SUPERSPACE
Aviation simulation

A system for simulating passenger behaviours in the departure lounge of airports.

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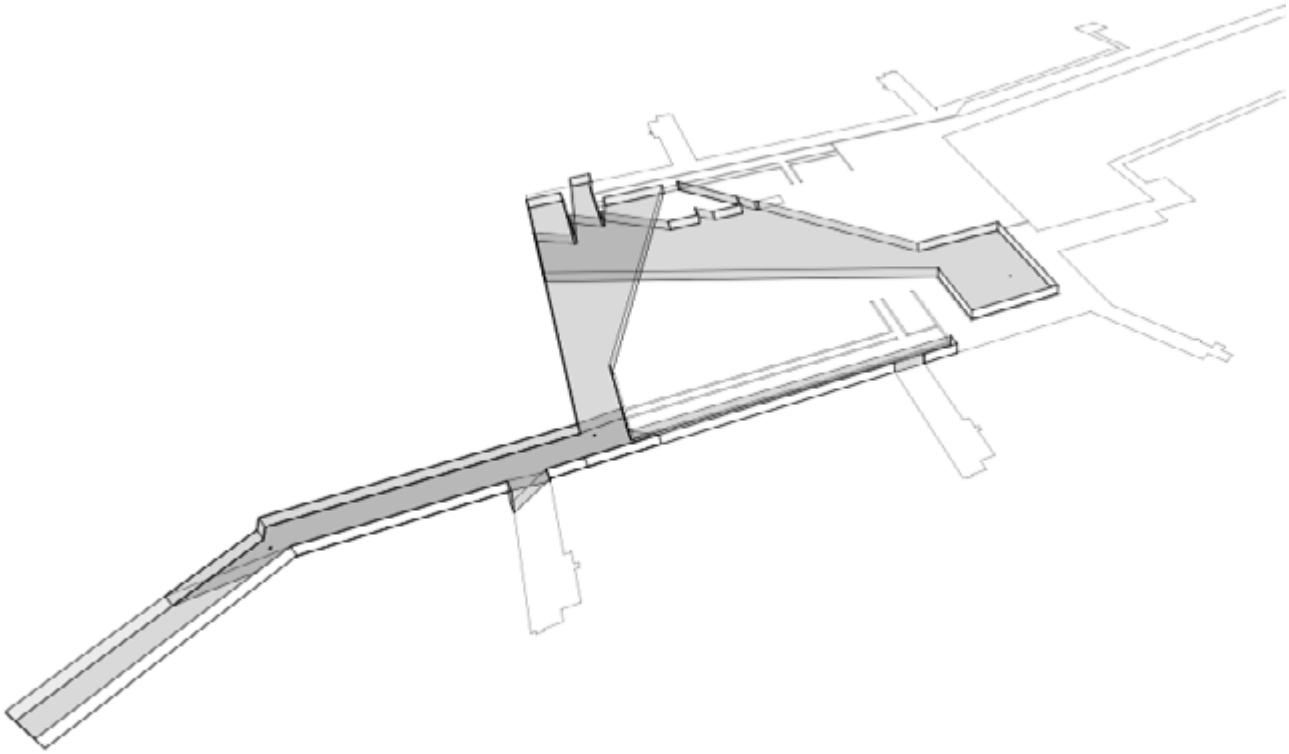

