to use a GIS the statistical information must have attached to each record a "geocode" which could be, for example, the location of the statistical record in terms of latitude, longitude, and altitude, or its UTM (Universal Transverse Mercator) co-ordinates.

Geocoded data is particularly important in transport applications. Geocoding of travel survey results is now commonly done in developed country household travel surveys. Geocoding allows the use of any or various zone systems to aggregate the data for further analysis or display. It permits the calculation spatial statistics that cannot be calculated otherwise and it allows additional data checking routines to be performed on the survey data so that inconsistent data are removed.

With the advent of the Global Positioning System (GPS) adding a geocode to provide the location of a surveyed household is inexpensive and very beneficial for analysis. During the conduct of a Community Questionnaire the geocodes of community facilities such as schools, clinics, markets, bus terminals, village "gateway" locations, etc. should also be routinely collected. For rural households where barns and other outbuildings may be some distance from the main household these other locations should also be collected. In order to establish the location with a better degree of precision a number of GPS readings (3 to 5) should be taken at the same location at different times and the results averaged. In household surveys with more than one visit to the household this could be done once per visit. The use of GPS can present challenges in implementation – the technology does not always work in urban areas with tall buildings, mountainous areas, or areas with heavy tree cover.

In addition to locations where the geocode can be collected using a hand-held GPS receiver there are locations of interest which may not be visited in the field survey. For example, a place of work or a market in another community not covered in the sample. Attaching a geocode to the household record for these other locations requires either a database of street addresses or reference points ("monuments" such as a school, clinic, bus station etc.) linked to the geographic coordinate system or digital maps on which locations can be manually coded. These types of databases or maps may not always be available in developing countries. Survey resources need to be allocated for geocoding important non-household locations for the usefulness of GIS approaches is to be realized.

## 6 INTEGRATING TRANSPORT QUESTIONS INTO HOUSEHOLD SURVEYS

As discussed above, it is possible to incorporate specific questions into existing core modules, or include a separate module to get at more detailed issues, depending on the country circumstances. Table 6 summarizes the core modules typically found in multitopic household

surveys, and what kinds of data can be collected related to transport in both rural and urban areas. Specific questions are included in Annex I for (a) household surveys, (b) community surveys, and (c) travel diaries.

In addition to the household survey, qualitative approaches can also provide important information from respondents that may not come across in a coded

survey. Qualitative approaches include techniques such as focus groups and open ended interviews generally use small sample sizes. This includes subjective data on the attitudes and reasons which underlie travel behavior and public transport use. Ideally, a study approach would include both a statistically representative household survey, and a smaller number of qualitative surveys from the same sample.

**Table 6. Transport information that can be obtained through household surveys by standard modules.**

Standard Modules	Specific information for transport sector analysis	Recall Period	Unit of data collection
Metadata on household	<ul style="list-style-type: none"> <li>Geographic location, sample frame</li> </ul>	Current	Household
Household Roster	<ul style="list-style-type: none"> <li>Composition of household (demographic breakdown)</li> </ul>	Current	Individual
Consumption <i>Food expenditure</i>  <i>Non-Food expenditures</i>	<ul style="list-style-type: none"> <li>n.a.</li> <li>All transport related expenditures should be detailed: bus services, taxis, boats, other public transport modes, tolls, gasoline for motor vehicle); vehicle (car, motorcycle, bicycle) parts and repairs (tubes, tires, spare parts), vehicle insurance, vehicle registration, drivers licenses, parking fees)</li> </ul>	Last 7 days, 30 days, 1 year	Household
Housing	<ul style="list-style-type: none"> <li>Can include travel to collect drinking water, firewood, laundry, bathing (or in water module) (by mode, time, distance, frequency, cost).</li> <li>Basic information on housing relevant for location models.</li> </ul>	Current	Household
Durable goods	<ul style="list-style-type: none"> <li>Should include ownership of all vehicles (car, bus, truck, motorcycle, bicycle, boat, pushcart, etc.). Also should include year of purchase, amount paid, estimated value today if sold.</li> </ul>	1 year	Household
Other Assets	<ul style="list-style-type: none"> <li>Animals for transport</li> </ul>	1 year	Household
Labor income	<ul style="list-style-type: none"> <li>Travel to economic activity (by mode, time, distance, frequency, cost ) (primary and secondary employment)</li> </ul>	Last 7 days	Individual
Transfers and other non labor income	<ul style="list-style-type: none"> <li>Transport services in-kind, subsidized services</li> </ul>	Last 7 days, 30 days	Individual

