TRANSPORT ACCESSIBILITY AND SOCIAL EXCLUSION: A BETTER WAY TO EVALUATE PUBLIC TRANSPORT INVESTMENT?

Juan Pablo Bocarejo Suescún, PhD. Grupo de Estudios en Sostenibilidad Urbana y Regional Universidad de los Andes, Bogotá (Colombia) jbocarej@uniandes.edu.co

Daniel Ricardo Oviedo Hernández, Msc. Grupo de Estudios en Sostenibilidad Urbana y Regional Universidad de los Andes, dan-ovie@uniandes.edu.co

ABSTRACT

The project starts from traditional definitions and measurements of transport accessibility and establishes a methodology that enables policy evaluators to involve income levels, primarily of the poorest segment of population, in the assessment of transport-related projects in developing countries. Social Utility evaluation is also suggested to analyze different alternatives of public transport fare structures.

The proposed method will be applied to the case study of Bogotá (Colombia). Publi c a)0 ' " transportation systems, including local BRT *Transmilenio* in certain cases. Traditional accessibility is measured using Hansen´s gravity indicator and Job market measurements. It is then applied to determine accessibility levels related to activity clusters from each of the selected zones.

Keywords: Accessibility, Social Exclusion, Urban Transport, Developing countries

INTRODUCTION

In transport policy formulation, attributes that give value to transport systems have been progressively changing. While in the past speed and reduced travel times were given too much importance; currently the relevance of characteristics such as system reliability, low environmental impact, provided accessibility and equality contribution have constantly increased.

For example, the 1982 LOTI Transport Act of France defined the necessity to strengthen mobility in terms of reasonable access, quality, and price for the individual. The United Kingdom's DfT has complemented development procedures in mobility plans, which should

be implemented by all municipalities, with an accessibility plan. This initiative was produced as a result of research performed on social exclusion and equity issues.

Although the concept of social equity seems to be ubiquitous in most mobility plans of major Latin American cities, when evaluating transport projects for financing and prioritization there are no specific and solid indicators to measure social impacts and how they can contribute to promote better access to opportunities, particularly for the most vulnerable segments of population.

Transport demand is derived from people's needs to reach activities and accessing to opportunities that are not available at their trip origin. In that order, social and economical benefits depend directly on the number of om uaities ssinea ! ooMA'' oc

matters as equity and productivity as well as indicators and methodologies needed to verifying the achievement of these objectives.

ACCESSIBILITY CONCEPT AND MEASURES

The study of transport accessibility has produced a large amount of research and working papers over the years. New studies and practical approaches are emerging continuously on this subject; however, most of them apply the existing methodologies to the contexts and data previously studied. This section presents a compilation of the most representative methodological approaches to the study of transport accessibility, and an overview of relevant concepts directly and indirectly related to the study topic that can contribute to the

Transport accessibility and social exclusion: a better way to evaluate public transport investment?

Potential measures are generated by weighting opportunities located in a given area using an attribute of attraction (population, ability to pay, etc.), and discounting a measure of impedance (Knox, 1978; Handy, 1993; Geertman & Ritsema, 1995; Wyatt, 1997; Johnston, 2000). These accessibility indicators provide a powerful tool of analysis because they consider both measures of attractiveness and impedance to establish a reliable value of the potential of a given area.

People-based indicators: these measures are based on spatial and temporal geography, and consider the restrictions of an individual to reach activities. The accessibility measures at the individual level examine the activities that a person can perform in a given time, measured in terms of their time budgets for the mandatory activities (working, studying), flexible activities (entertainment, leisure, etc.), and the speed offered by the transport systems for moving between areas of activity.

Also known as space-time accessibility measures (Kwan, 1998, Miller 1999, Miller & Wu, 2000; Kwan & Weber, 2003), people-based measures consider accessibility as an attribute of individuals (Kwan & Weber, 2003), and evaluate it from the daily schedule of activities and spatial and temporal constraints for an individual (Landau, 1982; Kwan, 1998).

Using these indicators requires a considerable level of disaggregation, and separately evaluating accessibility for different trip purposes, modes of transport, income level, ge a Ů l ˛ , g lity

METHODOLOGY

Proposed Indicator

Accessibility to jobs (Hansen equation)

Several hypotheses have been made over the years around the concept of accessibility and how it can be measured, as identified in the conceptual framework of this paper. Colombia has no record of the application of any of the existing methodologies for measuring accessibility neither in urban nor in other kinds of contexts, making the possibility to explore this potential an interesting field of research at the local level.

Therefore, a first approach to the use of accessibility as a measure of evaluation of transport systems and social exclusion in urban locations in Colombia is the adoption and parameterization of Hansen accessibility indicator for its usage in local context.

The conventional Hansen equation, one of the most used in the scientific literature for several years to estimate the level of accessibility of a given area is defined as:

(1)

Where,

Ai = Accessibility of the zone i (origin zone)
aj = Attractiveness of Zone j (destiny zone)
f(dij) = Function of the distance (cost) between zones i and j

The attractiveness of a land use area can be determined in different ways depending on the information available and the type of analysis being performed. The activities located in a destination area are the main target. Nevertheless, given the context in which is intended to work, the information available is limited and can be difficult to determine the number of activities of all kinds located in a specific area. In that sense, it is advisable to reduce the analysis to the grounds for mandatory commutes as study and work to use the number of positions of employment and educational institutions in a given area as an index of its attractiveness.

