



ANYLOGIC CONFERENCE 2026

**Simulating Passenger Transfers at Coventry
Transport Hub: An Integrated Rail and Bus
Interchange Model**

September 2026



Introduction

Coventry Transport Hub serves as a key interchange between rail and bus services, handling significant passenger transfer volumes throughout the day.

During peak periods, passenger congestion can lead to increased transfer times, uneven utilisation of facilities, and reduced service quality.

A comprehensive simulation-based approach is required to understand passenger movement, evaluate transfer performance, and support evidence-based planning decisions.



Business Challenge

- The challenge was not only to evaluate passenger transfer performance but also to create a digital representation of the entire transport hub.
- The project needed to:
 - Integrate rail, bus and pedestrian systems into one model
 - Capture both operational and behavioural dynamics
 - Test alternative infrastructure configurations in the future
 - Provide stakeholders with an intuitive visual tool to support planning decisions
- Traditional modelling approaches would typically require multiple disconnected tools, making scenario assessment more difficult and less transparent.



AnyLogic was selected because it offers:

- End-to-end system representation:
 - Rail operations
 - Bus operations
 - Passenger movements
 - Infrastructure interactions
- **Powerful visualisation capabilities:**
 - Real-time animation
 - Congestion visualisation
 - Stakeholder-friendly outputs
- **Scenario testing capability**
 - Infrastructure changes
 - Timetable adjustments
 - Passenger demand growth
 - Operational interventions

**The reason for
using AnyLogic**

Executive Summary

▪ Request

- An integrated methodology to observe and evaluate pedestrians' movement, rail and bus operations at the same time.

▪ Approach

- A multi-method simulation model in AnyLogic combining:
 - Train timetable simulation
 - Bus operations
 - Pedestrian movement

▪ Outcome

- The model enables stakeholders to:
 - Quantify transfer performance
 - Identify passenger bottlenecks
 - Assess infrastructure changes
 - Support future station planning
 - Contingency planning, emergency scenario planning, short notice planning

MODEL ARCHITECTURE

Rail station platforms, concourse, and exits

Bus station bays and waiting areas

Pedestrian pathways and crossing zones

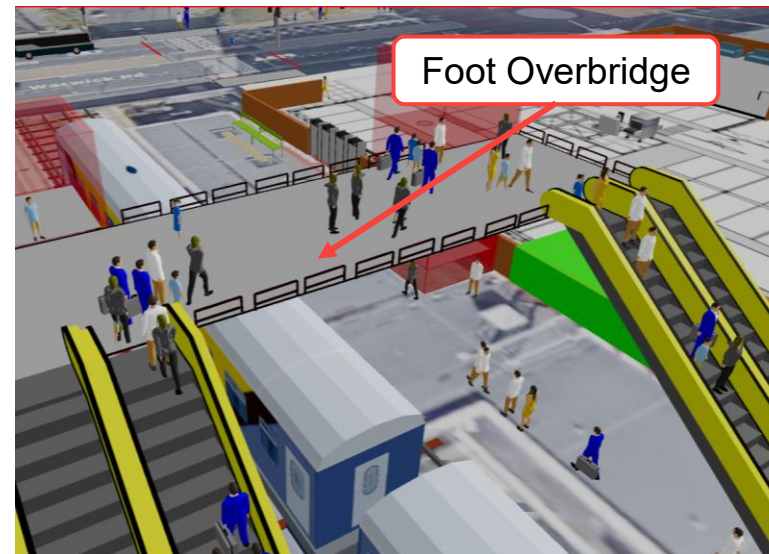
Dynamic arrival patterns for trains and buses

Passenger behaviour (walking speed, route choice,
waiting tolerance)

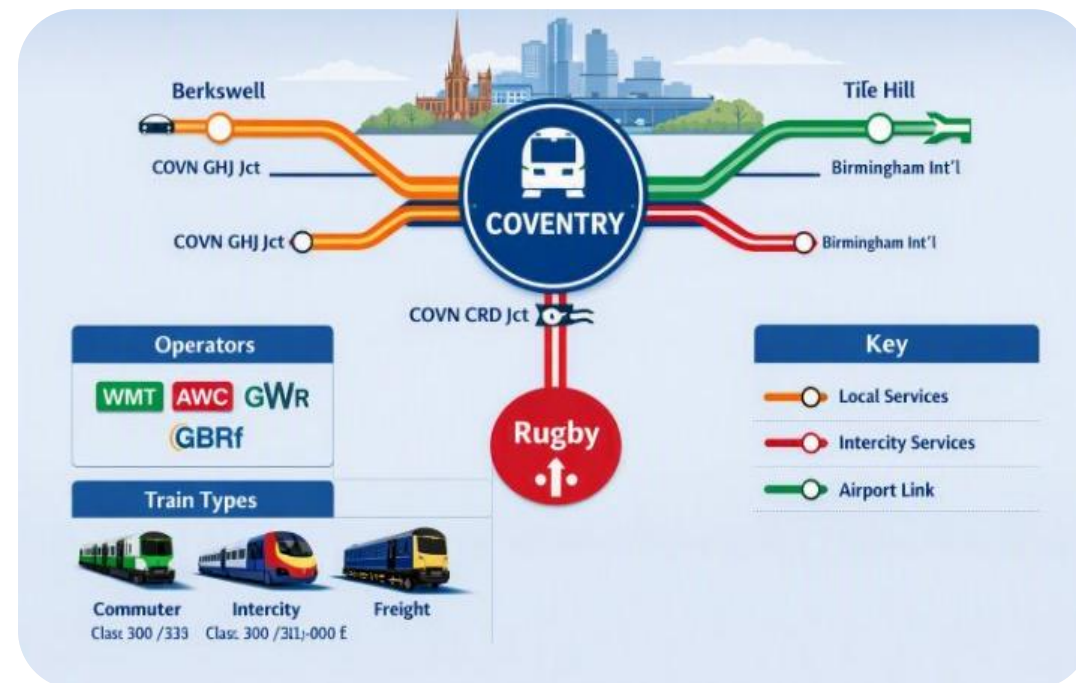
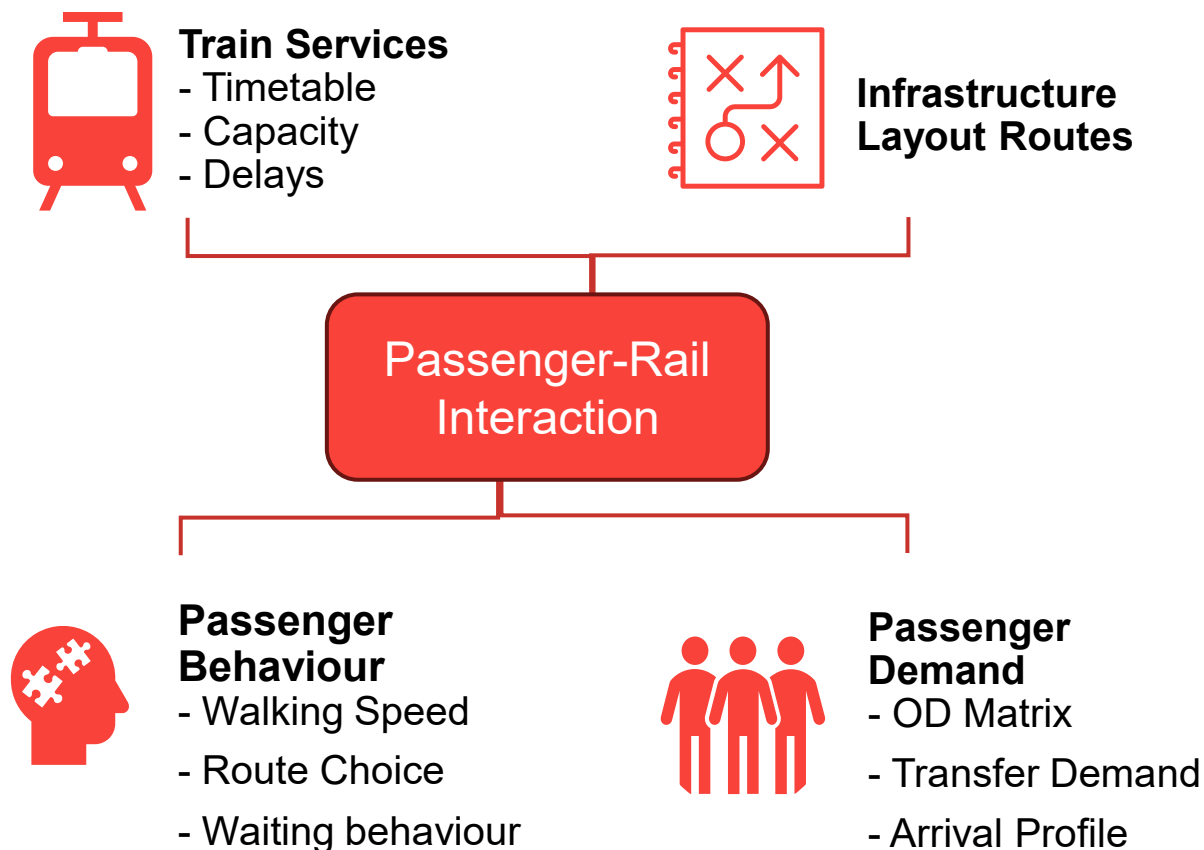
RAIL



Layout



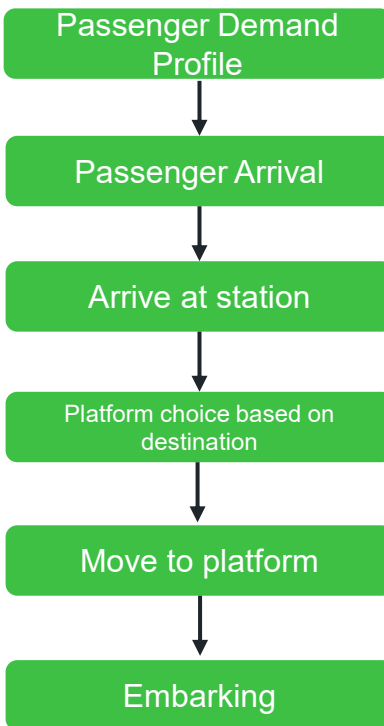
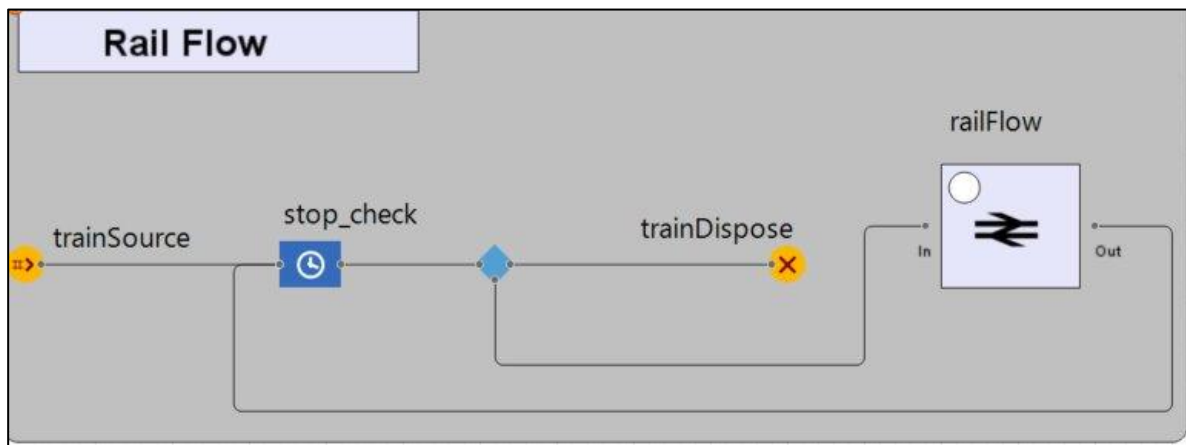
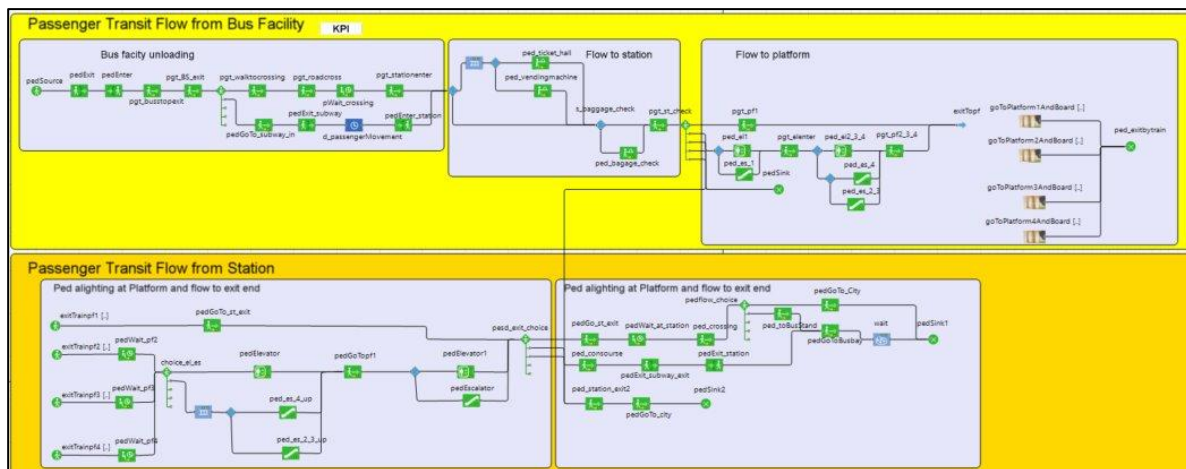
Passenger-Rail Interaction Modelling



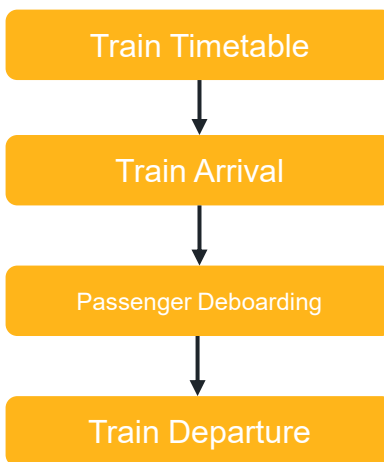
Typical ridership during different periods of the day

Period	Period	Time duration	Percentage ridership
5:30 – 8:00	Off-peak	2.30 hours	7%
8:00 - 12:00	Peak (morning)	4.00 hours	31%
12:00 - 17:00	Non-peak	5.00 hours	30%
17:00 – 21:00	Peak (evening)	4.00 hours	28%
21:00 – 23:30	Off-peak	2.30 hours	4%

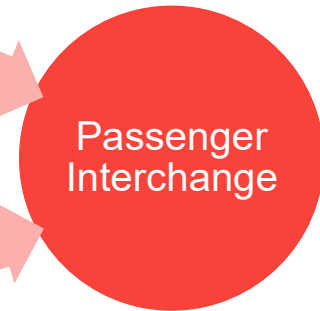
Model Flow



Passenger Mobility Flow



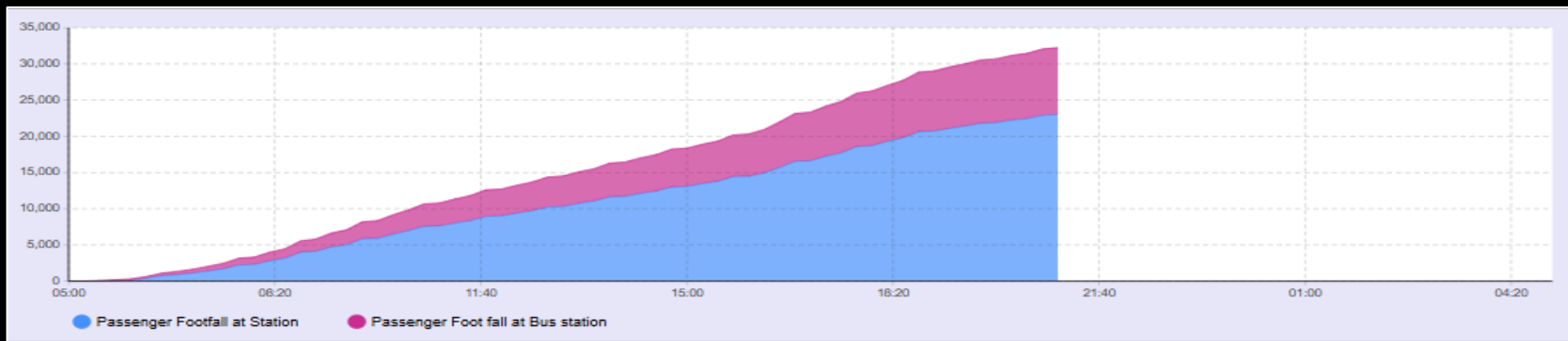
Train Flow



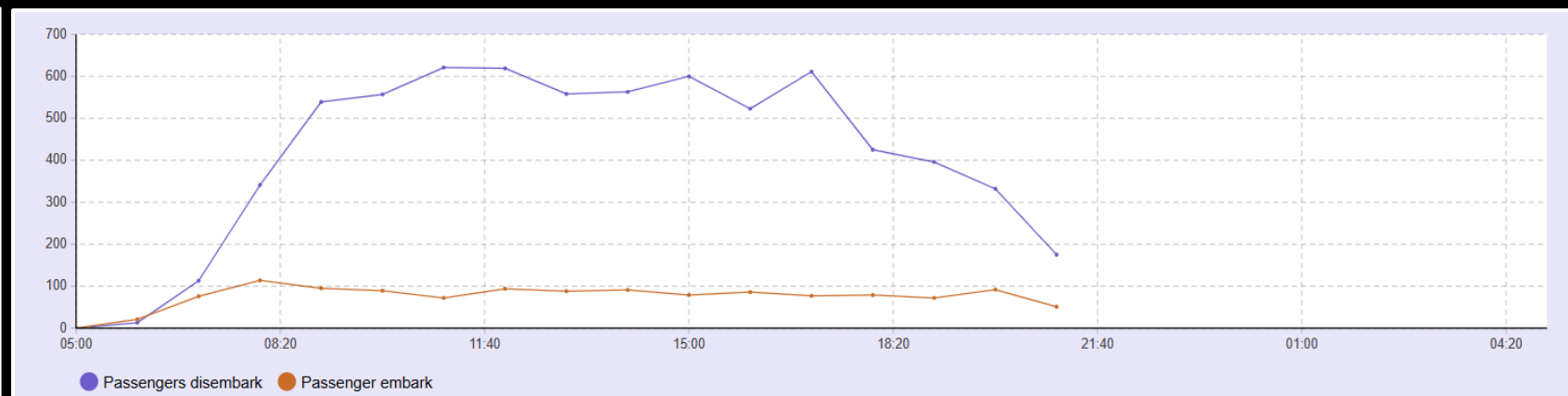


Station and Train Flow KPI

Passenger throughput at Train/Bus Station



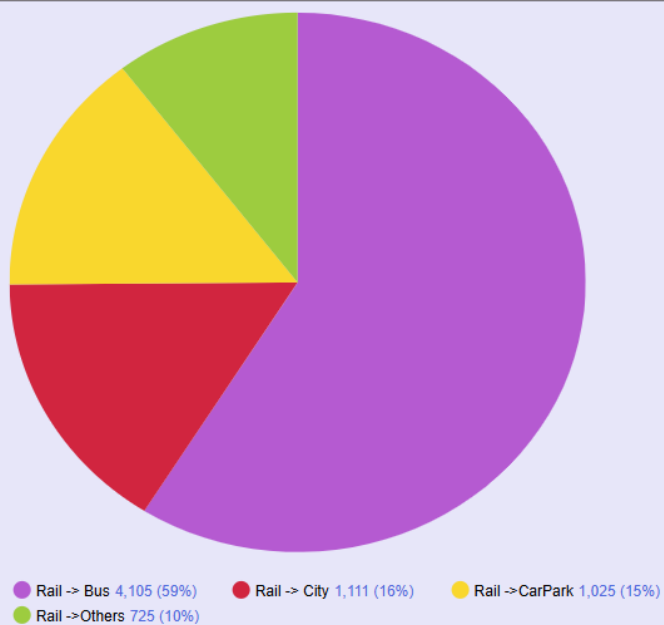
Passengers Boarding & Alighting per Hour



Train Arrival to Station Profile

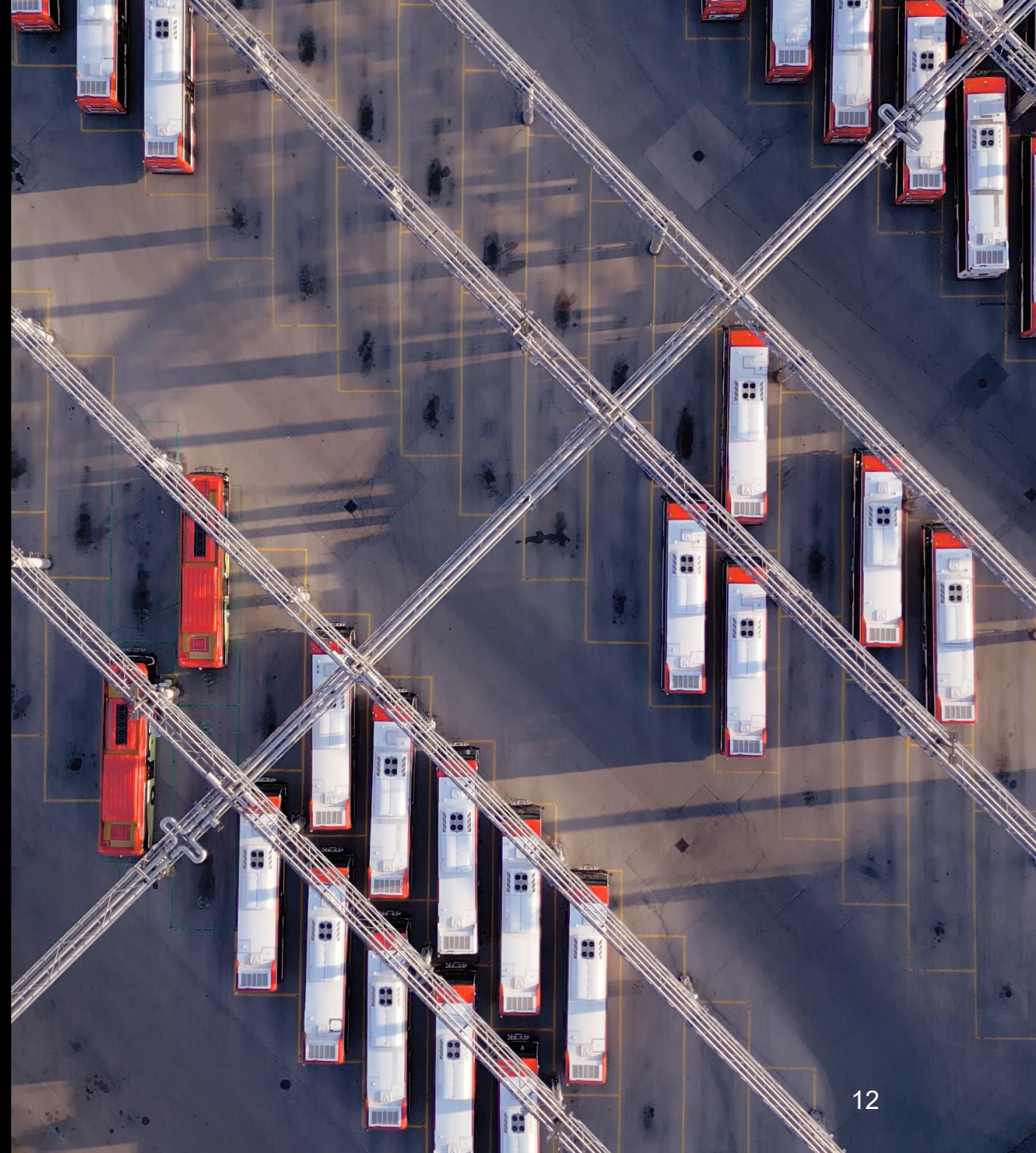


Disembarking Passengers Destination Distribution



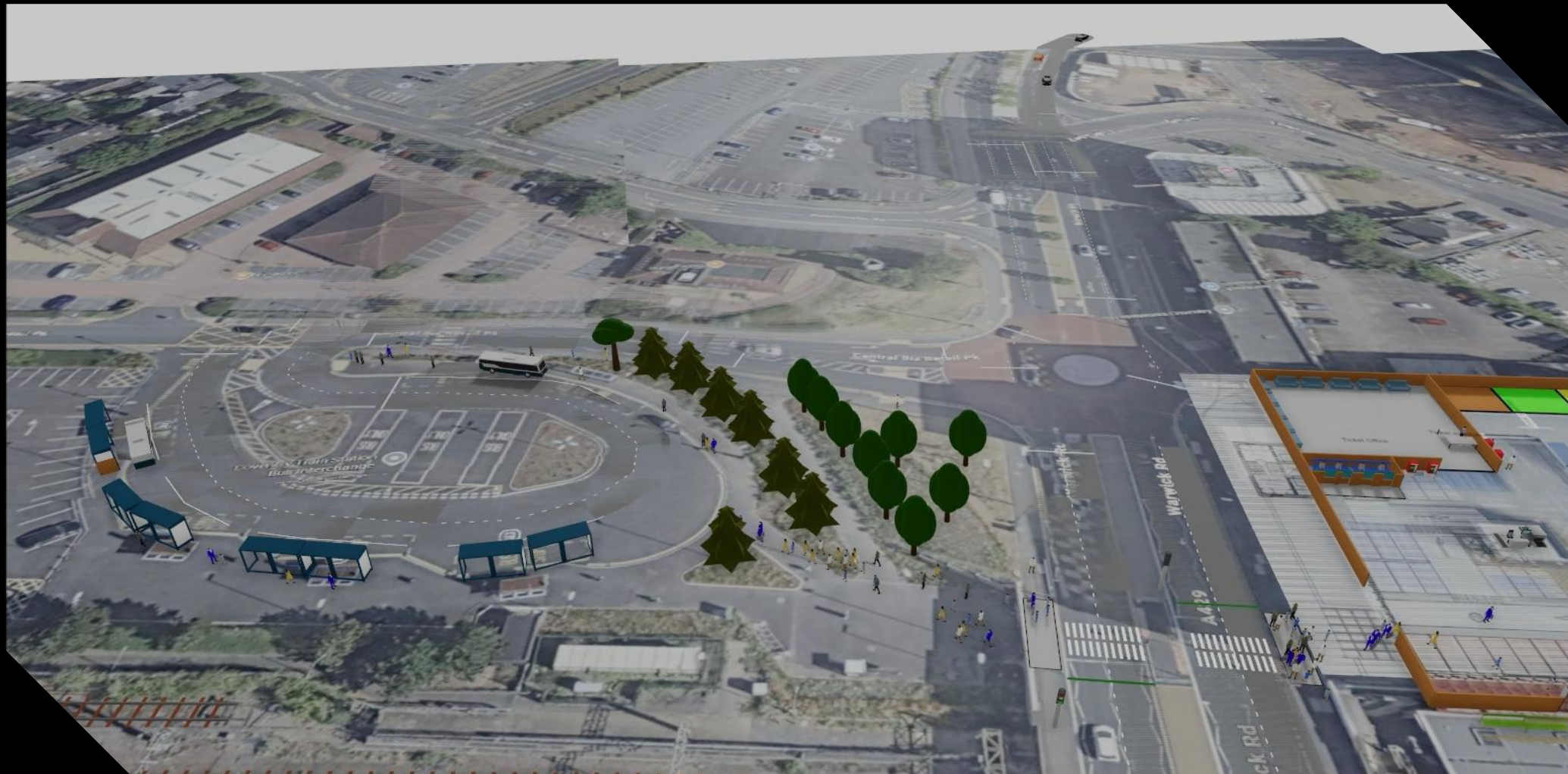


BUS



BUS



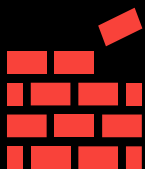


MODEL LAYOUT - BUS

Introduction to Traffic and Bus Operations Modelling:

Configuration

- Pedestrian Facilities
- Vehicle Routes



Infrastructure

- Road Network Layout
- Bus Stand



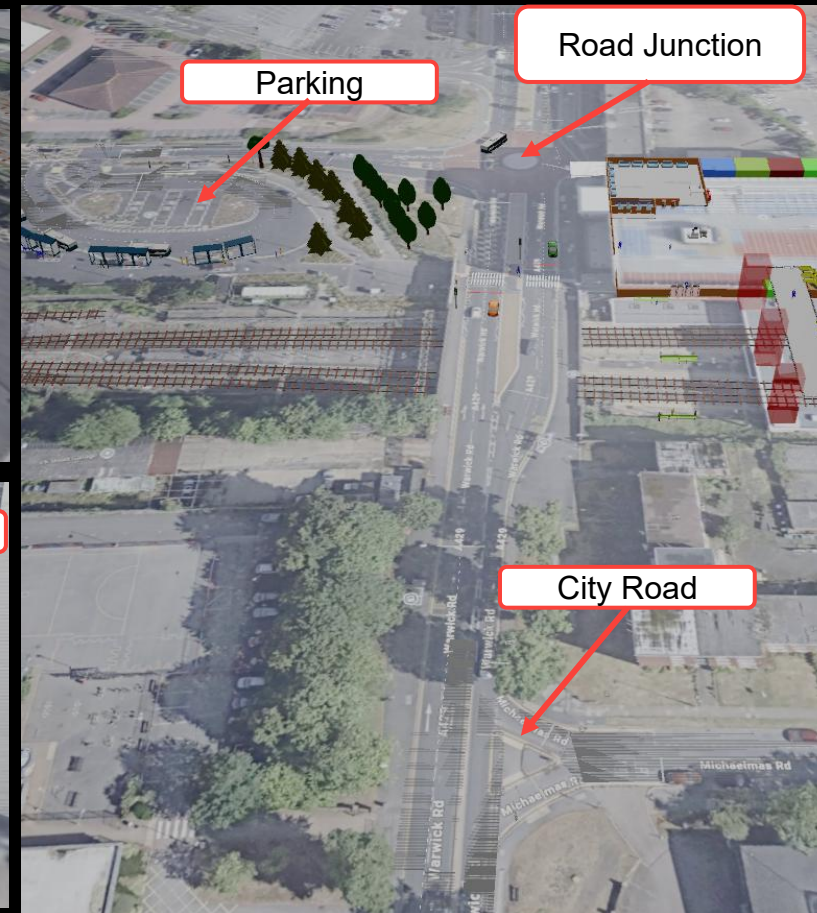
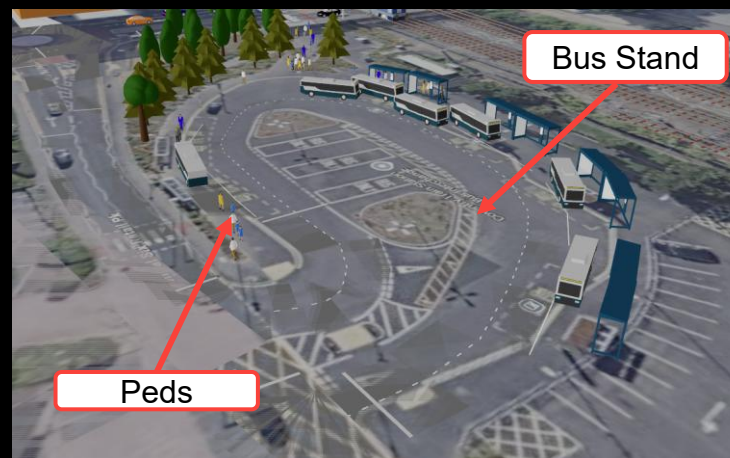
Vehicle Operations

- Service Timetables
- Vehicle Capacity
- Route Assignment
- Delays & Queueing
- Passenger Pick-up / Drop-off

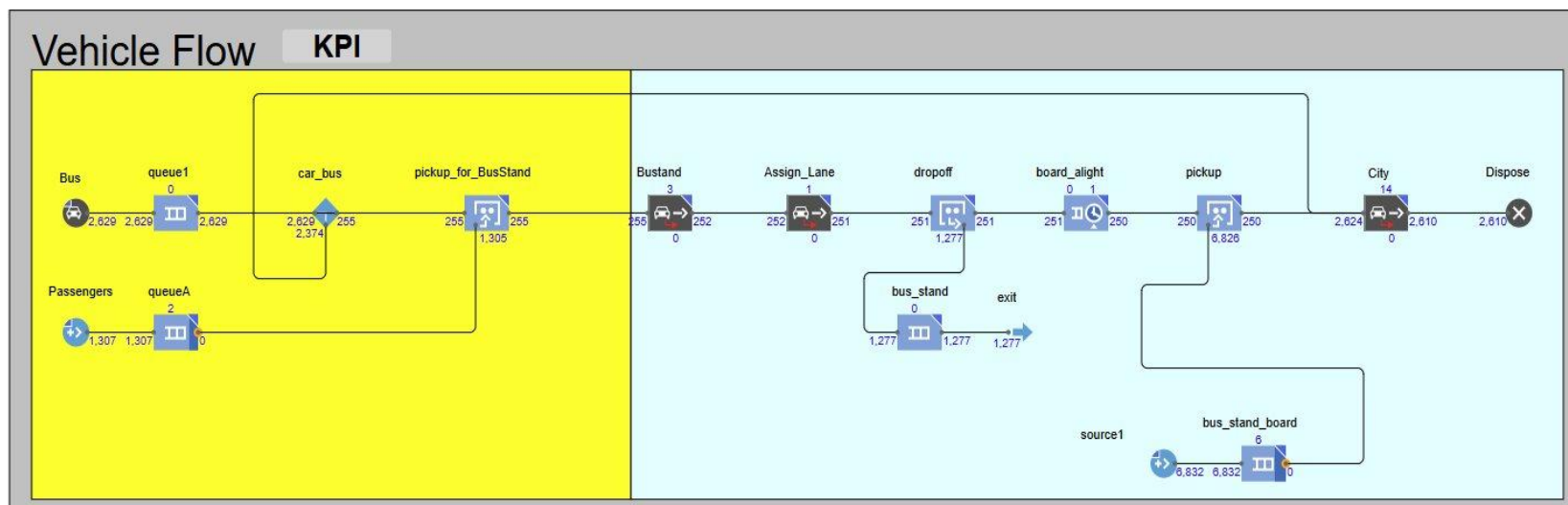


Passenger Operations

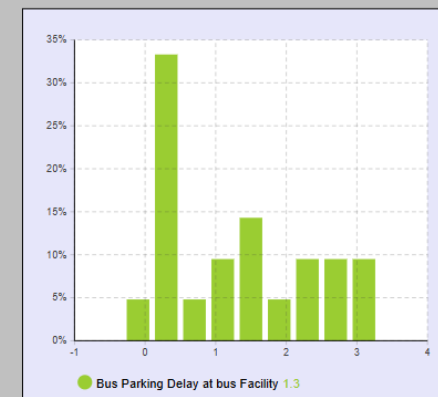
- Passenger Demand
- Walking Behaviour
- Waiting Time
- Boarding
- Alighting



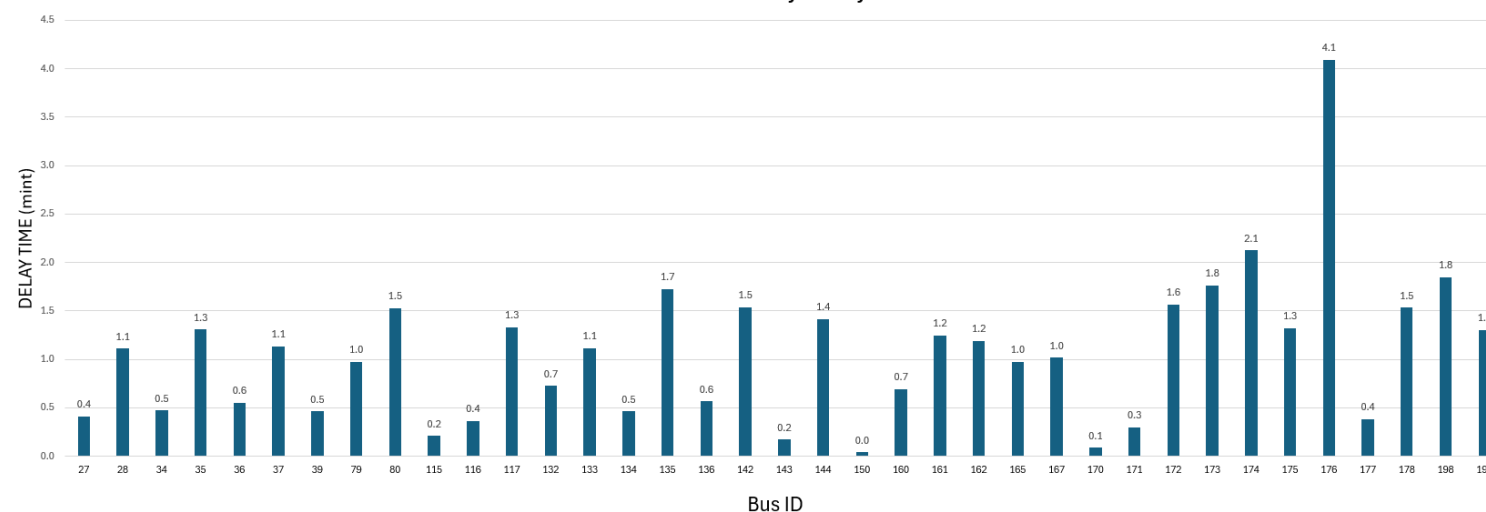
Bus Stand Utilisation: Peak vs Non-Peak Operations



Bus Boarding Delay @Bus Facility in minutes



Bus-Level Delay Analysis



Bus facility Berths Utilization





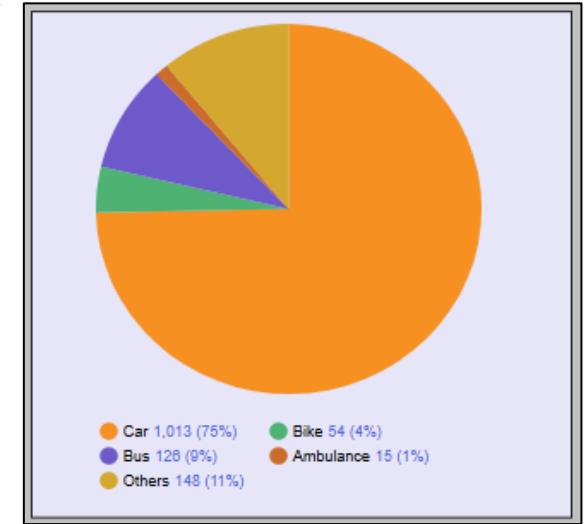
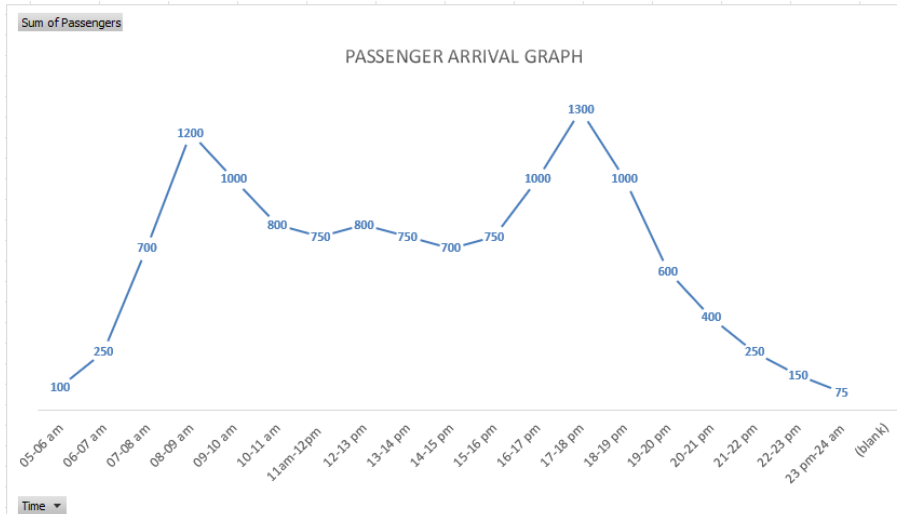
Passenger & Road Traffic Demand Modelling (Time-Dependent Passenger Arrival Behaviour)

■ Passenger Demand Characteristics:

- Morning commuter peak (08:00-09:00)
- Evening commuter peak (17:00-18:00)
- Stable midday activity
- Gradual decline during late evening
- Low overnight demand

Peak Demand Levels

- Morning Peak: ~1200 passengers
- Evening Peak: ~1300 passengers

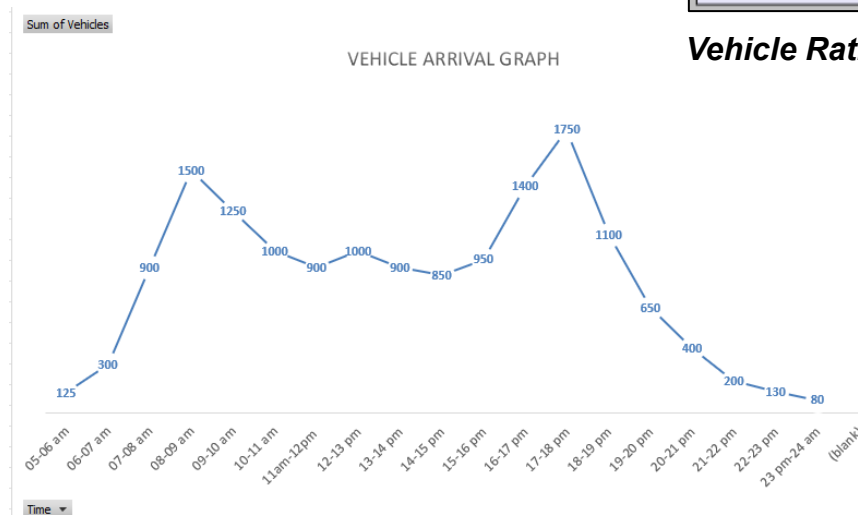


Vehicle Ratio on Road network

■ General Traffic and Bus Operations:

Model Output: The output distribution confirms that the simulated vehicle composition closely follows the intended demand profile:

- Cars & Taxis: ~75%
- Motorcycles: ~4%
- Buses: ~9%
- Ambulances: ~1%
- Other Vehicles: ~11%



PEDESTRIANS

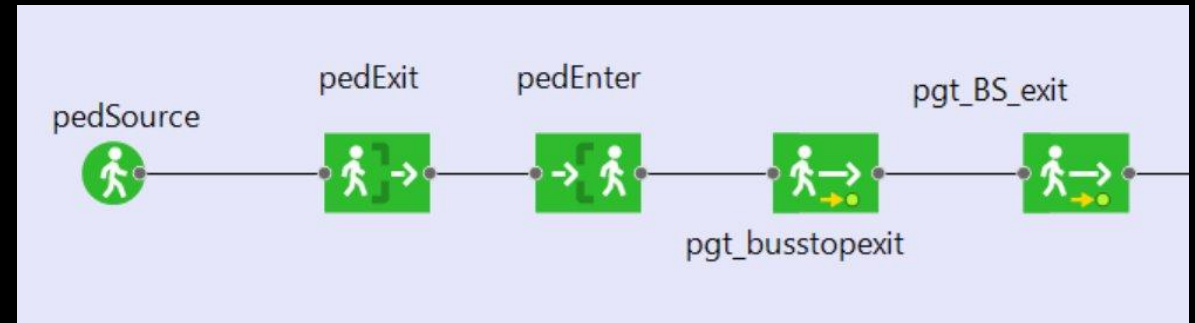




Model Layout - Pedestrians

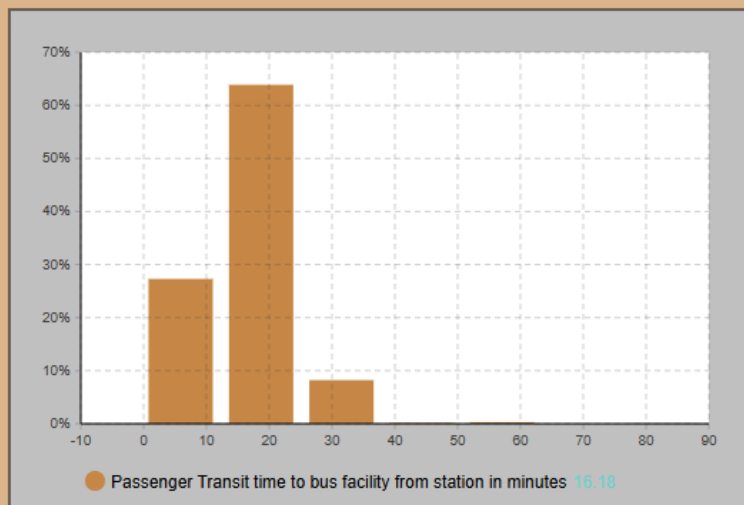
Logic Flow

- Pedestrians are generated at the Bus Stand area
- They move through designated pedestrian routes
- They pass the Bus Stop Exit and Bus Stand Exit areas
- They then continue towards the station access routes
- Finally, they enter the Railway Station

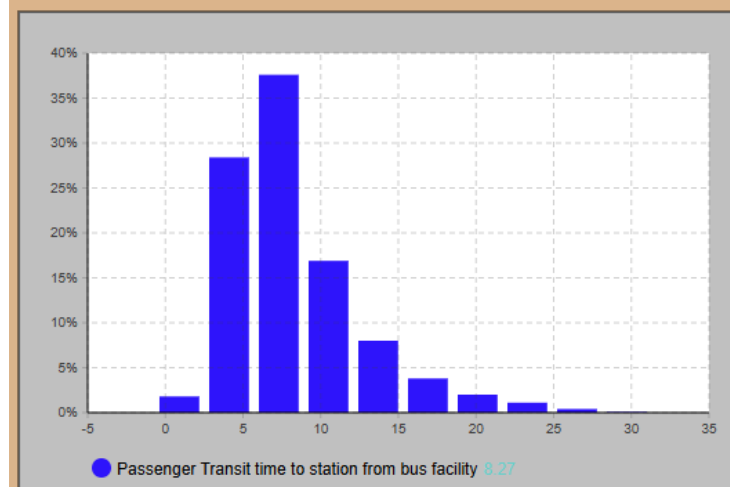


Pedestrian Interchange KPI

Passenger Transfer Lead Time to bus facility in minutes



Passenger Transfer Lead Time to station in minutes

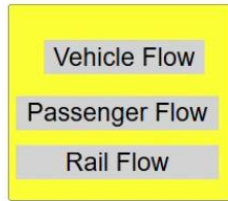


People crossing wait count vs Time





Simulation Demonstration



Timelapse of the flow



BENEFITS ACHIEVED

Tangible Benefits

The simulation provides quantifiable evidence to support transport planning decisions, including:

- Identification of peak congestion locations
- Utilisation of station facilities and bus bays
- Queue lengths and waiting times at critical bottlenecks
- Passenger throughput at key station areas
- Average passenger transfer times between rail and bus services

Intangible Benefits

- **Improved Stakeholder Engagement:**

The animated simulation provides an intuitive visualisation of passenger movements, helping both technical and non-technical stakeholders understand system behaviour.

- **Better Communication:**

Complex interactions between trains, buses, passengers and infrastructure can be demonstrated in a clear and accessible manner.

- **Increased Confidence in Decision Making:**

The model allows stakeholders to explore potential future scenarios in a risk-free virtual environment before committing to physical changes.

- **Digital Twin Foundation:**

The model establishes a scalable digital framework that can support future planning, operational analysis and network expansion studies.

Contact details

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Thank you / Q&A

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