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Approach

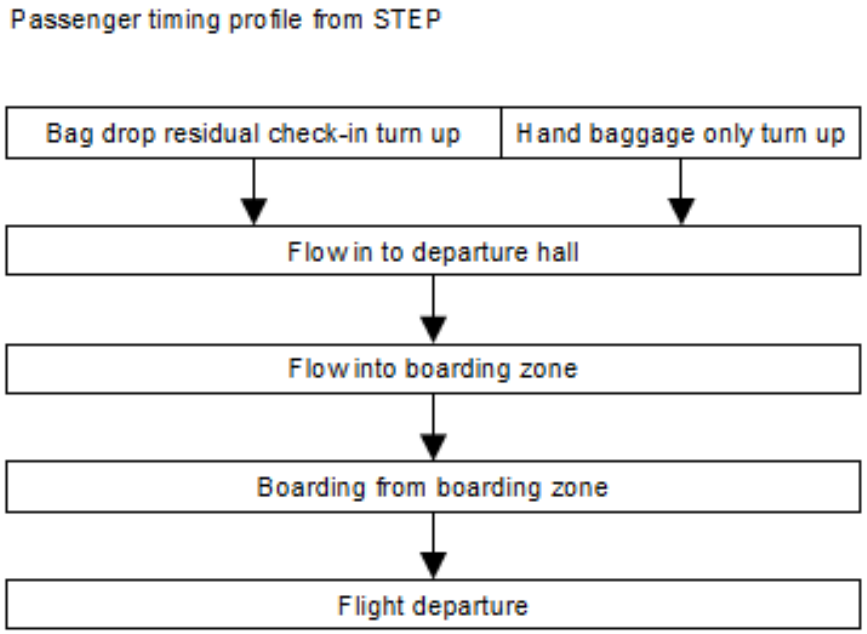
The current development looks simulating occupational patterns and behaviours in the departure lounge area of airports, in this case study it specifically looks at the Perth Airport International Expansion Project.

The system is composed of the following parts

- Timing profiles for the overall airport journey of each passenger/passenger group.
- Specifications of passenger types and their behaviours in response to the departure lounge configuration.
- A spatial representation with embedded information about conditions of visibility and distances.
- Simulation of the occupation and use of the departure lounge area, Duty Free, retail and F&B.

Timing Profiles

Generation process



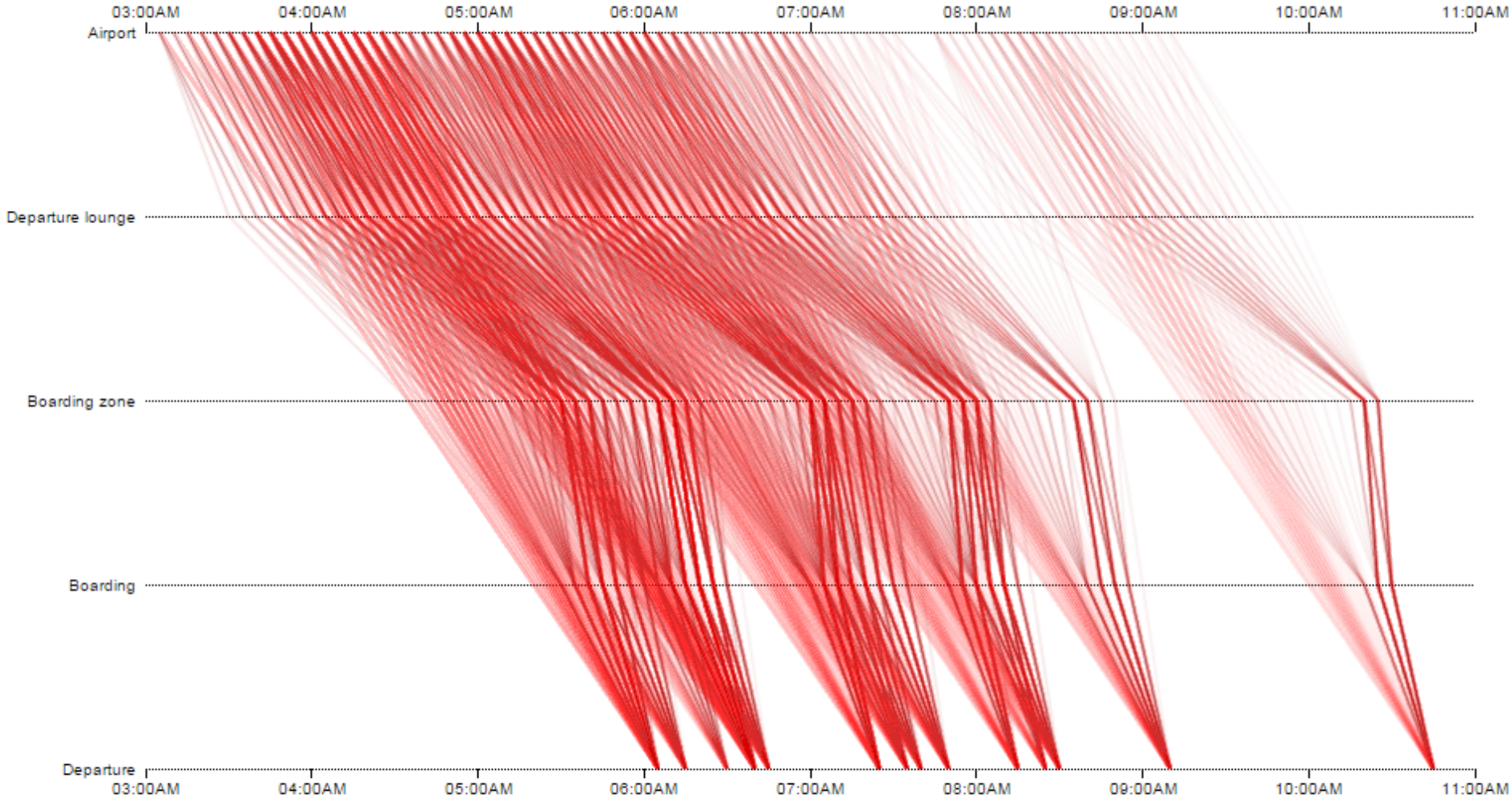
To generate timing profiles for each passenger based on the STEP model, so each passenger / group of passengers will have a time of arrival, time to arrive in departure lounge, boarding zone, boarding and flight departure which is a predefined structure of the overall timing independent of the departure lounge layout.