**Table 6. Transport information that can be obtained through household surveys by standard modules.**

Standard Modules	Specific information for transport sector analysis	Recall Period	Unit of data collection
Savings and Credit	<ul style="list-style-type: none"> <li>• n.a.</li> </ul>	Current, 1 year	Individual
Prices	<ul style="list-style-type: none"> <li>• Average prices of transport</li> </ul>	Current	Community
Agriculture Agro-pastoral activities	<ul style="list-style-type: none"> <li>• Transport of agricultural inputs or products to markets, processing, etc.) (ask mode, time, distance, frequency, cost)</li> </ul>	Last 7 days, 30 days, 1 year	Household
Non-farm self employment	<ul style="list-style-type: none"> <li>• Collection of firewood, water (<i>also could be collected under housing</i>)</li> <li>• Travel/transport use</li> </ul>	Last 7 days Last 7 days	
Education	<ul style="list-style-type: none"> <li>• For those in school, travel to schools (travel mode, time, distance, frequency, cost )</li> </ul>	Current	Individual
Health	<ul style="list-style-type: none"> <li>• For those using health services, travel to clinics, hospitals, health centers, (travel mode, time, distance, frequency, cost )</li> </ul>	Last 30 days	Individual
Social Services	<ul style="list-style-type: none"> <li>• For those using social services such as nutrition programs, workfare programs, etc. travel to benefit, (travel mode, time, distance, frequency, cost )</li> </ul>	Last 7 days, 30 days	Individual
Participation in community affairs ( <i>non-core</i> )	<ul style="list-style-type: none"> <li>• Social visits, festivals, ceremonies, religious events, (travel mode, time, distance, frequency, cost)</li> </ul>	Last 7 days, 30 days, 1 year	Individual
Community Infrastructure and Transport	<ul style="list-style-type: none"> <li>• Physical access: Foot path, unpaved road, paved road, highway, river, lake, train, airport.</li> <li>• Access of other services: transport services, schools, health clinics, post, markets, church etc. (and travel to these services)</li> <li>• Affordability: Standard costs of services</li> <li>• Quality/barriers to mobility: -Condition of roads, closures due to flooding, reliability of public and private transport services, security, comfort</li> </ul>	Current and Seasonal	Community

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## ANNEX I: SAMPLE QUESTIONS ON ACCESS, MOBILITY, AFFORDABILITY AND QUALITY

### A. Household Survey

**Basic Access Questions** (which can be included in sector modules - education, health, employment, etc.):

1. How far from your home is [...] (depending on module: place where you work, school, market (for selling produce, or shopping), nearest health clinic, nearest all weather road) ?

Fill in \_\_\_\_\_ (distance) \_\_\_\_\_ (code) Distance Codes (meters 1, kilometers 2, ).

Or precoded responses:

1. 0-1 km
2. 1-3 km
3. 3-5 km
4. 5-10 km
5. 10-20 km
6. >20 km

2. How long does it take you to travel from your home to [...] (destination above depending on module, e.g. school, work, etc.) ?

\_\_\_\_\_ hours \_\_\_\_\_ minutes (total time one way)

Or precoded responses (which may need to be adapted for rural/urban distances):

1. < 5 minutes
2. 5-10 minutes
3. 10-20 minutes
4. 20-30 minutes
5. 30-60 minutes
6. > 60 minutes

3. What modes of transport do you use to go to [...] (work, school, sell goods, shop) ?

Primary mode \_\_\_\_\_ Secondary mode \_\_\_\_\_

Country specific (select applicable, can be adapted for country circumstances)

- |                            |                     |
|----------------------------|---------------------|
| 1. Public Bus              | 9. Bicycle          |
| 2. Private Bus, Van        | 10. Ferry           |
| 3. Own private car/truck   | 11. Boat            |
| 4. Other private car/truck | 12. Train           |
| 5. School bus              | 13. Subway          |
| 6. Taxi                    | 14. Walking         |
| 7. Motorbike               | 15. Ox/Horse Cart   |
| 8. Auto-rickshaw           | 16. Other (specify) |

