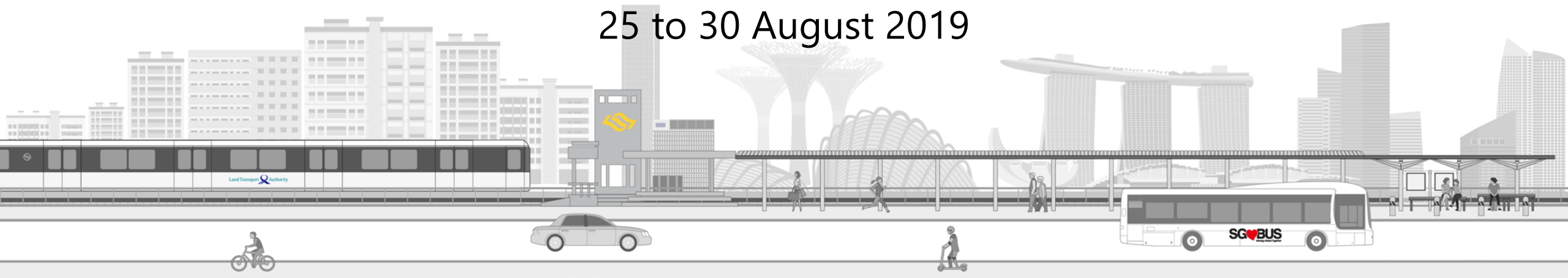


Resource Optimisation and Seamless Commutes: On-Demand Public Bus Trial in Singapore

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On-Demand Bus Services

- On-demand bus services traditionally operated to plug the gaps of existing networks as first- and last-mile solutions, or to substitute existing fixed & scheduled services (FSS)
- Studies of on-demand bus services operating alongside FSS within pre-defined areas for the purpose of resource optimisation are few
- Paper explores concept and benefits of on-demand bus services operating alongside existing FSS that have low demand, from resource optimisation and service level perspectives
- Empirical example of On-Demand Public Bus (ODPB) trial in Singapore

ODPB Trial Objectives



Understand operational effectiveness



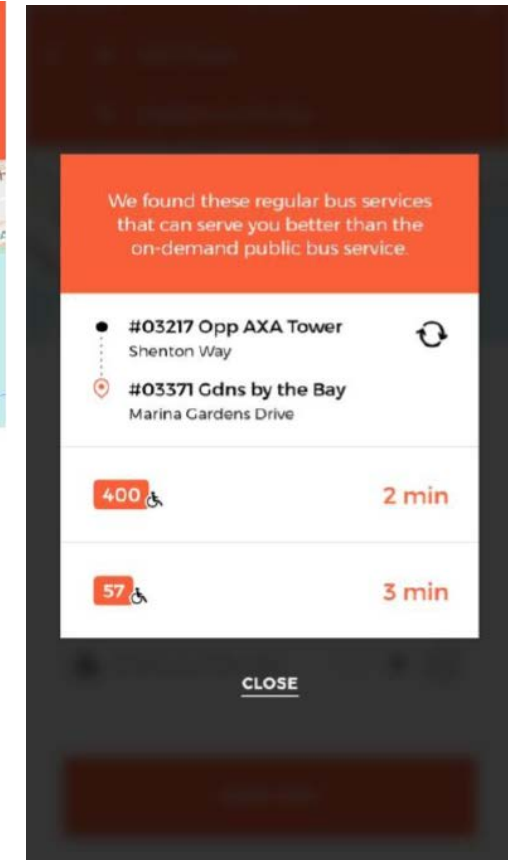
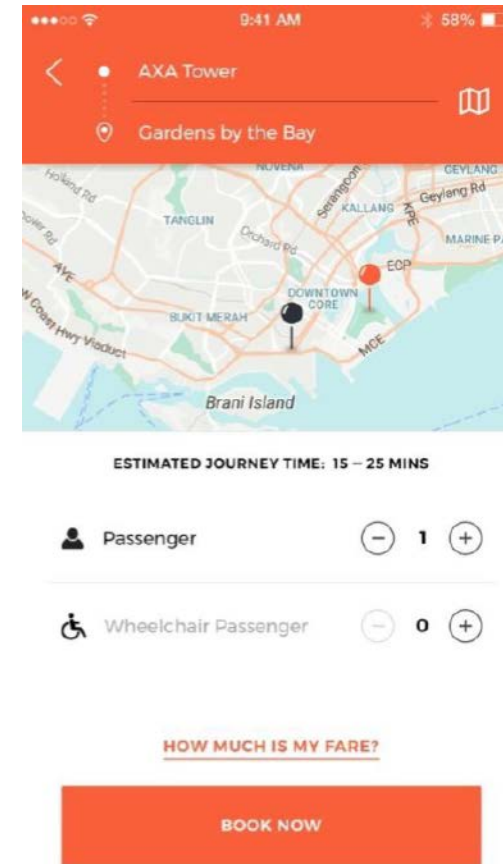
Determine commuter receptivity of on-demand bus service concept



