

# Transportation Planning Survey Methodologies for the Proposed Study of Physical and Socio-economic Development of Deprived Rural Regions: A Review

Mir Aftab Hussain Talpur<sup>1</sup>, Madzlan Napiah<sup>1</sup>, Imtiaz Ahmed Chandio<sup>1</sup> & Shabir Hussain Khahro<sup>1</sup>

<sup>1</sup>Department of Civil Engineering, Universiti Teknologi Petronas, Malaysia

Correspondence: Mir Aftab Hussain Talpur, Department of Civil Engineering, Universiti Teknologi Petronas, Bandar Seri Iskandar 31750, Tronoh, Perak Darul Ridzuan, Malaysia. Tel: 60-1-6519-6075. E-mail: aftab\_g01903@utp.edu.my

Received: May 7, 2012

Accepted: May 31, 2012

Online Published: June 6, 2012

doi:10.5539/mas.v6n7p1

URL: <http://dx.doi.org/10.5539/mas.v6n7p1>

## Abstract

Transportation is considered as an essential part of human life and backbone of national, regional and local economy. Transportation sector plays a crucial role in boosting up the life styles of common men by providing facilities and accessibilities as required to them. Deprived rural regions are always struggling from services and facilities aspects due to their remote and scattered locations. Transportation is a tool, which can mitigate rural regional problems by providing proper accessibilities and links to employment, health, education and services. The proposed study objective is to provide accessibility and proper transportation services to these rural regions. For this purpose regional transportation policy plan is required, which can't be formulated without relevant and quality data. The purpose of this paper is to review different surveys methodologies, which are essential for data collection. Different techniques have been reviewed including face-to-face interviews, telephonic interviews, web and postal survey methodologies, pilot survey, participatory rural appraisals and household surveys. It is concluded that during study primary as well as secondary data can be used. This exercise can save time and other crucial resources. The data can be used for the development of transportation policy for the study area. This plan can be helpful in bringing prosperity, mitigating poverty and uplifting the living standards of common men in these deprived regions.

**Keywords:** rural regions, regional economy, accessibility, quality data, surveys methodologies, transportation policy plan

## 1. Introduction

Transportation planning surveys are appropriate tools to collect relevant data for sustainable development (Haghshenas & Vaziri, 2012; Black, 1996) of remote regions and backward communities. The local, regional or national economy mostly depend upon an efficient and reliable transportation system, which is provided for accessibility and efficient movement of people and goods (Chen et al., 2002). Surveys are precise solutions to many problems, which can assist in collecting and gathering socio-economic data for the well-being of aloof rural regions. It is believed that less accessibility or inaccessibility is main hindrance in the planned development of rural regions and their depreciation (Etter et al., 2006). These developing world's rural regions are suffered by physical and socio-economic problems including inaccessibility and poverty (Gulati et al., 2007; Castella et al., 2005; Porter, 2007). With the help of transportation services and facilities; these remote regions can be accessed properly, which seemed impossible in history (Masood et al., 2011). These policy based solutions became possible with the collection of relevant data, which can really assist in providing timely solutions to regional transportation problems.

Regional transportation planners and professionals are always worried about the quality of data and its authenticity (Bonnell & Le Nir, 1998) because of various surveys related constraints and bottlenecks in rural regions. Earlier concentration was given on the provision of infrastructure and related facilities, then it's shifted towards the collection of data in many European and American countries (Stopher, 1995; Gosselin, 1995). Data can really assist in clarifying the intensity of problems faced by rural communities. This can be done by

analyzing the existing collected data with certain planning standards. After this exercise transportation action plans and policies can be formulated and implemented with the help concerned planning agency.

Transportation services are inevitable ingredients, which can fulfill certain basic needs especially in remote regions. It is evident from many studies that transportation related data is collected through different methodologies and relevant tools like, Computer Assisted Telephone Interviews (CATI) (Jackson Fowler et al., 2002); Computer Aided Personal Interviews (CAPI) (Fuchs et al., 2000); face-to-face interviews (Nielsen, 2011); postal survey method (Dillman, 1991) and web or internet surveys (Dillman, 2007). The quantitative approach of data collection is much impressive than qualitative, which can not only elucidate non-community problems of road network but also transport and households characteristics (Fouracre, 2001). For some organizations data collection and survey activities can be time consuming and hectic experience; when they engaged with data, which is collected by other professionals or organizations (secondary data). For those organizations and professionals; who are betrothed in the process of fresh data collection (primary data), it may be a challenging task with opportunities, which can explore new skills in the field of regional transportation survey methodologies (Richardson et al., 1995). Surveys are aiming to collect data for entire region in order to find out their basic problems and needs, which are incurred due to unavailability of basic transportation services and infrastructure.

The availability of resources and appropriate framework of survey activities are significant elements, which can facilitate in finishing survey proceedings in time and according to available resources. It should be noted that all the surveys methodologies, proceedings and stages are important for reliable data collection.

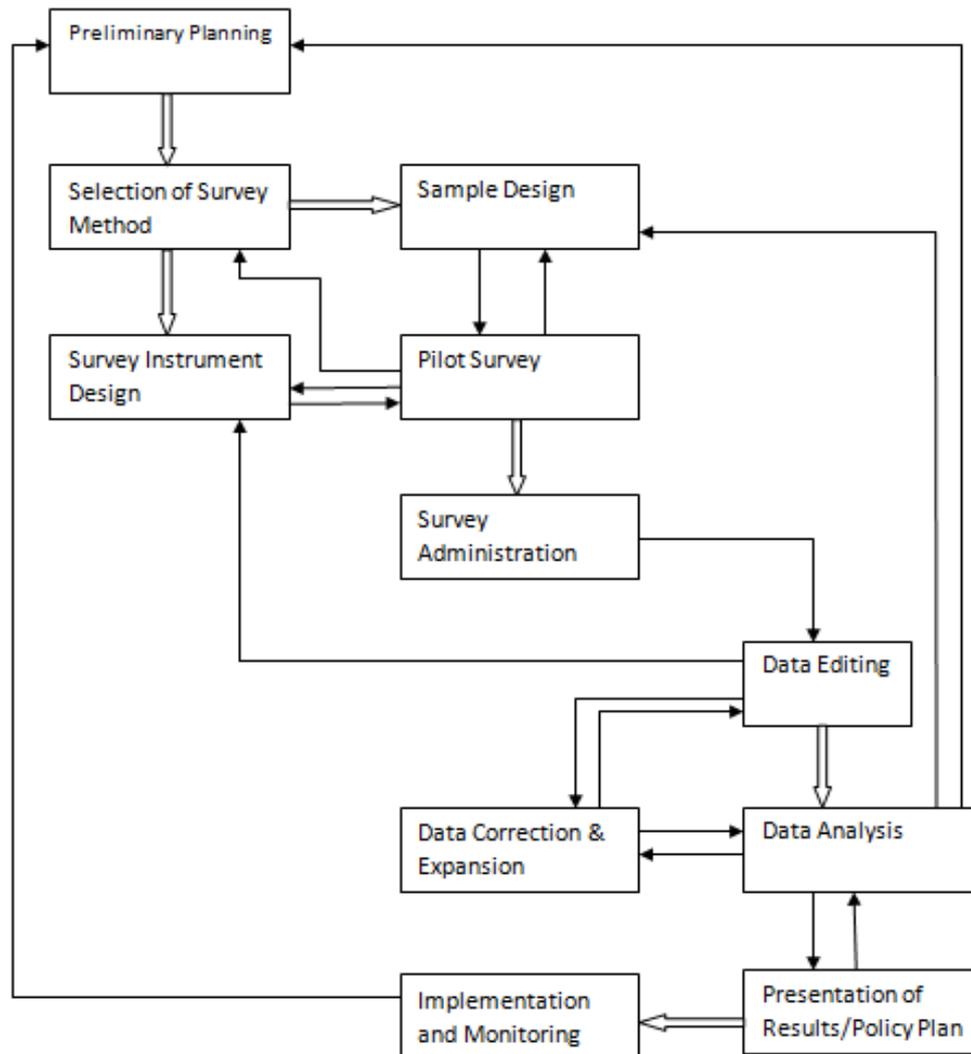


Figure 1. The transportation survey process (Source: Richardson et al., 1995)

