

Defining transport disadvantage in Perth: early findings

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Abstract

The provision of transport services and infrastructure to access employment, education, medical/health services, shopping and social activities is integral to enabling members of the community to meet their economic, social, cultural and health needs. Access to a wide range of opportunities contributes to economic growth and promotes better wellbeing. Transport is an essential service to connect people to opportunities, enhancing social connectivity and addressing social exclusion. Transport disadvantage is a complex multidimensional concept relating to lack of access.

This bridged paper aims to present preliminary findings of the project entitled “Identifying opportunities to address transport disadvantage in Perth” which aims to identify and apply locally relevant indicators to estimate the extent, spatial distribution and nature of transport disadvantage in Greater Perth. It will present the research approach, key findings of the literature review and preliminary findings of the spatial analysis (to date).

1. Introduction

Transport is essential in everyone’s everyday life, providing opportunities for economic, social, cultural and healthy life by facilitating the movement of people and goods. Transport disadvantage (TD) is a type of disadvantage associated with transport systems. TD can cause social exclusion which then leads to poor wellbeing outcomes and social disadvantage as a result. Addressing TD contributes to enhancing prosperity, improving liveability, safety and health, and achieving governments’ objectives and community goals.

A problem needs to be well defined and identified to select a solution that is effective and provides the most benefits. Although gaps in public transport (PT) services and provision of wheelchair access are well studied and understood in Perth, a more holistic view of TD that considers all kinds of people, multimodal journeys and systems thinking is needed.

This abridged paper aims to present preliminary findings of the project entitled “*Identifying opportunities to address transport disadvantage in Perth*” (the Project) which aims to identify and apply locally relevant indicators to estimate the extent, spatial distribution and nature of transport disadvantage in Perth. It will present the research approach, key findings of the literature review and preliminary findings of the spatial analysis (to date).

2. Approach

The Project adopted a three-staged approach to incorporate progressive findings to inform subsequent stages which is illustrated in Figure 1.

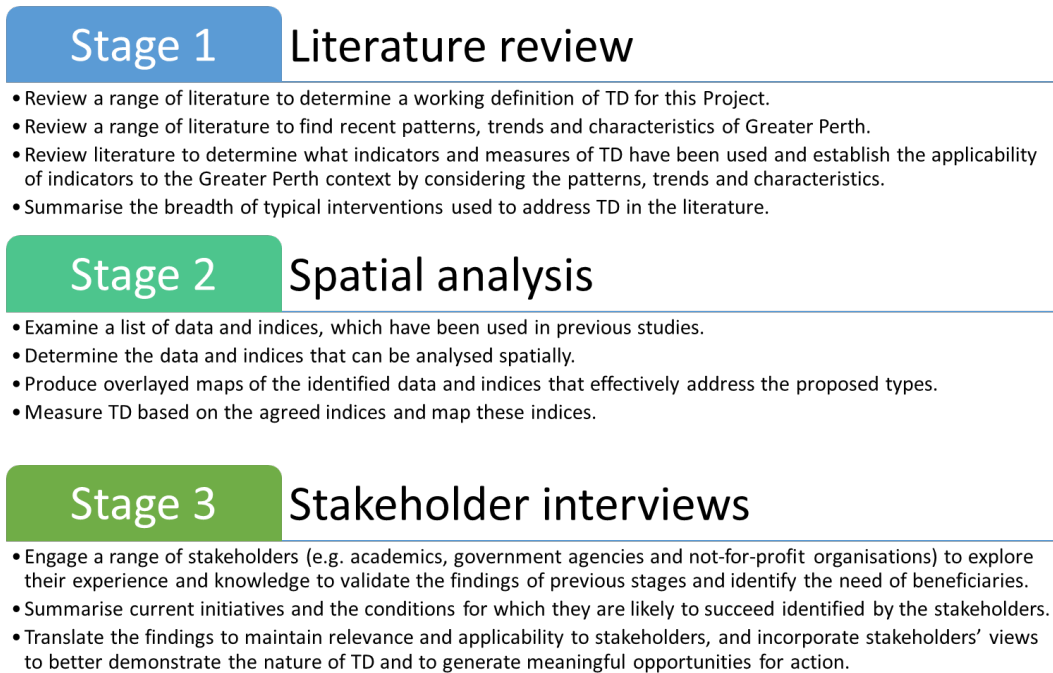


Figure 1 Research approach

This abridged paper presents preliminary findings for Stage 1 and Stage 2. Stage 1 includes the following outputs:

- How TD has been understood and previous knowledge on how people can experience TD (see Section 3.1 and Section 3.2);
- The population groups that have previously been found to be experiencing TD (see Section 3.3); and
- The indicators that are generally used elsewhere to evaluate TD (see Section 3.4, Section 3.5 and Section 3.6).

The approach for Stage 2 is illustrated in Figure 2. The findings of Stage 1 informed the persona development and evaluation framework development. This ensures that the previous knowledge of TD is considered in the Stage 2 process.

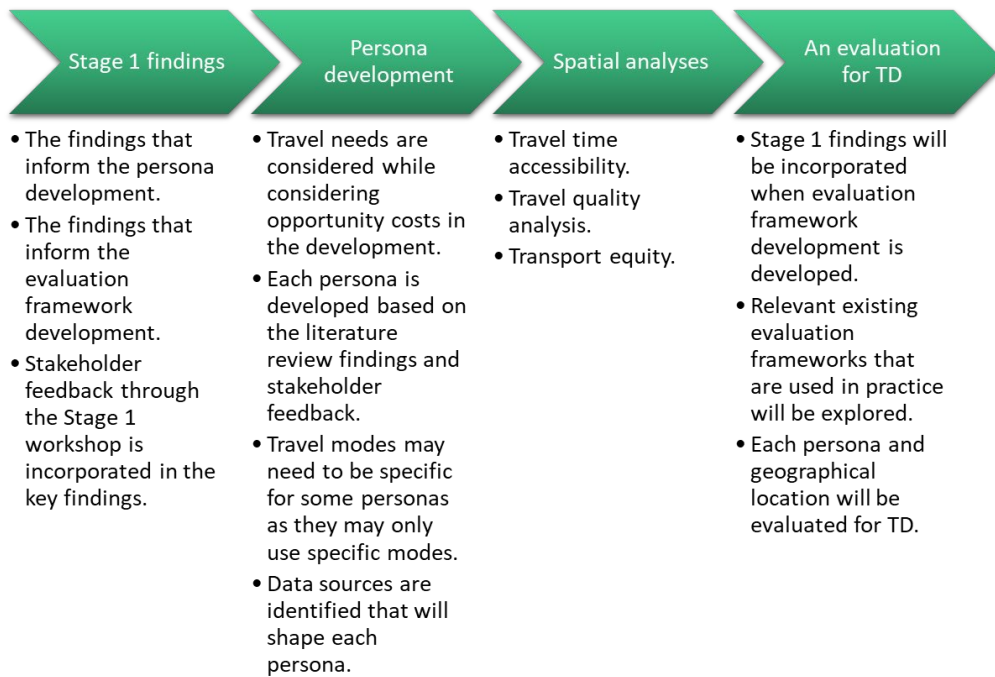


Figure 2 Stage 2 approach

Stage 2 first develops a variety of personas for spatial analysis. The personas may include population groups such as people with disability and the elderly. Each persona will inform which and how data sources need to be analysed and whether a specific mode needs to be considered. In the meantime, an evaluation framework is developed. Relevant existing evaluation frameworks will be considered in the development. The personas will also inform the evaluation framework to ensure that it will sufficiently consider the different characteristics of each persona. Once all personas are analysed (through travel time accessibility analysis, travel quality analysis and transport equity analysis) and evaluated, those population groups who are most likely to experience TD will be identified. Through the spatial analysis, geographical locations where the most TD exists will also be identified. The evaluation results will reveal common geographical features and social, health and economic characteristics of the identified groups and locations.

