Success factors and impact of Self-Driving-Buses in an urban environment

Master‘s Thesis of Ioannis Sklavounos

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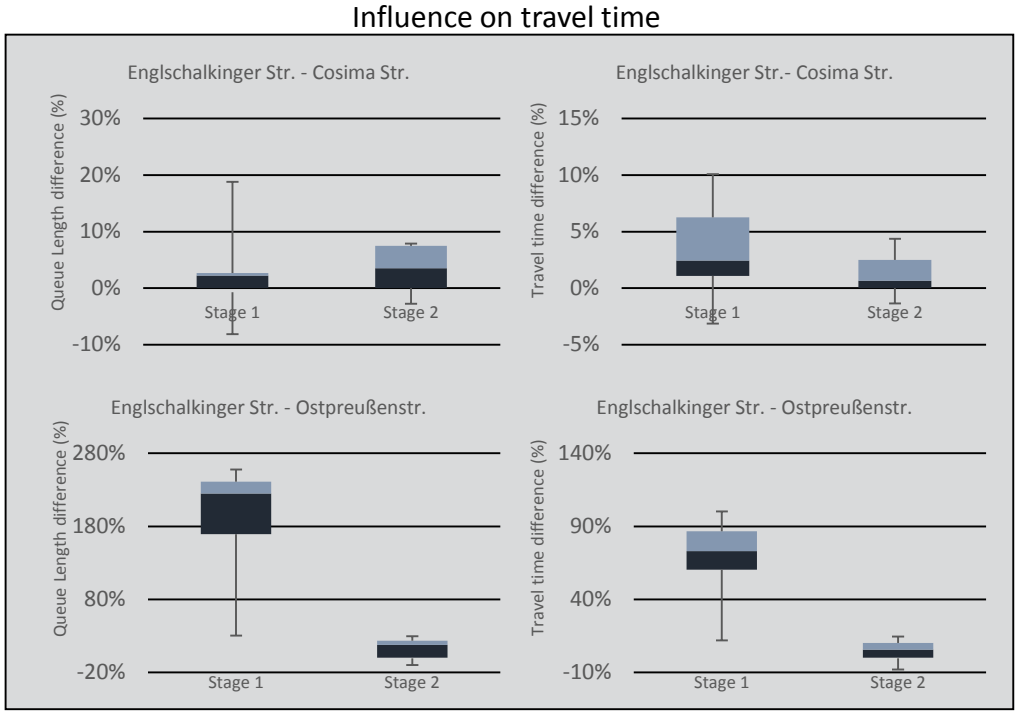
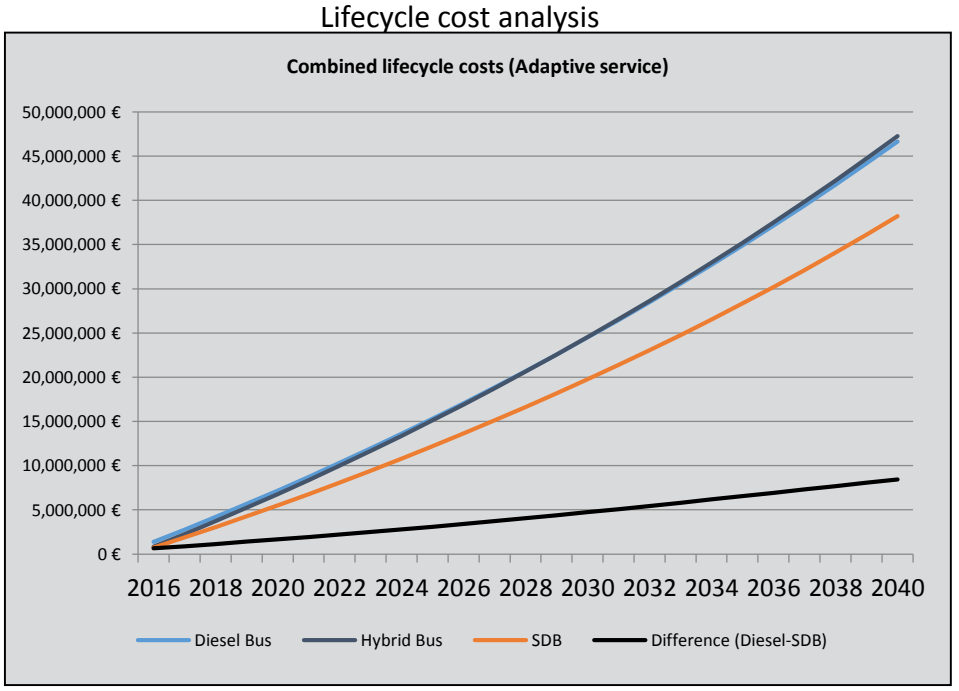
Influence on travel time