The current version of this model uses some simplifications, that could be amended if necessary later on, and potentially also enriched with more information.

- It's based on discrete 5 minutes intervals, and could be interpolated to a finer grain.
- The original step model makes the calculations in floats, so there might be a flow of 5.3 passengers at a certain time interval, this rounding is now done very simply without taking into account left over parts to the next interval and results in some rounding errors.
- It's based on a First in - First out principle so the first passenger to arrive to the departure lounge for example will also be the first person to go to the boarding zone.
- In this model the characteristics of the passenger type is not distinguished in the timing. There is for example no differentiation between hand baggage only and check in passengers.

Timing Profiles

Visualisation



Passenger Types

Behaviours in response to spatial conditions

Passenger
Type: Leisure traveler Flight name: 189 Dubai Timing profile Propensity to visit restaurant: 60% Propensity to visit bar: 20% Propensity tovisit airline lounge: 0%

We assign different characteristics to each passenger depending on if they are leisure traveler, business, family and so, and also do a spatial analysis which will produce measures that the passenger will interact with and make decisions according to. The result of this is to generate passenger journey in more detail according the type of traveler and their response to the specific environment.

The passenger types specifications will be user configurable in an Excel document and can be tweaked further. A set of initial valuess can be used to start with, and these can be modified when there is more data and cases available, so that we can simulate the passengers with more confidence.