More seamless and convenient commute

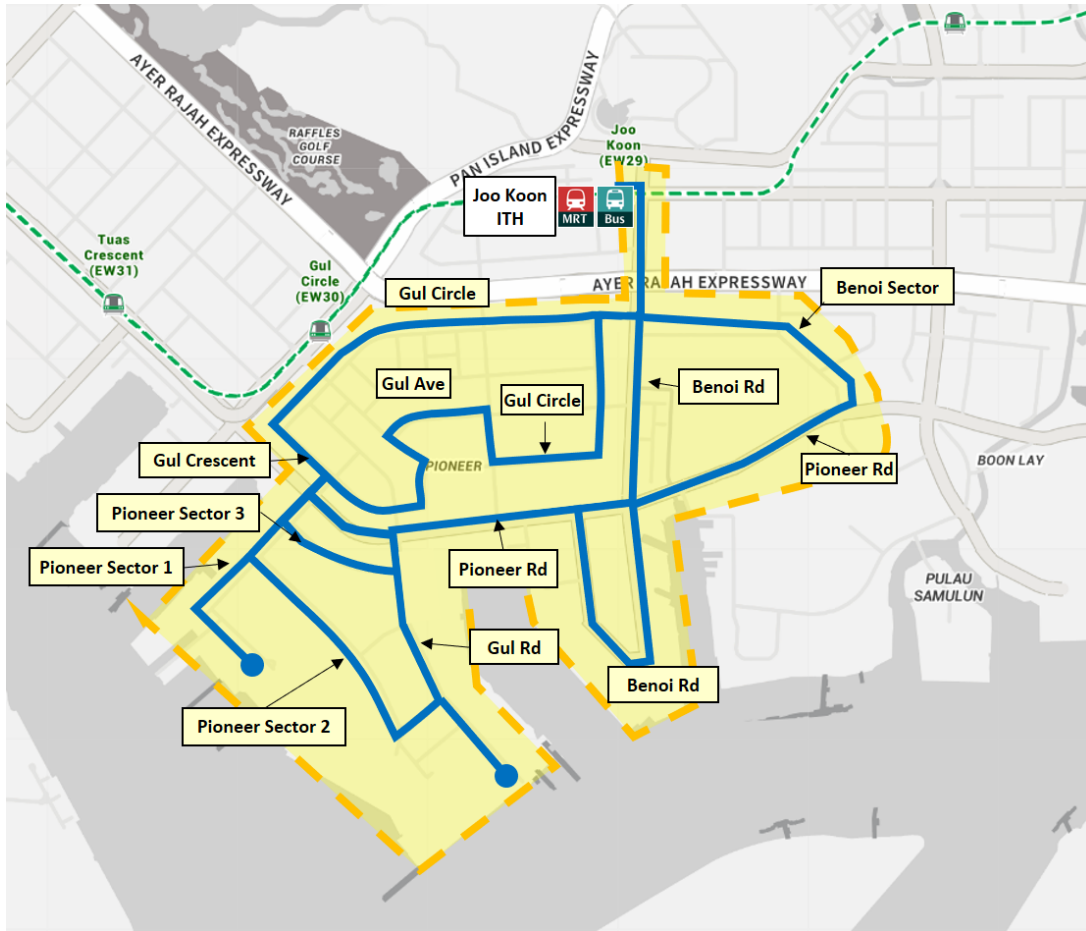
Weekday ODPB Trial Concept

- Trial areas have at least 2 bus services with low demand during off-peak hours
- Low-demand services operated at lower frequencies to free up resources to operate ODPB services
- Commuters can book an ODPB ride by requesting pick-ups and drop-offs at any bus stop within the trial areas through mobile apps
- Mobile apps offer commuters an ODPB or FSS bus, depending on expected wait time, in order to maximise efficiency

