On-Demand Suspended railway systems: Evaluation for Urban Contexts

Master‘s Thesis of Julian Sandoval

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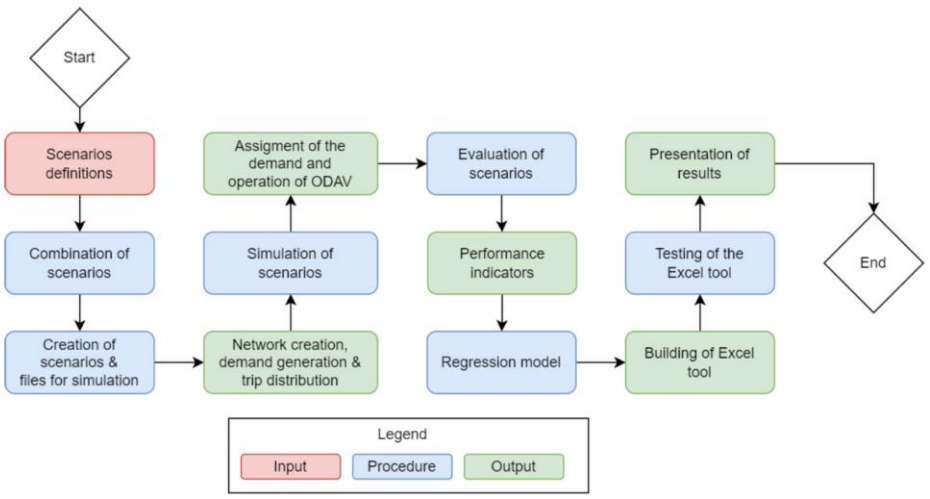

Figure 1: General Methodology

This study conducts 957 systematic simulations, varying crucial factors such as area, network density, demand, and supply, to assess the performance of the Ottobahn system as an On-Demand Automated Vehicle (ODAV) system. Illustrated in Figure 1, the project methodology encompasses defining scenarios, combining scenario parameters, generating simulation files, and executing simulations through the Simulation of Urban MObility (SUMO) tool. These scenario combinations span a diverse spectrum of operational conditions, facilitating a meticulous assessment of the Ottobahn system's performance (see figure 2). The results from these simulations are then utilized to evaluate and construct linear regression models, which seamlessly integrate with an Excel-based analytical tool. Specifically designed for user interaction, this tool serves to estimate the potential performance of similar systems within the scope of the research and compare different transportation alternatives that could be implemented in the future development of cities.

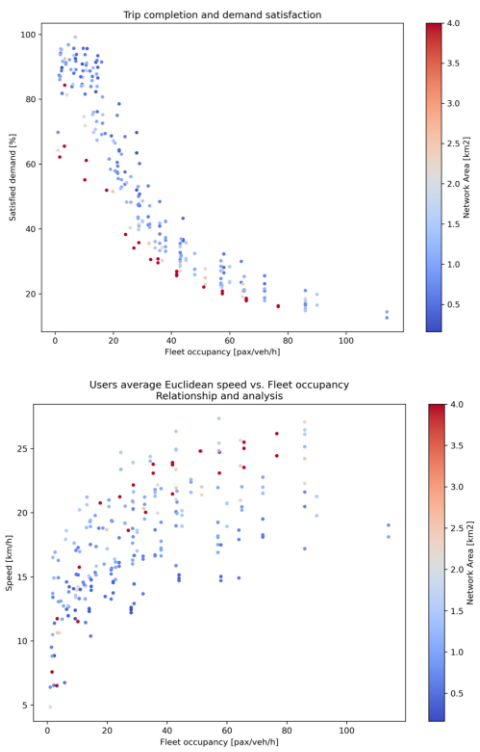

Figure 3: Simulations results

The Ottobahn, an innovative transportation prototype, represents a new generation in the on-demand and Mobility-as-a-Service market, featuring an electric and autonomous rail-hanging cabin system operating on an independent overhead rail network. This research project aims to analyze and compare such systems with conventional transportation alternatives, considering crucial elements like environmental impacts, time, budget, socio-economic conditions, and geographical constraints. Through transportation modeling, simulations, and scenario development, the project seeks to provide insights into Ottobahn system performance under various conditions, supporting informed decision-making processes and contributing to the discourse on the potential implementation of such alternatives for the well-being of citizens. The results, including linear regression models and an Excel tool, identify operational conditions and performance parameters, raising questions about Ottobahn's potential role as a standalone or complementary system within an urban context.

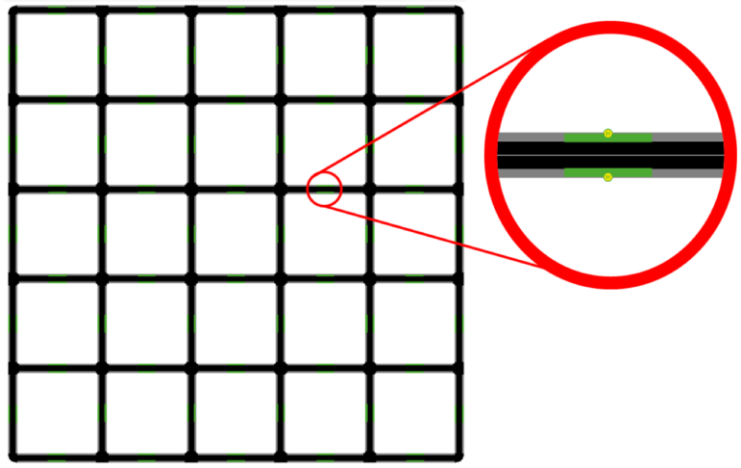

Figure 2: Example of a generated grid

Figure 3 shows how the system performance significantly declines beyond 20 passengers per vehicle per hour, impacting efficiency in completing trips. However, below this threshold, the system demonstrates high performance, effectively serving the majority of users under non-saturated conditions. Euclidean speed consistently falls behind route speed, with larger networks potentially supporting higher average speeds. Increased occupancy rates correlate with faster transportation, indicating that fewer vehicles in the network lead to quicker service. In high-demand scenarios, average speeds cluster in a region with relatively low fleet sizes. As fleet size increases, speed declines, and certain high-demand scenarios exhibit slower performance despite a higher number of vehicles.

This research extends an evaluation tool for transportation modes by integrating a dedicated module for the Ottobahn system into an Excel-based framework. Focused on simulating Ottobahn's behavior under various conditions, the project aids decision-makers in public transport infrastructure planning. Noteworthy features of the Ottobahn system, like autonomous cabins on rails and limited speed in urban settings, are highlighted. The methodology demonstrates adaptability by successfully simulating on-demand solutions, such as taxis, within the existing framework. This flexibility streamlines the assessment of emerging technologies, facilitating their integration into transportation planning and infrastructure development, contributing to the ongoing evolution of the field.

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