4. How much do you pay for this transportation ?

Total Cost \_\_\_\_\_ One way trip (if more than one mode include total cost)

**Consumption Module** (transport expenditure data should be included in consumption module)

Under the standard non-food consumption module, information on the following transport expenditures should be collected for the past 7, 30 days and the past 12 months (depending on item):

1. How much have you spent during the past \_\_\_ days on:

a. Past 7 days:

1. Fares for public transport within the community/town (specify by mode)
2. Taxis
3. Parking
4. Gasoline, Petrol, or Diesel

b. Past 30 days and past 12 months:

1. Inter-city transport (specify by mode, train, bus, air)
2. International travel (transport costs only)
3. Purchases of Bicycle
4. Routine bicycle maintenance, parts
5. Purchase of Car / Truck/ Motorcycle (should be asked separately) (include car payments, etc.)
6. Routine vehicle maintenance, parts (do NOT include gasoline)
7. Motor vehicle repair after vehicle accident
8. Motor vehicle registration/ license
9. Insurance (auto, other motor vehicle)

2. Under the standard Ownership of Durable Goods include the following transport items:

Bicycle  
Motorcycle/scooter  
Car  
Van  
Truck  
Cargo trailer for vehicle  
Boat

**Specific Transport Services** (might be added to a separate transport module)

1. How far is the nearest \_\_\_\_\_ (bus stop, train station, subway station, etc.) from your home?

1. Less than one kilometer
2. Between one and two kilometers
3. Between two and four kilometers
4. More than four kilometers
5. Don't know [DO NOT READ.]

2. How long would it take a person to walk to this [...] (bus stop, train station, subway station, etc.) from your home?

1. Less than 5 minutes
2. 5-10 minutes
3. 10-20 minutes
4. 20-30 minutes
5. More than 30 minutes
6. Don't Know [DO NOT READ]

3. How reliable is the [...] (bus, train, subway, etc.) service? Is it .... (Read list below to respondent.)

1. Very reliable
2. Somewhat reliable
3. Unreliable
4. Don't Know [DO NOT READ]

4. How do you feel about the amount of crowding on [...] (buses, trains, etc.)? (Read list below to respondent.)

1. Satisfied
2. Neutral (neither satisfied nor dissatisfied)
3. Dissatisfied

5. How safe do you feel when riding [...] (buses, trains, etc.)? (Read list below to respondent.)

1. Very safe
2. Neutral (neither very safe nor very unsafe)
3. Unsafe

6. How convenient are the [...] (bus, train, etc.) routes for you; do they go to the places you wish to go? (Read list below to respondent.)

1. Very convenient
2. Neither convenient nor inconvenient
3. Not very convenient

7. How frequently do the [...] (bus, train, etc.) service come ?

- \_\_\_ times per hour  
\_\_\_ times per day

8. How satisfied are you with the frequency of service ? (Read list to respondent)

1. Satisfied
2. Neutral (neither satisfied nor dissatisfied)
3. Dissatisfied

### ***B. Community Survey***

The prototype survey below can be asked at the community level, typically from a community leader or knowledgeable person and will provide substantial information on transport issues. This information can then be merged with household level data for distributional analysis.

Now I would like to know about transportation in this community to places that community residents sometimes use, such as bus terminals, markets and post offices.