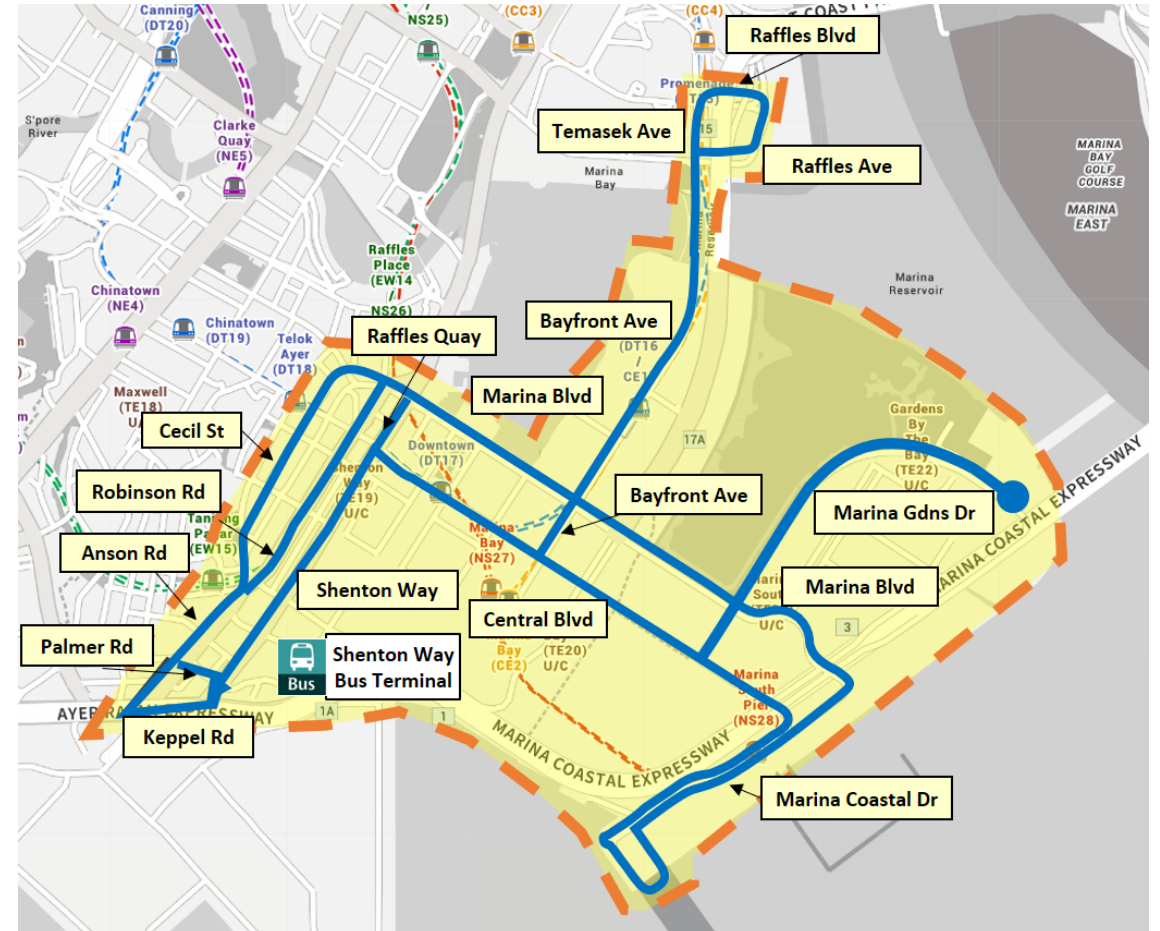


Weekday ODPB Trial Areas

Joo Koon - Industrial



Marina-Downtown - CBD



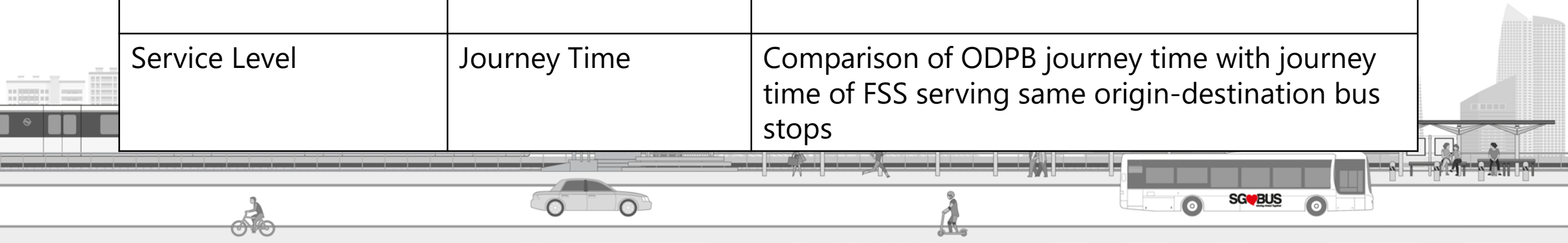
Operational Considerations

- To meet the ODPB trial's objectives, LTA leveraged on resources under BCM:
 - Appointed existing FSS bus operators & deployed existing buses
 - Specially procured onboard equipment (e.g. tablets & mounts) to be installed on buses
 - Leveraged on existing fare-collection system
 - Acted as bridge to facilitate discussion between bus operators and technology providers to develop features of ODPB system



Key Performance Indicators

Category	Key Performance Indicator	Description
Commuter Receptivity	Ridership	Comparison of average daily ridership of ODPB services against average daily FSS ridership during trial
Resource Efficiency	Operated Mileage	Comparison of combined operated mileages of ODPB services & FSS during trial against pre-trial FSS
	Ridership per km	Comparison of ridership per km of ODPB services against pre-trial FSS
Service Level	Journey Time	Comparison of ODPB journey time with journey time of FSS serving same origin-destination bus stops