3. How transport disadvantage (TD) is understood

3.1 How TD has previously been defined

TD has been defined in a number of studies in the past. However, scholars have defined TD differently. There is some level of consensus that TD is caused by lacking access. While some define TD as lacking access to various opportunities, others define TD as lacking access to transport. Also, while some understand access as an indicator comprising a variety of factors not limited to travel time such as frequency of PT services, time of day and safety, others simply understand access as travel time. Notable past definitions are summarised as follows. These are noted as they provide a clear definition that describes TD specifically. Other studies presumed what TD is without specifically providing its definition.

[TD is defined as] the [un]availability of transport infrastructure and services that enable spatial and temporal autonomy under conditions of affordability, convenience and independence (Oviedo & Sabogal, 2020a).

[TD is defined] as a relational and dynamic outcome of a lack of access to basic resources, activities and opportunities for interaction, of a lack of cognitive knowledge, know-how, aspirations and/or autonomy regarding travel and its externalities, and of a lack of influence on decision-making in the context of transport policy and governance. TD can be both absolute and relative, and it occurs at both individual and collective levels. (Schwanen et al., 2015)

[TD is defined as] travel choice is removed as a result of an urban environment built around the notion of high mobility in order to access goods, services and participate in society. These conditions are often reinforced by poverty and a low quality of public transport services in neighbourhoods with low car ownership. (Bocarejo & Oviedo, 2012)

3.2 Social exclusion as a result of TD

There is a large body of literature that considers TD in the context of social exclusion. Social exclusion can result in the absence of transport, thereby making it difficult to access essential services (Bocarejo & Oviedo, 2012; Stanley et al., 2011). The neighbourhoods with higher densities, a variety of land use, convenient access to amenities and services, and a walkable infrastructure reduce social exclusion and TD (Ma et al., 2018b).

Interestingly, while low-income households do not always benefit or receive fewer benefits compared to other population groups from transport infrastructure projects (Benevenuto & Caulfield, 2022), the potential effectiveness of TD interventions that will address social exclusion is not diminished by social disadvantage (Stanley et al., 2021). Additionally, Stanley et al. (2021) attempted to estimate the value of additional trips made by those who have had TD and been exposed to social exclusion. They argued that the value increases as the level of exclusion risk rises for the persons making the additional trips. This indicates that the potential benefits of TD interventions can be maximised when they effectively address social exclusion.

Along with social exclusion, negative impacts on social wellbeing have also been widely discussed. Accessibility is linked to wellbeing (Oviedo & Sabogal, 2020b) and TD augments social exclusion and leads to lower physical and mental health, and wellbeing (Ma et al., 2018b). Delbosc and Currie (2011b) indicated that wellbeing was most negatively impacted when people experience both social exclusion and TD, followed by those who experience only social exclusion, those who experience only TD and those who do not experience either.

3.3 Association with specific population groups

Some specific population groups are thought to experience TD more than others. As there are some disagreements among various studies, each claim is summarised in Table 1.

Table 1 The population groups associate with TD

Author	(Delbose & Currie, 2011b)	(Hine & Kamruzzaman, 2020)	(Pyrialakou et al., 2016)
Age group	<ul style="list-style-type: none"> Between 20 and 54 years old 	<ul style="list-style-type: none"> Elderly Children 	<ul style="list-style-type: none"> Below 14 years old Above 65 years old
Financial difficulties	<ul style="list-style-type: none"> Unemployed 	<ul style="list-style-type: none"> Low-income person/household 	<ul style="list-style-type: none"> Unemployed Not in the labour force Persons below the poverty line
Caring responsibility	<ul style="list-style-type: none"> Single parents 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Single-parent family with working parent and children under 18 years old
Disability	<ul style="list-style-type: none"> Those who receive disability benefits 	<ul style="list-style-type: none"> People with disability 	<ul style="list-style-type: none"> People with disability
Vehicle ownership	<ul style="list-style-type: none"> Owning no cars 	<ul style="list-style-type: none"> Low levels of vehicle ownership 	<ul style="list-style-type: none"> Owning no cars
Other groups	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Women Those who live in public housing 	<ul style="list-style-type: none"> None

3.4 Association with travel time and accessibility

Travel time and distance are frequently studied as measures to identify TD in a number of studies. While travel time is more commonly used, travel distance can be more relevant to specific population groups. For instance, travel distance is particularly relevant to those with physical disability and/or health conditions (see Martínez et al., 2018). Travel time and distance can be examined for multiple origins and destinations via different modes, which would be particularly useful in the context of TD as it is important to examine accessibility for specific population groups to specific types of locations. For instance, a Brazilian study found that low-income individuals tend to experience longer commuting time to the CBD (Costa et al., 2021). Similarly, a South African study has also found that lower-income neighbourhoods tend to experience longer travel time (Van Heerden et al., 2022).

While the term “accessibility” is often used to indicate travel time and distance, accessibility is also an index, comprising multiple factors. There is no common agreement in terms of which set of factors needs to be considered in determining accessibility (e.g. Bocarejo & Oviedo, 2012; Lättman et al., 2016; Sharma & Patil, 2021b). Another concept that is frequently examined closely with accessibility is connectivity. Connectivity refers to the level of coordination between transit routes, service schedules, speeds, capacity and features of urban form (Welch & Mishra, 2013a).

3.5 Association with travel quality measures

Some literature studied TD by examining the indicators relating to travel quality such as walkability, road safety and exposure to high traffic volume which can result in congestion, higher crash risks and emissions. For instance, a Brisbane study that examined exposure to high traffic volume found that disadvantaged neighbourhoods had greater connectivity and transit access as well as more exposure to traffic (Rachele et al., 2017). Also, Kamruzzaman et al. (2015) examined the correlation between the level of emissions, access and social exclusion. These studies emphasise the importance of improving connectivity and access via PT and active travel to address TD due to the negative environmental impacts of cars.

Additionally, Ma et al. (2018) examined the adequate provision of street amenities and transport services, and the availability of walking infrastructure, which were found to be correlated with reduced TD. Also, Yuan and Wang (2021) have examined the relationship between freight-related crashes and the socioeconomics of neighbourhoods. They have found that both household income and percentage of the minority population are significantly correlated with the density of both freight-related crashes (in general) and freight-related serious injury and fatality crashes.

3.6 Transport equity

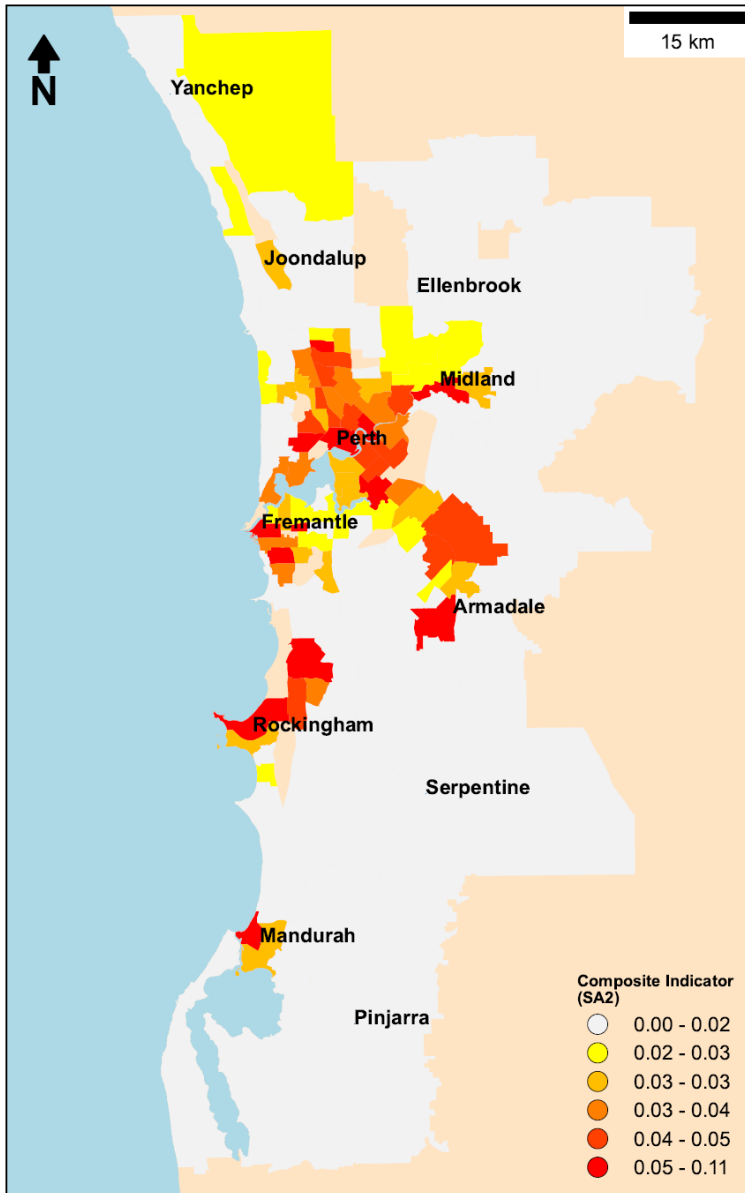
Transport equity measures such as the Gini index are also frequently studied in the context of TD. Equity is a multidisciplinary concept and can be applied in transport planning to assess the equitable distribution of benefits (Welch & Mishra, 2013a). In the context of transport equity, it relates to how transport services are distributed to people's homes and workplaces (Welch & Mishra, 2013a). Transport equity analysis can be undertaken to evaluate transport policy impacts from an equity perspective and can effectively indicate the variation of accessibility between different types of people. Litman (2022) describes the factors that can be considered as horizontal and vertical measures within transport equity analysis.

The Gini index is a commonly used index representing equity which ranges from 0 (perfectly equitable distribution) to 1.0 (inequitable distribution) (Litman, 2022b). It measures disparities that compare a population's distribution income to the equitable line using the Lorenz curve (Delbosc & Currie, 2011c). For instance, it is used to assess transport infrastructure and system provision inequalities (see Dixit et al., 2021; Ricciardi et al., 2015).

4. Preliminary findings of the spatial analysis

Although not yet fully completed at the time of submission of this paper, some preliminary findings of the spatial analysis have been made and are included in this draft. Initial personas have been developed and overlay maps have been created, which combine relevant measures of TD for these groups into single composite indicators.

Figure 3 illustrates the vehicle ownership for each Statistical Area, Level 2 (SA2) from the 2016 Australian Statistical Geography Standard within Greater Perth. It has combined the measures of the proportion of zero-car households with the proportion of households with eight or more household members, using data acquired from the Australian Bureau of Statistics.

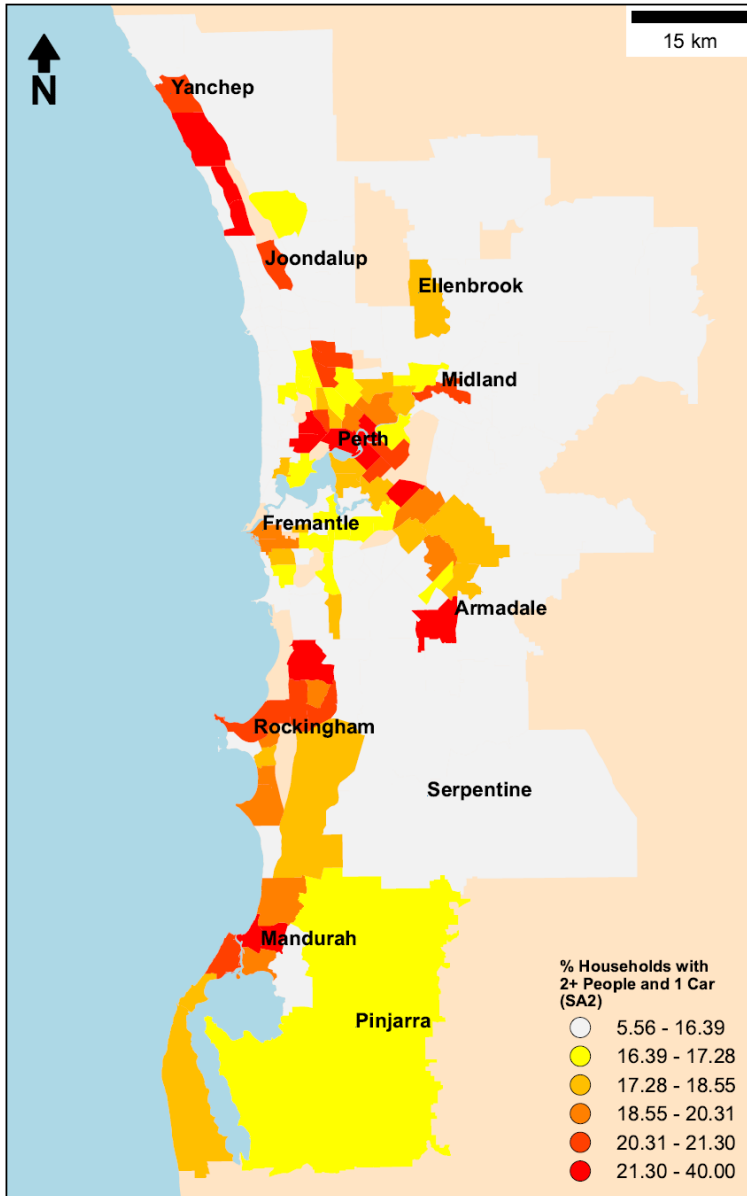


Data Source: Advised separately for brevity.
Geography Source: ABS ASGS (Vol 1 & 3)
Map prepared by Planning and Transport Research Centre (PATREC)

Note: Composed of % Zero Car Households, %
Households with 8+ People.

Figure 3 Vehicular ownership by SA2

Figure 4 illustrates the percentage of households in each SA2 that contain multiple persons but only a single car, excluding those where there is a zero-percentage.



Data Source: Derived from ABS Census of Population and Housing (2016)
 Geography Source: ABS ASGS (Vol 1 & 3)
 Map prepared by Planning and Transport Research Centre (PATREC)

Figure 4 Multiple-person households with one car – percentage of households (non-zero) by SA2

In both Figures 3 and 4, the grey colour indicates the bottom 50% of SA2’s when ranked by the measure ascending, then each class thereafter represents the next 12.5%, 12.5%, 8.33%, 8.33% and 8.33% of SA2’s respectively.

In Figure 3, it can be seen that the areas with the highest values are primarily focused around major population centres, the south-east railway line to Armadale and the areas south of Fremantle, between Rockingham and Mandurah, the far north-west and the inner-city. This may indicate in the case of the inner-city a lack of need for private vehicles due to well-established PT networks. In Figure 4, a similar pattern emerges, however there is less of an impact in the middle-distance north-western suburbs, the north-eastern suburbs near Midland and an increased impact between Rockingham and Mandurah.

Stage 2 (i.e. the spatial analysis) is expected to be completed by the end of September 2022. Hence, we expect to present further preliminary findings at the conference relating to the:

- Evaluation framework and criteria for TD assessment;
- Outcomes of evaluation for TD;
- Population groups that are likely to experience TD and the locations where TD exists; and
- Common geographical features and social, health and economic characteristics of the groups and the locations.

5. Concluding remarks

This abridged paper presented the research approach, key findings of the literature review and preliminary findings of the spatial analysis. The conference presentation will present more up-to-date findings of the spatial analysis.

The transport network is primarily radial and there may be opportunities for the transport sector to provide flexible mobility to meet gaps in the need for transport disadvantaged groups and/or locations. This may include opportunities to enhance first and last-mile connectivity to PT (e.g., demand-responsive transport (DRT), etc.). Hence, a deeper understanding of TD is required to ascertain the nature of the problem and the possible solutions to address it. This will facilitate a people-centred approach that focuses on the need of the beneficiaries (i.e., transport users, governments and communities).

Given that the comprehensive Australian TD studies undertaken by Currie and his associates were undertaken about ten years ago (Currie & Delbosc, 2011; Delbosc & Currie, 2011a, 2011b, 2011c, 2011d) and since, there have been radical changes in our life, the Project is particularly crucial in re-defining TD. For instance, the uptake of micro-mobility which may offer a cost-effective and flexible mode of travel has benefited many commuters and students, providing a last-mile solution. Also, teleconsultation and other technology-based solutions have been regularly used, particularly during the COVID-19 pandemic which provides participation opportunities without needing to travel. The presentation will shed some light on the “updated” TD.

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