Transportation disadvantage has been recognised to be the key source of social exclusion. Therefore an appropriate process is required to investigate and seek to resolve this problem. Currently, determination of Transportation Disadvantage is postulate based on income, poverty and mobility level. Transportation disadvantage may best regard be based on accessibility perspectives as they represent inability of the individual to access desired activities. This paper attempts to justify a process in determining transportation disadvantage by incorporating accessibility and social transportation conflict as the essence of a framework. The framework embeds space time organisation within the dimension of accessibility to identify a rigorous definition of transportation disadvantage. In developing the framework, the definition, dimension, component and measure of accessibility were scrutinised. The findings suggest the definition and dimension of accessibility are archive by the study. Personal based accessibility measures are the significant approach of research to evaluate travel experience of the disadvantaged. Concurrently, location accessibility measures will be incorporated to strengthen the determination of accessibility level. Literature review in social exclusion and mobility-related exclusion identified the dimension and source of transportation disadvantage. It was revealed that the appropriate approach to justify transportation disadvantaged is to incorporate space-time organisation within the studied components. The suggested framework is an inter-related process consisting of component of accessibility; individual, networking (transport system) and activities (destination). The integration and correlation among the components shall determine the level of transportation disadvantage. Prior findings are used to retrieve the spatial distribution of transportation disadvantaged and appropriate policies are developed to resolve the problems.

Keyword: Accessibility, social exclusion, transportation
Introduction

Providing sustainable transportations has become a substantial new challenge for policy makers and urban transport planners. Sustainable transportation has emerged as a mechanism that provides physical, economic and social equity in every aspect of life. Unfortunately, as transportation is moving towards “sustainability”, there are individuals, and communities not served by transportation equitably, in other words the transportation disadvantaged. These include the elderly, disable, the young, low income and those who for various reasons must reside in low density or remote areas. Within the wider context, transportation disadvantaged are referred as those with an inability to travel when and where ones needs without difficulty for completing obligatory activity. The National Road and Motorist Association (NRMA) Public Affairs Group has identified transportation disadvantage as an occurrence which reduces access to essential services and resources including employment, shops, and commercial and community services. These are the larger consequences of a lack in accessibility and mobility for those affected groups. Consequently, the shortcoming of transportation provision and transportation disadvantaged has resulted in further social problems particularly represented by Social Exclusion Unit (SUE, 2002).

Many scholars have urged transportation to play a more prominent role in resolving certain social problems. Therefore, the gap between social and transportation should be minimised by incorporating social aspects within transportation planning. In addition, defining transportation disadvantage will well fit this social perspective. Unfortunately a definitive definition and framework for determining transportation disadvantage is still elusive. A definition is essential in order to recognise those affected by transportation disadvantage and appropriate measures could be proposed via policies and strategies of urban transport planning, and transportation provision. In doing so, it necessary to develop a framework to better understand those who have been marginalized by transportation disadvantage.

The paper is based on a PHD research proposal that aim to identify definition and distribution of transportation disadvantage. The paper is divided into three main section concept of accessibility, issues of social and transport, conceptual dimension of mobility related exclusion and transportation disadvantage and transportation disadvantage determination framework.

Concept of Accessibility

In the literature, the concept of accessibility is comprehended in varieties of way. The definition of accessibility is determined by area and its application (van Wee, Hagoort, & Annema, 2001). Vandenbulcke, Steenberghen and Thomas, (2009), recognise that the concept of accessibility differs by individual at any moment of the day, which results in considerable variation in components included in the measure, and how it is formulated. Hine and Grieco (2003), address accessibility by direct and indirect role of transport (ability of individual to plan and undertake journey by public or private modes subject to time and cost, and the extent to which individual or groups can rely on neighbours or other support network to access goods and facilities on their behalf subject to time and financial budgets, respectively). Halden (2002), on the other hand, comprehended accessibility as determined by three key elements; people or freight under consideration (each has specific needs and
desires to be involved in defined activities), supply point (land use supply) and availability of transportation. The most operational concept of accessibility was suggested by Geurs and van Wee (2004); as the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of (combination of) transport.

Accessibility is determined by the dimension in which it is evaluated. The dimensions of access are pre-condition elements to enable the individual to be accessible based on means or the point of access (bus, rail, private vehicles etc) and elements consist and from means of access (travel time, speed, and operational factor in public transport) to the desired services or destination (Dodson, Gleeson, & Sipe, 2004; Murray, Davis, Stimson, & Ferreira, 1998). Cass, Shove and Urry (2005) on the other hand, suggested a more comprehensive dimension of access for passenger transport consists of financial, physical, organisation and temporal. Each of the dimensions has its significance towards the capabilities of individual accessibility.

