In the context of mobility and transit engineering, the emergence of new technologies has provided engineers with tomorrow's solutions to today's problems. Enhanced connectivity and information services have resulted in the rise of a new breed of transportation alternatives, such as rideshare (Uber, Lyft, etc.) and micro-mobility (Lime bike-share, Spin scooter-share). Mobility-as-a-Service (MaaS) is a concept that seeks to fully unify service with information to provide optimal travel solutions from a holistic framework that combines multi-modal private and public alternatives. Current research on existing MaaS applications has shown promising results in encouraging multi-modal trip planning and increasing transit ridership, however, the impacts on network performance have not been explored in-depth. This research aims to comprehensively quantify the benefits or detriments of different modes in a MaaS network in terms of performance and sustainability factors. A VISSIM model of I-Drive in Orlando was developed to reflect the existing conditions of a multi-modal transit corridor during a typical weekday PM peak hour. Alternative MaaS scenarios are analyzed by implementing ride-share and micro-mobility as alternative modes in addition to three existing modes: personal vehicles, transit, and walking. Varied modal splits are tested according to three (3) multi-level experimental designs under D-Optimality criteria. Several network-level and route-level performance measures were analyzed including average network delay, speed, total queuing, transit stop queuing, sidewalk travel time, and vehicular travel time along I-Drive. A practical benefit-cost analysis was also conducted comparing the costs of traditional capacity improvement projects with MaaS-oriented transit improvement projects in terms of externalities, operating costs, capital investment, and costs-over-time.

Analysis and statistical modeling of network-level factors found significant effects and interactions across all modes. Generally, transit was found to have major benefits for improving network-level factors relative to other modes. For instance, in congested conditions, increasing the transit modal share by eight (8) percent resulted in a 15.5% decrease in average delay throughout the network. Rideshare was found to have significant adverse network-level impacts while the roles of the walking and micro-mobility modes are less pronounced and dictated by their interactions. Route-level performance measures also suggest that rideshare represented the heaviest load per person on roadway capacity. Notably, transit was found to have no effect on transit stop queuing and interacts with vehicular demand such that adding transit capacity does not affect vehicular travel times at high congestion levels, suggesting the potential for transit to improve throughput in congested conditions. The impacts of infrastructure were also considered for queuing effects at shared rideshare-transit stops; on average, stops with lay-bys were found to enjoy over 1200% reduced spill-over queuing. Finally, the benefit-cost analysis demonstrates the cost-effectiveness of MaaS-oriented infrastructure and transit improvements per-mile and over time. Several transit improvement project cost estimates were compared with traditional lane build scenarios using real-world data. Despite the relatively high capital investment, the costs per-person-mile of added capacity were found to be at least 11.7 times cheaper for even the most expensive, cutting-edge transit improvements. Furthermore, operating costs and externalities for transit improvements were also found to be cheaper over time than the costs and externalities of vehicle ownership and maintenance. These findings lay the groundwork for standardizing efficient, conscious, and sustainable MaaS implementation in terms of modal focus, infrastructure requirements, and capacity utilization. Overall, the research findings were very encouraging, demonstrating the potential of MaaS for cost-effective congestion relief with strong implications for enhancing the practice of multi-modal transportation planning in Florida.

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The public is welcome to attend.