

Impact of Connected and Autonomous Vehicles (CAVs) on the Urban Road Network Performance of Singapore

Master's Thesis of Pooja Yeola

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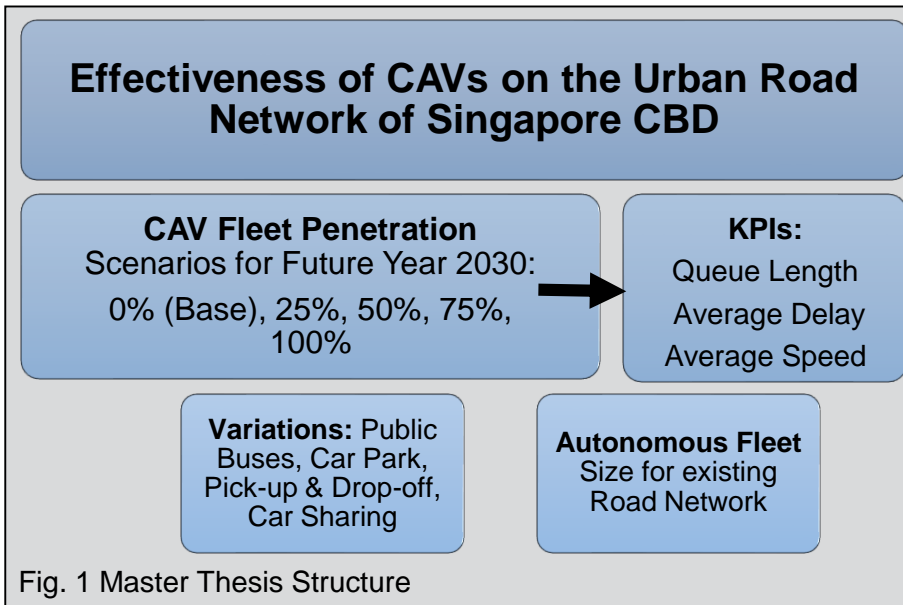


Fig. 1 Master Thesis Structure

Connected and Autonomous Vehicles (CAVs) have been in research for decades now and their arrival in reality is anticipated in the near future. With such technologies on the verge of being inherited on the roads of Singapore, it becomes necessary to know the possible implications. Hence, this study involving the CBD area was undertaken to fulfill the below-mentioned objectives.

The main objective of this research topic was to highlight the comparison of network performance of the legacy fleet as against the autonomous fleet at different penetration levels for the future year 2030. The penetration levels are as mentioned in the adjacent fig. 1.

The detailed version of the objectives was:

- To carry out a literature review to learn about the existing research on the potential impacts of CAVs all over the world
- To build an urban road network of the Singapore CBD for the purpose of micro-simulation using PTV's VISSIM software
- To analyse the results extracted from the various scenarios of CAV fleet penetration and compare them on the basis of defined Key Performance Indices (KPIs)
- To determine the autonomous vehicle fleet size for the existing road network
- To poach in ideas related to the inclusion of aspects such as public buses, car parks, pick-up drop-offs and car-sharing

CAV Fleet Penetrations	Queue Length (% decrease)	Average Delay (% decrease)	Average Speed (% increase)
Scenario 2 : 25%	32	23	27
Scenario 3: 50%	32	24	27
Scenario 4: 75%	36	25	29
Scenario 5: 100%	47	30	36

Tab. 1 Comparison of Change in KPIs with respect to Scenario 1: 0% CAVs

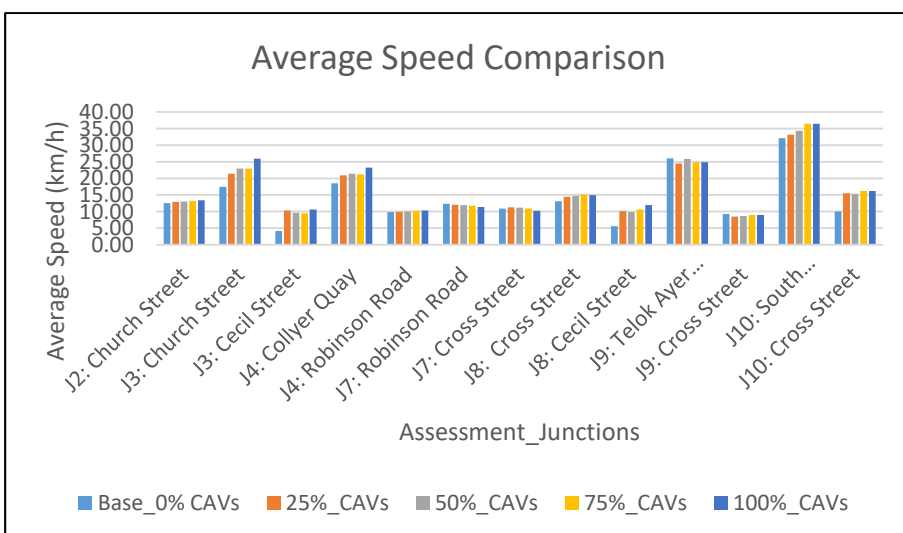


Fig. 2 Average Speed comparison for different CAV fleet penetrations

The results for the KPIs were extracted from the VISSIM Evaluation Results. They were compared for 10 (8 signalized, 2 unsignalized) assessment junctions which were chosen from within the CBD area. The comparison chart of the effect of CAVs at different levels of penetration is as shown in the tab. 1.

The impact on average speed as one of the KPIs is shown in the adjacent fig. 2. It was observed that the average speed on the links increases when CAVs run alongside the legal fleet on the urban road network.

It was hence inferred that, to welcome the CAVs in the future, proper rules and regulations along with some modifications in the infrastructure could be made to accommodate a self-driving behavior on the roads so as to be able to witness a significant effect on the urban mobility.