- Financial: All points of access require expenditure or financial resources to the means of access (e.g. car ownership, long haul journey, telephone and SMS)
- Physical: Accessibility requires physical capabilities to participate in a journey. E.g. physically impediment, blindness or disability that limits an individual’s accessibility
- Organisation: Personal organisation or adaptation to be accessible. For individual/private car, e.g. organising a lift from others. While, for the public commuter, it is vital to be well informed of the scheduling and operational factors that link to public transport availability
- Temporal: Access is also matter of timing, time resources and time management are particularly important when coordinating daily routines or obligation with public transport availability.

Accessibility can also be regarded as a system that enables (groups or) individuals to access desired activities or locations by means of a (combination of) transport mode (Geurs & van Wee, 2004). Within the system that comprises of land use, transportation, temporal and individual, the components interact to create travel demand, influence distribution of activities, temporal availability or transport services, individual opportunities, travel movements and patterns.

The land use components, provides the means of access; determines the distribution and amount of activities, opportunities and competition between activities. The transportation system reflects individual resources (time, cost and effort) used to cover the distance between origin and destination and the supply of infrastructure (e.g. maximum travel speed, numbers of lanes, public transport schedules and travel cost). Thirdly, accessibility also includes the temporal component that reflects the temporal constraints (e.g. demand of the services by time of day and day of a week) and time availabilities for desired activities. Fourthly, individual components reflect needs, abilities, and opportunities for travel.
Four basic perspectives of accessibility measure are infrastructure-base measures, location-based measures, person-based measures and utility base. Further, in determining appropriateness and limitation of these measures, accessibility measurement should fulfill a sound theoretical basis, be easily operable, able to be interpreted and communicate and preferably be able to perform as an effective social and/or economic indicator (Geurs & van Wee, 2004).

Infrastructure-based measures analyse the performance or service level of infrastructure. Examples of such measures are level of congestion and average speed on the road network (Geurs & van Wee, 2004; van Wee et al., 2001). The infrastructure bases measures are easily to operationalise do not reflect integration of land use and not able to treat temporal constrains.

From the macro level, accessibility can be determined by space-time availability of activities. It may be considered as a more complex measure by incorporating capacity restriction of supply activity characteristics, to including a competition effect. Potential measures are derived by weighting the opportunities located in an area by measures of attraction (Geurs & van Wee, 2004; van Wee et al., 2001; Vandenbulcke et al., 2009).

Person based measures are known as space-time accessibility measures, analysing accessibility at the individual micro-level (participation of an individual at a given time). The analysis disaggregates the data based on personal mobility and travel characteristics. Person-based measures are evaluated accessibility based on trip purpose, transport modes, incomes, gender age, occupation groups and types of activity. This measure is founded in the space-time domain that activities are occurring only at specific time locations for limited time periods (e.g the location and distribution of mandatory activities, the time budgets for flexible activities and travel speed allowed by the transport) (Miller & Wu, 2000).

Utility-based accessibility measures can be used to analyse the economic benefits that individuals derived from access to spatially distributed activities. It interprets accessibility as the outcome of a set of transport choices. The theory behind this measure addresses the decision to purchase one discrete item from a set of potential choices (Geurs & van Wee, 2004). The utility based measures therefore are difficult to interpret and are data intensive (Vandenbulcke et al., 2009).

In mixed measures/approaches, are simple and easy to calculate, and relevant if access and egress times are important. e.g. distance to a bus stop or motorway connection (van Wee et al., 2001).

A shortcoming of these accessibility measures is that they require generic measures that congregate the advantage of each measure. If location based and person based accessibility approaches cannot be reconciled in one modelling approach; they might be used to supplement each other (Geurs & van Wee, 2004).
Measure | Transport component | Land-use Component | Temporal component | Individual component
--- | --- | --- | --- | ---
Infrastructure-based measures | Travelling speed; vehicles hours lost in congestion | Peak-hour period; 4-h period | Trip-based stratification, e.g. home-to-work, business |
Location based measures | Travel time and or costs between locations of activities | Amount ad spatial distribution of demand for and/or supply of opportunities | Travel time and costs may differ, e.g. between hours of the days of the week, or seasons | Stratification of the population (e.g. by incomes, educational level)
Person-based measures | Travel time between locations activities | Amount and spatial distribution of supplied opportunities | Temporal constrains for activities and time available for activities | Accessibility is analyzed at individual level
Utility based-measures | Travel cost between locations of activities | Amount and spatial distribution of supplied opportunities | Travel time and cost may differ, e.g. between hours of the day, between days of the week, or season | Utility is derived at the individual or homogeneous population group level

Table 1: Perspectives of accessibility and components (Geurs and Van Wee, 2004)

Social-transport issues: Roles of Transportation in Social Exclusion
Within society, ones need to travel is to participate with a network of activity; work, education, leisure etc, and thus, participate with the social network; family ties, well being, religious etc. The need for travel requires individual to be accessible and mobile for such participation. Thus, inability to participate or being able to access goods at pre-determined locations is considered as exclusion.

