Golden Mile Bus Corridor Analysis

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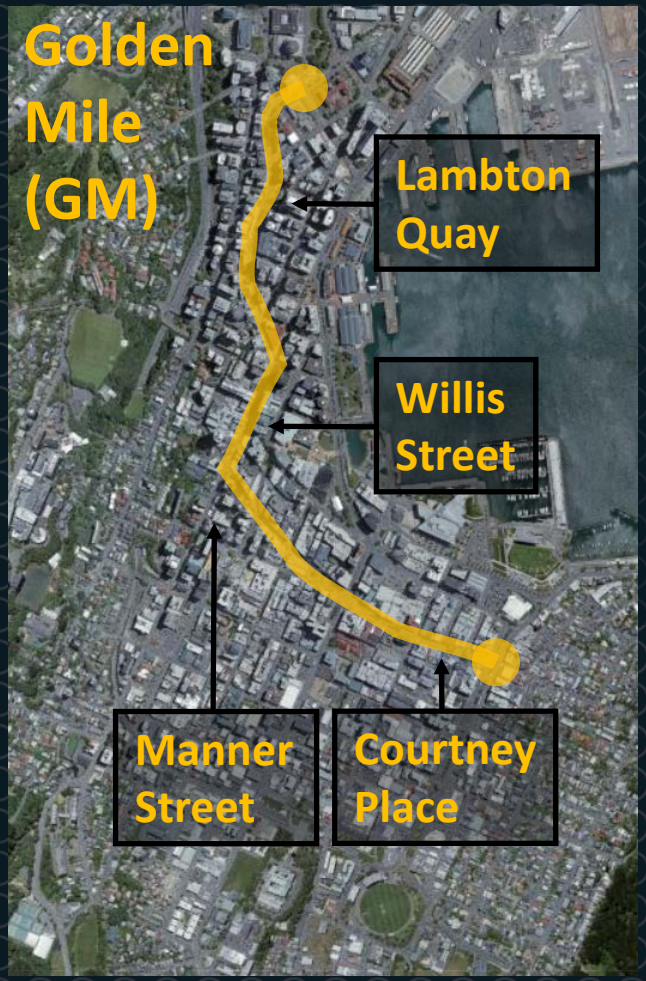
Project Background



- One of the most important passenger corridors in Wellington
- Purpose of the study – bus capacity and performance analysis of the final GM design
- Confirmation of existing key bus performance metrics
- AIMSUN traffic modelling simulation for bus capacity analysis under various future scenarios of growth

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International Best Practice

Corridor capacity[1]

- Two lanes exclusively for buses: **180 buses/h**
- One lane exclusively for buses, partial use of adjacent lane: **100 buses/h**
- One lane exclusively for buses, no use of adjacent lane: **70 buses/hour**
- Buses in curb lane in mixed traffic: **60 buses/h**

Speed

- Ideal bus operational speed in a city centre – 10-20 km/h

Dwell time[2]

- Dwell times of less than 30 seconds are optimal

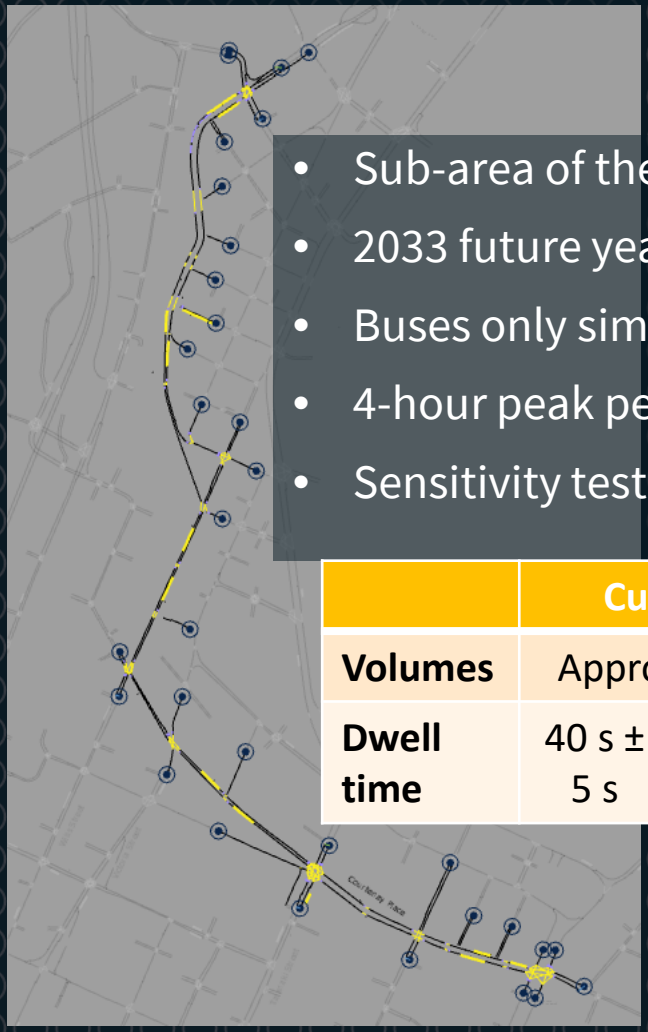
1 Transit Capacity and Quality of Service Manual (TCQSM), 2017
2 NZTA bus stop capacity guidelines