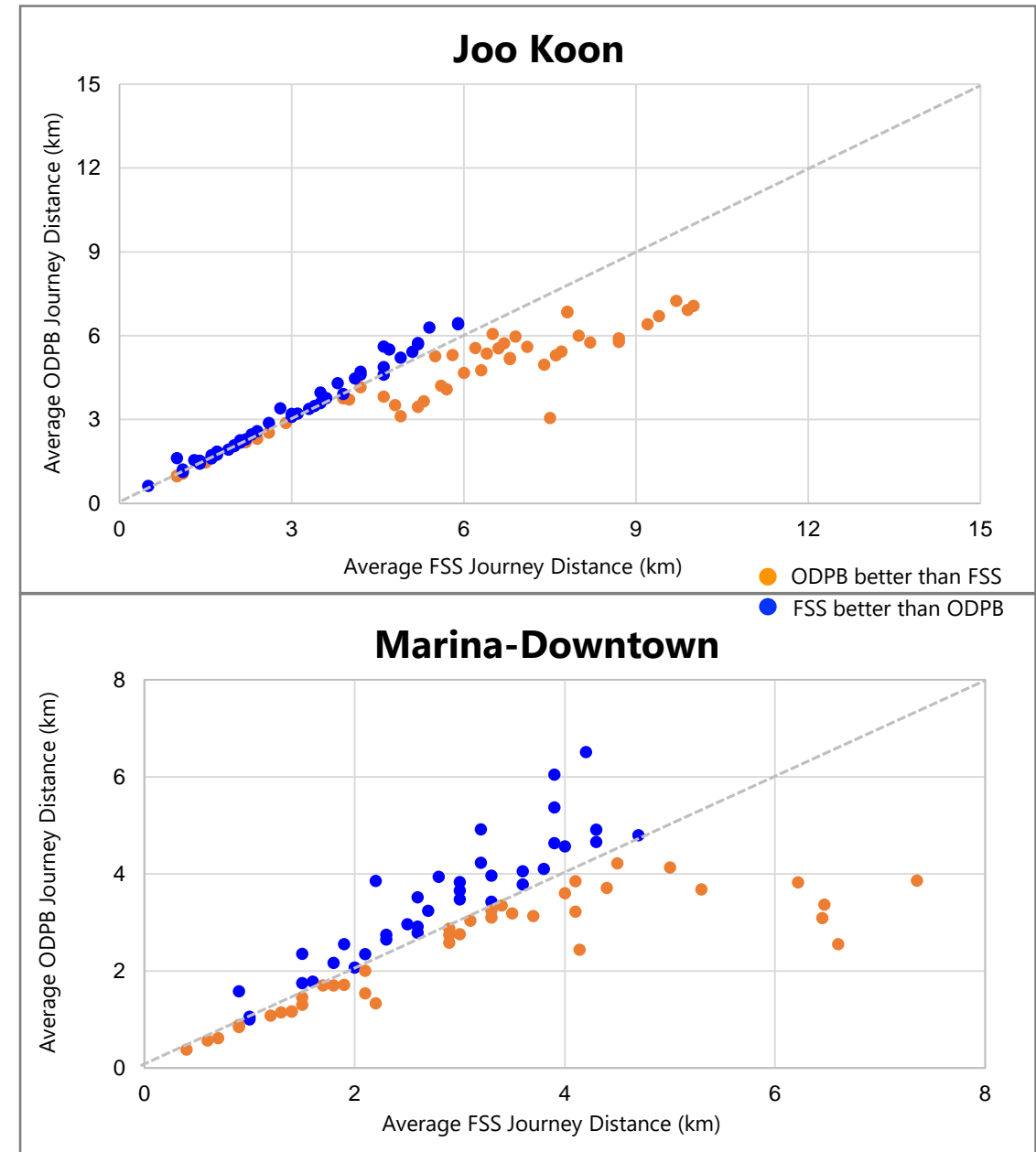


Commuter Receptivity: Ridership

- More than 29,000 ODPB rides
- Low take-up rate of ODPB services: daily ODPB ridership accounted for 10 to 15% of combined daily ridership of ODPB + FSS
- Based on commuter survey, 57% of respondents were aware of ODPB trial, though only 27% tried it
- Reasons for not trying the ODPB services:
 - Troublesome to use mobile app to book a bus ride
 - Journey time for FSS provided greater certainty
 - Difficulty in accessing mobile apps
 - Mobile apps not in preferred languages
- One-time users of ODPB services (e.g. visitors to tourist attractions) were less likely to download mobile app

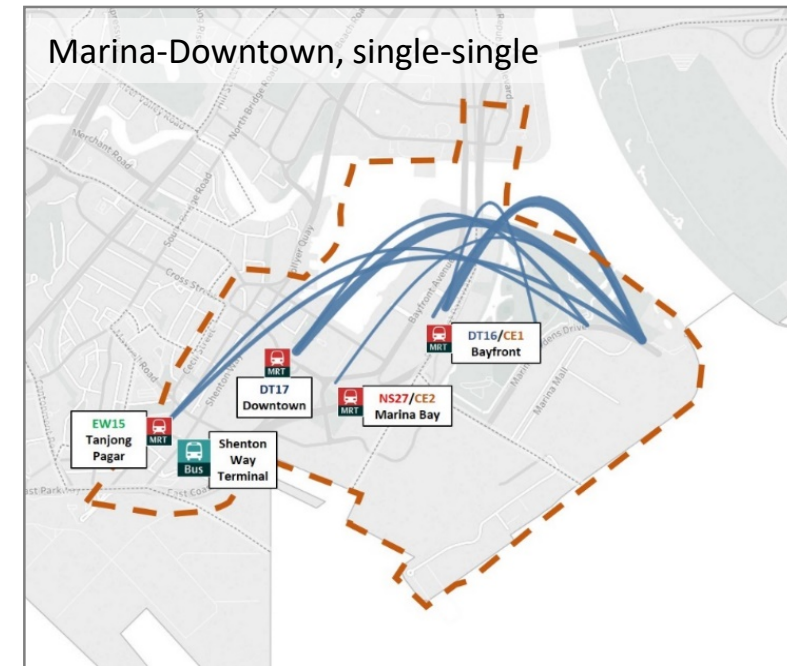
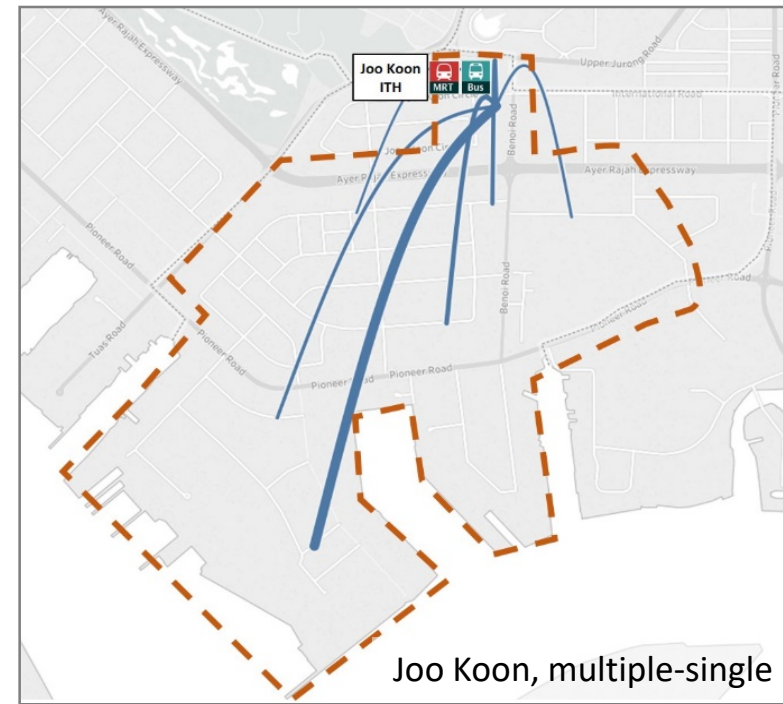
Resource Efficiency: Operated Mileage