Social exclusion relates to the degree and extended of individual (or groups) participate within society. Generally, the term social exclusion refers to poverty and disadvantaged groups, which traditionally lack resources to participate in society. More widely, social exclusion can be defined as that which causes individual or groups, located within a society, not to able to participate as normal citizens in that society (Poggi, 2005). The UK Government defined social exclusion as the situation where people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime, bad health and family breakdown (SUE 2003). A definition of by Burchardt (2000), gives a comprehensive understanding of the multi-dimensional facets of social exclusion
which consist of element of activities in society (spatial), period of exclusion (temporal), and demand for activities.

Poor transport is identified as the major factor that causes social exclusion (SEU, 2003). There are varieties of way this could occur. Consider automobile dependency, which has increased social exclusion by reducing non-automobile travel options and increasing total transport cost (Litman, 2003). Among the apparent causes of social exclusion is the lack of opportunity to participate within the normal social environment. Therefore, social exclusion can be generally be describe as an incapability of the transport/physical network to integrate the individual within the society. Mobility related exclusion exist in different forms and concept. Kenyon, Lyons and Rafferty (2002, p. 210-211) define mobility-related exclusion as:

*The process by which people are prevented from participating in the economic, political and social life of the community because of reduced accessibility to opportunity, services and social network, due in whole or in part to insufficient mobility in society and environment built around the assumption of high mobility.*

Examples of the disparity of mobility-related exclusion are documented by Lucas (2004), based on the study of SEU in United Kingdom as been concluded as below:

- Work: two third of job seekers say that lack of transport is a barrier to getting a job.
- Learning: nearly half of 16-18 years old student find their transport cost hard to meet
- Health: Over a 12-month period, 1.4 million people missed, turned down or chose not to seek medical assistant because of transport problem
- Food shopping: 16 percent of people without car find access to supermarket is difficult
- Social activities: 18 percent people without car access find seeing friends and family difficult because of transport problems, compared with 8 percent of people with car access
- The impact of traffic; children from households in the lowest socioeconomic group are five times more likely to die in road accidents than those from the highest.

Consequently, social exclusion has been the major concern issues of socio-transport integration. Literature of transport and social exclusion relationship and transportation disadvantaged are well documented (Cass et al., 2005; Denmark, 1998; Duvarci & Yigitcanlar, 2007; Julian Hine & Grieco, 2003; J. Hine & Mitchell, 2001; Hodgson & Turner, 2003; Kenyon et al., 2002; Lucas, 2006; Lyons, 2003; Stanley & Lucas, 2008).
Conceptual Dimension of Mobility Related Exclusion and Transportation Disadvantaged

From the previous section, it can be concluded that, the determinant factor of mobility related exclusion or transportation disadvantaged is accessibility level of the individual/household. Correspondingly, Lyons (2003), suggested that social exclusion behavioural study should be governed by the overarching need to understand behaviours of people's actual experiences and constrains. Thus, research of social exclusion within travel study should be accessibility based, where it can be recognised daily patterns of activity and travel in time and space which are governed by individual’s resources (private, public transport) and aspirations concerning social participation. Therefore, the dimension of access should be embedded in determination process of social and transportation disadvantaged.

Church, Frost and Sullivan (2000), conceptualise the relationship of access with exclusion using individual attributes, transport attributes and service attributes as the dimension of access that determined the individual abilities to participate in the desired activities. The interrelated process consists of three dimensions of access; house hold (space-time organization, means of access (transport system) and destination (space-time organisation of service/activities). The first, space-time organisation in house-hold interacts with other individuals and manner in which space time budget influence the ability to travel and travel choice.

Subsequently, the prior outcomes are translated into individual mobility that are determined by the nature of transport system in particularly operational factor (cost, network coverage and services pattern, personal security and public spaces) and the nature of the space-time organisation of the services/activities that people are seeking to access. The interaction of these elements within the sequential process shall verify causes of social exclusion in from of physical (e.g. design of station and barriers which cause by built environment), geographical (e.g. poor public transport system in fringe area/periphery), facilities (e.g. lack of access to service, financial, leisure, health and education facilities), economic (e.g. constrains in entering labour market), time-based (e.g. working hours restrain social activities), fear based (e.g. fear of public spaces) and space exclusion (e.g. underdevelop areas within the CBD). Similarly, Cass et al. (2005) identified these circumstances as the ‘block desires’ and further suggest that exclusion determination should relate these difficulties to where the respondent live. Therefore, the dimension/conceptualisation of access that determined the mobility related exclusion and transportation disadvantaged may be represented in circular form as depicted in the diagram below refer figure 1)
Transportation Disadvantaged Determination Framework: Conceptual and Dimensional

