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PTV Group

Network Rail Adopts New PTV Solution for Station Capacity Analysis

Analysis of rail station capacity is a key function of Network Rail, which owns the over 2,500 train stations across Great Britain.

While it is only responsible for the management of 20 of the biggest and busiest stations, it is the asset owner for all stations and must approve all functional changes to station design and layouts. Station capacity planning has recently become a particularly important topic, given the social distancing guidelines introduced across the public transport network. It is also expected that the successor organisation of Network Rail set out in The Williams-Shapps Plan for Rail will have a larger role in the management of stations.

Balancing Detail and Time to Support Programmes More Efficiently

Currently, there are two main options to analyse the capacity of rail stations. The first is to build a very detailed microsimulation model, which usually requires a large amount of data including passenger numbers, accurate station layouts, and calibrated parameters. These models can be expensive to build and need frequent maintenance to ensure that they remain accurate. Hence, they are only used for large stations such as the London Terminals, where there are complex interactions between passengers across multiple concourses, retail facilities, platforms and exits. The second option is spreadsheet-based analysis using simple metrics and KPIs, without detailed representation of station layout and passenger conflicts. Therefore, it may not be able to capture the level of detail required to analyse different station layouts and evaluate possible interventions to manage capacity. While these tools have served planners well in the

past, there is a large gap in detail and modelling effort between these two options.

A 'Middle Ground' Solution

The new tool aims to provide a "middle ground" between high-level analysis and microsimulation, utilising PTV Visum to store data – such as passenger movements – and run the simulation, before exporting a standard set of analyses such as passenger flows and platform densities and clearance times.

The mesoscopic approach allows for the modelling of individual passengers through a station, including interactions between passengers on walkways, stairs, platforms and concourses, without the need for extensive calibration or data collection. From the simulation, key metrics such as queue length, walking speeds and levels of service can be obtained and used to evaluate the performance of the station.

Making the Most of Standard Datasets

The tool has been developed to utilise standard datasets including timetables, passenger numbers and station layouts. These are available for stations across the network and can be simply processed to produce the inputs for the model. The station network in Visum can be created by tracing the layout using either a standard background map or a more detailed CAD layer, with only the outline of the concourses, walkways and platforms required to be drawn by the user. The speed of setting up these models means that
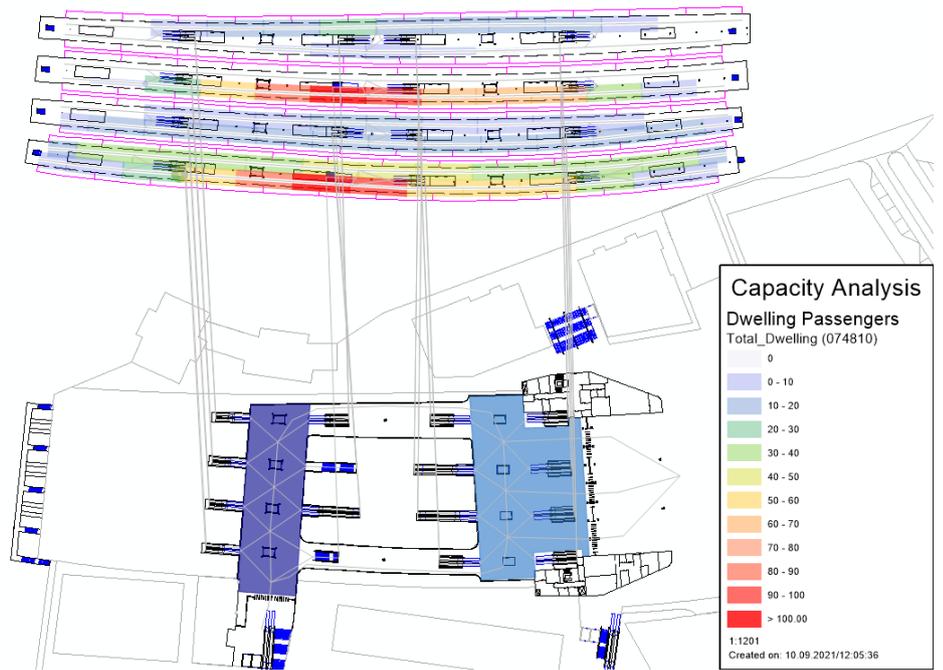
multiple scenarios and mitigations can be tested very quickly on a consistent basis.

The outputs from these models include easy-to-understand visuals such as 'moving-dot' animations showing passengers moving through the station, and graphs of passenger numbers and density, delays, and levels-of-service throughout the simulation period. This means that they can easily be shared with stakeholders, including those who may not have a technical background.

Not Just Capacity Analysis

In addition to the core use case of capacity planning, these models can also give valuable insights in relation to safety. As an example, it can be used to consider the number of passengers and potential crowding on platforms when a non-stopping service is passing through a station at high speed. This is an issue in the medium-sized stations

along busy corridors that the tool would be primarily used to analyse that may not typically have existing microsimulation models that could be used for this purpose. This can be used either at the planning stage when designing timetables as these issues can be flagged early and allow for mitigations and alterations to be put in place, or from the operational side, with more staff available to advise passengers and automated announcements to warn passengers.