These survey stages can be shown in Figure 1. Surveyors should follow such stages properly for the smooth and successful conduct of survey. The main purpose of this paper is to review different transportation planning survey techniques, which are essential for data collection. The collected data can be utilized in making transportation policy proposals/plans for remote rural regions, focusing transportation planning and transportation accessibility related problems. On one hand, this measure can speed up proposed study process and assist in achieving study objectives in given time and on the other, proposed transportation policy can provide framework for the planned development in destitute regions.

## 2. Importance of Surveys

Transportation surveys are carried out for the identification of current transportation system of particular area or region including the points of future development, needs and priorities. Surveys are much essential for recording the facts and finding out the ground realities of remote regions. It is a grave reality that rural communities are facing problems related to accessibility, which seems the biggest obstacle in their physical and socio-economic development (Guagliardo, 2004; Kam et al., 2005; Nanayakkara, 2006; Olsson, 2009; Chandio et al., 2011). Poor access in these remote areas does not only affect cost and trading but also upsurge poverty together with social exclusion (Edmonds, 1998; Booth et al., 2000). The problems of remote rural regions and poverty with respect to accessibility have been discussed in many studies (Porter, 1997; 2002a; 2002b; Bird et al., 2002; Stifel et al., 2003; Christiaensen et al., 2003). These flaws within transportation sector when linked with poor access considered as major drawback, which can cause less profits to growers and can derail the efforts of poverty alleviation plans and programs (Christiaensen et al., 2003). In most of the developing world's rural regions, distances to acquire basic socio-economic amenities are higher than urban or well developed areas. Majority of the rural population don't use motorized transport on primary, secondary and local roads in developing world. People in remote rural regions used bicycle or animal driven carts to fulfill their basic needs on unpaved tracks between rural settlements, which are scattered in location (Barewell, 1988).

The information and communication technologies have revolutionized overall scenario of development sectors including transportation. This innovative trend has also modernized the transportation survey techniques for the purpose of data collection (Fricker et al., 2005; Zhang, 2000). These modern survey tools/methods can be supportive in injecting the growth into remote regions, which seems inevitable for the sustainable development of transportation sector (Leeuw, 2005). The choice of survey depends upon the availability of resources to the researchers and surveyors (Czaja & Blair, 2005). Decision about the choice of survey for data collection can be tempered by the limited availability of resources.

Following are the main guidelines explaining survey types with respect to their specific purpose of data collection (Brog & Erl, 1980):

- For demographic data collection, structured questionnaires are very appropriate tools.
- For getting travel information, diaries are the better alternative for data collection.
- For land uses and transport data collection, official statistics or inventories are suitable selections.
- For knowing the perceptions and attitudes of people about the transportation infrastructure and overall situation, face-to-face in-depth interviews are appropriate.
- For obtaining the data about household, organizations and decision rules; the methodology of group discussion is better choice.

Transportation planning can provide credible solutions to counter the problems related to inaccessibility within remote regions. Therefore, in order to provide credible solutions to such regions; surveys are required for recording the facts and judging the severity of various transport related problems. These aforementioned survey approaches can really facilitate in formulating policies and proposals for remote regions of the developing world.

Table 1. Overview of the world national travel surveys

Country	Survey Name	First Edition	Ultimate Addition	Periodicity	Add-ons	Seminars	Data on www	Result on www
<b>England</b>	NTS	1965	2008	Annual			•	•
<b>USA</b>	NHTS	1969	2009	Irregular	•	8/2009: Workshop on add-ons. 10/2010: Using National Household Travel Survey Data for Transportation Decision Making	•	•
<b>Belgium</b>	MOBEL	1998	1998	None		Trafikdage, yearly conference including NTS papers	•	•
<b>Switzerland</b>	MZ	1974	2005	Every 5 Years	•	3/9/2008: information on new MZ 2010		•
<b>South Africa</b>	NHTS	2003	2003	None	•	6/2006: African Workshop. 3/2006: Seminar on National Household Survey	•	•
<b>Spain</b>	MOVILIA	2001	2006/2007	None				•

Source: Endemann et al., 2010

Table 2. Results of the national travel surveys objectives classification

Country	Travel Behavior				Bench Mark		Policy				Planning			Other			
	Knowledge	Change	Special Issues	Monitoring	Geographical Areas	Modes	National	Specific Issues	Mode Specific Car	Public Transport	Cycling & Walking	Model	Infrastructure	Regional/Urban	Knowledge	Statistical Gaps	Research Stimulation
<b>England</b>	•	•	•	•		•	•	•	•	•			•	•	•	•	•
<b>USA</b>	•	•	•	•	•		•	•		•		•	•	•	•	•	•
<b>Belgium</b>	•						•					•	•		•		
<b>Switzerland</b>	•	•	•	•	•		•	•		•		•	•	•	•		•
<b>South Africa</b>	•		•		•		•	•	•				•				
<b>Spain</b>	•											•	•		•		

Source: Endemann et al., 2010

Overview and results of national travel surveys proceedings of some developed countries can be seen in Tables 1 and 2. These surveys in fact have played an important role for the advanced countries like America, Great Britain and Switzerland in accomplishing their predefined aims and objectives of developing rural regions. Data collection is mandatory for making policy plans at national level and for providing solutions to transportation problems at regional level. These sorts of exercises are mostly carried out continuously throughout the year, e.g. every year with the aim of fresh collection of data and monitoring of transportation and related projects.

### 3. Transportation Planning Survey Categories

Transportation planning is a significant discipline, which provides specific information about travel characteristics and patterns of population in order to prepare sustainable regional transportation policies (Bayart & Bonnel, 2012). Traveling is considered as an integral part of our lives due to many reasons; such as, spatial distribution of different activities, various land use activities and human nature to connect outside world (Chen &

Mokhtarian, 2006). It is very difficult to collect relevant data by using single approach or method of data collection. In order to know the actual behavior of target area or population different varieties and methodologies are required for data collection (Stopher, 2009).

