

Transport Planning with a Web Planning Support System

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Abstract

The authors have guided development of a web-based planning support system (PSS) that extends and operationalises previous research models and analysis. This paper discusses how the combination of research yields new insights that are driven by the sum of the parts and how these can be applied in the field of transport planning, by letting professionals combine analysis to come to their own conclusions. Some indicative outcomes are presented as well as applicability to a wider context.

1 Introduction

As part of the Australian Government's Smart Cities and Suburbs Program, the Planning and Transport Research Centre (PATREC) recently designed and developed a web-based planning support system (PSS) to aid in land use and transport planning. While definitions of smart cities vary, one concept of them is that of using data to benefit a city (Hollands, 2008).

Hence, PATREC partnered with the City of Wanneroo, an outer municipality of Perth, to apply previous models and analysis as well as undertake new research, as a case study on sites within the municipality. These sites were chosen due to the imminent building of a heavy rail line extension through them. New insights can be gained in the fields of land use and transport planning from the use of the models and analysis.

These areas will have implications for both land use and transport planning. The PSS helps explore the endogeneity problem between these two facets of planning by providing tools which can be used in further analysis, as described below.

2 Methodology

The PSS combines seven models and analyses as follows, applied in the context of the Perth metropolitan area primarily using data sources specifically for the area:

- A. Olaru et. al.'s (2019) analysis of railway station precincts, including regression and clustering of station typologies from transit and place characteristics;

- B. Cardell-Oliver & Povey's (2018) determination of transport hubs and their primary activities through data mining of transit smartcard data;
- C. A re-oriented version of the work completed by Sun et. al. (2017) that determines the number of jobs, dwellings and population accessible via public transit or private vehicle from the hubs identified in B above;
- D. An analysis completed by Martinus & Biermann (2018) that is a categorisation of jobs into population following and non-following (strategic) jobs, as well as the creation of related metrics;
- E. A questionnaire of residents in the case study area regarding their views on emerging modes of transit and existing mode choice;
- F. Two cost-benefit analyses built upon the Australian Transport Assessment and Planning (2018) guidelines for travel behaviour change and active travel;
- G. Spatial mapping of demographic and transport trends throughout metropolitan Perth used to provide context, alongside descriptive layers in the demographic, transport, land use and environment space;

While the *Cost-Benefit Analysis* became its own stand-alone tool, the remaining six formed the *Metropolitan Analysis* tool which provided an evidence base through explaining the state of the Perth metropolitan area as it currently stands. The *Metropolitan Analysis* allows the end user to view the result of the analyses (A, B, D, E) as well as adjust the parameters of the tools (C and F).

Tools A, B and D were then used as part of the *Scenario Builder*, which attempts to model patronage, population and employment of the new stations in the City of Wanneroo based on these stations assuming characteristics of the existing stations within Perth, as well as increasing jobs in particular sectors. The end user can input these parameters – such as station characteristics and increases in employment sectors – to model the patronage, employment and population in the study area.

3 Results

The purpose of the PSS is to provide a platform that allows experienced practitioners to gain their own insights through manipulating and investigating data, alongside combining the outputs of the multiple tools. As such, the outcome of this work is not only actionable insights, but also the ability for others to create their own. This paper, however, will briefly explain some insights gained from the use of the system by the authors in the case study area of the north-west portion of the City of Wanneroo.

The PSS provides tools to help understand the land use and transport characteristics of areas within metropolitan Perth which can be used to help design the precincts of the stations on the railway extension.

The existing end of the railway line in the areas surrounding Butler and Clarkson allows the user to see how the transport and land use networks are functioning in what is a similar location. The power of the PSS is combining the constituent tools to yield new insights; in this case, the SmartRider Hubs (Methodology B) and Accessibility

(Methodology C) tools are used alongside the geographic context layer showing non-deviated bus and railway routes.