In equation (1), the cost function is traditionally defined in terms of travel time or distance inherent to move from one area to another, and takes the standard form of utility functions. Although this may represent a first approach in accessibility measurement in developing countries, in order to consider a component of exceptional relevance given the characteristics of the population residing in the study area, it is necessary to incorporate an affordability component to the function, which can be expressed in terms of the percentage of individual income spent in transportation, obtaining:

Transport accessibility and social exclusion: a better way to evaluate public transport investment?

BOCAREJO, Juan; OVIEDO, Daniel

Transport

RESULTS

In order to test our methodology we decided to analyze the different types of accessibility in different zones of Bogota.

Available information

Information on travel patterns can be assessed from 2005 OD Travel survey of Bogota. (EOD, 2005) the survey considers 846 homogeneous zones in terms of socio-economic characteristics. We will group these zones in 117 planning zones, called UPZ.

Information on number of jobs and location is provided by the Planning Department (*Secretaría Distrital de Planeación* de Bogotá, 2005). F áo- otá v 05)

Figure 2 – Income distribution of Bogotá

It is possible to notice that high income population tends to settle close to CBD, while the poorest live at Bogota´s

Table 1– Main attributes of selected study zones

	Income			BRT Service		Car ownership			Distance to main job clusters		Population density	Job density	Road density
Zone	High	Medium	Low	Yes	No	High	Medium	Low	High	Medium			

Accessibility Estimation

Table 2 shows the main information obtained for each zone in terms of accessibility in number of work trips (Aj) *per capita*, average travel time and percentage of income used in transportation. The following are some initial facts that may be determined with this analysis:

First*, per capita* real accessibility does not depend entirely on level of income. Even though lowest income areas tend to have lower real accessibility, some interesting exceptions can be identified.

Accessibility in areas such as Country Club and Ciudad Salitre, the last one being in average of lower income, shows that location regarding employment and public transport availability can be determinant. With less time spent in commuting, Ciudad Salitre has the same

Second, according to the obtained results, the potential access for the observed conditions of supply and demand reveals a dilemma of inequality to access to opportunities of work. According to the needs and characteristics of various socioeconomic groups, which directly affects their chances to satisfy their main needs and access to better quality of life, as in the case of the areas of Bosa Central, Lucero and San Blas. Although the difference in time spent by the lower strata is greater than 48% compared to the upper strata, the most critical differences correspond to the percentage of income destined to travel that is 400% higher. In addition, some of these zones s

(9)

(10)

(11)

(12)

Regarding desired expenditure in time and income, results show that:

First, the time individuals would like to spend travelling to work is similar for all income levels and locations and it is close to 40 min with few exceptions that are more close to 35 minutes such as Ciudad Salitre, La Esmeralda and Chicó. These atypical cases can be explained in terms of spatial location relative to Employment centres because these zones are located on favourable places, have a higher income and also better access to transport systems than other zones. Regarding percentage of income they wish to spend in average 13% with marked variations depending on purchase power of each zone. Unusual budgets are identified following a similar explanation of the previous case.

Second, difference between the desired condition and the real condition for individuals in Bogota is quite dramatic. The low income individuals spend 40% more time and 38% more money that they wish to do. In comparison middle income individuals spend 39% and wish to spend 5%; for higher income these percentages are 8% and -43%. This certainly is a way to measure transport quality and its impact on quality of life in cities.

Third, considering the actual transport supply and cost as well as activity location of Bogota, spending a “desired” time travelling and expenditure would cause an important decrease in accessibility, mainly in lower r t

Transport accessibility and social exclusion: a better way to evaluate public transport investment?

BOCAREJO, Juan; OVIEDO, Daniel

low-income groups and only an increase of 1% for higher-income areas. In addition, contrasting to these low changes in travel costs it can be seen that the benefits individual and zonal accessibility in areas like Gran Yomasa and Lucero are considerable while the losses in the other zones are negligible both in absolute and relative terms.

A

Transport

combined with a fare policy as the evaluated in the previous section, benefit in terms of accessibility for low-income areas of cities as Bogotá could be enormous.

WORK IN PROGRESS

The present research stills in progress. Some of the work that is being developed includes:

- Accessibility generated by different modes, in different income level zones
- Differential accessibility related to gender
- More complex definition of impedance function f(ij).
- A more comprehensive analysis of transport policy impacts

This model could be used afterwards in evaluating the impact of differential accessibility on equity and social exclusion. It can also be apprehended to produce analysis regarding economic impact.

The purpose of the research is to develop a useful tool for transportation planning processes in developing countries and evaluation of existing policies. Therefore, it is expected that the tool can be used in the future for the assessment of accessibility benefits of expanding and existing projects as Transmilenio and also benefit analysis of proposed policies as the first line of a metro system for the city, subsidy schemes for public transportation, or new land use developments.

REFERENCES

Banister, D., Berechman, J., (2000). Transport Investment and Economics Development. University College London Press, London

Ben-Akiva, M., Lerman, S.R., (1979). Disaggregate travel and mobilitychoice models and measures of accessibility. In: Hensher, D.A.,

Ben-Akiva, M., Lerman, S.R., (1985). Discrete Choice Analysis. MIT Press, Cambridge, MA.
Bruinsma, F., Rietveld, P., 1998. The accessibility of European cities; theoretical framework and comparison of approached. Environment and Planning A 30, 499–521.

Burns, L
B u " T ,

Geurs, K.T, Van Wee, B., (2004