Improvement of Bus Operations at the Boon Lay Bus Interchange

Master's Thesis by Muhammad Zuhair Aslam

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Problem Statement

Buses queue up at the entrance of the Boon Lay bus interchange during peak times, resulting in congestion and exceptionally high delays, eventually reducing the reliability of the public transport.

Research Objectives

- To identify the problem causing the formation of queues.
- To address the problem by proposing possible solutions.
- To analyse the solutions with the help of microscopic traffic simulation tool

Boon Lay Bus Interchange

- Ranked as busies bus interchange in Singapore
- 32 bus lines serving ~120 K passengers daily
- Consists of 6 saw-tooth, 4 alighting and 11 end-on bays

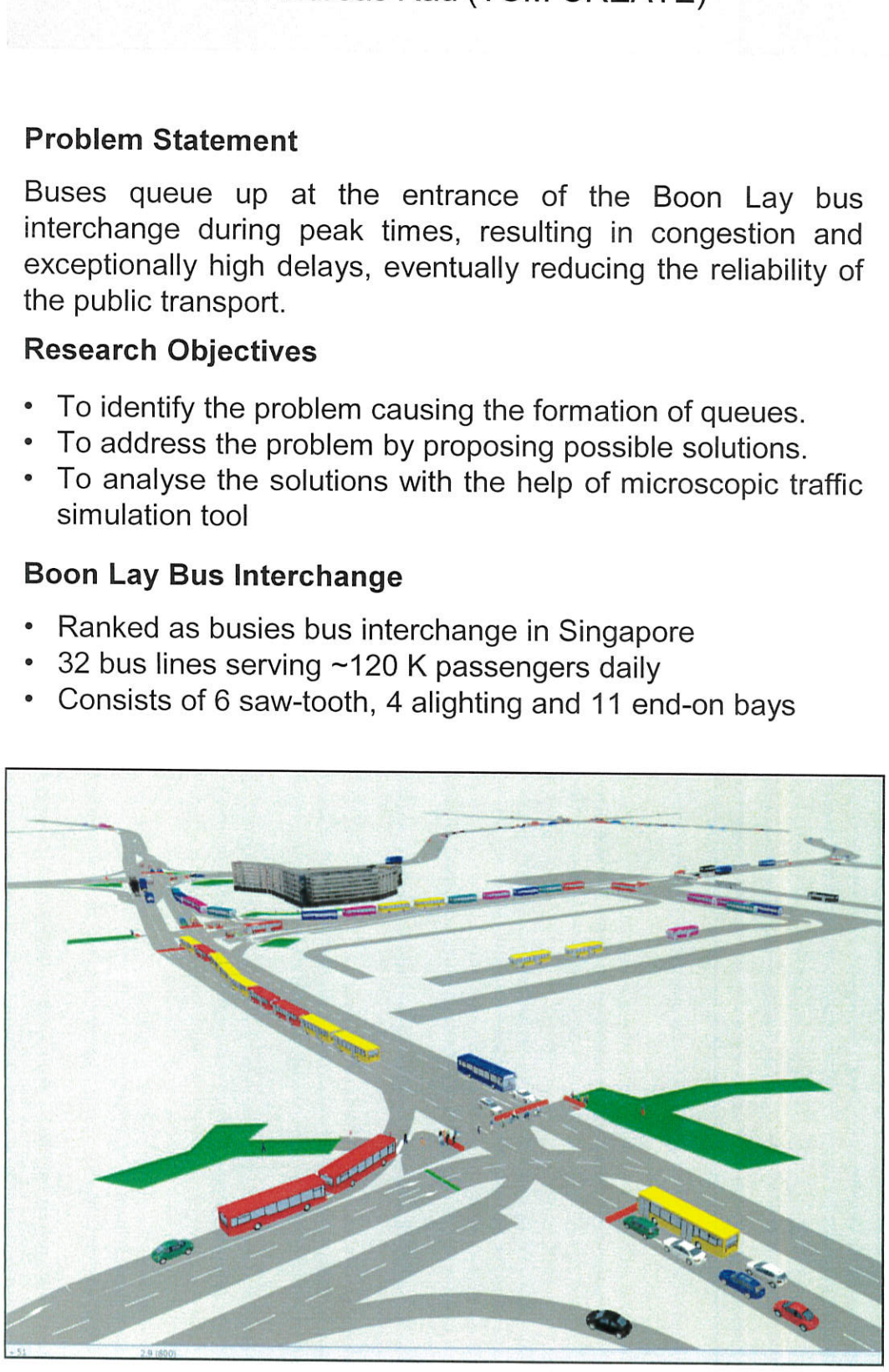

Fig 2: Microscopic simulation model

Solutions

- O1 – Modifications due to Joo Koon bus interchange
- O2 – Modifications to bus line 179A
- O3 – Dynamic allotment of boarding bays for alighting buses
- D1 – Addition of loading area in alighting bay
- D2 – Adding parallel alighting bay to existing bay
- D3 – Redesigning the layout of the bus interchange

Result

The study successfully achieved its goals and the proposed solutions are expected to reduce the maximum queue length by 72% to 90% depending on the solution adopted. It also appears that the travel time can be reduced by more than half on the investigated route. Furthermore, few recommendations were also given for the design of future similar bus interchanges in Singapore by suggesting improvements in the design guidelines of bus interchanges given by LTA.