Propensity to

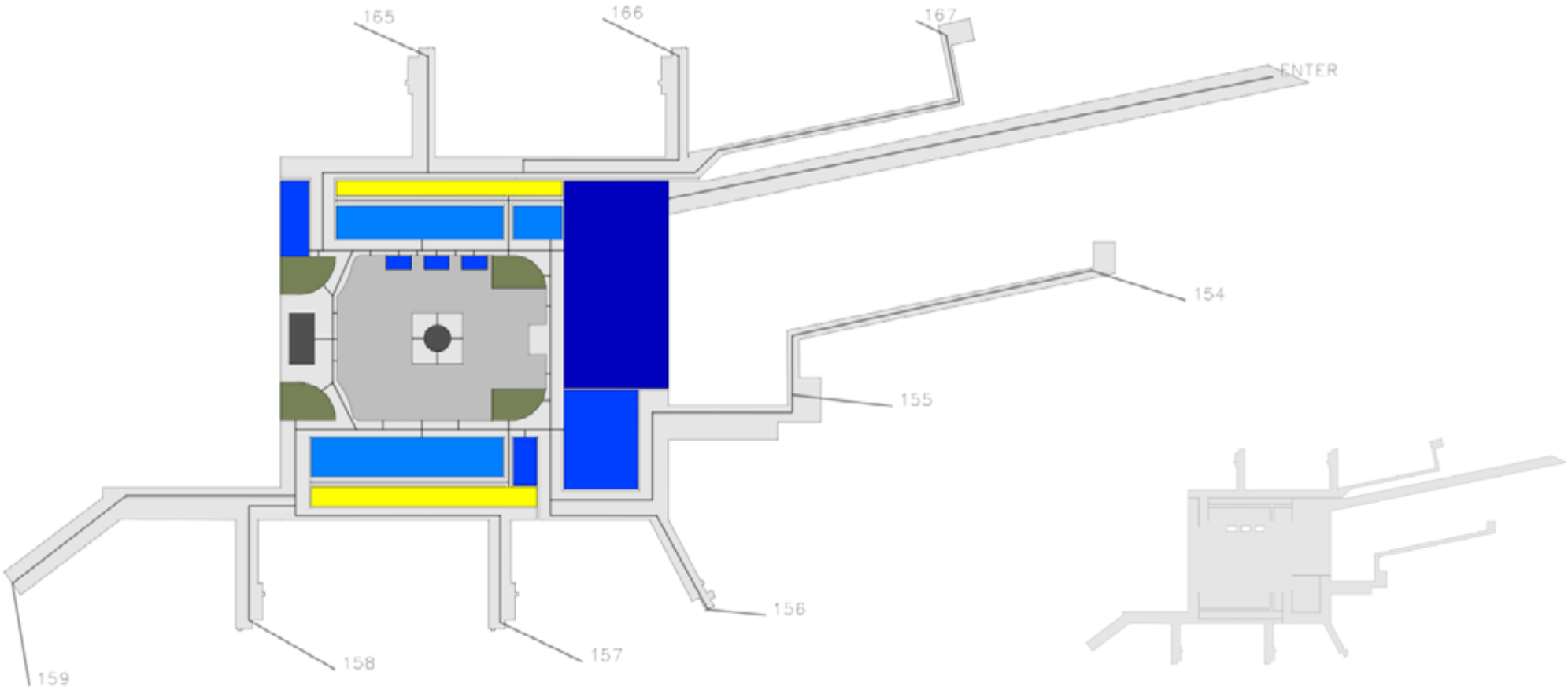
- Browse Duty Free when first walking through
- Shop in Duty Free (conversion rate)
- Revisit Duty Free if there is time and it's visible
- Etc...

Spatial Representation

Modelling the configuration

The spatial representation is based on a CAD drawing with a movement graph and the different areas, and with the visibility boundaries as a polygon.

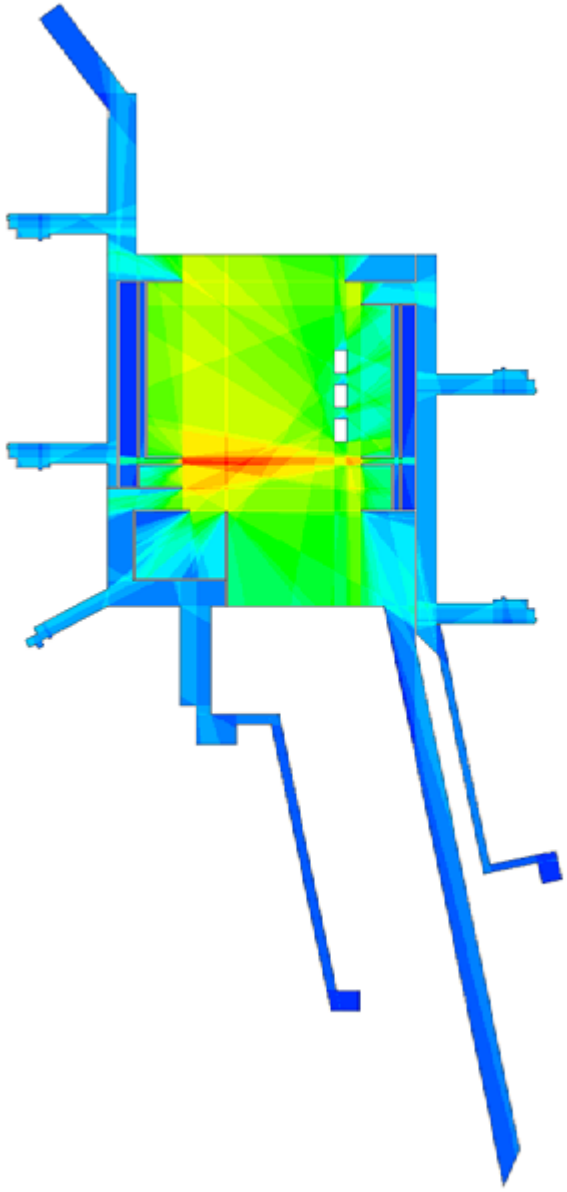
The current model is missing the airline lounge which is on another level, but this can be added in later if required.