As discussed earlier, wide range of surveys techniques are available to the surveyors or transport planners including modern survey techniques for transportation data collection (Roberts, 2007). The inventions of computers and information technologies have changed the overall scenario of transportation and other related disciplines. This modern era has altered the trends of data collection and survey techniques (Nathan, 2001; de Leeuw, 2001). The new development in this context is web or internet surveys, which are cost and time efficient but at the same time these are affected by the problem of non-response. In some developing countries, these web based surveys are also affected by the unavailability of proper internet facilities and higher illiteracy rates.

Besides modern surveys techniques, traditional surveys possessed great importance and these are being used over the years for data collection. Conventional surveys can be subdivided into two major categories, i.e. supply-side and demand-side surveys (Laboratory, 2002). These surveys are much beneficial in rural and deprived regions for their development. This should be kept in mind that supply side surveys are mostly quantitative in nature and target certain crucial indicators like growth factors and cost. While demand-side surveys also consider quantitative data but largely focus on qualitative aspect of data collection in order to describe the needs of users and their satisfaction. Accessibility is the main indicator of this research, which may help in quantifying some qualitative related elements.

Table 3. Supply-side surveys different categories of supply-side and demand-side surveys with their purposes and indicators

Sector	Surveys	Purpose/Potential Output	Indicators/Comments
<b>Roads</b>	Inventory	To verify the data of road published by concerned authority. Inventory of rural roads judged by different standards, according to distance per km. Other data like street furniture and structure of road may also be collected.	For accuracy purpose, one can't rely on the facts and figures of highway authority. Paths and tracks are unlikely to be recorded.
	Traffic Counts	To know traffic congestion situation and to identify the intensity of traffic at peak/off hours, daily and seasonal distributions and composition on local roads.	Measure as an estimate of Average Annual Daily Traffic (AADT). Extreme variations can be experienced in daily counts on low trafficked roads and as well as seasonal variations.
	Travel Speed Surveys	To calculate delays and average speeds on local routes.	Measure the performance of transport service and road.
	Road Maintenance	To establish the need for remedial works for road betterment.	Development authority can be used for getting data about the condition of road. For local roads this task may be not easy due to its geographic isolation.
	Axe-load Surveys	To know about the load on heavy vehicles and their impacts on road.	This can be an input to road pavement design.
	Safety Statistics & Audits	To search dangerous spots and nature of hazards on local and regional roads.	Accident rate and trends.
<b>Road Users</b>	Operator Surveys	To develop variety of data like route and fare structures, vehicles in use and their characteristics, nature of regulatory and institutional issues.	Analyzing the quality of passenger/freight services for local community.
	Passenger Loading & waiting Time Surveys	Passenger loading surveys used to measure vehicle speed and average passenger journey distance and waiting time surveys used to measure frequency of service and waiting time (level of service).	Clarifying how to improve output of vehicle productivity. While waiting time surveys are Performance Indicators of transport service.
	Passenger Interviews	To collect data about journey distance, comfort, time and fare.	Measure the performance of transport as judged by the user.

Source: Fouracre, 2001

Table 4. Demand-side surveys different categories with their purposes and indicators

Survey Types	Surveys	Purpose/Potential Output	Indicators/Comments
<b>Traditional Transport Surveys</b>	Origin-Destination Surveys	To know the travel pattern of population.	This is carried out at household level together with household surveys. Non-motorized trips ignored in this survey.
	Cordon & Screen line Surveys	Same as origin-destination survey but on smaller scale across an imaginary line or cordon around the survey area.	These surveys only capture trips crossing the screen or cordon. These ignore public transport and even non-motorized trips.
	Stated Preference & Revealed Preference Surveys	To build perception about the respondents of surveys they how they will response about the changes in transportation and how these can be monitored.	Computer software is available for analysis of responses.
	Household Surveys	To develop travel patterns and their relationship with household characteristics for future demand.	Household surveys are very expensive
<b>Participatory Surveys</b>	Village Leadership Discussion	The goal of participatory surveys is to understand problems and their context as apprehended by local people or stakeholders and getting their ideas for remedial measures.	Making environmental friendly and sustainable livelihoods and understanding the cross-sectoral relations requires participatory approach
	Participatory Poverty Assessments		
	Rapid Rural Appraisal Participatory Rural Appraisal		

Source: Fouracre, 2001

The details of supply and demand-side surveys with their purposes and comments are depicted in Tables 3 and 4. These tables are really helpful in understanding the purposes of different types of surveys.

#### 4. Road Surveys

Road surveys involved many survey techniques like road inventory and traffic count survey. Road inventory provides suitable information to the residents about the name of road, its status, right of way, length and destination that whether this road was discontinued or abandoned (Wathen & Attorney, 1991). Traffic count survey is conducted to know the use of the road together with the type of traffic and purpose. Main output of this survey is the provision of information about average traffic flow and number of vehicles moving in both directions for 24 hours. Manual counts observed most expedient method, but new technologies for this survey are also very much impressive (Leduc, 2008).

##### 4.1 Household Surveys

Household may be defined as the group of persons living together under the same roof and using same facilities including common kitchen (Rastogi, 2007). Two traditional approaches were extensively adopted for travel surveys, i.e. postal surveys and face-to-face interviews. It is observed through out the globe that response rate has declined by using these conventional surveys (Atrostic et al., 2001). Households avoid and hesitate most of the times to answer on telephone or cell phone about their private lives, which makes data collection process more difficult. Variety of techniques has been used to increase response rate like prior warning, financial incentives and simplicity of questionnaire. But these techniques failed to give reliable results. Conducting household surveys on larger scale is not an easy task for the transport planners because enormous number of population and geographic area has to be covered.

The aim behind household travel surveys is to collect data, which is as accurate as possible. CATI is worthwhile method of household travel surveys. CATI is considered as a credible tool, which can facilitate telephonic surveys and enhance the quality of data. This method permits interviewers in managing the survey questionnaire

via telephone and collect the responses electronically. CATI utilize interactive computing systems, which can help interviewers and their supervisors in collecting reliable information (II, 2001). Computer Assisted Survey Information Collection (CASIC) methods described survey automation tools, which can be obliging in the collection of authentic data (Couper et al., 1998). Some researchers believed that non respondents with convinced socio-economic characteristics may behave like respondents (Bonnel, 2001; Richardson, 2003; Murakami, 2004). In this scenario combination of different data collection methodologies can give possible solutions and results because non respondents of one method may respond to the other (Bonnel, 2003). This approach adopted in the German National Travel Survey; where both CATI and postal survey method were used for the purpose of data collection (Armoogum et al., 2005). Many examples can be viewed throughout the Europe; where questionnaires were posted to households targeting larger area and same were contacted later on by telephone, requesting to take part in survey and give response to mails at their earliest.

It is quite clear that combination of different survey methodologies are useful to collect reliable and genuine data with maximum coverage and improved quality (Gunn, 2002). Household travel surveys are mainstay of transportation planning & modeling efforts and these are conducted by keeping in mind the aim to record personal travels (Goudie, 2002). For the development of transportation policies and proposals at different levels of planning 'household travel surveys' are considered as most significant element, addressing wide range of transportation issues including inaccessibility.

