

# A review of methodologies on measure of accessibility to tourist attractions

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**Abstract:** One of essential issues in the tourism industry is accessibility to tourist attractions. This paper aims to review methodologies that have been used to measure accessibility to tourist attractions in different disciplines. The advantages and disadvantages of these methods will be discussed from a transportation point of view. There are three essential methods to measure accessibility to the opportunities in any geographic area: infrastructure-based accessibility measures, activity-based accessibility measures, and utility-based accessibility measures. This paper identifies activity-based accessibility measures as preferred measure of accessibility to tourist attractions. Specifically, gravity-model and distance measures are identified as the best measures to quantify accessibility to tourist attractions through the road networks by different transport modes at the macro-level. Meanwhile, space-time and utility-based measures are preferable for use at the micro-level.

**Key words:**

Tourist attractions, Accessibility, Transportation, Infrastructure-based, Activity-based, Utility-based measures,

## 1. Introduction

The way to maximise the utilisation of tourist attractions is one of biggest tourism challenges faced by the various tourist destinations. Especially, when the tourist attractions are located at a great distance from the tourist origin zones or when the heavy traffic is over roads. The demand for the tourist attractions, therefore, becomes beyond their absorptive capacity.

Accessibility, as one of the affective indicators to reorganise the targeted areas, has been studied extensively from different disciplines such as transportation, tourism, geography and economy (e.g. Andersson & Karlsson 2007, O’Kelly 2007, Chien & Qin 2004, Card *et al* 2006 ). The transportation system plays a crucial role in joining locations to each other and easing people and goods movement from/to various locations. Therefore, accessibility becomes one of the fundamental issues that is related to tourist attractions and transportation planning. The measure of accessibility can also provide reliable indicators that may help tourism operators or agencies to recognise the potentials of development areas of tourist attractions and make right decisions on tourist attraction site selections.

In the past 20 years, only a few review papers have been written that critically compare the methods of measuring tourist attractions from different perspectives including objectives, advantages and disadvantages and major applications (Israeli & Mansfeld 2003, Chhetri & Arrowsmith 2008). For example, Dievorst (1995) provided the time-space paths of tourists in southern Limburg, and in the Dutch theme park, the Efteling. Taplin & Qiu (1997) utilised the gravity model for modelling car trips made over long distances to the major tourist destinations in Australia. Recently, Kong *et al* (2007) and Oh & Jeong (2007) studied accessibility to open spaces and parks in the urban environment, respectively.

This paper aims to review methodologies that are used to model accessibility to tourist attractions in different disciplines. A review of these methods will lead to identifying appropriate accessibility measures that can be efficiently used as indicators for the tourist attractions accessibility through different transportation modes.

The structure of this paper is as follows. A brief review of the literature on the concept of accessibility and tourist attractions in section 2. The framework for accessibility to tourist attractions is presented in section 3. The fourth section provides a discussion to determine an appropriate accessibility measure. The final section presents the study's conclusions.

## **2. Concept of accessibility and tourist attractions:**

### **2.1 Accessibility**

There is no universal definition among the scholars about accessibility concept. Therefore, Gould declares "accessibility is ... slippery notion ... one of those common terms that everyone uses until faced with the problem of defining and measuring it" (Gould 1969, p. 64).

Accessibility has been identified in different ways by the scientific field that is studying accessibility. Litman (2007) reviews accessibility means and its implications in various disciplines, such as transportation planning, geography and urban economics, and social planning.

Accessibility, in transportation planning, commonly refers to actual access to goods, services, and destinations. For example, Litman (2003) defined accessibility as an ease of reaching the opportunities (goods, services, activities and facilities) in a given destination. Also, Baradaran & Ramjerdi (2001) define accessibility as "a state of connectivity". In the field of geography and urban economics, accessibility refers to the relative ease of reaching a particular location or area. Hence, Hansen (1959) defines accessibility as an ability of interaction between places or locations. In social planning, accessibility refers to people's satisfactions and behaviours. Moreover, it is concerned with the local societies' attitude and focuses on psychological points of view. Accessibility, also, refers to people's ability to use services and opportunities (Litman 2007). Furthermore, in field of marketing, accessibility refers to maximise people or customers access to activities locations. Consequently, Kotler states that accessibility "the degree to which the segments can be effectively reached and served" (Kotler 1997, p. 269).