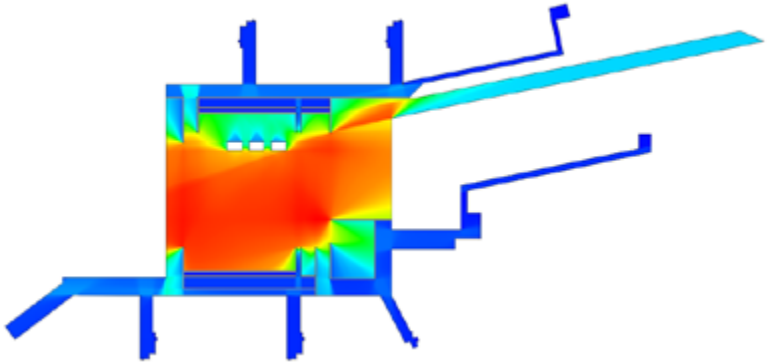


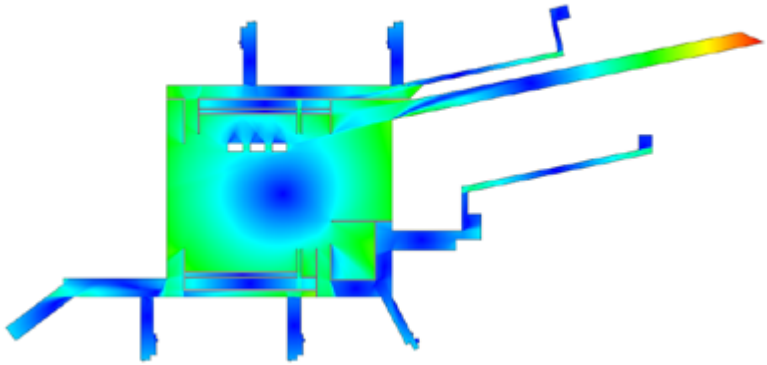
Spatial Conditions

Modelling visibility and access

The spatial conditions are analysed on the spatial representation use bespoke Superspace methods.