<p>1. Is the [...] located within or outside the boundaries of the community?</p> <p>FIRST ASK QUESTION 1 FOR EACH LINE, THEN ASK QUESTIONS 2-7 FOR EACH LINE BEFORE GOING TO THE NEXT LINE. (Note if Question 2 is less than 1 km then skip to next line)</p>	<p>2. Approximately how far is the [...] from the center of the community, in kilometers?</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;">                 IF &lt; 1 KM, GO TO NEXT LINE             </div>	<p>3* Is it possible to travel from the community center to the [...] using public transportation?</p>	<p>4* How often is public transportation available for travel to the [...]?</p> <p>HOUR.....2 DAY.....3 WEEK.....4 FORTNIGHT..5 MONTH.....6 QUARTER...7 HALF-YEAR..8 YEAR.....9</p>	<p>5. What is the most common mode of transportation to travel from the community center to the [...]?</p> <p style="text-align: center;"><b>INSERT CODE FOR MODE OF TRAVEL MOST COMMONLY USED</b></p>	<p>6. How much does it cost to travel to the [...] from the community center using this mode of transportation?</p>	<p>7. How long does it take to travel from the community center to the [...] using this mode of transportation?</p>								
<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">WITHIN...1</td> <td style="padding: 2px;">OUTSIDE...2</td> </tr> </table>	WITHIN...1	OUTSIDE...2	<p><b>KILOMETERS</b></p>	<p>YES..1 NO...2 (≥5)</p>	<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">TIMES</td> <td style="padding: 2px;">TIME UNIT</td> </tr> </table>	TIMES	TIME UNIT	<p><b>INSERT CODE FOR MODE OF TRAVEL MOST COMMONLY USED</b></p>	<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">HOURS</td> <td style="padding: 2px;">MINUTES</td> </tr> </table>	HOURS	MINUTES	<table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">HOURS</td> <td style="padding: 2px;">MINUTES</td> </tr> </table>	HOURS	MINUTES
WITHIN...1	OUTSIDE...2													
TIMES	TIME UNIT													
HOURS	MINUTES													
HOURS	MINUTES													

1	Nearest supply of drinking water								
2	Nearest supply of cooking fuel								
3	Nearest supply of heating fuel								
4	Nearest primary school								
5	Nearest secondary school								
6	Nearest post-secondary school								
7	Nearest health clinic								
8	Nearest hospital								
9	Nearest pharmacy								
10	Nearest intercity bus terminal								
11	Nearest passenger railway station								
12	Nearest railway freight depot or siding								
13	Nearest daily market								
14	Nearest periodic market								
15	Nearest cinema, theatre								
16	Nearest library								
17	Nearest place to use a telephone								
18	Nearest post office								
19	Nearest bank								
20	Nearest car rental								
21	Nearest tractor rental								
22	Nearest fertilizer depot								
23	Nearest all weather road								
24	Nearest Regional / District Road								
25	Nearest National / Trunk Road								
26	Distance from the center of the community to the farthest edge point of the community								
27	Nearest community of the same size								
28	NAME OF COMMUNITY: _____								
29	Nearest community of at least twice the size								
30	NAME OF COMMUNITY: _____								
31	Administrative Capital (Level 1, National Capital)								
32	NAME OF ADMIN CAPITAL _____								
33	Administrative Capital (Level 2, Regional or District Capital)								

**C. Trip Diary**

The travel diary can be left and completed by the respondent, or can be recorded by the interviewer. It is important to ensure a random selection of days.

**For each member of the household**

NAME: \_\_\_\_\_ ID: \_\_\_\_\_

HH ID: \_\_\_\_\_ TRAVEL DIARY DATE \_\_\_\_\_

At the beginning of my travel day (4:00 a.m.)

I was at HOME or SOMEPLACE ELSE \_\_\_\_\_  
(Circle HOME or write the name of someplace else in the space above)

**TRIP 1**

Where did you go next? \_\_\_\_\_

Purpose of this trip? \_\_\_\_\_

1. Work
2. Shopping
3. School
4. Social Visit
5. Entertainment
6. Doctor / Hospital
7. Personal Business [This could be Bank, Paying Bills etc.]
8. Return to Home
9. Other \_\_\_\_\_ [Non Blank if selected]

Where was this located?