Current Corridor Performance

- The bus corridor carries the highest daily number of passengers in Wellington, and it has the 12 busiest bus stops

- The bus corridor is currently over capacity with the following key metrics a standout:
  - Up to 94 buses operate on the corridor during the peak hour
  - The operational speed can be as low as 8km/h during the peak hours
  - Variability of the bus service is more than 30%
  - Average dwell times exceed 40 seconds

Modelling Scope

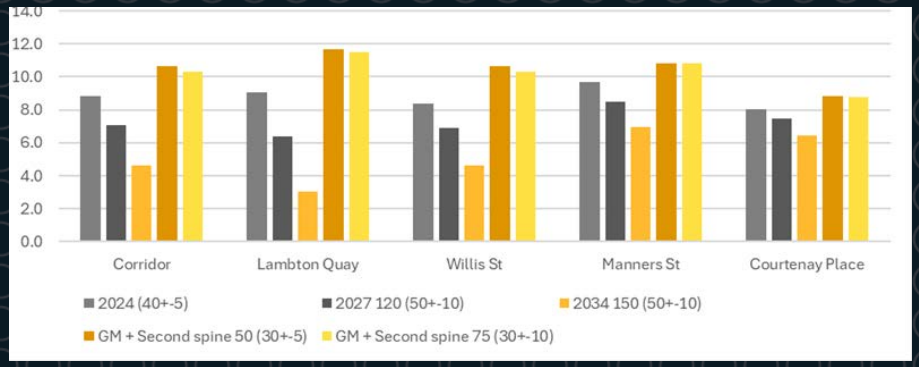


- Sub-area of the model covers the Golden Mile corridor
- 2033 future year scenario (using the Golden Mile design)
- Buses only simulated in the model (no general traffic)
- 4-hour peak periods were modelled for AM and PM
- Sensitivity tests with higher bus volumes and/or longer dwell times

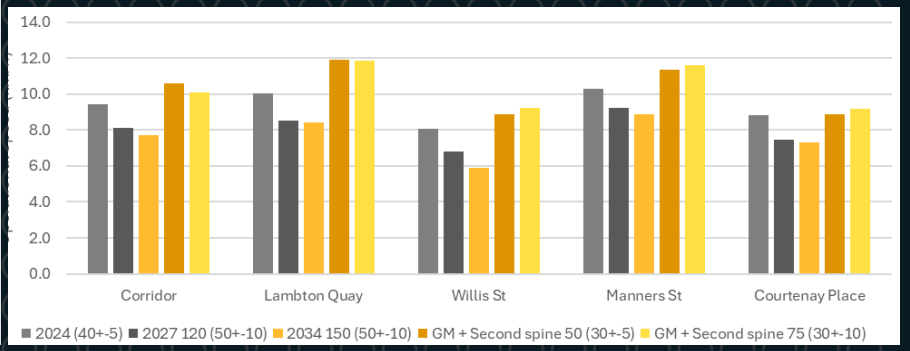
	Current		Medium		High		GM+2nd Spine	
Volumes	Approx. 95/h		120		150		50	75
Dwell time	40 s ± 5 s	50 s ± 10 s	40 s ± 5 s	50 s ± 10 s	40 s ± 5 s	50 s ± 10 s	30 s ± 5 s	30 s ± 10 s