It is clear that the concept of accessibility varies from study to study depending on its aims and the scientific field that it comes from. In this paper, as mentioned previously, the aim is to identify the suitable accessibility measures that can be efficiently used as indicators for the tourist attractions accessibility through different transportation means from the geographical perspective. Therefore to identify concept of accessibility, it should be related to land use (the tourist attractions) and the transportation system in a given geographic area.

Accessibility is a theoretical concept which illustrates where the opportunities (activities, services, goods and facilities) are located in relation to people and the convenience or difficulty to get to these opportunities (Black & Conroy 1977). Accessibility can be divided to potential and actual accessibility. Potential accessibility refers to opportunities that can be reached within specific time or distance (Koenig 1980) or they have the ability of interaction between them (Hansen 1959), Whereas actual accessibility refers to the physical accessibility to opportunities (Pirie 1979, Handy & Niemeier 1997).

On the other hand, Ingram (1971) has divided accessibility into functional form when distinguishing between relative and integral accessibility. Relative accessibility is the degree of accessibility between two points, whereas integral accessibility is the degree of accessibility of one point and all other points in the area. This operational form of accessibility is applied through aggregation techniques (Geertman & Van-Eck 1995, Song, 1996, Handy & Niemeier 1997).

However, from a theoretical viewpoint, the tourism system consists of two primary elements: an origin and a destination (Uysal 1998). The origin is referred to residential location of the tourists, which is represented in accommodation sites at the tourist destination, while the destination is referred to the tourist attractions that are visited by the tourists. Nevertheless, the origin and the destination, as sites in the place, remain isolated from each other unless they are connected to each other by linkage. From the spatial perspective, the road networks are that linkage, thus road networks are considered the core element, in accessibility studies, because they allow tourists to reach tourist attractions by using available modes such as car, bus, taxi, cycling and walking.

## **2.2 Tourist attractions**

Tourist attractions are the cornerstone of the tourism industry. In this sense, Gunn (1988, p.37) declared that “without developed attractions, tourism as we know it could not exist”. This confirms the significance of tourism attraction, and implies the necessity of recognising the type of attractions that exist at the tourism destination as a sort of land use in that geographical area.

Tourist attractions, in a broad sense, can be divided into natural and man-made attractions. National parks, reserve parks, picnic sites, caves and rock formations, and zoos can be recognised as natural attractions. On the other hand, man-made attractions can be categorised into two essential classes: primary and secondary attractions. The primary attractions include: recreation or entertainments (i.e., private parks and cinemas) and cultural or heritage attractions (i.e., museums, events and churches), While the secondary attractions include: accommodations (i.e., hotels, motels and coaches “camping sites”) and services facilities (i.e., restaurants and shops centres).

To determine accessibility concept for measuring accessibility to tourist attractions, there are two basic elements that interact with each other within the content of tourist destination, tourists and tourist attractions on the one hand, and on the other hand, the physical relationship between the tourist residence locations (the trip origins) and the tourist attractions locations (the trip destinations). Hence, existence of an efficient road network, which connects the tourists to tourist attractions conveniently by the valuable transport means in the tourist destination, is the another basic element. As a result of this, accessibility is a concept that can be seen generally from two different perspectives, first one is “ease or difficulty of reaching a destination”, and another one is “the number of opportunities that can be reached from a given site”. Subsequently, this paper adopted the accessibility definition provided by Geurs & Ritsema van Eck (2001, p. 36):