\_\_\_\_\_  
(Street Address, Neighbourhood, Code (PIN, Postal or other))

What time did you leave? \_\_\_\_\_ AM / PM Arrive? \_\_\_\_\_ AM / PM

	<b>How You Went (Bus, Train, etc.)</b>	<b>Waiting Time</b>	<b>Travel Time</b>	<b>Cost (Rs.)</b>
Mode A				
Mode B				
Mode C				

Codes for Modes:

1. On foot
2. By bicycle
3. By train
4. By bus
5. By auto-rickshaw
6. By taxi
7. By two-wheeler (own vehicle)
8. By own car/jeep/van
9. In someone else's car/jeep/van
10. Other \_\_\_\_\_ (Non Blank)

Did you use a bus pass for this trip? YES / NO (Circle the correct one)

If so, Duration of Pass: \_\_\_\_\_ and Cost of Pass (Rs.): \_\_\_\_\_

Did you use a train pass for this trip? YES / NO (Circle the correct one)

If so, Duration of Pass: \_\_\_\_\_ and Cost of Pass (Rs.): \_\_\_\_\_

## **TRIP 2**

Repeat pattern for each additional trip loop for the entire day.

## ANNEX II : WELFARE AGGREGATES

The following is an excerpt from Chapter 2 "Theory of the Measurement of Welfare", in "Guidelines for Constructing Consumption Aggregates for Welfare Analysis, LSMS Working Paper No. 135, May 2002.

### Box 1. Summary of Theoretical Issues and Recommendations

Issue	Recommendations
<p><b>Money Metric Utility (MMU) vs. Welfare Ratio (WR)</b></p> <p>MMU is the amount required to sustain a level of living and requires that consumption be adjusted by a Paasche price index that reflects the prices the household faces and whose weights are different for each household.</p> <p>WR is an indication of how much better or worse off a household is than a reference household (usually at the poverty line) and requires consumption to be adjusted by a Laspeyres price index that reflects the prices faced by the reference household but whose weights are the same for all households.</p> <p>The use of MMU can cause difficulties in analyzing the impact of redistributive policy but, on the other hand, WR does not necessarily represent welfare correctly. The latter is the more serious drawback in practice.</p>	<p>Attempt should be made to use Money Metric Utility and to calculate the Paasche price indices with individual household weights.</p>
<p><b>Income vs. Consumption</b></p> <p>Consumption is a theoretically more satisfactory measure of well-being.</p> <p>Income is used in industrial countries where self-employment is relatively rare so that most household income comes from a few sources, where annual income variation is low, and consumption data are relatively costly to gather.</p> <p>Consumption is less variable over the period of a year, much more stable than income in agricultural economies and makes it more reasonable to extrapolate from two weeks to a year for a survey household. When self-employment is common, income data is at least as expensive and as difficult to collect as are consumption data.</p>	<p>In most developing countries where LSMS and / or household expenditure surveys are available, consumption is the appropriate measure to use.</p>
<p><b>Durable Goods and Housing</b></p> <p>A measure of use-value, not purchase, of durable goods is the right measure to include in the consumption aggregate from a welfare point of view.</p>	<p>Exclude expenditure s- instead calculate a rental equivalent / user cost for housing and durable goods owned by the household.</p>
<p><b>Time and Leisure</b></p> <p>Households with more leisure time have a higher level of welfare than households with no leisure. However, valuing leisure for each individual is problematic. Furthermore, it is difficult to distinguish between leisure, non-market work for the household, and involuntary unemployment.</p>	<p>Omit time and leisure in the calculation of consumption.</p>
<p><b>Public Goods</b></p> <p>Clearly presence of public goods such as hospitals and schools improves the welfare of nearby households more than that of households without good access to these services. However, estimating the value of those services is problematic. Households may choose private services even if public services are available. Contingent valuation of services that don't exist are sometimes but of questionable accuracy;</p>	<p>Do not include any valuation of public goods in the calculation of the household consumption aggregate.</p>
<p><b>Farm Households</b></p> <p>It is possible to consider household as consumers separately from household businesses or farms in economies with active markets. In subsistence economies, this assumption is sometimes hard to justify; however, trying to separate the producer from the consumer using estimates farm-date prices is the best strategy in practice. In countries where a large fraction of consumption comes from home production and markets are less active, the evaluation of welfare becomes sensitive to difficult decisions about imputations, and should be regarded with caution.</p>	<p>Treat the farm household as a business selling to the household. Attempt to value produce at "farmgate" rather than "market" prices.</p>

<b>Issue</b>	<b>Recommendations</b>
<b>Differences in Tastes</b> Expenditure on regrettable necessities should, in theory, be excluded but in practice it is impossible reliably to distinguish between necessities and choices. Household size however, is important and affects the household welfare associated with a given level of expenditure.	Include expenditure on items that may or may not be regrettable necessities. Adjust household expenditure to reflect household size.