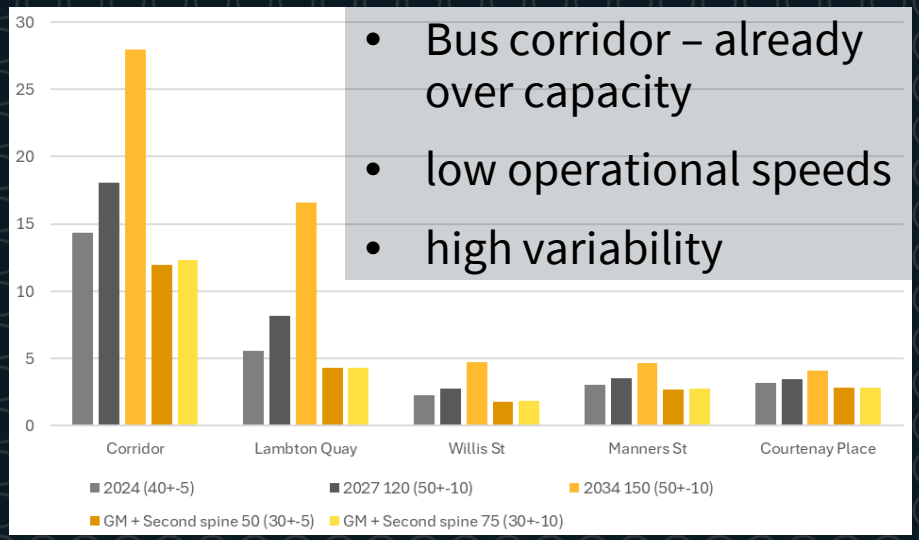
General Findings

Northbound AM

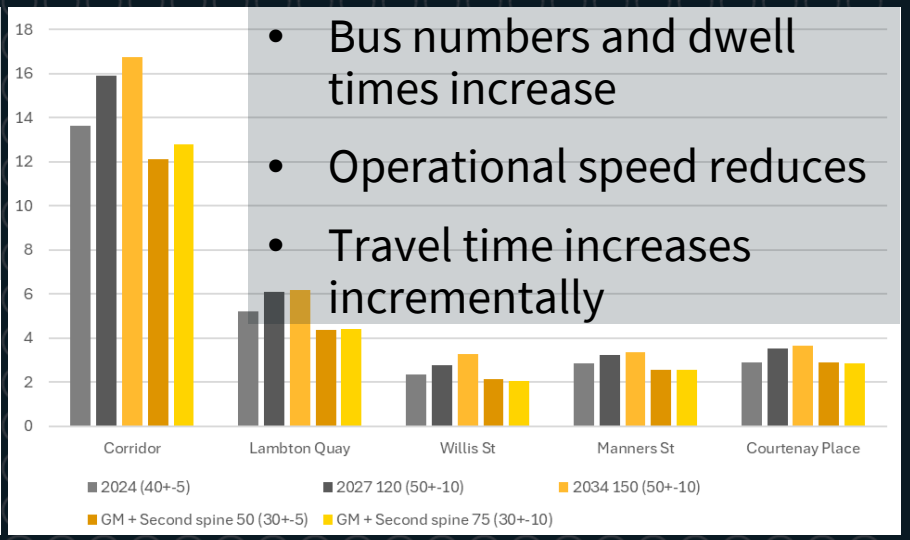


Southbound PM





- Bus corridor – already over capacity
- low operational speeds
- high variability



- Bus numbers and dwell times increase
- Operational speed reduces
- Travel time increases incrementally

2024 (40+-5) 2027 120 (50+-10) 2034 150 (50+-10)
GM + Second spine 50 (30+-5) GM + Second spine 75 (30+-10)

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Bus Bunching

An innovative methodology had been developed to capture the bus bunching frequency during the simulation. It visually compares the operation of the corridor with different scenarios.