A further use case is to model the entire passenger experience, particularly at a time when the rail industry is seeking to entice passengers back. This may include factors other than those traditionally measured using transport models, including the planning of retail space and facilities within the station. A better understanding of passenger movements around these aspects of the station within a fast and easily updated model platform offers unique advantages over alternative methods.

Platform Density
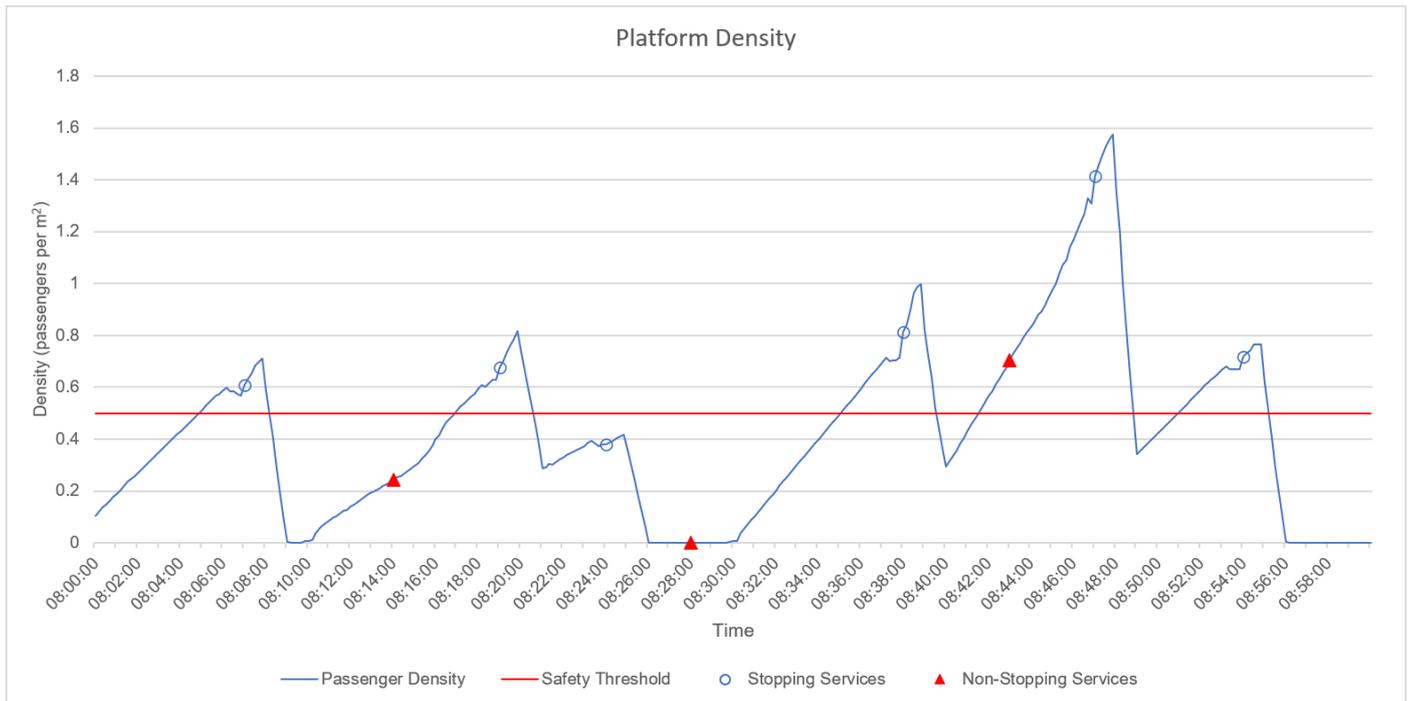
A Game-Changing Tool

This first of a kind tool offers unique insight into the planning and operation of rail stations of all sizes. It allows for detailed and comprehensive modelling of stations that may not require a full microsimulation model but cannot be fully understood with aggregate spreadsheet analysis. However, it has wider applications than capacity planning and can integrate with other core Network Rail functions such as safety analysis, retail planning and timetable development.

Looking forwards, the opportunity exists to connect these discrete station models to understand passenger experience and impacts at a corridor and/or network level. This shows a clear opportunity for the tool to be pivotal in short-term disruption planning (including understanding changes in passenger flows using the demand assignment capabilities) and long-term capacity planning for the network.

"The development of a bespoke mesoscopic station modelling tool within the Visum package has been a truly collaborative piece between PTV Group, RelativeGAP, and Network Rail. Having such a tool is a game changer for our analysis, not only allowing us to undertake advanced assessments much more quickly, but also in terms of transparency and governance, where the methodology is much more defined and controlled than previous spreadsheet modelling. The capability for Visum to interpret these models as a network or line system will be a 'first of a kind' for the UK rail network and is an exciting opportunity to better serve our passengers, such as by minimising crowding and simplifying interchanges."

Daniel Chaney, Senior Station Capacity Planner, Network Rail

PTV Visum - Your Tool Kit for Rail Planning

▶ Assess passenger experience and crowding
▶ Explore connections and accessibility
▶ Optimise the timetable for passengers
▶ Estimate and explore fare revenues
▶ Understand costs and assess recovery
▶ Assess vehicle requirements and costs
▶ Optimise allocation of vehicles to timetables
▶ Assess risk of delays on passenger experience
▶ Compare multiple scenarios

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