### ANNEX III: LIST OF TRANSPORT INDICATORS AND USE OF HOUSEHOLD SURVEY DATA<sup>10</sup>

Dimension	Mode	Indicator	Use of Household Survey ?
ACCESS			
	Roads	Access to all-season road by rural population (% of total rural population)	*
	Roads	Average distance to nearest transport stop for urban population (km)	*
	Roads	Average distance to nearest transport stop for rural population (km)	*
	Roads	Road Density in terms of population (km/1,000 people)	
	Roads	Road Density in terms of land area (km/1,000 km <sup>2</sup> )	
	Rail	Rail Lines Density in terms of land area (route-km/1,000 km <sup>2</sup> )	
	Rail	Rail Lines Density in terms of population (route-km/1,000 people)	
	Roads	Motorized Road Vehicle Ownership in Rural Areas: Private Cars (% of rural households)	*
	Roads	Motorized Road Vehicle Ownership in Rural Areas: Motorcycles (% of rural households)	*
	Roads	Non-Motorized Road Vehicle Ownership in Rural Areas: Bicycles (% of rural households)	*
	Urban	Motorized Road Vehicle Ownership in Urban Areas: Private Cars (% of urban households)	*
	Urban	Motorized Road Vehicle Ownership in Urban Areas: Motorcycles (% of urban households)	*
	Urban	Non-Motorized Road Vehicle Ownership in Urban Areas: Bicycles (% of urban households)	*
	Roads	Non-Motorized Road Vehicle Ownership: Bicycles (% of households)	*
	Air	Aircraft Departures (thousands)	
AFFORDABILITY			
	Road	Motor Vehicle Fuel Prices: Gasoline (Super/Regular) (US\$/ liter)	
	Road	Motor Vehicle Fuel Prices: Gas/Diesel Oil (US\$/liter)	
	Urban	Spending on Transport Services by Urban Households (% of Urban Household Expenditure)	*
	Rural	Spending on Transport Services by Rural Households (% of Rural Household Expenditure)	*
	Rail	Average Rail Tariff, Passenger (US\$/passenger-km)	
	Rail	Average Rail Tariff, Freight (US\$/tonne-km)	
	Roads	Road User Charges as Share of Total Road Expenditure (%)	
	Ports	Port Handling Costs: containers (US\$/TEU)	
	Ports	Port Handling Costs: containers (US\$/ton)	

Dimension	Mode	Indicator	Use of Household Survey ?
QUALITY (*Technical Dimension*)			
	Roads	Paved Roads (% of Total Road Network)	
	Roads	Roads in Fair/Good Condition (% of Total Road Network)	
	Rail	Rail Traffic Density (traffic units/km)	
	Rail	Route Length of Multi-tracked Rail Lines (% of total route-km)	
	Rail	Rail Service Frequency (passenger train-km/route-km)	
	Roads	Fatalities in Road Motor Vehicle Accidents in terms of vehicles (Fatalities/10,000 vehicles)	
	Roads	Fatalities in Road Motor Vehicle Accidents in terms of population (Fatalities/100,000 people)	
	Urban	Urban Transport Modes (% of work trips)	*
	Ports	Seaport Traffic: containers	
	Ports	Seaport Traffic: general cargo	
	Rail	Rail Share of Passenger Domestic Travel (%)	
	Road	Road Share of Passenger Domestic Travel (%)	
	Water	Inland and Coastal Shipping Share of Passenger Domestic Travel (%)	
	Air	Air Share of Passenger Domestic Travel (%)	
	Rail	Rail Share of Total Freight Domestic Carriage (%)	
	Road	Road Share of Total Freight Domestic Carriage (%)	
	Water	Inland and Coastal Shipping Share of Total Freight Domestic Carriage (%)	
	Air	Air Share of Total Freight Domestic Carriage (%)	
QUALITY (*Perception*)			
	All	Average Total Time Traveling by Rural Households (minutes/days)	*
	All	Average Total Time Traveling by Urban Households (minutes/days)	*
	Urban	Travel Time to Work in Main Cities (minutes/one-way work trip)	*
	Roads	Commercial Perception of Services Delivered by Road Department/ Public Works	
	Rail	Commercial Perception of Railway Services	
	Air	Commercial Perception of Air Transport Services	
	Ports	Commercial Perception of Port Facilities and Inland Waterways	
	Ports	Cargo Handling Services: Market Openness	
EFFICIENCY (*Cost*)			
	Ports	Shipping Costs (ratio)	
	Rail	Railway Employee Productivity (Annual Output/Employee)	
EFFICIENCY (*Economic*)			
	Roads	Road Transport System Technical Efficiency (US\$/km)	
FISCAL COST			