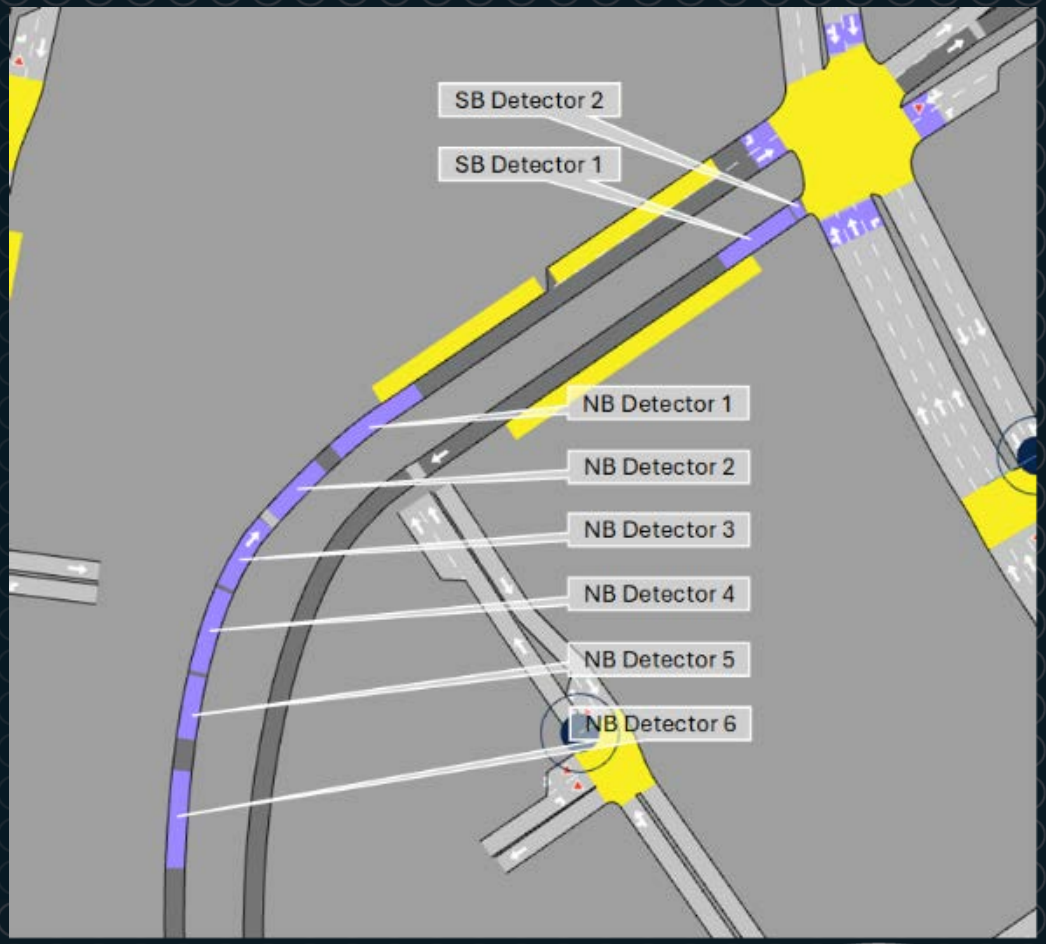
The main locations of bus bunching are at the bus stops at:

- Courtenay Place in both directions
- Southern end of Lambton Quay in the northern direction
- Northern end of Lambton Quay in both direction (worst operation)

	Lambton Quay NB S	Lambton Quay NB N	Lambton Quay SB N	Courtenay Place NB	Courtenay Place SB
Base 40+-5	No noticeable bus bunching	4	More than 2, but could have been more (see notes)	1	1
Base 50+-10	No noticeable bus bunching	4		No noticeable bus bunching	1
Medium 40+-5	No noticeable bus bunching	4		2	2
Medium 50+-10	Queuing beyond Grey St	More than 11 (beyond Stout St)		3	2
High 40+-5	Queuing affecting Willis St	6		Queuing beyond Blair St crosing	3

Bus Bunching Methodology

- Multiple detectors were placed behind each bus stop to evaluate the bus queuing
- The length of the detector covers one bus only
- Bus bunching diagram (in the following slides) indicates the occupancy of the detector in the interval of 30 seconds
- Based on the model observation, when the occupancy is over 60%, it is considered a noticeable bus bunching