Based on the literature we interpret social exclusion as the consequence of an inability to access essential activities. Therefore, the essence to determine transportation disadvantaged relates to individual/household access level. The framework (refer figure 2) is based on the individual/household experience of transportation disadvantage. The dimension of the framework consists of individual/household, transport system, service/activities and land use. Each component is inter-related and influences travel choice/demand of individual/household. In depth, the framework includes space-time organisation of each attribute to determine the blocked desire and eventually identifies the transportation disadvantage. Generally the framework is distinguished into four parts. The first are individual/household attributes consist of profile and space-time individual/house organisation. The second set, are the inter-related system of service and network and its space-time organisation. The third set is the determination and generalisation process. The fourth is the development of policies to resolve transportation disadvantaged problems.

The first section of the framework intends to determine the individual/household attributes of the samples. The information gathered, could be distinguish into two categories which are profile of the household and travel behaviour study. Information which fall under the profile of household are social/demographic structure, income level, vehicles ownership, education level, licence availability, number of dependent members. To determine the derived demand of the household, information required are obligatory travel, purpose of travel, travel time, travel period, travel frequency and means of travel to undergo trip. The data of household are then geo-coded via street address a Geographic Information Systems (GIS) application.
The second section of the framework consists of service and network attributes. The purposes of this section are to determine the accessibility of services and networks, and to identify the service-network space-time accessibility. To undergo these, two types of data must be gathered, the service related data and network related data. Service category data are types of service (education, commerce, business, leisure etc), distribution (determine via address of the establishment), ratio per population and availability (operational hours). Whereas, network data includes means/types of public and private services (bus, para-transit, rail and private vehicles), public transport routes, roads, public transport coverage areas, operational elements of public transport (frequencies, headways, schedule) and fares structure. The data from both categories and its space-time organisation will be stored in the GIS and geo-coded to the street address and actual geographical references. These aggregated data will be gained from government and delivery agencies.

The third section of the framework is determination and generalisation process. In determining transportation disadvantaged, space-time information is analysis to identify correlation among components. Initially, the studied component shall be determined by its space-time attributes; service space-time, network space-time and person/household space time. Subsequently, the information of service space-time and network space-time are analysed to determine the correlation and integration of service-network space-time. This is essential to identify initial source of transportation disadvantage. Subsequently, network-service space-time correlates to person/household space-time travel demand to identify accessibility of
person/household to services. This process will determine the travel deprivation of person/household or the transportation disadvantage.

Prior analyses are then scrutinised to identify the distribution of the transportation disadvantaged and the non-transportation disadvantaged within the study areas. The disaggregate data (person/household) are correlated with the aggregated data (in particular network) to identify the spatial distribution of the transportation disadvantage and the non-transportation disadvantage. By using the statistical tools inference, the transportation disadvantage and the non-transportation disadvantaged are identified.

The developments of transportation disadvantage policies are prominent objectives of the research. The framework will assist agencies take corrective action against transportation disadvantage within the fields of transportation and land use planning and embark on the development of appropriate policies. Further, the recognition of transportation disadvantage will enhance the integration of socio-transportation planning and uphold sustainable transportation provision.

Conclusion
The framework have demonstrates the capabilities of accessibility measure to depict the characteristic of transportation disadvantage. Since, transportation disadvantage is regard as the inability of the individual to access essential network and activities, the framework has embedded person based measures and space time organisation to develop. Incorporating individual accessibility experiences and space time organisation of access component will identifying the essence of the problem either at the point of entry, the mobility system or destination accessibility. While the retrieval process help to identify the distribution of transportation disadvantage and the non-disadvantage. Therefore appropriate policy and strategy could be developed to apprehend the source of the problems.

The framework is still under development and some limitations may arise. Data availability and generalization of micro disaggregated data (individual data) and macro aggregated data (spatial data) will be the main challenges and require new methodology and techniques.

The operation and applicability of the framework are the essential considerations. This is vital to ensure that the framework is easy to comprehend by policy maker and urban and transport planners. Concurrently, the framework will not discriminate the theoretical elements.

To further develop and reinforce the framework, comparison of transportation disadvantaged characteristic from different geographical or social characteristic will require research. This process tends to measure the extent and flexibility of the framework to adapt to different spatial and socio-economic characteristics.

The research intends to seek to integrate social and transport matters within the transport modelling/planning process. Thus, the integration will resolve social-transportation dilemmas and enable plausible policy to be created to resolve this problem. The social-transportation issues should be synthesised from the
perspective of accessibility and through the experience of the transportation disadvantaged. The framework is part of PHD research and a pilot study will be conducted at the Gold Coast, Australia. The framework is then applied in Shah Alam, Malaysia as a case study.

References:


