



THESIS DEFENSE



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Evaluating the long-term sustainability of emerging vehicle technologies: An emphasis on their built environment interactions

As the transportation sector's environmental impact continues to rise, the sustainable integration of emerging transportation technologies—autonomous vehicles, electric vehicles, and autonomous electric vehicles—into urban and regional environments has become increasingly critical for researchers and urban planners. While the near-term interactions of these technologies with other urban systems have become increasingly more well-studied, the long-term interactions of AVs and EVs remain uncertain. From an environmental impact perspective, the long-term interactions of AVs and EVs with, for example, the built environment could have long-lasting environmental outcomes that either usher society toward or away from a more sustainable transportation system.

This dissertation investigated the long-term sustainability of emerging transportation technologies by emphasizing the interactions they have with their built environment. Using supervised machine learning, the research demonstrated the increasing role of the built environment on EV adoption and highlighted the evolving relationship that exists between transportation and the built environment. Given this insight, the research then employed an agent-based simulation to explore how incremental AV adoption could influence residential preferences and a co-evolving housing market in Miami, Florida. The findings indicated that AVs could increase urban sprawl and travel distances, leading to increased greenhouse gas emissions, but the ultimate impact depended on land use planning in the city. By switching AVs for AEVs, the net transportation emissions decreased thanks to electrification. However, the shifting residential preferences also affect building energy consumption and, if the land use policy promoted single-family housing, emission reductions from AEVs were negated by 14%. Thus, the research makes a case for taking proactive measures concerning the greater urban or regional infrastructure systems to guide emerging transportation technologies along more desirable adoption pathways.



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