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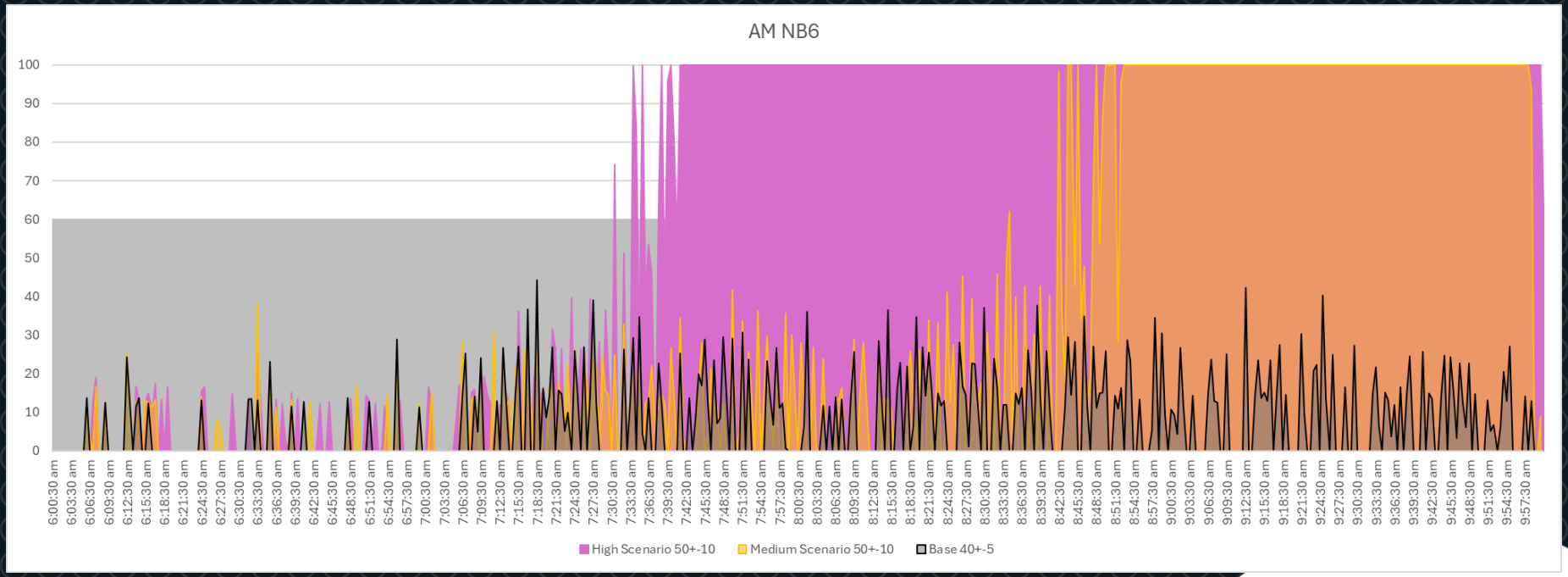
Bus Bunching Diagram

Detector 6 on Lambton Quay in Northbound direction during AM peak period

- High scenario – bus bunching occurs between 7.30 am and 10 am
- Medium scenario – bus bunching occurs between 8.40 am and 10 am
- Base – occupancy did not exceed 60%, no bus bunching



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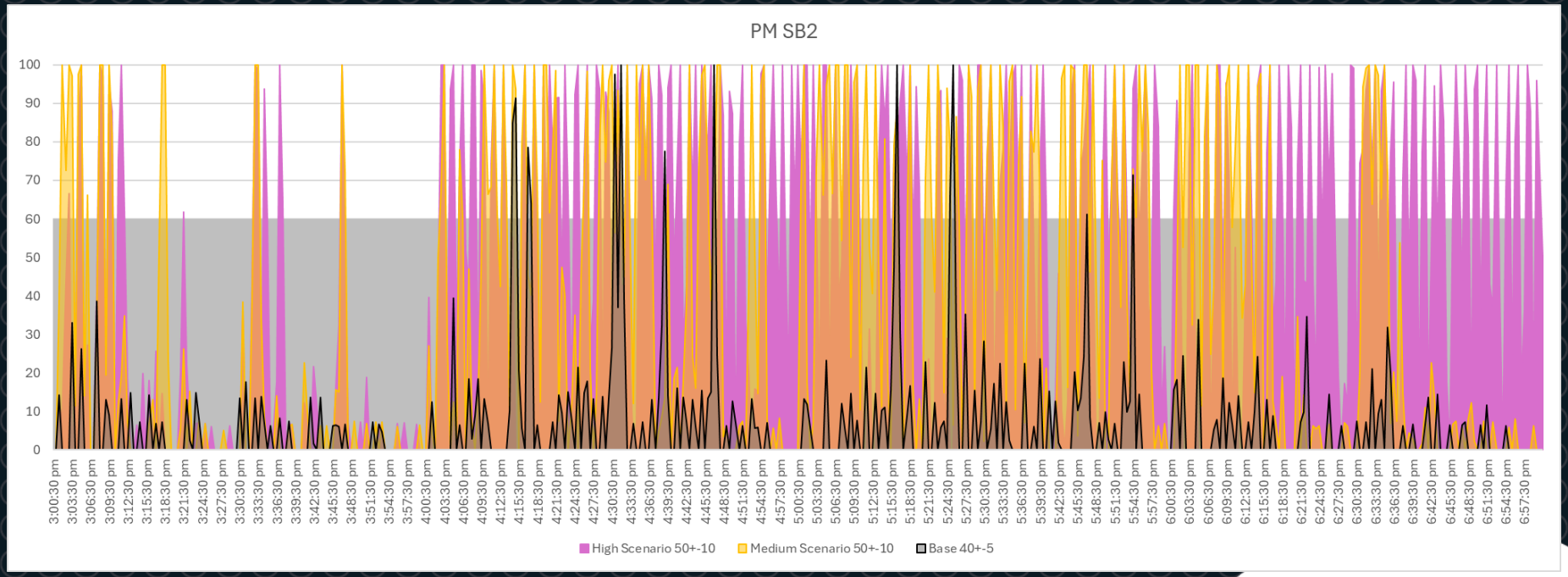
Bus Bunching Diagram