	Roads	Road Expenditure as share of GDP (%)	
	Roads	External Funds as Share of Total Road Expenditure (%)	
	Roads	Actual to Required Road Maintenance Expenditure (%)	
FINANCIAL AUTONOMY			
	Roads	Expenditure on Owning and Operating Vehicles (US\$)	
INSTITUTIONAL DEVELOPMENT			
	Roads	National Roads Boards (NRB) Exists and Reports (at least annually) (Y/N)	
	Roads	Private Sector Representatives form majority of NRB (Y/N)	
	Roads	Main (National) Road Agency operating with Annual Report published (Y/N)	
	Roads	Main (National) Road Agency publishing Technical and Financial Audits (Y/N)	
	Roads	National Road Safety Action Plan (Y/N)	
	Roads	Social Assessment of Road Projects Mainstreamed (Y/N)	
	All	Gender assessment (Y/N)	
	All	Access for all (Y/N)	
	All	Planning (Y/N)	
	Roads	Environmental Assessment of Road Projects Mainstreamed (Y/N)	
	Roads	Communicable disease control (Y/N)	
	All	Competitive Private Sector Participation in Transport Services (Y/N)	
	All	Core labor standards (Y/N)	
	All	Health and safety (Y/N)	

## ENDNOTES

- <sup>1</sup> See Grosh and Munoz, 1996, "A Manual for Planning and Implementing the Living Standards Measurement Study Survey", LSMS WP 126; Scott, 2003, "Multi-topic Household Surveys" in *The Impact of Economic Policies on Poverty and Income Distribution*, eds. Bourguignon and Pereira da Silva, and Scott, Steele and Temesgen, (forthcoming), "Living Measurement Study Surveys" in *The Analysis of Operating Characteristics of Surveys in Developing and Transition Countries*, ed. Ibrahim-Sorie Yansaneh, UN Statistical Division
- <sup>2</sup> See Grosh and Munoz, 1996; Grosh, A Guide to Living Standards Measurement Study Surveys and their Data Sets, LSMS WP 120; Scott, et. al., (forthcoming); and Grosh, M. and Glewwe, P., 2000, *Designing Household Survey Questionnaires for Developing Countries*.
- <sup>3</sup> See Scott, 2003 for a discussion on measuring welfare with Income and Expenditure Surveys.
- <sup>4</sup> See Chapter 1 "Poverty Measurement and Analysis" of the "Sourcebook for Poverty Reduction Strategies", 2001.
- <sup>5</sup> Ibid.
- <sup>6</sup> For the full report and background paper on the Transport and Poverty Profile see <http://inweb18.worldbank.org/external/lac/lac.nsf/Countries/Guatemala/90CF6C5A035DCEF585256CE90049E66C?OpenDocument> (Jyotsna Puri, 2002)
- <sup>7</sup> These resources can be found at: <http://www.worldbank.org/transport/> and <http://www.worldbank.org/poverty/library/impact.htm>
- <sup>8</sup> See Banjo and Robinson, "Developing Rural transport Policies and Strategies" (in progress)
- <sup>9</sup> See Baker, Basu, Cropper, Lall and Tekeuchi, "Urban Poverty and Transport; The Case of Mumbai," 2005, draft.
- <sup>10</sup> Source:  
<http://intranet.worldbank.org/WBSITE/INTRANET/SECTORS/INTTRANSPORT/INTTRM/0,,contentMDK:20283507~pagePK:210082~piPK:210098~theSitePK:514794,00.html>