Generally travel surveys conducted for the development of regional transportation policies for entire regions with respect to relationship analysis between regional transportation planning and land use planning (Richardson, 2002). Travel and transportation surveys provide information and data about the demographic, socio-economic and trip making characteristics of entire regional household's population including travel choice, location and scheduling of daily activities (Endemann et al., 2010). Griffiths et al. (2000) also described important ideas about travel surveys:

- Improvement of travel surveys quality through true documentation of the survey process. In the conference, which was held in the year 1997 on the topic "Raising the Standards of Travel Survey", it was concluded that all survey activities and processes should be documented.
- Technique of mixed-mode survey design should be adopted. This approach can increase the percentage of overall response rate for data collection.
- The excessive use of modern technologies for the enhancement of survey methodologies.
- Much focus should be given on the continue process of data collection.

The cost incurred on these surveys has risen over the years and the need of quality data has become so important to formulate the policies as never before (Stopher et al., 2003). The household travel surveys serve two primary purposes in the transportation planning process, i.e. description of travel trends and collection of data. These purposes are to be used as an input to many forecasting models (Stopher, 2002).

In many countries, face-to-face interviews have been replaced by other methodologies of surveys like mail-out/mail-back; personal delivery/pickup; mail out/telephone retrieval and telephone surveys. The techniques like mail out, telephone and internet surveys have been used in many countries for reliable data collection (Inbakaran & Kroen, 2011). It is observed that responses from mailing interviews are very much low. Financial incentives may be offered to increase the response rate and decrease unit non-response rate. Personal Interviews with mail back questionnaire surveys and telephone surveys with mail out/mail back surveys have incredible role in household data collection (Stopher, 1985; Stopher, 1982).

Table 5. Survey types and their applicability according to data

Survey Type	Data Type		
	Travel	Demography	Attitude and Opinion
Document Search	Yes	Yes	Yes
Personal Observation	Yes	No	No
Household Self Completion	Yes	Yes	Limited
Telephone Surveys:			
Household	No	Yes	Limited
Individual	Yes	Yes	Limited

Validation	Yes	Yes	Yes
Intercept Surveys	Limited	Yes	No
Household Personal Interview	Yes	Yes	Yes
Group Surveys	Limited	Limited	Yes
In-depth Surveys	Limited	Limited	Yes

Source: Stopher & Banister, 1985

Table 5 narrates the uses of survey methods and issues related to selection of proper survey methods for the data collection (Stopher & Banister, 1985).

It is worth to check whether these sorts of inducements can work accordingly or not in the main survey. Pilot survey is the tool, which can benefit in testing the various aspects of the actual survey on smaller scale and on smaller population size (Denstadli & Hjorthol, 2003). This technique can help in observing whether everything will work according to plan in actual survey proceedings and whether this exercise can give the expected results or not. Pilot survey conducted on smaller population size that can be sampled from the main targeted population. Pilot survey should be conducted when there are no facts available about the different aspects of the main survey. This can improve the survey design and quality when a large sample is to be taken out from unknown and undefined area (Yates, 1965; Heinisch, 1965; Wiegand, 1968). It is also noted that due to resources (i.e. time, finance and human) constraints; pilot survey can be carried out for the purpose of data collection. Socio-economic data and information about the travel patterns together with geographic and demographic characteristics can be collected from the proposed study area. Furthermore planning documents or reports (secondary data) can also be referred for the proposed study. Problems and their intensity can easily be figured out from the current data. Transportation strategies and policies can be formulated accordingly by keeping in view the existing data and current scenario of the study area. This can support in providing the framework and policies for the future development and planning as well. Both primary and secondary data can be utilized for analysis to fulfill the predefined study objectives.

From this whole discussion, it is clinched that selection of particular survey method depends upon the data requirement, population characteristics, suitability & location of study area and survey methodology. This should be noted that preliminary planning and scheduling exercises are very essential for the successful conduct of survey. Relevant quality data can be collected through proper planning and management of all survey steps and stages.

#### 4.2 Participatory Rural Appraisals (PRAs)

Decade of 80's was known as the decade of rapid rural appraisals (RRAs). RRAs is defined as, "study which is conducted by several teams of survey members, used to judge the current local circumstances". It should be noted that time duration of RRAs is ranged from 3 days to 4 weeks (Beebe, 1985). In 90's utterance participation was used, which changed RRA to participatory rural appraisal (PRA) (McCracken et al., 1988; Theis & Grady, 1991; Ison & Ampt, 1992).

PRA is defined as, "a planned systematic approach used for recording the facts about any community with the help of multidisciplinary squad including community members" (Theis & Grady, 1991). PRA can be considered as credible tool in formulating the solutions for backward communities in rural regions. Data collection from the rural regions is very much difficult and hectic experience, due to remote environment. History showed that the various programs and development projects have failed due to unavailability of proper methodologies and systematic approaches (Binns, 1995). PRA presented systematic approach in providing solutions to the problems of rural regions. PRA is a combination of different aspects and approaches, enabling local population in the decision making process and giving them equal opportunity in suggesting solutions to their problems. PRA included various approaches and techniques for the purpose of data collection; like personal observations, group discussions, mapping and modeling. Maps and models may be used for highlighting the problematic areas.

The intentions behind the utilization of PRAs were not only to resolve the problems of rural population but also involving them in decision making process and making them aware from different ongoing development projects and proposals (Chambers, 1992). Other methods like interviews, diaries and questionnaires had not given the appropriate results of data collection. PRAs alternatively provided great results in rural regions due to its focus on the quality data collection (Chambers, 1994).

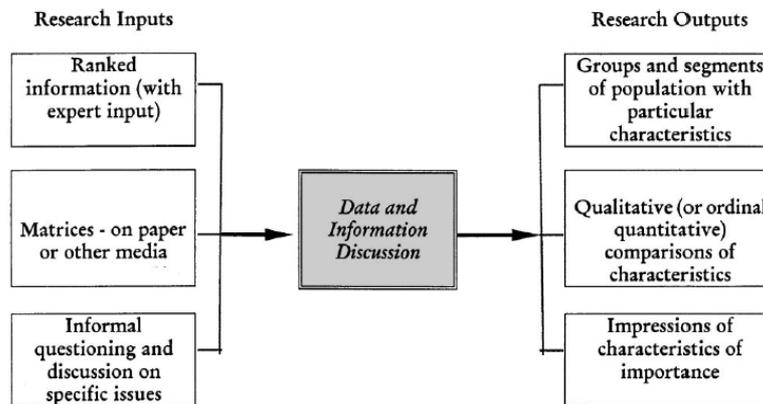


Figure 2. PRAs input/output process (Source: Chambers, 1983)

As shown, Figure 2 exemplifies the PRAs process elements, which can be important for the success full conduct of PRAs. This Figure 2 explains that researchers should formulate the research design with respect to injecting inputs to research process, which can clarify the related problems (Chambers, 1983). PRAs have used throughout the world but mostly in Asian and African rural regions. PRAs may be used in exceptional cases for the proposed study. While secondary data (collected by planning agencies and various public and private departments) may be used extensively for the study because of shortage of resources including time.

## 5. Conclusion and Discussion

Large amount of data were collected at the beginning era of transportation planning, which was based on face-to-face home interviews with the sample size of 1 to 3% of the total population (Stopher & Greaves, 2007). This data really helped transport planners in formulating different remedial policies for transportation issues. Data can play crucial role in clarifying the ground realities with respect to various development issues including transportation related problems of deprived regions. If the data shows problem with respect to shortage of roads for the proposed study area; policy could be made accordingly, which can focus on the provision of road facilities in proposed study area.