Detector 2 on Lambton Quay in Southbound direction during PM peak period

- Medium & High scenario – bus bunching occurs during the whole period, being more frequent after 4 pm
- Base – occasional bus bunching occurs between 4.15 pm and 6 pm



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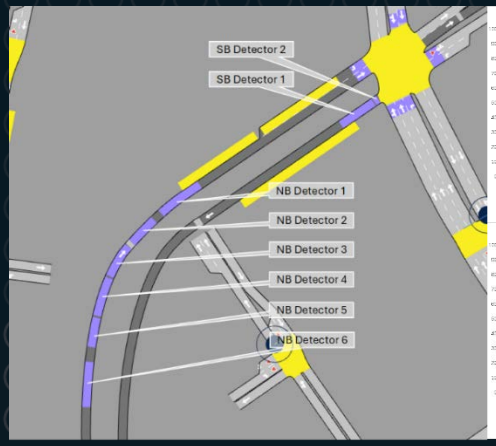
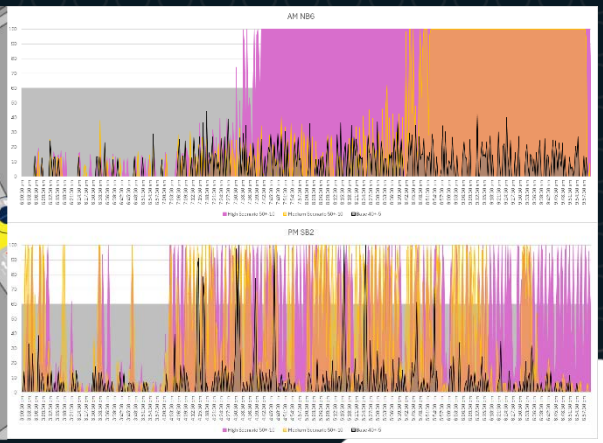
Bus Bunching Comparison

- Base scenario – negligible bus bunching
- Higher dwell time, higher bus bunching frequency
- The bottlenecks for **Northbound** are the traffic signal and the movements caused by two separate bus stops. In Medium/High scenarios, long queues could be easily formed but hard to dissipate, meaning there were more buses approaching or already waiting behind Detector 6.
- The bottleneck for **Southbound** is only the long bus stop. Although the queues formed and dissipated in a pattern, they are immediately next to a signalised intersection (with the 2nd bus in the queue must wait inside the intersection). This potentially has operational impacts on the upstream approaches.





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Conclusion

- The bus corridor is currently over capacity, with low average operational speed and unreliable performance
- The modelling predicts a saturation point of 130 bus trips per hour
- Study confirmed need for Second Spine, however proposed further investigation
- The innovative bus bunching diagram has so far only been used for the Golden Mile bus corridor analysis
- The advantage of this method
  - effectively monitors and records the bus queueing in AIMSUN, including outcomes such as when they start forming, when they dissipate,
  - how long the queues are, how long the queues last,
  - and the queueing frequency at specific locations

Thank you

Any questions?

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