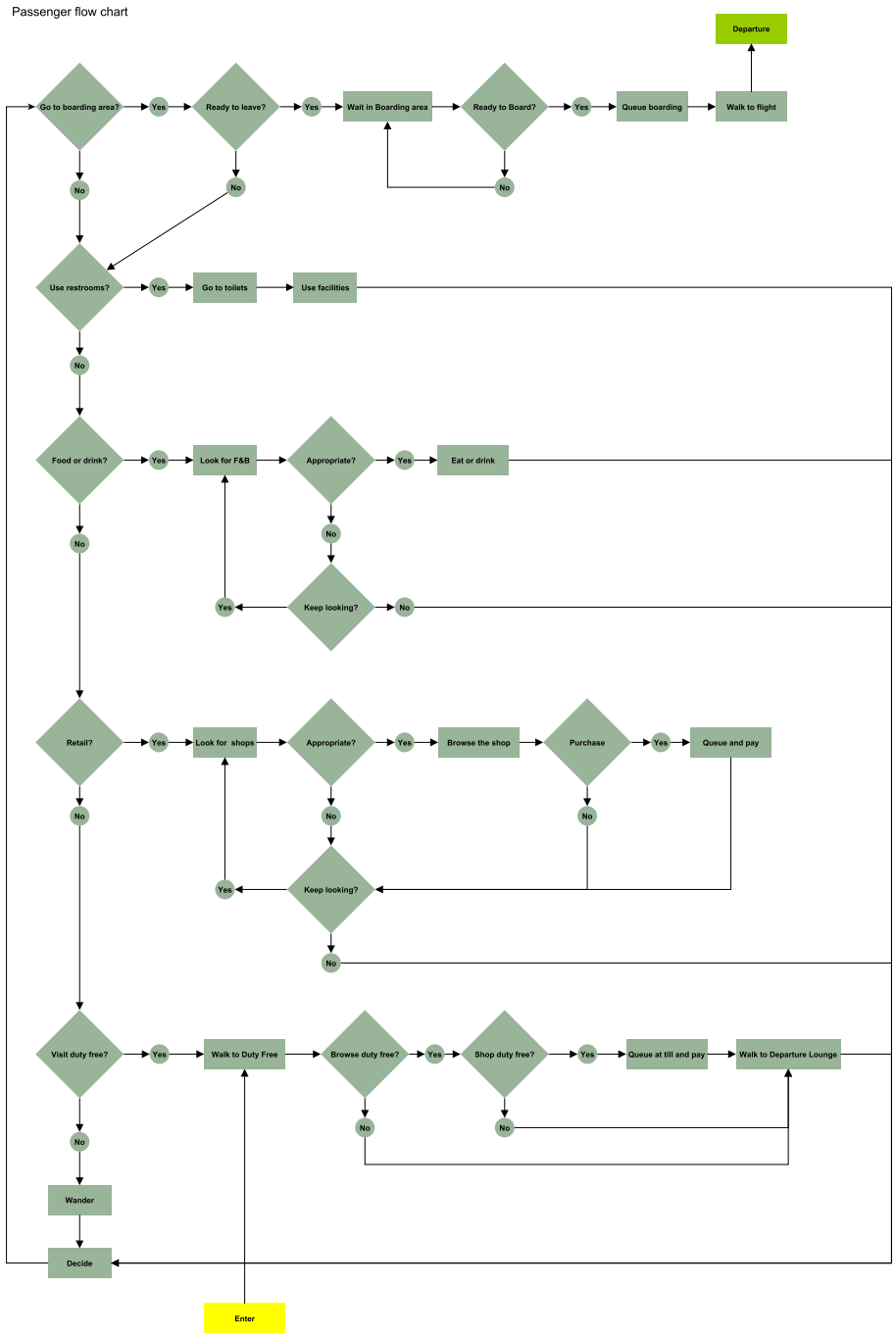


Simulation

Passenger behaviour

With the spatial repressentation and using the generated timing profiles, we can then simulate more detailed behaviours of each passenger moving through the departure lounge on the graph and to the areas. This can be done by combining definitions of passenger types combined with the spatial properties such as visibility and distances in order to make decisions.

Statistical data is needed in order to determine the duration spent on each activity, and would need to be provided for a reliable result.

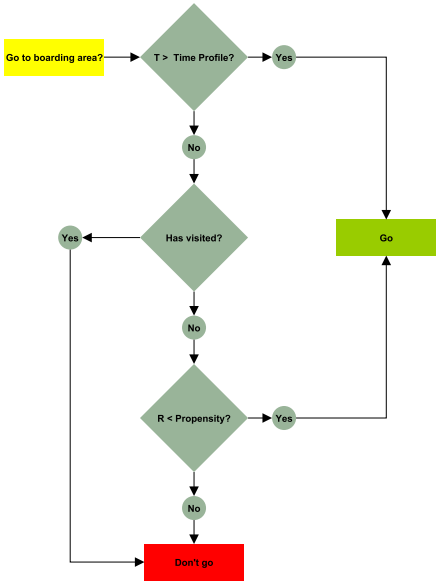


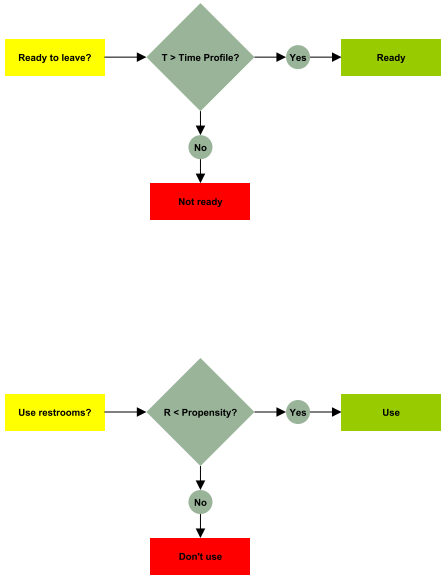
Right: Example of Passenger journey flow chart. The individual journey is determined according to passenger type, generic behaviour, and spatial conditions.