Various surveys techniques have been discussed in this paper in order to know the importance and credibility of surveys. Different surveys tools and techniques can help transport planners and surveyors in collecting accurate information. Regardless of the subject matter, transportation surveys may serve many purposes. These purposes may describe the conditions of transportation system at a given time, which may assist in understanding transportations system behavior. Predictive models and policy proposals can be developed after analyzing such conditions of transportation systems and existing data.

Table 6. Referred citations with respect to authors, years and research areas

S.No	Order of Ref.	Authors	Research Areas/Topics
1.	1,2	H. Haghshenas and M. Vaziri, 2012	Sustainable Transport
2.	3	A. Chen et al., 2002	Road Efficiency
3.	4	A. Etter et al., 2006	Inaccessibility
4.	5 -7	A. Gulati et al., 2007; J. C. Castella et al., 2007; G. Porter, 2007	Poverty, Remoteness and Inaccessibility
5.	8	M. T. Masood et al., 2011	Transportation Problems and Solutions
6.	9	P. Bonnel and M. Le Nir, 1998	Data Quality in Telephonic and face-to-face interviews
7.	10,11	P. R. Stopher, 1995; L. Gosselin, 1995	Data Collection and Modeling
8.	12,15,52,58	F. J. Jackson Fowler et al., 2002; D. A. Dillman, 1991; W. L. N. II, 2001; J. Armoogum et al., 2005	Computer Assisted Telephone Interviews, Postal Surveys
9.	13	M. Fuchs et al., 2000	Computer Aided Personal Interviews
10.	14,82	J. S. Nielsen, 2011; P. R. Stopher and S. P. Greaves, 2007	Face-to-Face Interviews
11.	16, 44-46	D. A. Dillman, 2007; V. Toepoel et al., 2008; D. Heerwegh and G. Loosveldt, 2008; M.P.	Web and Internet Surveys

		Couper, 2000	
12.	17,18,40,41	P. Fouracre, 2001; A. J. Richardson et al., 1995; P. R. Stopher, 2009; C. Roberts, 2007	Transportation Planning Surveys Methods and Techniques
13.	19-23	M. Guagliardo, 2004; S. P. Kam et al., 2005; A. G. W. Nanayakkara, 2006; J. Olsson, 2009; I. A. Chandio et al., 2011	Socio-economic Accessibility and GIS usage in providing Accessibility
14.	24,25	G. Edmonds, 1998; D. Booth et al., 2000	Poor Economy, Poverty due to Inaccessibility
15.	26-32	G. Porter, 1997; G. Porter, 2002; G. Porter, 2002; K. Bird et al., 2002; D. Stifel et al., 2003; L. J. Christiaensen et al., 2003; I. Barewell, 1988	Rural Problems due to Inaccessibility
16.	33,34,38, 42,43,66	S. Fricker et al., 2005; Y. Zhang, 2000; C. Bayart and P. Bonnel, 2012; G. Nathan, 2001; E. D. de Leeuw, 2001; C. Inbakaran and A. Kroen, 2011	New and Modern Technologies in Surveys and Data Collection
17.	35,53	E. D. de Leeuw, 2005; M. P. Couper et al., 1998	Modern Survey Tools
18.	36,37	R. Czaja and J. Blair, 2005; W. Brog and E. Erl, 1980	Survey Guidelines and Choice Criteria
19.	39,61-63	C. Chen and P. Mokhtarian, 2006; A. J. Richardson, 2002; P. Endemann et al., 2010; R. Griffiths, et al., 2000	Transport and Land use Activities
20.	47-51,67-69	T. R. Laboratory, 2002; M. S. A. Joseph Wathen, 1991; G. Leduc, 2008; R. Rastogi, 2007; B. K. Atrostic et al., 2001; P. R. Stopher, 1985; P. R. Stopher, 1982; P. R. Stopher and D. Banister, 1985	Conventional or Traditional Surveys Methodologies and techniques
21.	54-60	P. Bonnel, 2001; A. J. Richardson, 2003; E. Murakami, 2004; P. Bonnel, 2003; J. Armoogum, 2005; H. Gunn, 2002; D. Goudie, 2002	Solution to Survey Problems specially Non Response
22.	64,65,82	P. R. Stopher et al., 2003; P. R. Stopher, 2002; P. R. Stopher and S. P. Greaves, 2007	Survey Cost/Standards, Travel Surveys
23.	70-73	J. M. Denstadli and R. J. Hjorthol, 2003; F. Yates, 1965; O. Heinisch, 1965; H. Wiegand, 1968	Sampling Techniques, Pilot Survey
24.	74-81	J. Beebe, 1985; J. A. McCracken et al., 1988; J. Theis and H. M. Grady, 1991; R. L. Ison and P. R. Ampt, 1992; T. Binns, 1995; R. Chambers, 1992; R. Chambers, 1994; R. Chambers, 1983	Participatory Rural Appraisal

Source: Mir Aftab Hussain, 2012

Table 6 provides information about the references cited in writing this paper. Information includes author name, year of publication, research area and over all order of references usage.

Table 7. Number and percentage of referred references

S.No	References Cited	No. of References	Percentage
1.	Journal Articles	45	54.88
2.	Conference Papers	12	14.64
3.	Working, Discussion and Briefing Papers	06	7.31
4.	Reports	07	8.53
5.	Books	12	14.64
	<b>TOTAL</b>	<b>82</b>	<b>100</b>

Source: Mir Aftab Hussain, 2012

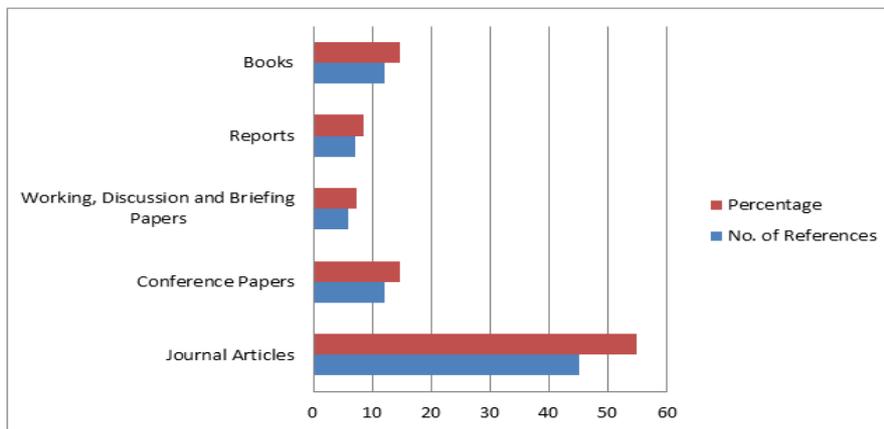


Figure 3. Number and percentage of citations according to type (Source: Mir Aftab Hussain, 2012)

Table 7 and Figure 3 give information about the number and percentage of referred references according to their types like articles, conference and books.

