



# **Dimensions of Accessibility Benefits**

## Discussion Paper

**182**  
Roundtable

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## Background and overview

There is increasing pressure in the current transport planning debate for accessibility to be given a wider role in appraisal methodologies, in a context in which the overarching goals are shifting from savings in travel time to achieving a sustainable and inclusive transport system. “The central concept in all transport analysis has been desire to ‘save travel time’. Transport appraisal is almost totally (80%) dependent on the user benefits resulting from travel time savings and hence the overwhelming desire to speed up traffic. This in turn reinforces ... the social and environmental problems that are created” (Banister, 2011).

The transport system and its social impacts have undergone a sweeping transformation since the traditional appraisal methods were first developed. At that time, the goals of network efficiency maximisation – measured mainly through travel time and cost savings – were at the core of appraisal methodologies and there was limited academic knowledge and few societal concerns about the concomitant and interrelated effects on domains such as energy scarcity, the health impacts of air pollution, and social exclusion, to name some of the transport-related impacts on well-being (Banister, 2008; Ferreira, Beukers and Te Brommelstroet, 2012; Reardon and Abdallah, 2013).

The role of transport projects in minimising accessibility-related social exclusion and inequality is moving into the spotlight (Cass, Shove and Urry, 2005; Stanley et al. 2011; van Wee and Geurs, 2011). Vulnerable groups affected by transport disadvantages have a high risk of suffering involuntary mobility-related social exclusion. The provision of “accessibility for all” has significant benefits that are often overlooked in appraisal methodologies, despite the fact that all citizens have been found to gain from them (Odeck, Hagen and Fearnley, 2010). These equity considerations are the basis for the justification to move from a travel-savings goal “towards (improved) accessibility to basic services” (Lucas, van Wee and Maat, 2016).

The contribution of accessibility to well-being is now a dynamic research field. Indeed, one of the most important goals of transport policy is the enhancement of well-being. It has even been recently claimed that “the ultimate aim of transport policies is to increase individuals’ well-being” (Ettema et al. 2010: 730). This social sciences-linked research topic is broadening the conventional view of accessibility – as something to be strictly measured in terms of “objective” variables such as travel time or distance (Banister, 2011) – in favour of considering physical and organisational aspects in addition to time and cost (Cass, Shove and Urry, 2005).

The unanswered question for research is how the accessibility provided by the transport system may affect well-being. Accessibility influences individual well-being as it facilitates participation in life’s essential activities such as work and education, but also enables other interactions that are crucial for psychological health such as social interaction and leisure (Banister and Bowling, 2004; De Vos et al., 2013). Recent research is revealing evidence of the links between well-being and transport (Delbosc, 2012; Mokhtarian, 2019; Reardon and Abdallah, 2013), which until recently has been a largely neglected area of study for the travel behaviour community (Mokhtarian, 2019; Stanley et al., 2011). Most of the studies have focused on commute well-being and issues such as the health-related benefits of active travel, or the psychological benefits of connectedness with key social networks, where “active commuting modes” such as walking and cycling have been associated with higher levels of subjective well-being (SWB) (Abou-Zeid and Ben-Akiva, 2011; Gatersleben and Uzzell, 2007; Singleton, 2019). However, there is no agreed conceptual model of the relationship between transport and well-being, and the trade-offs between the different dimensions of well-being require further investigation (Reardon and Abdallah, 2013) before considering their inclusion in appraisal methods.

Researchers therefore face numerous methodological challenges when seeking to develop a sound and comprehensive framework for the appraisal of accessibility benefits. The research tasks include capturing the whole range of benefits, defining the potential beneficiaries and assessing the distributional effects. Accessibility analysis must be integrated in more holistic, cross-sectoral methodological approaches, comprising not only transport-system and land-use variables, but also psychosocial variables that may affect how individuals benefit differently from certain improvements in accessibility.

This paper aims to shed light on these issues, and is structured as follows. The following section revisits the accessibility concept from a four-fold approach, following the four dimensions of access, as developed by Cass, Shove and Urry (2005), namely: economic (financial), physical, organisational and temporal. The third section of this paper explores the relationship between accessibility and well-being, and proposes a conceptual model. It then looks at a variety of current challenges and opportunities for accessibility research from this holistic perspective, including the development of accessibility elements to take account of the whole range of accessibility benefits, subjective personal factors, the importance of addressing social connectedness and health-related issues, as described in the fourth section. The concluding section contains some recommendations for transport project appraisal methodologies and outlines further research challenges. Throughout the text, some of the issues dealt with in the paper are exemplified with empirical evidence and included in illustrative boxes.

## Revisiting accessibility: The dimensions of access

There is abundant scientific literature on the concept of accessibility and related indicator formulations; for example Geurs and Ritsema van Eck (2001); Geurs and van Wee (2004); Gutiérrez et al. (2011); Páez, Scott and Morency (2012); and Monzón, López and Ortega (2019), among others. However, the new vision outlined in the previous section broadens the concept of accessibility. According to Banister (2011), “It is now opportune to reassess the dominant paradigm and to look at the means by which travel distance can be shortened, through slower travel to more local activities, through travel as a quality experience, through taking responsibility and ownership of the urban environment, and through exploring the means by which all people can increase their accessibility”.

On the basis of existing conceptualisations of accessibility, below we propose to “revisit” the concept of accessibility using the categorisation of Cass, Shove and Urry (2005) on the four dimensions of “access”, namely financial, physical, organisational and temporal. A look at accessibility from these four points of view can help us further identify and categorise accessibility benefits.

### The economic dimension

This dimension deals with the required expenditure of financial resources to travel by different transport modes, such as costs of car ownership and use or cost of transit. For certain vulnerable low-income population groups – for example, the retired and unemployed or teenagers – the cost of transit may constitute an access constraint (Lucas, van Wee and Maat, 2016). In other cases, low-income population groups have higher transport expenditures than they can afford (Cascajo et al., 2018; Lucas et al., 2016),

as in the case of population groups “forced into car ownership” given the lack of public transport options. Elsewhere, mostly in developing countries, unaffordable transport can exclude access to individual basic needs (Bocarejo and Oviedo, 2012).

Financial barriers can also act as a choice determinant between different alternatives, compelling people to make trade-offs between travel times and fares. A recent example of the importance of the fare structure is the upsurge of low-cost air carriers offering extremely low fares and making air travel accessible to low-income populations.

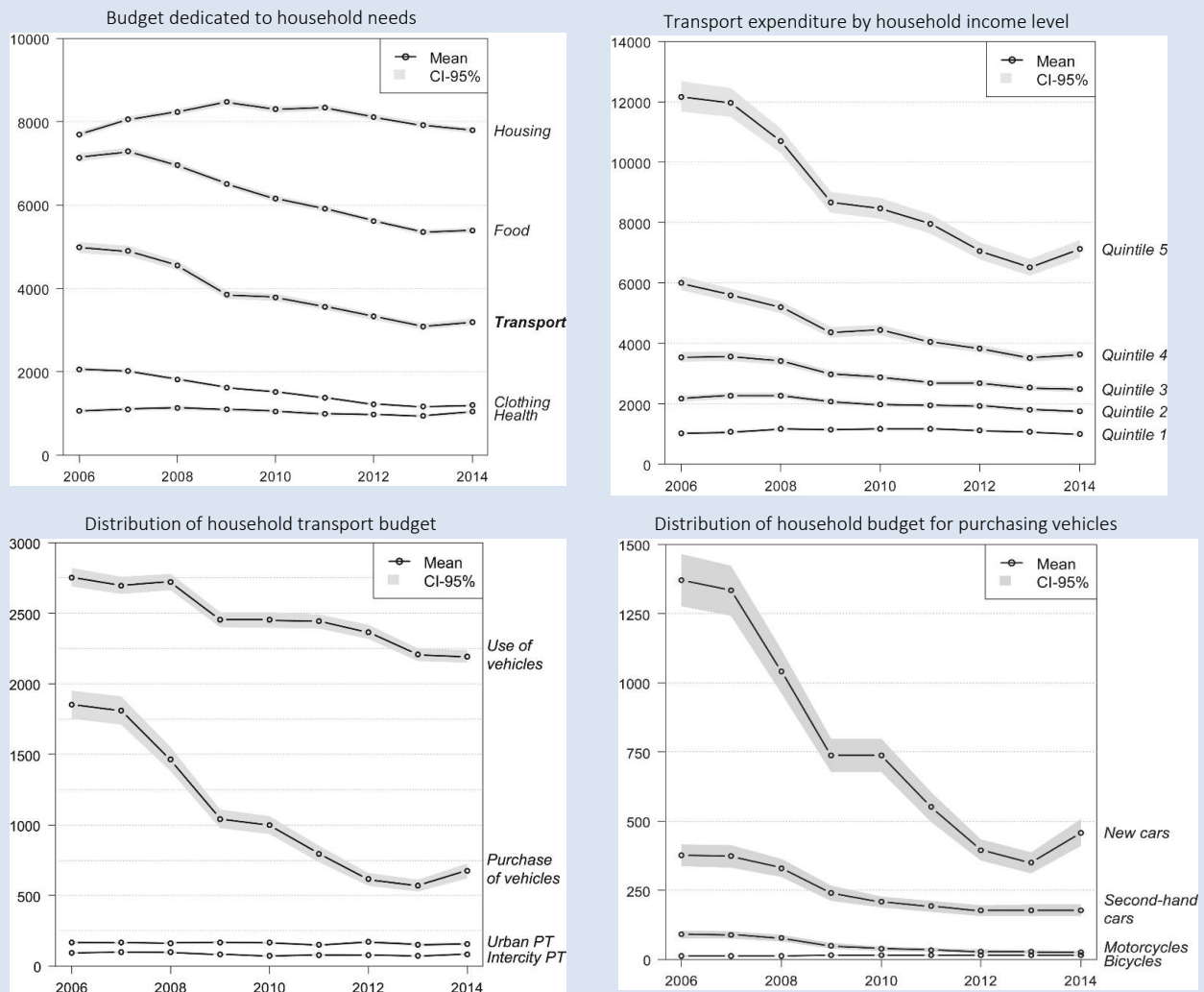
In order to consider cost-related barriers, which risk leading to social exclusion, accessibility formulations should account for each individual’s transport affordability. This makes it possible to assess the degree of equity in accessibility across population groups with different income levels, as travel costs may act as a budgetary constraint for low-income groups in accessing their desired destinations. Only a few examples of accessibility formulations include transit fares. Bocarejo and Oviedo (2012) analyse this problem in their work done in the capital of a developing country (Bogotá, Colombia) for the case of the TransMilenio bus rapid transit (BRT) corridor. They used an accessibility formulation with an impedance function that included both travel time and percentage of income spent on transport, and found that the effects of equitable transit fares on accessibility to the labour market may be greater than the impact of policies to expand the public transport network.

However, this approach poses a number of methodological difficulties, as fare structures in large metropolitan areas are determined by multiple transit agencies. This was highlighted by El-Geneidy et al. (2016), who used an equity approach to assess job accessibility by transit in socially disadvantaged neighbourhoods in Montreal, Canada. This research proposes a set of new transit accessibility measures that incorporate both travel time and transit fares. The authors claim that these accessibility measures are more accurate and easier to communicate, as accessibility is converted into a monetised value.

**Box 1. Household transport expenditures in a context of economic crisis: the case of Spain (2006-2014)**

Households make trade-offs between different expenditure items, including transport. In a situation of economic crisis, these trade-offs may be altered and transport expenditure may change as a result. This issue was the subject of research analysing changes in household transport expenditure during the 2008 – 2013 economic crisis in Spain (Cascajo et al., 2018). Transport was found to be among the items of household expenditure most affected by the crisis. The average amount spent on transport dropped to its lowest value in 2013, falling by 37% over six years. The research looked at whether the changes in the relative level of transport expenditure differed among households depending on their purchasing power. As can be seen in the figure below, whatever the year, higher-income groups (quintile 5 and 4) saw a greater fall in their expenditure than the lower-income groups (quintiles 1-3), demonstrating that it is harder for the poorest quintile to adapt their transport costs than for the other quintiles. The reduction in expenditure is related to vehicle purchase and use.

**Figure 1. Impact of the economic crisis in Spain (2007-13) on household transport expenditure**



Source: Cascajo et al. (2018).



## The physical dimension

Physical constraints on access depend both on the design characteristics of the transport/land-use system, and on personal capabilities, which may imply impediments to accessibility. Transport projects aimed at minimising potential barrier effects include built environment measures, such as the design of transport infrastructure (e.g. interchanges), stops/stations designed for all (e.g. wheelchairs) or vehicles (e.g. low-floor bus). There are three interconnected aspects involved in providing good accessibility levels to public transport. The first affects all types of users, and consists of the adequate design of transport nodes and transfer facilities between modes, to save time and ensure hedonic transfer and waiting. It has physical and organisational elements that refer to the third dimension. The other two aspects are more relevant for disabled people and include the vehicle and station characteristics.

The transport literature is slowly beginning to pay attention to accessibility aspects that focus on people with disabilities and the elderly (Banister and Bowling, 2004; Currie et al., 2010; Spinney, Scott and Newbold, 2009). This dimension is related to the policy objective of “accessibility for all”, which is an explicit goal of the European Accessibility Act of the European Commission (2015). Another closely related term is that of Universal Design (UD), which refers to “the design of transport systems in a way that they are accessible to all users, irrespective of the users’ abilities” (Odeck, Hagen and Fearnley, 2010). The appraisal of projects to remove physical barriers to access should obviously take into account the accessibility benefits for vulnerable groups such as the elderly, people with disabilities, children and the physically impaired. In addition, as recently noted (Odeck, Hagen and Fearnley, 2010), all transport users benefit from these projects through enhanced efficiency from reduced travel times on public transport.

There are some data on “soft measures” in public transport from the economic appraisal of benefits such as the provision of real-time information at bus stops or low-floor buses (see the review in Fearnley, Flügel and Ramjerdi [2011]). This is the case of the work of Odeck et al. (2010), who carried out a cost-benefit analysis (CBA) on the economic appraisal of UD measures in local public transport projects (such as low-floor buses and accessible ramps to bus stations). Another example is the appraisal of London Underground's platform hump programme (Karekla, Fujiyama and Tyler, 2011), which used a CBA to demonstrate its social profitability.

## The organisational dimension

These organisational aspects of access refer mainly to the frequency, reliability and punctuality of the transport service, but also include other measures such as the definition of bus routes, the quality of the travel experience, and the conditions in waiting and interchange locations. Some of the variables in the organisational dimension of access can be investigated within the scope of the assessment of the convenience of public transport. Convenience assessment includes (Wardman, 2014):

- access and egress time, in particular walking time at any stage of the journey
- waiting time, including time spent while transferring between services or modes
- being unable to travel at the desired time, covering service headway and displacement time
- having to transfer during a journey
- travel time variability and lack of reliability
- absence of good information or signage

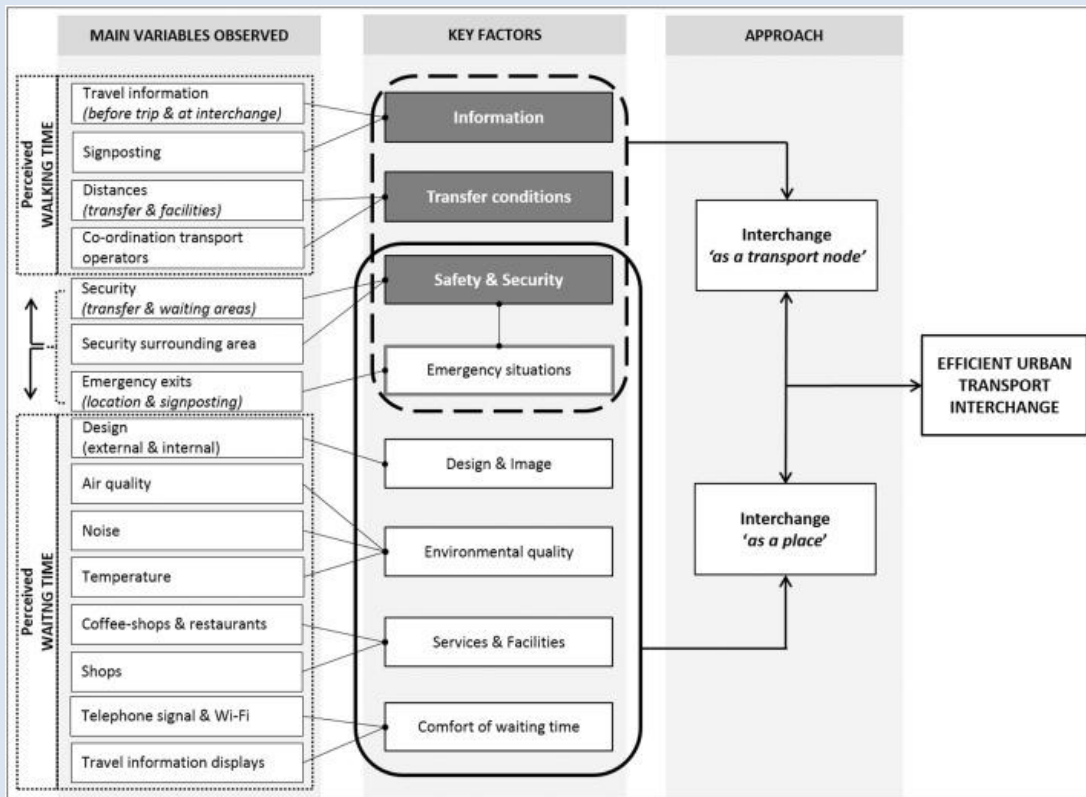
- crowding.

Many of these assessment elements are key factors for the quality of interchanges, which are coming under greater scrutiny due to their role as genuine urban nodes and city landmarks, but mainly because they are key elements in assuring accessibility in connecting transport modes.

**Box 2. Accessible interchange as a “transport node” and as a “place”**

The factors defining an efficient urban transport interchange were investigated from two different perspectives: functional and psychological. They can be allocated to three groups: related to ease and speed, related to comfort and services, and finally factors affecting safety and security. These groups define the dual perception of the interchange as a transport node and as place to wait and engage in activities. High values in these factors reduce subjective costs and generalised time when accessing public transport and transferring between modes.

**Figure 2. Key factors explaining quality of access and use in interchanges**



Source: Hernandez and Monzon (2016).

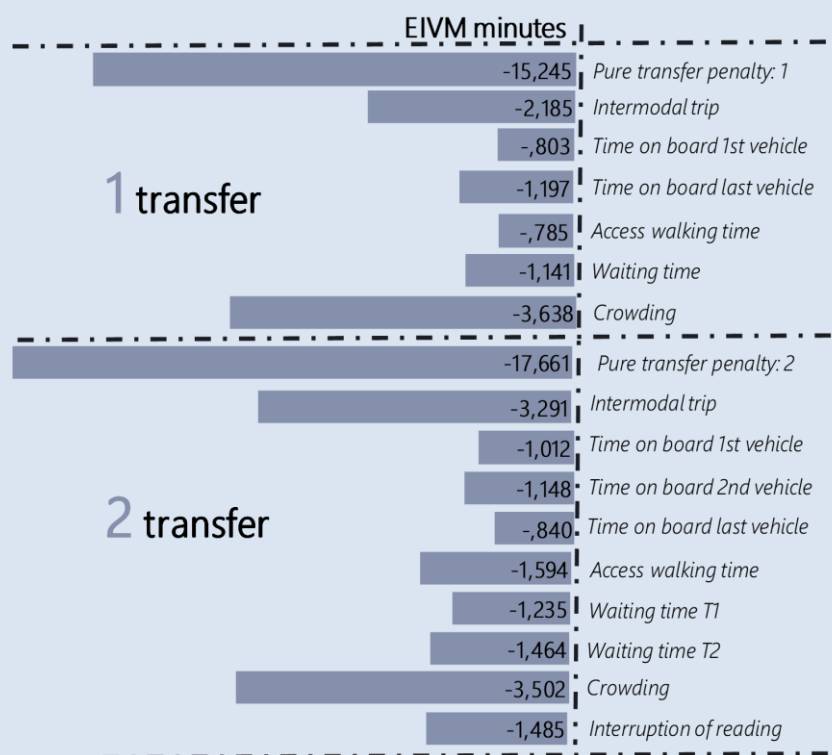
The task of incorporating these organisational dimensions into definitions of accessibility is complex, although necessary to assess the whole range of “user benefits”. Organisational issues also have an effect on the range of activities that can be carried out while travelling, which are also part of the utility of the trip (Ettema et al., 2010; Mokhtarian and Salomon, 2001). People do not value equally all travel time savings, so an additional ten minutes’ travel time standing on a crowded bus would not be valued the same as the same ten minutes seated in a modern train.

In other cases, organisational constraints may prevent some population groups from using the transport network, such as people who wish to spend their commute doing tasks that require being seated (Garcia-Martinez et al., 2018). The inclusion of these organisational features – largely overlooked in accessibility formulations – could be of great potential to capture additional accessibility benefits.

### Box 3. Determinants of transfer penalty: beyond access and waiting time

Travel patterns in urban areas are becoming increasingly complex, and many public transport users need to transfer during their daily journeys. Transfers in multimodal public transport cause a disutility for users that goes beyond the additional walking and waiting times. This additional disutility has been proven to be an essential element in the structural design of public transport networks. Some recent research (Garcia-Martinez et al., 2018) has estimated the penalty perceived by commuters when making transfers in multimodal urban trips. The framework is based on stated-preference (SP) surveys and discrete choice models and was applied to trips with one or more transfers in Madrid, Spain. The results show the differential disutility assigned to each transfer type, accounting for 15.2 EIVMs (Equivalent in Vehicle Minutes) for trips with one transfer and 18.4 EIVMs for two transfers. The model outputs reveal interesting results in terms of transfer characteristics: crowding, the disruption of reading activity, waiting and access times.

Figure 3. Equivalent in vehicle minutes (EIVM) of transfer characteristics



Source: Garcia-Martinez et al. (2018).

## The temporal dimension

This dimension of accessibility depends on temporal availability, and relates to both trip duration and to time and frequency of services, which may act as a barrier for people with limited time resources. It is also important to include the need to “juggle” to carry out an individual’s or their family members’ various mobility-related activities, such as food shopping after work, picking up children from school, and arriving home by dinner time (Cass, Shove and Urry, 2005). Mixed land-use and transport designs can help in this juggling challenge, combined with information and communication technologies (ICT) capable of providing real-time information to minimise waiting times or include multimodal alternatives in the choice options.

Transport network nodes in particular can play an important role in this temporal access, as providers of opportunities to carry out daily activities. This is mainly the case of urban transport interchanges, which are increasingly receiving attention as “places” (not merely “nodes”) in which activities can be carried out if they are strategically planned (Hernandez and Monzón, 2016; Hernandez, Monzón and de Oña, 2016).

## Accessibility and well-being

The concept of well-being has been extensively researched, although it is not easily defined. Most authors agree that it is a multidimensional construct that includes psychological, physical, social, cognitive and economic dimensions. It is frequently used interchangeably with other synonymous terms such as satisfaction with life and happiness, a fact that does not contribute to its definition (Diener et al., 1985; Pavot and Diener, 2008).

One way to measure well-being is to use objective lists of dimensions/attributes that are assumed to constitute well-being. These commonly include the basic characteristics and attributes necessary to fulfil human needs, such as health, income, education, housing and social relations (Delbosc, 2012; Durand, 2015; Reardon and Abdallah, 2013). One such objective list developed by the OECD is entitled the “Better Life Initiative” (Durand, 2015), where well-being is broken down into 11 dimensions, some of which are related to transport and mobility, such as: access to housing and social activities, social connections, quality of environment and secure environment.

The subjective well-being (SWB) dimension is mainly assessed by means of psychometric scales, and refers to the individual’s perception of his/her general satisfaction with life (see a recent review of key scales in Mokhtarian [2019]). The concept of satisfaction with life emerged in 1985 (Diener et al., 1985) and has been extensively researched (Pavot and Diener, 2008). It is commonly agreed that SWB is composed of three components: the first two are emotional: positive affect (PA) and negative affect (NA), and relate to immediate experiences, and the third is cognitive and refers to a global judgment of satisfaction with life.

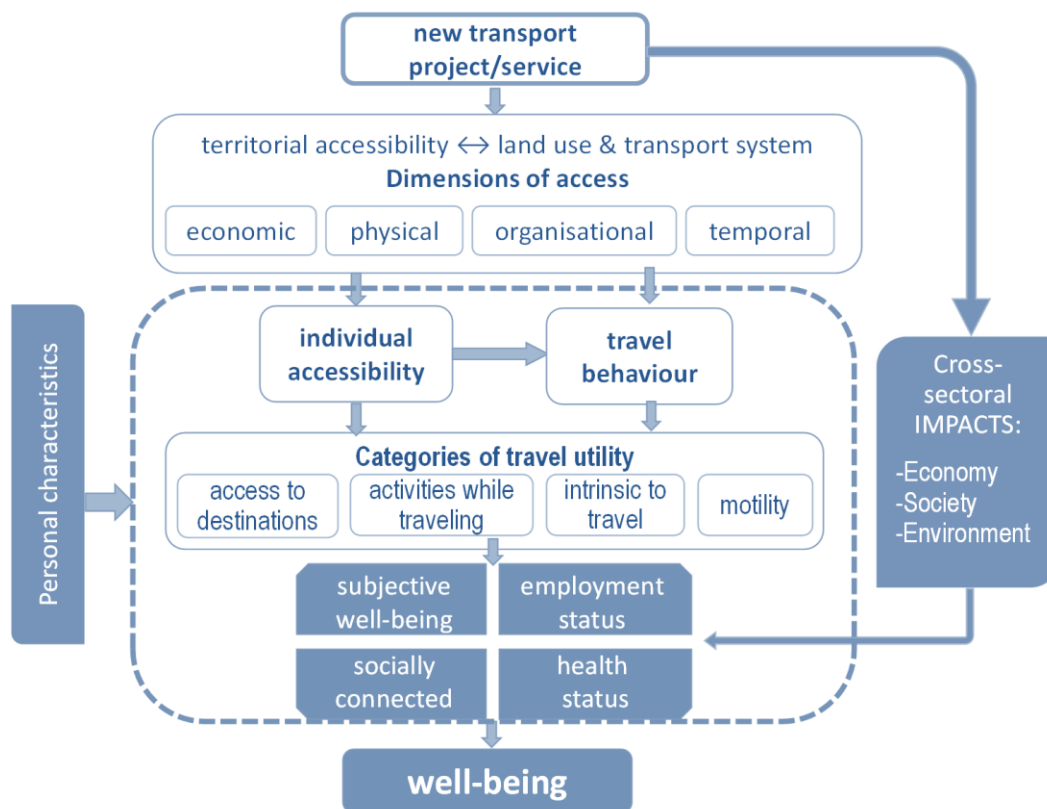
A recent policy paper from the International Transport Forum (2019) proposes examining the links between changes in accessibility and well-being: “Transport can contribute more effectively to wider well-being objectives if potential synergies between improving access to opportunities and such goals as reducing pollution, curtailing greenhouse gas emissions, limiting social exclusion and improving health are considered”.

It is clear that transport accessibility is linked to different dimensions of well-being. Some of these dimensions are objective, related to the goodness of access to certain destinations and facilities, while others are subjective and refer to the travel activity itself, and others consider various impacts on social relations and the environment. All impose either positive or negative changes in utility.

### Transport and well-being: An integration of conceptual models

There is a scarcity of research on transport-related effects on well-being. It has only recently begun to receive more attention, with promising developments in conceptual models that shed light on the complex relationship between our travel choices and well-being. Obviously, the accessibility provided by the transport system plays a significant role among the multitude of variables present in this relationship. Below, we briefly integrate the existing conceptual approaches into a proposed new conceptual model.

Figure 4. Transport and well-being: proposed integrative conceptual model



When a new transport project or service is implemented, it produces changes in the relationship between land-use and transport systems, and thus alters territorial accessibility. The effects on individual accessibility and travel behaviour will depend on a combination of the physical, economic, organisational and temporal characteristics of the new transport project/service. Personal characteristics, including psychosocial variables such as attitudes also play an important role in how these accessibility changes are translated into individual accessibility and travel behaviour effects.

## Revisiting the utility of travel concept

Individual accessibility affects travel behaviour, which in turn implies a utility gain or loss (otherwise travel behaviour would not be modified). However, in order to fully capture the benefits derived from “increased utility”, we need to reconsider the concept of “utility”. Indeed, the basic assumption of traditional travel demand models that travel time is a variable that must be minimised – thus maximising utility – is being revisited thanks to new developments in models based on behavioural economics. Recent research is challenging this view and calling for the inclusion of the “positive utility” of travel (De Vos and Witlox, 2017; Duarte et al., 2010; Ory and Mokhtarian, 2005) and the possibility that travel has an intrinsic utility, since not everybody considers travel time as a disutility: “Ultimately, improving our forecasts of travel behaviour may require viewing travel literally as a “good” as well as a “bad” (a disutility), and modelling the demand for that good as we do for other goods. [...] The demand for travel is a function of fundamental human characteristics as well as the external variables typically measured, and those relationships need to be understood much better than we do at present” (Mokhtarian and Salomon, 2001).

We therefore propose to widen the utility concept to include four categories of “travel utilities”:

- *access to destinations*: referring to the traditional meaning of travel utility, i.e. the utility gained at the destination through the activity or activities carried out on arrival (Currie et al., 2010; Ettema et al., 2010; Kenyon, Lyons and Rafferty, 2002)
- *activities while travelling*: referring to the utility of activities such as reading or checking emails (Bergstad et al., 2011; Chatterjee et al., 2019; Páez and Whalen, 2010)
- *intrinsic to travel*: the utility derived from the activity of travelling itself (Mokhtarian and Salomon, 2001; Stanley et al., 2011)
- *motility*: meaning the capacity to become mobile, which can trigger feelings such as freedom or place attachment (De Vos et al., 2013).

## Exploring the paths linking travel utility and well-being

Changes in the aforementioned “travel utilities” impact the different dimensions of well-being, among which transport may have effects on different dimensions (Delbosc, 2012; Ettema et al., 2010; Mokhtarian, 2019). Then, we can distinguish four “well-being dimensions”:

- employment status, through accessibility to employment opportunities
- health status, mainly when accessibility by active travel is promoted, due to the health benefits of physical activity and to the indirect reduction in externalities
- socially connected, when enabling accessibility to socially relevant networks; and
- subjective well-being, which includes the positive affect associated with travel, and the instrumental factors associated to travel activities.

This broader perspective on the “utility” of transport choices allows a similarly expanded view of the impacts of improved transport accessibility on the well-being of travellers and of society as a whole. This is a relatively new field for transport planners that is attracting increasing interest, mostly in the area of commuting well-being (Bergstad et al., 2011; Chatterjee et al., 2019; De Vos et al., 2013; De Vos and Witlox, 2017; Delbosc, 2012; Ettema et al., 2011; Singleton, 2019).

Finally, another link relates to the effects of transport projects on other sectors, producing wider social, economic and environmental impacts (Banister, 2008; Chatterjee et al., 2019; ITF, 2017; Reardon and Abdallah, 2013), which in turn indirectly affect well-being dimensions.

## **Capturing accessibility benefits for an enhanced transport project appraisal practice**

This section introduces three different issues that should be addressed as promising paths for assessing accessibility benefits and the subsequent enhancement of transport project appraisal methodologies.

### **Accessibility indicators accounting for personal subjective factors: perceived accessibility**

“Objective” accessibility indicators largely rely on the evaluation of quantifiable variables such as travel time or distance, so user benefits are calculated on the basis of these accessibility improvements. However, this objectively-measured accessibility may differ from people’s (subjective) perceptions and experiences, which might be crucial for understanding and forecasting travel behaviour (Curl, Nelson and Anable, 2015; Lättman, Olsson and Friman, 2018).

Another line of research into the assessment of user accessibility benefits complements our “objective” accessibility measurements by asking users about their subjective perception of their accessibility levels. This rationale underlies some recent interesting research on accessibility measures, which calls for traditional objective accessibility measures to be combined with “subjective approaches” to measuring accessibility. This is the case of the development of the concept of “perceived accessibility”, understood as “how easy it is to live a satisfactory life with the help of the transport system. This definition includes, but is not limited to, accessibility while using the transport system per se, ease of getting to the transport system, and the perceived possibilities and ease to live the life one wants (e.g. ability to reach activities of choice) with the help of the transport system” (Lättman, Friman and Olsson, 2016).

Researchers and planners have found it difficult to include and capture perceived accessibility in transport-related research, partly due to practical measurement issues, such as a lack of meaningful practical measures of perceived accessibility (Lucas, van Wee and Maat, 2016; van Wee, 2016). This points to the need for further research incorporating this complementary but essential dimension (Schwanen et al., 2015; Shay et al., 2016).

Another relevant issue when defining user benefits of accessibility improvements is the need to differentiate population segments. Obviously, not everybody is equally affected by accessibility improvements, so some people “will not be responsive to changes in accessibility” (Salomon and Mokhtarian, 1998). Hence, there are research issues to be addressed, such as the consideration of “mobility-inclined market segments”, the measurement of travel affinity or the desire for mobility, and the detection of “immune” population sectors that will not respond as forecasted by utility maximising models.

The role of unobserved subjective factors (such as attitudes and personality traits) should therefore be included on the research agenda on individual accessibility indicators.

## Assessing the benefits of active accessibility

The increasingly sedentary nature of modern society has profound implications for health, and daily travel is a potential source of additional physical activity. Projects improving accessibility for walking or cycling modes – i.e. “active travel” – therefore have health benefits (de Nazelle et al., 2011; Mansfield and Gibson, 2016) that are rarely considered.

The recent development of “health impact assessment” (HIA) frameworks (Mansfield and Gibson, 2016) could have synergetic effects for transport appraisal methodologies, although this integration still requires more time and research efforts. The development of accessibility formulations that take into account the promotion of active travel could be of great help in this task of integration. One example of a contribution on this issue is the evaluation of “active accessibility” (Vale, Saraiva and Pereira, 2015), which has been defined as “the ability of an individual to reach relevant activities by active travel alone. It can be either a place-based or an individual-based measure, and the special needs of older people, children, disabled people and other groups can be taken into consideration. It involves the analysis of walking and cycling infrastructure and the calculation of available routes” (Vale, Saraiva and Pereira, 2015).

In a global context in which cities are increasingly implementing car restriction measures, the health benefits of reduced car use should also be considered. These include not only emission reductions, but also the indirect benefits of transforming parking space and car lanes into green spaces and cycling/pedestrian/public transport networks, which in turn may increase active travel and social interaction in these public spaces (Nieuwenhuijsen and Khreis, 2016). However, the potential indirect negative effects should also be evaluated, such as the emergence of traffic rerouting.

Combined measures in the domains of transport and urban design policy are required to enhance pedestrian and cycling accessibility, although an empirical understanding of the efficacy of these measures is still on the research agenda. More evidence is required on how certain urban design characteristics (e.g. “new urbanist neighbourhoods” (Brown, Khattak and Rodriguez, 2008) influence travel behaviour and health-related outcomes. These studies mostly use the Body Mass Index (BMI) to measure health outcomes and compile travel information through self-reported travel (travel diaries), or using objective measures of travel (e.g. the GPS capabilities of smartphones). As an example, one contribution in this line is the framework developed by Frank et al. (2006), who devised a “walkability index”, including land-use mix, street connectivity, net residential density, and retail floor area ratios. They used linear regression models and found associations between neighbourhood “walkability” and a set of health-related indicators, namely per capita time spent on physically active travel, BMI, vehicle-miles travelled (VMT) and emissions of different pollutants.

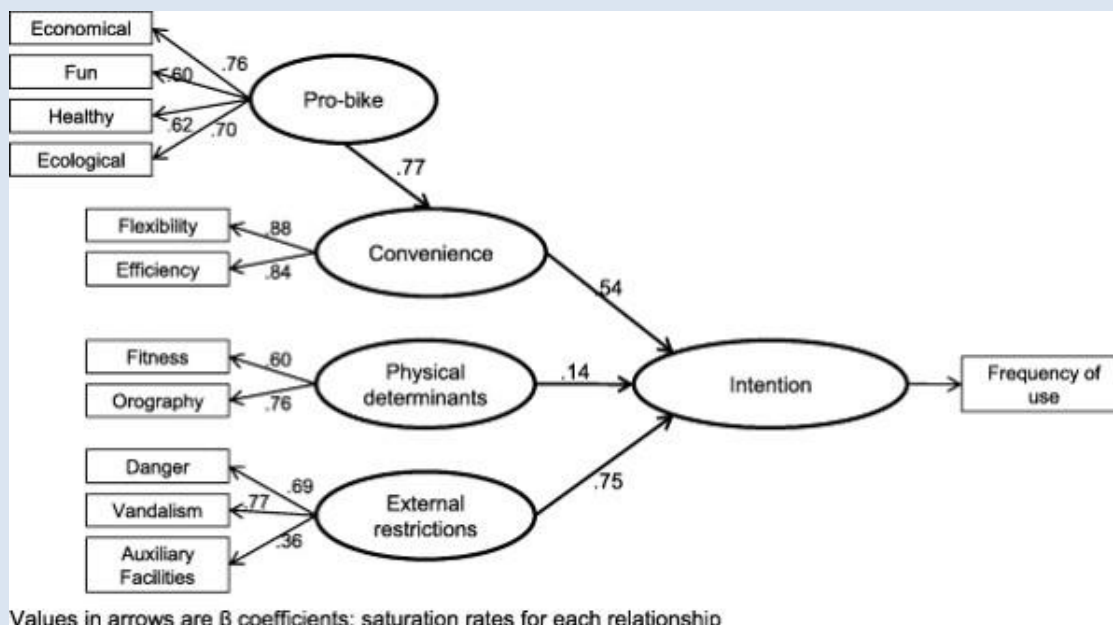
### Box 4. Explanatory factors and latent variables for bicycle use intention

The role of physical and psycho-social factors influencing cyclists’ perceptions was analysed in Madrid, Spain (Fernández-Heredia, Monzón and Jara-Díaz, 2014), detecting 14 factors related to intention, attitudes and perceptions. A SEM identified the structure and relationships among the variables. Four (latent) variables (LV) were identified, namely convenience, pro-bike, physical determinants and exogenous restrictions. The pro-bike LV captures the perception that riding a bicycle is economical, fun,



healthy and ecological. It explains 77% of the variance in LV convenience and was complemented with efficiency and flexibility.

Figure 5. Use of the bicycle as a function of latent variables and their indicators



Notes: latent variables are ovals and their indicators rectangles.

Source: Fernández-Heredia, Monzón and Jara-Díaz (2014).

## Transport accessibility as a provider of connectedness

Another key issue in accessibility evaluation is the provision of “accessibility for all”, as an explicit goal of the European Commission (2015), focused on people with disabilities and the elderly. This concerns vulnerable groups who suffer from mobility-related social exclusion (Kenyon, Rafferty and Lyons, 2003; van Wee and Geurs, 2011), defined 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 opportunities, services and social networks, due in whole or in part to insufficient mobility in a society and environment built around the assumption of high mobility” (Kenyon, Lyons and Rafferty, 2002).

The importance of providing accessibility for different groups of individuals is not exclusively related to ensuring accessibility as an individual “right”, but also as a matter of well-being. Some population groups are more potentially vulnerable to accessibility-related social exclusion, including people with disabilities and low-income populations, or people who rely on others for transport.

In these cases, deficiencies in accessibility can lead to social exclusion and poor social network support: “What seems important in contemporary life are overlapping and intersecting social networks – in leisure, friendship, family life as in work and organisations. And these networks appear to demand intermittent travel, such travel being crucial to forming and sustaining such networks produced through ‘moments of copresence’” (Cass, Shove and Urry, 2005).

For some local-scale projects, accessibility changes may affect social interaction patterns among members of the community. These social interactions include participation in community social activities, or human exchanges in the street, which may bring a sense of closeness among members of the community – commonly termed “community cohesion” or “neighbourhood cohesion”. For example, projects promoting walkable, mixed-use neighbourhoods have a positive impact on social connections (Leyden, 2003).

There is evidence that the quality of these social networks has an impact on health: people with strong social support networks are less likely to die from all causes (Boniface et al., 2015). Poor network interaction and support have been shown to have negative effects on health (Boniface et al., 2015; Currie et al., 2010; Delbosc and Currie, 2011; Stanley et al., 2011). It is argued that the promotion of “meetingness” (and the minimisation of “missingness”) should be included as one of the objectives of local transport initiatives (Cass, Shove and Urry, 2003: 54). Indeed, as reviewed above, the perceived quality of “social connections” is one of the indicators used in defining well-being (Durand, 2015) and perceived quality of life (Musselwhite and Haddad, 2010).

According to a recent work (Stanley et al., 2011), the monetary value of additional trips is four times higher than the value derived from conventional transport demand models, if the risk of social exclusion is considered. From this rationale, some researchers claim that transport policy should focus on reducing trip length – and not the number of trips – due to the high “value” of trips in enabling activities and subsequently reducing the risk of social exclusion.

Further research is therefore needed to compile more empirical evidence on the relationship between accessibility, connectedness and well-being. Accessibility benefits derived from the possibility of enhanced social relations is gradually receiving attention from researchers. From this standpoint, accessibility has an added value as a provider of “connectedness”, following the aforementioned idea that travel has its own intrinsic utility (Bergstad et al., 2011; De Vos et al., 2013; Mokhtarian and Salomon, 2001). Each travel behaviour differentially enables exposure to other people and the environment, and this exposure affects the sense of “being connected to places, communities and societies” (te Brömmelstroet et al., 2017).

## Conclusion

There is no comprehensive and consistent classification of the dimensions of accessibility benefits; nor is there any agreed procedure for including them in user benefit categories in appraisal methodologies. Conventional calculations of user benefit categories mainly include the benefits derived from instrumental factors such as travel time savings/costs or safety, which can be easily monetised. Under these assumptions, travel time constitutes a disutility, thus negating the “positive utility” of travel itself (Mokhtarian and Salomon, 2001; Ory and Mokhtarian, 2005) and of motility, or the possibility of travelling (De Vos et al., 2013). This “negative” assumption of travel time utility leads to a narrow conception of accessibility benefits, which in turn overlooks important benefit categories in appraisal methodologies (Ferreira, Beukers and te Brömmelstroet, 2012).

Complementary approaches to the study of accessibility benefits are therefore required. One such approach is the study of accessibility from the constituent dimensions of access, namely economic, physical, organisational and temporal (Cass, Shove and Urry, 2005). This categorisation identifies barriers

to access and the accessibility benefits deriving from a reduction in the risks of mobility-related social exclusion (Cass, Shove and Urry, 2005; Stanley et al., 2011; van Wee and Geurs, 2011).

Another research challenge is to empirically test the paths linking changes in accessibility with various dimensions of well-being. As reviewed in the paper, some of these paths are easier to investigate, such as the expected benefits of increased accessibility to jobs in terms of improving people's employment status. Other paths are more difficult to evaluate, such as the increased sense of connectedness with the community derived from greater access to walking in the neighbourhood. This justifies the need for further investigation into the role of transport accessibility in our daily lives and the impact of our satisfaction with our current accessibility level on our SWB.

The conceptual model proposed in this paper seeks to contribute to this research gap with our view on the potential paths linking transport projects and accessibility with the multidimensional SWB construct. These links include the "instrumental" utilities of accessibility, in addition to utilities related to the participation and interaction necessary for basic daily activities such as work, education and social connections that bring a sense of freedom, autonomy and competence, which are enablers of psychological well-being.

Recent developments in behavioural and transport economics suggest that indicators of travel satisfaction/happiness should be incorporated into travel choice models (Duarte et al., 2010). A further task would be to integrate these well-being impacts into transport appraisal methodologies. We agree that there is justification for utility theories to be complemented with SWB measures in accessibility formulations and in subsequent appraisal methodologies (Bergstad et al., 2011; Ettema et al., 2010; Mokhtarian, 2019; Reardon and Abdallah, 2013), in which accessibility rather than mobility should play a key role (Ferreira, Beukers and te Brommelstroet, 2012).

However, significant research efforts are still required to define these important dimensions of accessibility benefits. The complexity of this challenge requires holistic and multidisciplinary research, involving fields such as transport science, behavioural economics, land-use planning, health studies and sociology. Certainly the trail blazed by the recent aforementioned promising studies that address these issues will benefit transport planning decisions, thereby improving accessibility and achieving a more sustainable and inclusive transport system. Accessibility, through this path, can exert an influence that will ultimately enhance people's well-being.

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## Dimensions of Accessibility Benefits

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This paper addresses the problem of involuntary social exclusion resulting from mobility constraints by proposing a conceptual model for the interaction between transport and wellbeing. Providing accessibility for all yields widely shared benefits that are largely overlooked by traditional appraisal methods. While some see the ultimate aim of transport policy as increasing wellbeing, an agreed model of how these two interact does not currently exist.

All resources from the Roundtable on Accessibility and Transport Appraisal are available at:  
[www.itf-oecd.org/accessibility-and-transport-appraisal-roundtable](http://www.itf-oecd.org/accessibility-and-transport-appraisal-roundtable)