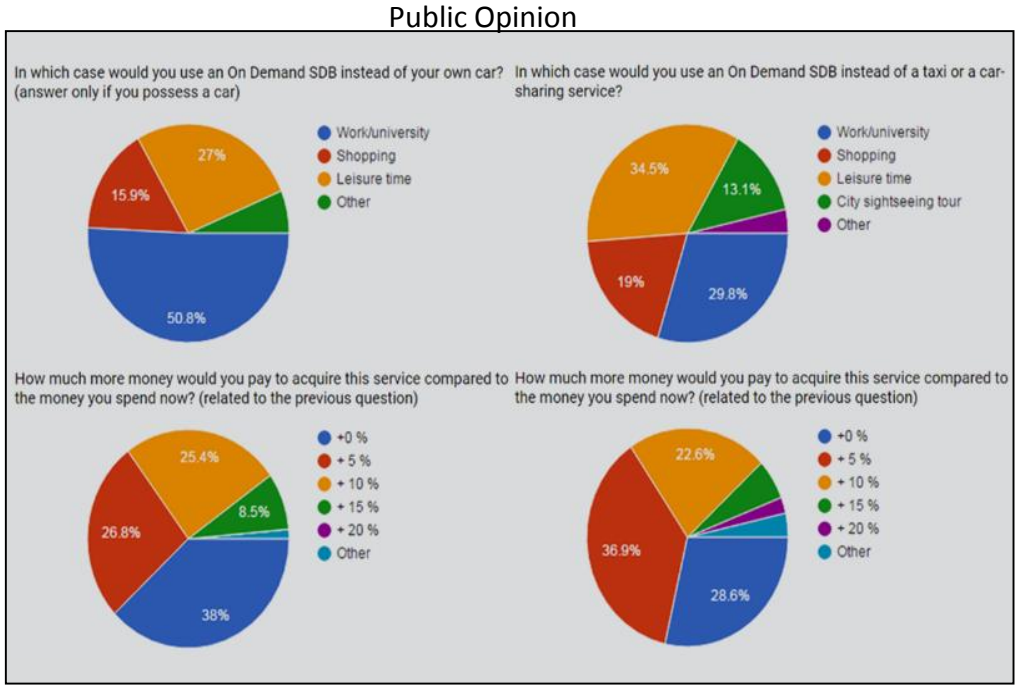
The difference in travel times is explained from the fact that at stage 1 the queue length and travel time at the intersection of Englschalkinger Str. with Ostpreußenstr. is doubled compared to the initial stage. At stage 2 the same behavior is observed and the queue length is around 75% longer than at the initial stage. The difference between stage 1 and stage 2, can be explained from the changes in the phase transition of the traffic lights in order to incorporate the dedicated bus lane in the street network and still prioritize public transportation. On the contrary, the difference for all the eastbound movements between the initial stage and stage 1 and 2, highlights the infrastructure limitations and the incapability of the intersection to handle the increased traffic volumes which are the result of more green time along the Englschalkinger Street. The adverse effect, however, is observed to the opposite direction. The intersection of Englschalkinger Str. with Cosimastr. has one more lane and a separate lane for left and right turning vehicles which is sufficient to handle the increased traffic volumes, thus resulting in shorter travel times in many cases. The influence on traffic caused by SDBs can be significant and this should be taken into consideration from PT operators and traffic managers.

Lifecycle cost analysis

The lifecycle costs of the examined bus lines are reduced if SDBs are chosen for the operation of the routes. These savings mainly originate from the salaries of the bus drivers and are only expected for bus lines with sparse timetable and few travelled kilometers. The effect of driver’s salary on operational expenses is also evident from the fact that even though SDBs are replaced twice during the 25 years period and regular buses once, SDBs are still the least capital demanding solution. These savings are multiplied if the system’s capacity is adapted on demand, and consequently the travelled kilometers are reduced. This result is expected because maintenance cost is a critical factor for the operational expenses of the bus lines. Therefore, SDBs are considered as an optimal economic solution for the operation of the bus lines. The demand analysis and the route segmentation led to reduced travelled kilometers by 26%. Moreover, the savings between diesel buses and SDBs at the end of the lifecycle period are increased by 420% compared to the regular service, thus making the decision in favor of SDBs even more obvious. The reduction in the travelled kilometers is crucial for the system’s economic performance since it influences the operational expenses of SDBs for maintenance and energy consumption.



Public Opinion



The majority of the respondents (76%) were educated young people and already familiar with the SDBs. More than 50% of them use one or more public means of transport (bus, metro, railway) for commuting to work/university or shopping. This percentage drops to 42% for leisure time activities since they prefer more private means of transport (bike, car). From the passenger’s perspective, the SDB is a promising mean of transport for commuting to work or university either as a service on demand or a regular service but under the condition that they wait 2-8 minutes less compared to the time they wait now. Moreover, the provided service should be punctual, safe and at a fair price. At last, the willingness of car drivers and taxi users to pay 5% to 10% more compared to the money they spend now for commuting to work or the university is a considerable revenue for PT operators who could offer personalized services at higher fares.