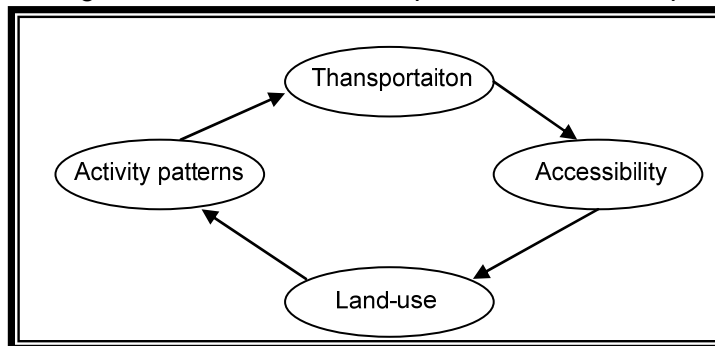
The extent to which the land-use/transport system enables (groups of) tourists to reach activities or tourist attractions by means of (a combination of) transport mode(s).

### 3. Accessibility to tourist attractions framework:

Regarding Tillema *et al* (2003) accessibility can be recognised by using two different approaches: traffic or transportation approach and geographic/transportation approach. These two approaches lead to different results. The transportation approach will show Perth, for example, is the lowest accessible city in Western Australia, because of less dense road network and public transportation. In contrast, the geographic approach will provide another conclusion, because more tourist attractions in Perth is than the other cities in Western Australia, therefore, accessibility to tourist attractions of Perth will be higher than the other cities, specially, when the tourist attractions are located spatially closed to each other.

From this perspective, when accessibility is investigated in a given geographic area, transportation and land use (tourist attractions) are related to each other. This relationship has been revealed as a rotation cycle (figure 1). The transportation available in a given geographic area plays a crucial role in determining accessibility to tourist attractions, where accessibility to tourist attractions becomes higher with an efficient transportation system. On the other hand, activities and attractions, which aim to attract the people, are usually connected by the road network and can be easily accessed by different transportation modes such as bus, cars, or railways etc, especially public transport. Therefore, the transportation system has a significant function to form the distribution of activities and attractions patterns. The spatial distribution of tourist attractions in turn affects tourists' daily activities. Consequently, attractiveness of tourist attractions verifies from the viewpoint of land-use (distribution of activities locations), and spatial activities of tourists needs spatial interaction (Tillema *et al* 2003).

Figure 1 land-use and transportation relationship



#### 3.1 Components of accessibility

There are three primary components of the actual accessibility: people, transport and activities (De Jong & Ritsma van Eck 1996, p. 182).



In fact, when a group of people needs to participate in various activities at different locations, they can be provided with transport that links origin to activity locations (Halden et al. 2005). Nevertheless, components of accessibility have been classified into four basic elements (Geurs & Ristema van Eck 2001, pp. 37-45, Geurs & Wee, 2004, p. 128):

### 3.1.1 Land-use component

The Land-use component of accessibility concerns the locations or attractions that provide space for conducting tourist activities. Therefore, tourist attractions are categorised into three fundamental elements. Supply-side is the first element including: spatial distribution of tourist attractions and the amount of tourist attractions. Demand-side is the second element that represents the spatial distribution of residence locations of tourists. The last one is represented in comparing between supply of and demand for tourist attractions that can highlight the competition among the tourist attractions based on their characteristics such as their capacity.

### 3.1.2 Transportation component

The essential elements of transportation components of accessibility focus on the connectivity of different tourist locations. The transportation components comprise supply infrastructure, travel demand and characteristics of transportation infrastructure. Spatial factors (travel time, cost and distance) and effort (e.g., reliability, comfort and accident risk) are the main factors that influence transport components regarding transport modes (car, bus, walking, etc). On the other hand, Halden *et al* (2005, p. 15) identified six essential constraints that affect the transport system: spatial, temporal, financial, physical, environmental, information barriers. These factors result from comparison between supply infrastructure and travel demand, which represent characteristics of transportation infrastructure. The supply of infrastructure is represented in its location and attributes (travel speed, number of lanes, travel costs, public transport timetable, etc), while the travel demand concentrates on both passengers and freight travel.