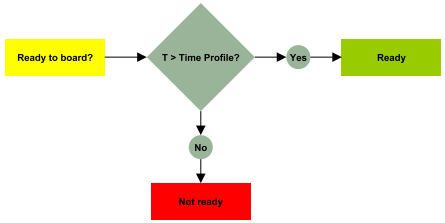
Passenger decisions

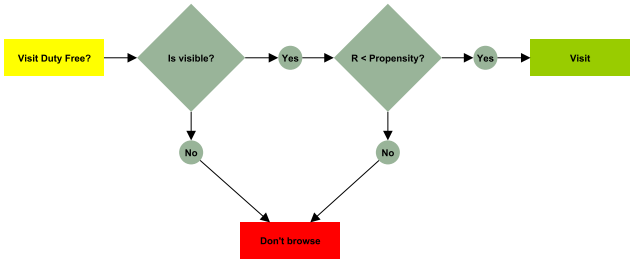
Modelling the decision process

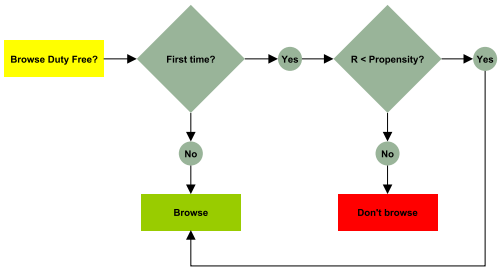
The decisions are based on timing charts, passenger types, statistical data and spatial conditions.

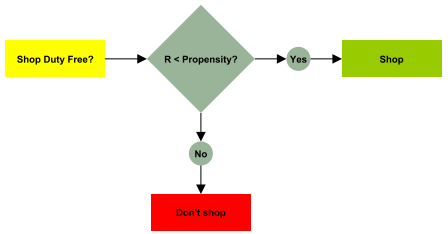








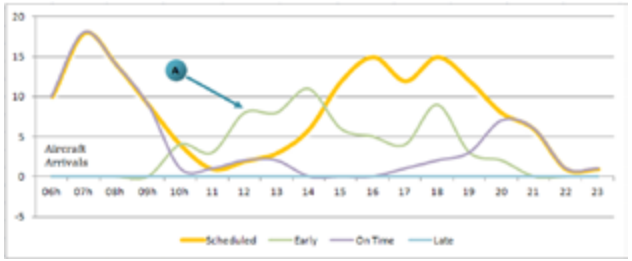


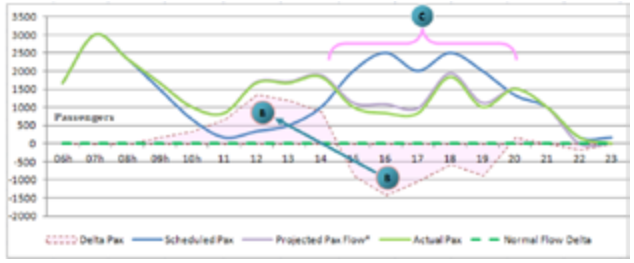


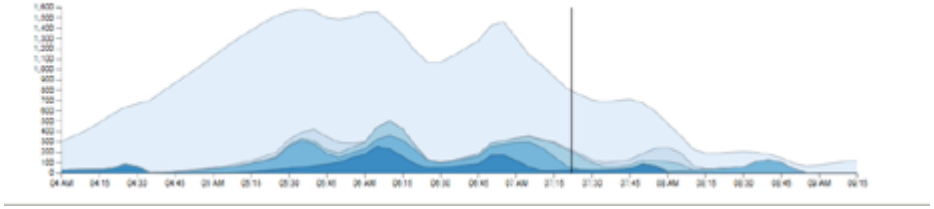
Examples of passenger decision processes

Visualisations

Visualisations and charts







The resulting aggregated behaviours and occupational patterns can then be visualised.

The occupation and density of the different areas in the departure lounge can be visualised as min, max and averages, and graphed over time. Where are bottle necks and are there queues?

How does passengers spend their time on different activities and how much distance do they cover? What are their spatial experiences in terms of visibility.

Finally we can show how the offerings of the airport are used by the passengers such as retail, duty free and f&b.

Benchmarking

Comparing performances

How can we compare the performance between different airports?

One can also benchmark different configurations and options against each other.