Table 8. Decade wise cited references

Year	Number of References Cited	Percentage
1960-1970	03	4
1971-1980	01	1
1981-1990	07	9
1991-2000	20	24
2001-2010	45	55
2011-2012	06	7
<b>TOTAL</b>	<b>82</b>	<b>100</b>

Source: Mir Aftab Hussain, 2012

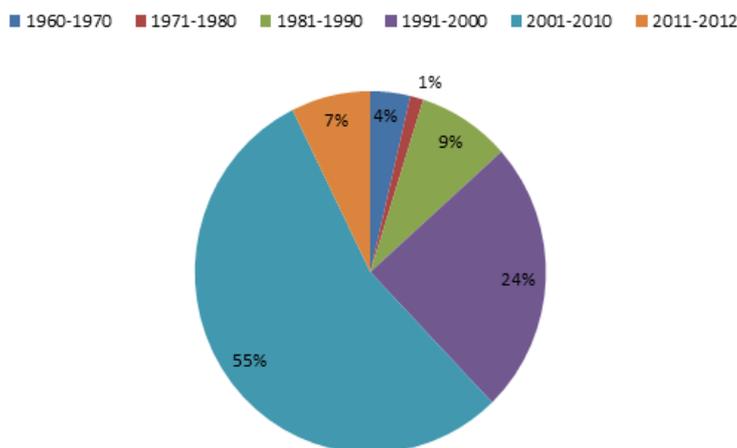


Figure 4. Decade wise percentage of overall cited references (Source: Mir Aftab Hussain, 2012)

Table 8 and Figure 4 explain the usages of citations decade wise from 1960 and onwards.

The information gathered from the different surveys can be utilized in making the policy plans for the existing as well as futuristic planning and development purposes. It is very much necessary that survey has the certain goals or purposes which can be utilized for the betterment of rural community. Credible survey proceedings must have time framework, financial assistance, technical staff, instrumental support and set of clear objectives. Clear definition of objectives can help in designing and selecting the particular tools and methodologies for the

successful conduct of survey. Objectives of this paper can help in determining the contents of surveys and the analytical tools required for addressing transportation planning issues. This should also be recognized and accepted that statement of problems may prevent the need of survey; this may be because problem statement provided the solutions to the problems or may be it became clear that sample survey may not assist in implementing remedies to problems.

Surveys should not be always aiming only at the collection of data. However, quality and authenticity of data can play successful role in decision making of finding solution of poor regions. Two important techniques face-to-face and telephonic survey are easier sources of household data collection. Telephonic survey regarded as most favored method with respect to transportation planning process and provides data for forecasting replicas. On the other hand face-to-face method is much handy in explaining individual travel behavior.

It should be noted that conduct of survey is not an easy task. It requires resources like time, money, credible tools, methodologies and manpower for the successful completion. This aspect should also be kept in mind that successful conduct of survey exercise totally depends on the available resources. This care taking measure can be useful in completing the survey job within the limits of available resources. Pilot survey can really assist surveyors in measuring the availability of resources or actual requirement of resources for the completion of survey exercise at the beginning level. That is why pilot survey can be carried out for the purpose of data collection (primary data). This can save the time and financial resources. Survey content list should also be prepared; this list should include items that may not relate with the objectives of the survey but which can assist in compiling and analyzing the data.

Surveys are important tools for data collection to address different regional transportation planning issues including inaccessibility and provision of basic transport infrastructure in rural regions. The quality of data, which is collected through different survey techniques, can only be utilized by the adoption of transportation planning standards and regulations. A sample exercise is mandatory prior to commencement of the actual survey. Furthermore, clear statement of objectives should be prepared, which will going to be achieved during the survey together with selection of proper methodology, targeted area or population and availability of resources. It is concluded that during the proposed study pilot survey can be carried out for data collection. Structured questionnaires can be developed and interviews can be conducted to collect household's socio-economic data and record study area's travel pattern information. This can assist in formulating transportation policy, which can mitigate the problems of rural regions with respect to inaccessibility and transportation services. It is expected that regional transportation policy can play its role in alleviating the poverty and injecting the growth in deprived regions.

### Acknowledgement

I am truly grateful to my study supervisor for his support and valuable comments about the paper and other co-authors for their assistance and dedication during the different completion phases of this Paper. Furthermore, I am indebted to my institution *Universiti Teknologi Petronas, Malaysia*, for its financial support and provision of facilities in conducting research.

### References

- Armoogum, J., Hubert, J. P., Axhausen, K. W., & Madre, J. L. (2005). Immobility and Mobility Seen Through Trip-Based Versus Time-Use Surveys. *Transportation Review*, 28, 641-658.
- Atrostic, B. K., Bates, N., Burt, G., & Silberstein, A. (2001). Nonresponse in U.S. Government Household Surveys: Consistent Measures, Recent Trends, and New Insights. *Journal of Official Statistics*, 17, 209-226.
- Barewell, I. (1988). Guidelines for remote area transport and socio-economic surveys. In: UNESCAP (ed.) *Report for the Transport, Communications and Tourism Division, Ardington: IT Transport*.
- Bayart, C., & Bonnel, P. (2012). Combining web and face-to-face in travel surveys: comparability challenges? *Transportation*, 1-25.
- Beebe, J. (1985). *Rapid Rural Appraisal: The Critical First Step in a Farming Systems Approach to Research*. University of Florida.
- Binns, T. (1995). *People and Environment in Africa*. Wiley John & Sons, Incorporated.
- Bird, K., Hulme, D., Moore, K., & Shepherd, A. (2002). *Chronic Poverty and Remote Rural Areas*. Chronic Poverty Research Centre, International Development Department School of Public Policy, University Of Birmingham, Institute for Development Policy and Management University of Manchester, Crawford House, UK.