### 3.1.3 Individual component

The individual component of accessibility addresses tourists/individual motivations, abilities, time and/or financial constraints to access tourist attractions. In this sense, the characteristics of tourists are categorised into three groups: their needs, abilities and opportunities. Tourists differ in their income, educational level, ages, gender, and marital status. Therefore, they have different motivations. Moreover, the ability of tourists can be defined, in a similar way, by their socio-economic characteristics, skills, physical condition, and availability of transport modes. Opportunities of tourists are related to their time-budget and income. All of these factors, in general, affect the level of individuals or tourists accessibility to tourist attractions.

### 3.1.4 Temporal component

Finally, time is a vital element in all aspects of the life whether tourists' lives or tourist attractions availability. To reach any tourist attraction, the tourist needs specific time, and tourist attractions have also limited hours to receive the visitors, therefore, the temporal component plays a significant role in tourist accessibility depending on the spatial distribution of tourist attractions and the times that they open during the day.

## 3.2 Accessibility indicators

In general, accessibility indicators give different values that rank accessibility to attractions from high accessibility to inaccessibility. They can also be used to classify attractions in terms of their peripherality and centrality locations (Schurmann & Talaat 2002). According to Srour *et al* (2002) accessibility indicators are varied from simple travel-time indicators, to measure

accessibility within certain distance or time threshold by using cumulative opportunities measures and utility measures. In addition, accessibility indicators, which are frequently used, can be classified into five essential accessibility indicators as following ( Schurmann & Talaat 2002, p.6):

- *Infrastructure measures*: sum of lengths of cars paths or quantity of bus stations.
- *Travel time indicators*: trip time to closest node of road networks.
- *Travel cost indicators*: cost of visiting a set of attractions cumulatively.
- *Daily accessibility*: a mount of attractions that can be visited within a certain trip time.
- *Potential accessibility*: a mount of attractions that can be visited weighted by a function of trip cost or population demographic characteristics, etc.

### **3.3 Accessibility measures:**

As there is no agreement about the concept of accessibility, measuring accessibility differs from study to another depending on its aims and the nature of factors that are used to measure accessibility, which might be quantitative or qualitative factors. These factors can be time or distance of travel, available transport modes, people characteristics, activities characteristics, etc. As a result of this disparity in the causes of measurement of accessibility, a number of accessibility measures have been appeared in the different disciplines. For this reason, Handy & Niemeier (1997) had recognised four interconnected elements, which must be determined:

- 1- The level and type of disaggregating, which are three types: spatial (individuals at specific zone), socio-economic and the type of activities.
- 2- The definition of origins and destinations, which identifies set of potential opportunities available for individuals in a zone.
- 3- The measurement of travel impedance, which measures often by travel time or distance.
- 4- The measurement of attractiveness, which measures number of attractions, their economic size (e.g., number of employment and entrance fees).

Geurs & Ritsema van Eck (2001, pp. 47-64) have categorised accessibility measures into three groups:

1. Infrastructure-based accessibility measures,
2. Activity-based accessibility measures, and
3. Utility-based accessibility measure.

#### **3.3.1 Infrastructure-based accessibility measures:**

This category of measurements concerns the transportation components to assess the performance of the transportation infrastructure, such as travel speeding, journey time and congestion. This category does not concern the spatial or land use components; therefore, it considers traffic or transportation measures.

#### **3.3.2 Activity-based accessibility measures:**

Activity-based accessibility measures take in account land-use components as well as people, transport and activities, as discussed aforementioned. Geurs & Ristma van Eck (2001 )

recognised the following measures as activity-based measures: distance measures, cumulative opportunities measures, potential measures and space-time geography measures. These measures have been categorised into two basic groups: Location-based measures and person-based measures ( Geurs & Wee 2004, Marki & Folkesson 1999).

### *3.3.2.1 Location-based accessibility measures*

Location-based measures focus on spatial separation between activities locations. These measures , basically, comprise two elements: pattern of land-use and transportation system (Geurs & Wee 2004). In transportation system, the consideration is usually trend to one the following factors: the distance and the travel time or the cost of travel by the various transport modes, meanwhile the consideration , in pattern of land-use, is on the following factors: spatial distribution of the potential activities and their quality, magnitude and number (Marki & Folkesson 1999). In this sense, location-based measures are considered as supply-oriented measures, because they are concerned with the accessibility to places and assume that all persons have equal level of accessibility to activities (Handy & Niemeier 1997, Ingram 1971).