- ODPB + FSS mileage was ~13% to 32% lower compared to pre-trial FSS mileage
- O-D pairs of FSS <4km in journey distance were generally traversed by most optimal path → limited scope to optimise route
- ODPB services able to achieve mileage savings for O-D pairs ≥ 4 km in journey distance due to potentially more direct routing between origin & destination bus stops



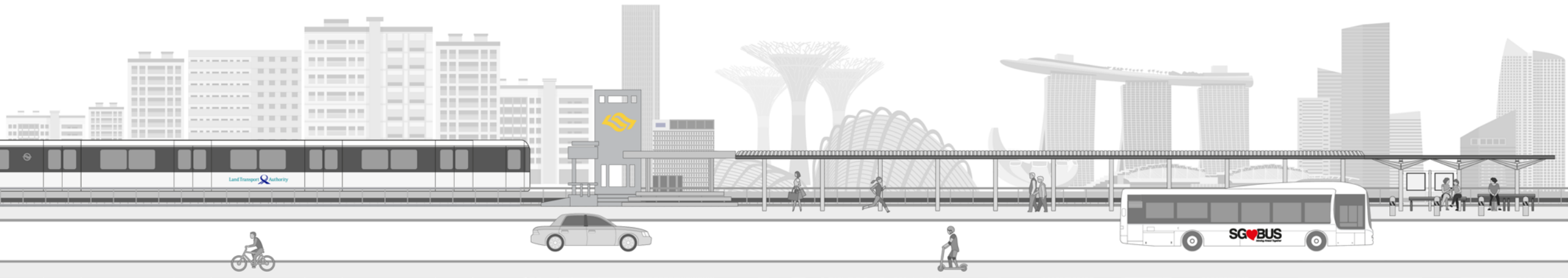
Resource Efficiency: Travel Patterns

- Travel pattern from multiple nodes to single node, and vice versa, allows consolidation of demand
- Most ODPB rides in Joo Koon were to/from Joo Koon Integrated Transport Hub
- Most ODPB rides in Marina-Downtown were to/from various transport nodes or key attractions → lesser scope for consolidation of demand, as demand is more dispersed