- Black, W. R. (1996). Sustainable transportation: a US perspective. *Journal of Transport Geography*, 4, 151-159. [http://dx.doi.org/10.1016/0966-6923\(96\)00020-8](http://dx.doi.org/10.1016/0966-6923(96)00020-8)
- Bonnel, P. (2001). Postal, Telephone and Face-to-Face Surveys: How Comparable Are They? *International Conference on Transport Survey Quality and Innovation*. Kruger Park, South Africa.
- Bonnel, P. (2003). Postal, telephone and face-to-face surveys: how comparable are they? In *Transport Survey Quality and Innovation*. Stopher PR and Jones PM (Eds.). *Pergamon, Oxford*, 215-237.
- Bonnel, P., & Le Nir, M. (1998). The quality of survey data: Telephone versus face-to-face interviews. *Transportation*, 25, 147-167. <http://dx.doi.org/10.1023/A:1005098605972>
- Booth, D., Hanmer, L., & Lovell, E. (2000). Poverty and Transport. In: (ODI), O. D. I. (ed.). London.
- Brog, W., & Erl, E. (1980). Interactive Measurement Methods: Theoretical Bases and Practical Applications. *Transportation Research Board (TRB), Consumer Perspectives in Travel Choice and Interactive Travel Data Collection*, 1-6.
- Castella, J. C., Manh, P. H., Kam, S. P., Villano, L., & Tronche, N. R. (2005). Analysis of village accessibility and its impact on land use dynamics in a mountainous province of northern Vietnam. *Applied Geography*, 25, 308-326. <http://dx.doi.org/10.1016/j.apgeog.2005.07.003>
- Chambers, R. (1983). *Rural Development: Putting the Last First*. Longmans, Harlow, UK.
- Chambers, R. (1992). *Rural Appraisal: Rapid, Relaxed and Participatory*. Institute of Development Studies, Discussion Paper, 311, Brighton, UK.
- Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development*, 22, 953-969. [http://dx.doi.org/10.1016/0305-750X\(94\)90141-4](http://dx.doi.org/10.1016/0305-750X(94)90141-4)
- Chandio, I. A., Matori, A. N. B., & Lawal, D. U. (2011). GIS-based Accessibility Analysis Using Suitable Land for Public Parks in Larkana City Pakistan. *Research Journal of Applied Sciences, Engineering and Technology*, 3, 553-557.
- Chen, A., Yang, H., Lo, H. K., & Tang, W. H. (2002). Capacity reliability of a road network: an assessment methodology and numerical results. *Transportation Research Part B: Methodological*, 36, 225-252. [http://dx.doi.org/10.1016/S0191-2615\(00\)00048-5](http://dx.doi.org/10.1016/S0191-2615(00)00048-5)
- Chen, C., & Mokhtarian, P. (2006). Tradeoffs between Time Allocations to Maintenance Activities/Travel and Discretionary Activities/Travel. *Transportation*, 33, 223-240. <http://dx.doi.org/10.1007/s11116-005-2307-4>
- Christiaensen, L. J., Demery, L., & Paternostro, S. (2003). *Reforms, remoteness and risk in Africa: understanding inequality and poverty during the 1990s*. Helsinki, United Nations University, World Institute for Development Economics Research.
- Couper, M. P., Baker, R. P., Bethlehem, J., Clark, C. Z. F., Martin, J., II, W. L. N., & O'reilly, J. M. (1998). *Computer assisted survey information collection*. New York: Wiley.
- Czaja, R., & Blair, J. (2005). *Designing Surveys: A guide to Decisions and Procedures*. Sage Publications Ltd.
- De Leeuw, E. D. (2001). Reducing Missing Data in Surveys: An Overview of Methods. *Quality & Quantity*, 35, 147-160. <http://dx.doi.org/10.1023/A:1010395805406>
- Denstadli, J. M., & Hjorthol, R. J. (2003). Testing the accuracy of collected geoinformation in the Norwegian Personal Travel Survey-experiences from a pilot study. *Journal of Transport Geography*, 11, 47-54. [http://dx.doi.org/10.1016/S0966-6923\(02\)00053-4](http://dx.doi.org/10.1016/S0966-6923(02)00053-4)
- Dillman, D. A. (1991). The Design and Administration of Mail Surveys. *Annual Review of Sociology*, 17, 225-249. <http://dx.doi.org/10.1146/annurev.so.17.080191.001301>
- Dillman, D. A. (2007). *Mail and Internet Surveys: The Tailored Design Method - 2007 Update with New Internet, Visual, and Mixed-Mode Guide*.
- Edmonds, G. (1998). *Wasted Time: The Price of Poor Access*. International Labor Organization (ILO).
- Endemann, P., Ballungsraum, V. P., & Rhein-Main, F. (2010). Review of Travel Survey Usefulness. *12th WCTR, World Conference on Transport Research*. Lisbon, Portugal.
- Etter, A., Mcalpine, C., Wilson, K., Phinn, S., & Possingham, H. (2006). Regional patterns of agricultural land use and deforestation in Colombia. *Agriculture, Ecosystems & Environment*, 114, 369-386. <http://dx.doi.org/10.1016/j.agee.2005.11.013>

- Fouracre, P. (2001). Rural Transport Survey Techniques. *The Rural Transport Knowledge Base*. Crowthorne: TRL Limited.
- Fricker, S., Galesic, M., Tourangeau, R., & Yan, T. (2005). An Experimental Comparison of Web and Telephone Surveys. *Public Opinion Quarterly*, 69, 370-392. <http://dx.doi.org/10.1093/poq/nfi027>
- Fuchs, M., Couper, M. P., & Hansen, S. E. (2000). Technology Effects: Do CAPI or PAPI Interviews Take Longer? *Journal of Official Statistics*, 16, 273-286.
- Gosselin, L. (1995). Portée et potentiel des méthodes de collecte de données de type réponses déclarées interactives. *International Conference Les enquêtes de déplacements urbains: mesurer le présent, simuler le futur*, Lyon.
- Goudie, D. (2002). Zonal method for urban travel surveys: sustainability and sample distance from the CBD. *Journal of Transport Geography*, 10, 287-301. [http://dx.doi.org/10.1016/S0966-6923\(02\)00013-3](http://dx.doi.org/10.1016/S0966-6923(02)00013-3)
- Griffiths, R., Joseph, A., & Lee-Gosselin, M. E. H. (2000). Travel surveys. *Transportation in the New Millennium, Transportation Research Board*, 7.
- Guagliardo, M. (2004). Spatial accessibility of primary care: concepts, methods and challenges. *International Journal of Health Geographics*, 33. <http://dx.doi.org/10.1186/1476-072X-3-3>
- Gulati, A., Minot, N., Delgado, C., & Bora, S. (2007). *Growth in high-value agriculture in Asia and the emergence of vertical links with farmers*. Chapter: 7, pp. 91-108.
- Gunn, H. (2002). Web-based surveys: changing the survey proces. *First Monday*, 7.
- Haghshenas, H., & Vaziri, M. (2012). Urban sustainable transportation indicators for global comparison. *Ecological Indicators*, 15, 115-121. <http://dx.doi.org/10.1016/j.ecolind.2011.09.010>
- Heinisch, O. (1965). Cochran, W. G.: Sampling Techniques, 2. Aufl. John Wiley and Sons, New York, London 1963. Preis s. *Biometrische Zeitschrift*, 7, 203-203. <http://dx.doi.org/10.1002/bimj.19650070313>
- II, W. L. N. (2001). *Computer-Assisted Telephone Interviewing: A General Introduction*. John Wiley & Sons.
- Inbakaran, C., & Kroen, A. (2011). Travel Surveys-Review of international survey methods. In: TRANSPORT, D. O. (ed.) *Australasian Transport Research Forum*.
- Ison, R. L., & Ampt, P. R. (1992). Rapid rural appraisal: A participatory problem formulation method relevant to Australian agriculture. *Agricultural Systems*, 38, 363-386. [http://dx.doi.org/10.1016/0308-521X\(92\)90029-N](http://dx.doi.org/10.1016/0308-521X(92)90029-N)
- Jackson Fowler, F. J., Gallagher, P. M., Stringfellow, V. L., Zaslavsky, A. M., Thompson, J. W., & Cleary, P. D. (2002). Using Telephone Interviews to Reduce Nonresponse Bias to Mail Surveys of Health Plan Members. *Medical Care*, 40, 190-200. <http://dx.doi.org/10.1097/00005650-200203000-00003>
- Kam, S. P., Hossain, M., Bose, M. L., & Villano, L. S. (2005). Spatial patterns of rural poverty and their relationship with welfare-influencing factors in Bangladesh. *Food Policy*, 30, 551-567. <http://dx.doi.org/10.1016/j.foodpol.2005.10.001>
- Laboratory, T. R. (2002). Rural Transport Operator Surveys. In: TRL (ed.) *The Policy Tool Kit for Increased Rural Mobility*. Crowthorne: Trl Limited.
- Leduc, G. (2008). Road Traffic Data: Collection Methods and Applications. *European Commission, Joint Research centre (JRC)*. Luxembourg: Institute of Prospective Technological Studies.
- Leeuw, E. D. D. (2005). To Mix or Not to Mix? Data Collection Modes in Surveys. *Journal of Official Statistics*, 21, 233-255.
- Masood, M. T., Khan, A., & Naqvi, H. A. (2011). Transportation Problems in Developing Countries Pakistan: A Case-in-Point. *International Journal of Business and Management*, 6(11).
- Mccracken, J. A., Pretty, J. N., & Conway, G. (1988). *An Introduction to Rapid Rural Appraisal for Agricultural Development*. International Institute for Environment and Development.
- Murakami, E. (2004). Survey Methods. *Transportation Research Circular, Number E-C071, Data for Understanding Our Nation's Travel, National Household Travel Survey Conference*. The National Academies Keck Center Washington, D.C.: TRB.
- Nanayakkara, A. G. W. (2006). Poverty in Sri Lanka-Issues and options.