The following measures are considered location-based measurement ( Geurs & Wee 2004, Marki & Folkesson 1999): distance measures, cumulative opportunities measures and gravity models or potential measures.

### *3.3.2.2 Distance measures*

These measures account for the distance from one location to various activities. Measuring distance between locations can use straight-lines (e.g. Euclidean distance) or through transport network. Ingram (1971) has classified the distance measures into two types: relative and integral accessibility. Relative measure is the simplest one that measures the accessibility between two locations by using the straight-line.

The merits of these measures can be summarised into the following points:

1. Easiest accessibility measures are simple to calculate and interpret.
2. Small amount of data.
3. Used as average distance, weighted area distance or distance to the closest activity.

On the other hand, they have some demerits that can be reviewed as following:

1. They cannot measure the level of accessibility variation among the various activities.
2. They assume all persons have equal access to activities.
3. They do not present persons' travel behaviours and their temporal movements.

### *3.3.2.3 Gravity-based measures*

Gravity model or the potential measures are based on the Newton's theory of gravity. Hansen (1959) was the first researcher who used this measure to quantify the potential of reaching various activities around specific location. This measure is based on assumption that accessibility is likely to decreased the farther activities or from departure location ( Ritsema van Eck & De Jong 1999).

Depending on the distance function and the constraints that influence the competitions on origins and destinations, different models are used to measure accessibility by using the competition on both sides, the origin and destination, this is called the doubly constraints model. Singly constraint model, on the other hand, is used when the competition happens on one side of them. According to Belal (2001, p. 23) this measure can be used as the following:

$$\sum P_i \cdot A_j \cdot R_{ij}$$

where,  $P_i$  is production of the origin  $i$ ,  $A_j$  is attractiveness of destination  $j$ , and  $R_{ij}$  is the resisting force between the origin and the destination.  $R_{ij}$  is determined by  $I_{ij}^{-a}$ , where  $I_{ij}$  represents impedance between  $i$  and  $j$ , whether it was the distance or the cost, and  $a$  is the decay value.

On the other hand, potential accessibility to activities can be represented without considering the competition factors on the origins. This model was synthesised by Hansen (1959) to describe the accessibility of employment opportunities. According to Geurs & Ritsema van Eck (2001, p. 52) this measure can be represented as following:

$$A_i = \sum D_j d_{ij}^{-a}$$

Where,  $A_i$  is the measure of accessibility at zone  $i$ ,  $D_j$  is the opportunities at zone  $j$ ,  $d_{ij}$  is the distance between zone  $i$  and  $j$ , and  $a$  is a parameter reflecting distance deterrence.

Both of those models mentioned above, have advantages and disadvantages. The advantages are that they are considered as a continuous measure depending on the distance, they are simple to understand and calculate, and they need a small amount of data. On the otherwise, the disadvantages are that they neglect the spatial behaviour of persons and the temporal constraints that face them, and they are affected by the zonal aggregation of the study area.

#### 3.3.2.4 Cumulative opportunities measures

These measures recognise accessibility to opportunities by calculating the number of possible opportunities that can be reached within certain travel time or distance from specific location. Time and distance threshold affects the reliability of this measure, where the increase of the threshold is meaning more opportunities can be reached and vice versa. The cumulative opportunities measure can be shown as following (De Jong & Ritsema van Eck 1996, p.186):

$$PCount(i) = \sum_{j^*} D_j$$

Where,  $j^*$  is the overall opportunities such that distance,  $j <$  threshold distance, and  $D_j$  is the number of opportunities.

This measure has a number of advantages. It is easy to interpret this measure. it, also, represents potential accessibility to opportunities in specific distance or travel time, and it uses to create an isochronic maps. On the other hand, it has obvious disadvantage that the cut-off value is determining arbitrarily to define the accessibility to opportunities, which lead to biased results. In addition, it treats the far and close activities within chosen travel time or distance similarly.

### 3.3.3 Person-based accessibility measures:

These measures focus on the person's ability to contribute in activities through space and time. It basically assesses accessibility of particular individual to one attraction or spectrum of attractions depending on the person needs, monetary and time resources ( Kwan 1998, Miller 1991). The person-based measures consider demand-oriented measures, because they take into consideration the persons sequential daily activities, their experiences to access the activities, and the spatial constraints that may hamper the person from reaching the activities ( Marki & Folkesson 1999).

#### 3.3.3.1 Space-time geography measures:

Space-time measure is created by Hagerstand (1970) to represent individuals interactions within feasible activities in a geographical dimension. This measure focuses on persons' behaviour possibilities and the influence of the spatial and temporal constraints on their behaviours.

The major advantage of this measure is that it can determine the accessibility of each person. In addition, it can determine the temporal activities of the person based on the time constraints. Nevertheless, it has some disadvantages. It needs large amount of data to measure accessibility. Moreover, it is difficult to use this measure at the zonal level, therefore, it is often used at small areas.

### 3.3.4 Utility-based accessibility measures:

This measure is based on the random utility theory. This measure represents evaluation for accessibility by the persons ( Tillema *et al* 2003). Therefore, it is based on the assumption that persons choose activity that gives them high value of utilisation compared to other valuable activities ( Marki & Flokesson 1999). This measure is often used in economic studies, especially, for cost-benefit analysis (Tillema *et al* 2003)

## 4. Discussion

From the previous section, there are three essential methods to measure accessibility to the opportunities in any geographic dimension, namely, infrastructure-based accessibility measures, activity-based accessibility measures, and utility-based accessibility measures. All of these methods have advantages and disadvantages as aforementioned.

According to Gutierrez (2001) an optimal method to measure accessibility did not exist until now. Determine the best method for measuring accessibility is depending on the aims of the study and the scientific field that it falls under its umbrella (Handy & Niemeier 1997). Furthermore, accessibility indicators and their components have a crucial role in determining the best method to analyse and evaluate accessibility to the opportunities.

As mentioned previously, there are three primary components of the actual accessibility: people, transport and activities. In fact, when a group of people needs to participate in various activities at different locations, it can be provided to them within transport that links origin to activity locations (Halden *et al* 2005). On the other hand, the potential accessibility to tourist attractions

is related to tourists' socio-economic characteristics, cultural characteristics, and their spatial behaviour.

Although the infrastructure-based accessibility measure has the ease of performance and the simplest of interpretation, it does not include the components of land-use or persons' characteristics (Geurs & Ritsema van Eck 2001, Geurs & Wee 2004). Thus, this measurement gives indicators, only, about the transportation components, this measurement, therefore, is confined to the transportation infrastructure regardless of other accessibility components that might be used to measure accessibility to tourist attractions, such as land-use components (origins and destinations locations) and persons (tourists) characteristics.

Activity-based accessibility measures can be classified regarding to the size of the study area into two groups: macro-level measures and micro-level measures. Location-based accessibility measures, such as distance, gravity-based and cumulative opportunities measures, are considered the macro-level measures, while the person-based accessibility measures are considered the micro-level measures. Beside the space-time geography measures, the utility-based accessibility measure has been recognised as the person-based accessibility measure because it measures accessibility to opportunities based on travel behaviour theory or person movement preferences as a basic element for measuring the accessibility to location ( Ben-Akiva & Lermant 1979). Therefore, it is considered to be one of activity-based accessibility measures. Because of this fact, Bowman & Ben-Akiva (1998) developed an activity-based model to measure accessibility based on the utility-based measure.

Proceeding from the fact that accessibility to tourist attractions is the ease of reaching the tourist attractions by available transport modes ( Geurs & Rtsima van Eck 2001), accessibility to tourist attractions can be measured by using both location-based and person-based measures based on the purpose of studying accessibility to tourist attractions. In this sense, there are two main purposes of studying accessibility to tourist attractions. The first one is the physical or spatial accessibility and the second one is the tourists (persons) accessibility to tourist attractions.