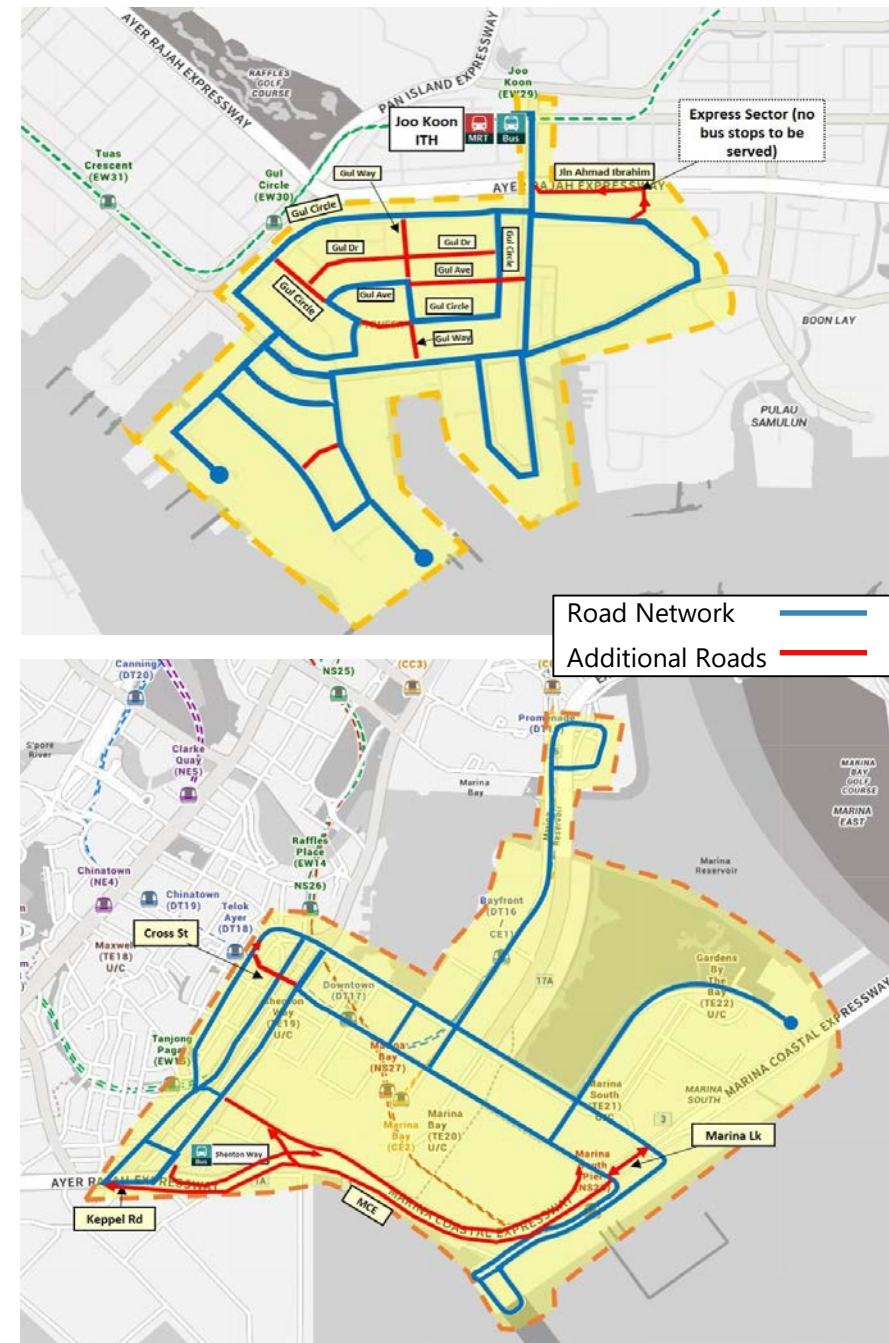
Resource Efficiency: Ridership per Operated km

- Ridership per km for ODPB < 0.5 vs ridership per km of 1.2 to 1.8 for pre-trial FSS → ODPB services not as utilised compared to pre-trial FSS
- FSS during the trial were better utilised with a ridership per km of ~1.4 to 3.2



Service Level

- Average journey times on ODPB services comparable to FSS
 - For top 10 O-D pairs, commuters experienced shorter journey times of ~2min in Joo Koon but longer journey times of ~0.3min in Marina-Downtown
- Well-connected road network allows ODPB service to be optimised, as buses can take shortcuts to destinations
- Average journey times improved by ~1.4 min in Joo Koon after road network expansion
- Impact of road expansion lesser in Marina-Downtown (average journey time improvement of ~0.4 min), as only one major road (i.e. MCE) was added



Conclusion

- Commuters enjoy seamless commutes and comparable journey times to FSS
- Lower operated mileage trial resulted in bus operating cost savings for LTA but low ridership made ODPB less utilised compared to FSS
- High software costs make ODPB less cost-effective compared to FSS
- Larger scale deployment of ODPB expected to become more cost-effective with improvements in algorithms and technology

Thank you