- Nathan, G. (2001). Telesurvey Methodologies for Household Surveys-A Review and Some Thoughts for the Future. *Survey Methodology, Statistics Canada, Catalogue No. 12001*, 27, 7-31.
- Nielsen, J. S. (2011). Use of the Internet for willingness-to-pay surveys: A comparison of face-to-face and web-based interviews. *Resource and Energy Economics*, 33, 119-129. <http://dx.doi.org/10.1016/j.reseneeco.2010.01.006>
- Olsson, J. (2009). Improved road accessibility and indirect development effects: evidence from rural Philippines. *Journal of Transport Geography*, 17, 476-483. <http://dx.doi.org/10.1016/j.jtrangeo.2008.09.001>
- Porter, G. (1997). Mobility and Inequality in Rural Nigeria: The Case of Off-Road Communities. *Tijdschrift voor economische en sociale geografie*, 88, 65-76. <http://dx.doi.org/10.1111/j.1467-9663.1997.tb01584.x>
- Porter, G. (2002a). Improving mobility & access for the off-road rural poor through Intermediate Means of Transport. *World Transport Policy & Practice*, 8, 6-19.
- Porter, G. (2002b). Living in a walking world: rural mobility and social equity issues in sub-Saharan Africa. *World development*, 30, 285-300. [http://dx.doi.org/10.1016/S0305-750X\(01\)00106-1](http://dx.doi.org/10.1016/S0305-750X(01)00106-1)
- Porter, G. (2007). Transport planning in sub-Saharan Africa. *Progress in development studies.*, 7, 251-257. <http://dx.doi.org/10.1177/146499340700700305>
- Rastogi, R. (2007). Household Survey design-Regional applicability and adaptability. *Indian Highways*, 35, 25-34.
- Richardson, A. J. (2002). Current issues in travel and activity surveys. In *Perpetual Motion: travel behaviour research opportunities and application challenges Oxford UK: Pergamon*, 341-357.
- Richardson, A. J. (2003). Behavioral Mechanism of Nonresponse in Mail-Back Travel Surveys. *Transportation Research Board (TRB)*. Transportation Research Board, Transportation Research Record No. 1855, Transportation Data Research.
- Richardson, A. J., Ampt, E. S., & Meyburg, A. H. (1995). *Survey Methods for Transport Planning*. Melbourne, Eucalyptus Press, University of Melbourne, Parkville.
- Roberts, C. (2007). Mixing modes of data collection in surveys: A methodological review. *Economic, Social Research Council (ESRC), National Centre for Research Methods Briefing Paper*, 30.
- Stifel, D., Minten, B., & Dorosh, P. (2003). Transaction Costs and Agricultural Productivity: Implications of Isolation for Rural Poverty in Madagascar. In: International Food Policy Research Institute 2033, K. S., N.W. Washington, D.C. 20006, U.S.A. (ed.) *Markets and Structural Studies Division, MSSD Discussion Paper NO. 56*. Washington, D.C.: International Food Policy Research, 2033, K. Street, N.W. Washington, D.C. 20006 U.S.A.
- Stopher, P. R. (1982). Small Sample Home-interview Travel Surveys: Applications and Suggested Modifications. *Transportation Research Board Record, No. 886, New Concepts in Data Analysis*, 41-47.
- Stopher, P. R. (1985). The State-of-the-Art in Cross-Sectional Surveys in Transportation. In: PRESS, V. S. (ed.) *New Methods in Transport*. Utrecht, Netherlands: VNU Science Press, Utrecht, Netherlands.
- Stopher, P. R. (1995). Current Transportation Planning and Modelling data needs in the USA: a review of separate and joint strategies for the use of data on Revealed and Stated Choices. *International Conference Les enquêtes de déplacements urbains: mesurer le présent, simuler le futur, Lyon*.
- Stopher, P. R. (2002). The Case for Standardizing Household Travel Surveys. In: BOARD, T. R. (ed.) *NCHRP Research Results Digest*. Washington D.C.
- Stopher, P. R. (2009). The Travel Survey Toolkit: Where to From Where? *8th International Conference on Survey Methods in Transport*. Annecy, France.
- Stopher, P. R., & Banister, D. (1985). Total Design Concepts. In: ES AMPT, A. R. W. B. (ed.) *New Survey Methods in Transport*. Utrecht Netherlands: VNU Science Press.
- Stopher, P. R., Chester, A., Wilmot, G., & Alsnih, R. (2003). Standards for Household Travel Surveys - Some Proposed Ideas.
- Stopher, P. R., & Greaves, S. P. (2007). Household travel surveys: Where are we going? *Transportation Research Part A: Policy and Practice*, 41, 367-381. <http://dx.doi.org/10.1016/j.tra.2006.09.005>

- Theis, J., & Grady, H. M. (1991). *Participatory Rapid Appraisal for Community Development: A Training Manual Based on Experiences in the Middle East and North Africa*. International Institute for Environment and Development, London, UK.
- Wathen, J., & Attorney, M. S. (1991). Developing A Road Inventory. *Legal Notes Archive Collection*. Maine Townsman.
- Wiegand, H. (1968). Kish, L.: Survey Sampling. John Wiley & Sons, Inc., New York, London 1965, IX + 643 S., 31 Abb., 56 Tab., Preis 83s. *Biometrische Zeitschrift*, 10, 88-89.  
<http://dx.doi.org/10.1002/bimj.19680100122>
- Yates, F. (1965). *Sampling Methods for Censuses and Surveys*. London: Charles Griffin and Co. Ltd..
- Zhang, Y. (2000). Using the Internet for survey research: A case study. *Journal of the American Society for Information Science*, 51, 57-68.  
[http://dx.doi.org/10.1002/\(SICI\)1097-4571\(2000\)51:1<57::AID-ASI9>3.0.CO;2-W](http://dx.doi.org/10.1002/(SICI)1097-4571(2000)51:1<57::AID-ASI9>3.0.CO;2-W)