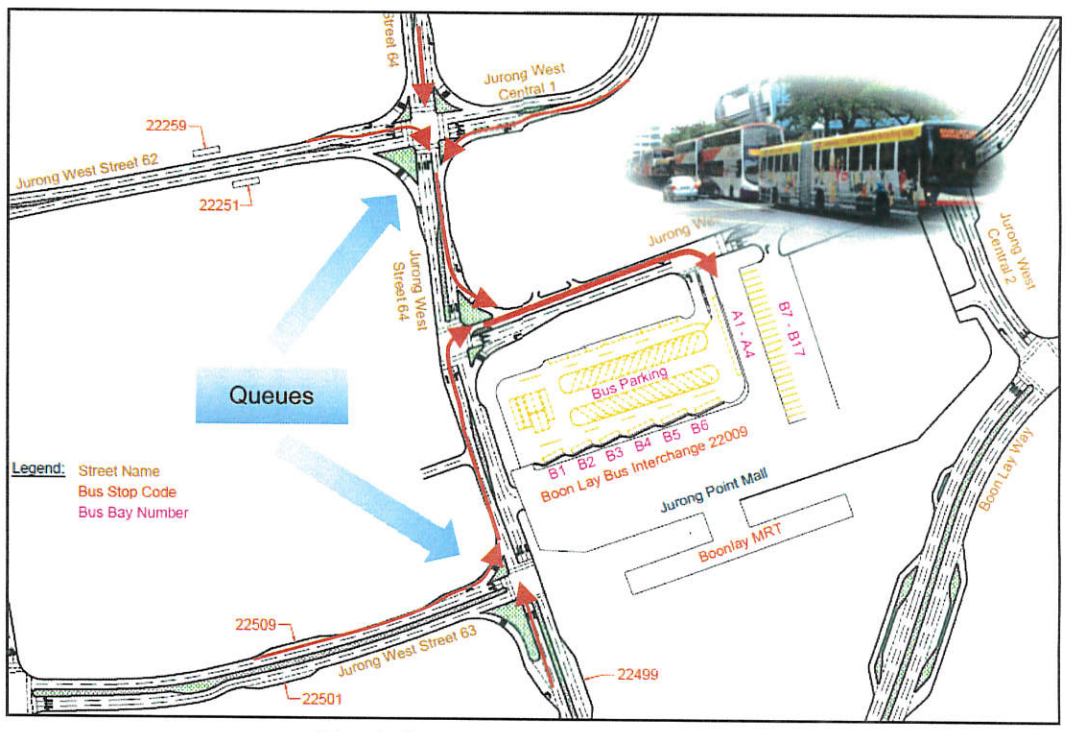

Fig 1: Layout of the study area

Problem Analysis

- One of the major bottlenecks causing formation of queues was the low capacity of the alighting bays during peak hours as bus arrival rate exceeded bus service rate at the alighting bays.
- Bus lines, with higher dwell times and variations in dwell times, tends to disrupt service rate more than the bus with lower and uniform dwell times

Modelling

One of the main tasks was to develop a model that could evaluate the proposed solutions. Hence, a microscopic traffic simulation model was developed and calibrated to the field conditions. Two measures of effectiveness were chosen to evaluate the performance of the solution i.e. maximum queue length and travel time on selected route. Solutions were modelled to investigate their impacts and to understand the factors that can be considered for designing or evaluating similar bus interchanges.

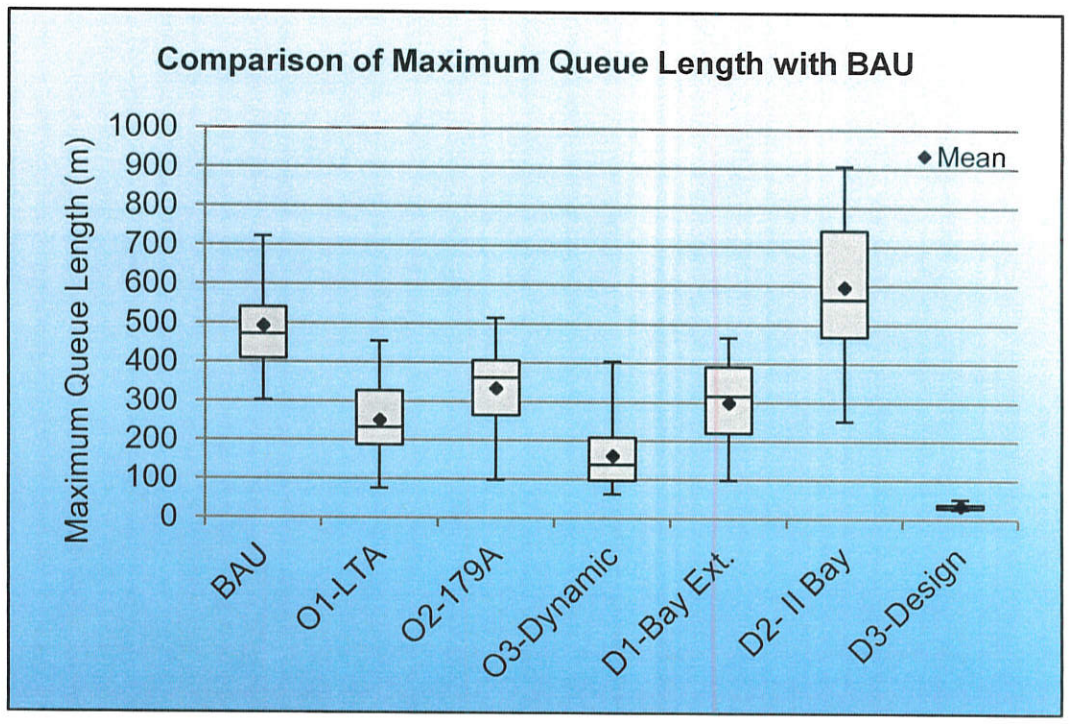

Fig 3: Results of maximum queue length of alternatives