On the other hand, to determine the appropriate method to measure accessibility to tourist attractions, four interconnected elements must be recognised (see the accessibility measures sections referred by Handy & Niemeier (1997)). The disaggregation type and level is incorporating spatial size, tourists' socio-economic characteristics and the type of activities. The spatial size can be ranged from regional area to a specific tourist attraction such a museum. Tourists' socio-economic can be recognised as a number of characteristics, such as age, gender, educational status, etc, or as on character, such as the gender. Type of activities can by the daily-chain movement of tourists or tourists access to number of tourist attractions. The second element is represented in centroid of the census zones of any study area as the origin of trips and the tourist attractions, in any study area, is the destinations. The third element is the impedance of travel that can be defined as time or distance unites, but because of the use the available transport modes, the time unites are more appropriate than the use of distance measures such straight-lines or Manhattan distance measures. Lastly, open hours of tourist attractions is the element that determine their attractiveness.

Regarding spatial accessibility, the location-based accessibility measures are considered because Kwan (1999) mentioned three general elements to measure the location accessibility, which are the origin and destination locations, the activities ( shops, schools, jobs, tourist attraction, etc), and the impedance of travel to determine the spatial separation between origins and destinations locations.

Consequently, measuring the spatial separation between locations can be completed by using distance measures by determining travel time, distance or cost by using road networks, straight-lines or Manhattan (Brabyn & Skelly 2002, Brabyn & Barnet 2004). Also, it can be measured by using the cumulative opportunity measures. The cumulative opportunity measures are used to account for the tourist attractions that can be accessed within specific travel distance or time. Wachs & Kumagai (1973) used the cumulative opportunities measure for measuring accessibility to health care facilities in Los Angeles. They used this measure based on the number of potential health care facilities that can be reached within a given travel-time or distance. The shortcoming of these two methods is treating the destinations equally regardless of their competition to attract the visitors. Accumulative measure, also, gives biased results that the travel time or distance determines by the researchers. Therefore, gravity-based model considers the most location-based accessibility measures that used since Hansen (1959) used this measurement. This measure enables to measure the accessibility to opportunities depending on their attractiveness factors such as their size or capacity; this gives the potential accessibility to attractions. Subsequently, the gravity-based method highlights the components of accessibility except it cannot measure the individual constraints and trace their daily-chain movement (Kwan 1998, 1999).

Both person-based accessibility measures, space-time geography and utility-based measures, have the ability to measure individual behaviours during space and time. The utility based measures are concerned with the cost-benefit of person accessibility to opportunities, space-time geography measures, therefore, have the priority to measure the tourists' (persons) accessibility to tourist attractions because they are able to focus on their behaviours regarding the spatial and temporal constraints.

## **5. Conclusion**

To sum up, there are three different methods to measure accessibility to tourist attractions: infrastructure-based measures, activity-based measures and utility opportunities measures.

The components of accessibility to tourist attractions are four components: land-use (origins and destinations locations), transportation ( transport modes, travel speed, road networks types and networks constraints), individual characteristics ( age, gender, educational status, etc) and temporal elements ( open hours of opportunities, person time budget, etc).

As a result, to the diversity of the amount of data that is requested to apply the above methods and complexity of conduct of each of them to measure accessibility to tourist attractions at macro-level, e.g. the regional level or the whole country level. Activity-based measures have superiority to measure accessibility to tourist attractions, particularly the location-based measures. Tourist attractions are places located in a particular geographic dimension and take various patterns of the spatial distribution. The occurrence of the tourist activity, in that destination, creates spatial relation between the various tourist attractions through using available transport modes. Therefore, gravity-based and distance measures seem to be the best measures to quantify accessibility to tourist attractions through the road networks by different transport modes.

In spite of the capability of person-based measures to highlight individuals' behaviours temporally and spatially, these measures still experience difficulties at the operational stage and need a huge amount of data, which confine them to measure micro-level areas such small city or zone of metropolitan area.

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