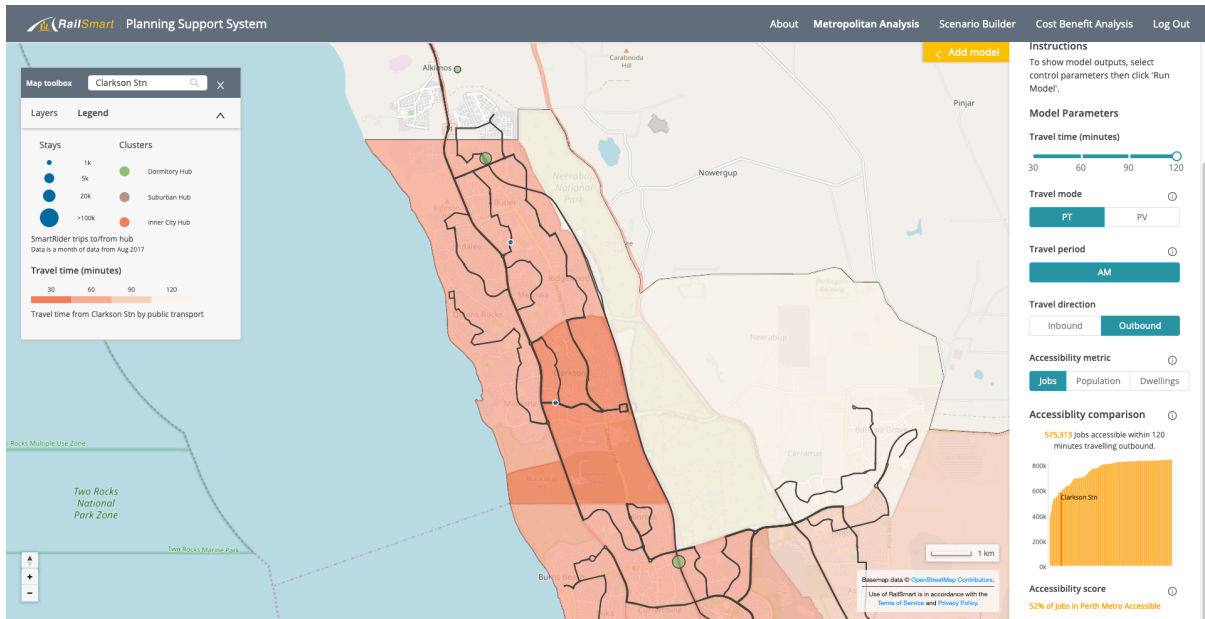


Figure 1 PSS with Accessibility and Hub Tools plus PT routes

Figure 1 above shows the output within RailSmart. The dashboard is geographically centered at approximately Clarkson station. The top of the PSS map corresponds with the southern extent of where the new railway works will be located. The legend for the accessibility tool is shown on the left, where the choropleth map colours are described for the travel zones shown in the dashboard.

It can be seen that the generally north-south directionality of the bus routes leads to a greater increase in travel time travelling east-west rather than north-south, apparent at a larger scale in Figure 2 below. Outside of the transit stations themselves, the major transit hubs that have been discovered through Methodology B in the area are located at schools and shopping centres.

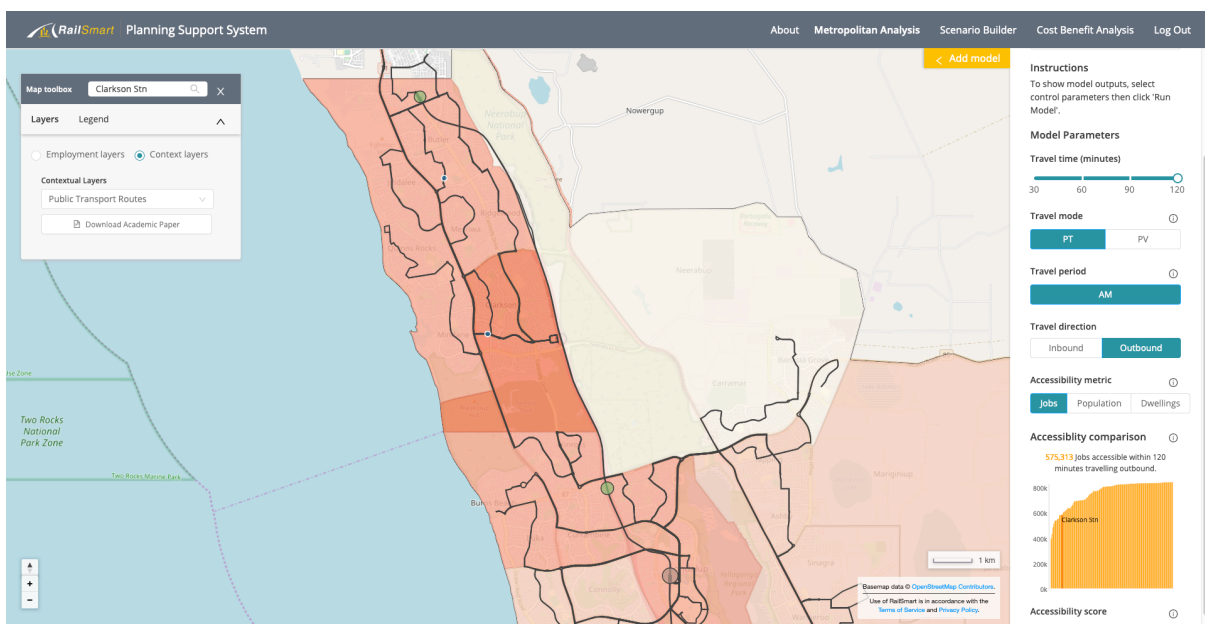


Figure 2 PSS at a further zoom with PT routes and Hubs.

These land uses find themselves close to the major north-south transport spine of Marmion Avenue. As such, accessibility between these locations is high compared to between other locations within the area. However, as evidenced by the routes, the accessibility from these places to some parts of the rest of the area is lacking – such as west towards the marina, located on the bottom left of the PSS map.

Other non-residential land uses in this area such as schools and parks are well-connected to the public transport network. Generally, there is a bus route running nearby. While some areas may only intermittently served by public transport through route deviations (such as schools), recreational and commercial areas are well served – except the marina identified above. This is appropriate for school usage that only experiences high demand when school begins and ends.

As such, the dashboard shows that retail and school land uses are popular within the area for public transport uses, however the time taken to travel short distances can be long when factoring in transfer time. The general north-south nature of the bus routes means that in some cases it may be quicker and easier to walk not insignificant distances between residences and popular land uses.

As such, to encourage use of public transport in the new development area, it is suggested to learn the lessons from this study area nearby. The PSS allows the combination of research to yield new insights such as the above.

4 Conclusion and Future Work

The creation of a PSS has combined and extended previous research to operationalise insights and apply them to a case study in outer metropolitan Perth. This is achieved through multiple evidence-based tools, which allow the user to gain new insights in the fields of transport planning and land-use planning. This is demonstrated above with the example in the north-west region of Perth.

The tool helps explore the common endogeneity problem between land-use and transport planning by providing various tools that explain the relationships between the two. While the tool does not provide the answers directly, it provides analysis which can guide practitioners towards further analysis.

While until now the PSS has only been used as a case study in Perth, most data sources used in the research behind the system are national in coverage and as such the analysis can be undertaken for other areas within Australia. The architecture of the system has been designed to maximise modularity and automation to minimise the work required to complete analysis on new areas.

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