Using Machine Learning to Understand the Built Environment's Influence on 15-Minute Transit-Oriented Communities

Recipient/Grant (Contract) Number: University of New Orleans; Florida Atlantic University/69A3552348337

Center Name: Center for Transit Oriented Communities (CETOC)

Research Priority: Preserving the Environment

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Project Partners: N/A

Research Project Funding: $150,000 (USDOT) + $75,000 (matching funds) = $225,000

Project Start and End Date: 10/01/2023 to 09/01/2025

Project Description: Transit-oriented development is an old idea, but now it is complemented with the newer idea of 15-minute cities. 15-minute cities propose the concept that neighborhoods within cities can have most everyday activities located within a 15-minute walk or bike ride of most residences. Presumably, if a high-capacity transit station also incorporated 15-minute neighborhood design, then it would be possible for residents of that area to live without owning a vehicle, between the local access provided by the 15-minute neighborhood and the regional access provided by the transit station itself. This project will explore how the built environment can contribute to 15-minute neighborhoods in the vicinity of high-capacity transit stations. Our objectives are to 1) merge the concept of the 15-minute city with that of transit-oriented development 2) examine how supportive mixed-use built environments can increase the internal trip capture of transit-oriented communities 3) increase the attractiveness of transit-oriented communities by making them more self-contained 4) facilitate the affordability of transit-oriented communities by making it possible to live in such a community without owning a vehicle 5) apply emerging machine learning tools to develop new insights into the problem of internal trip capture and 15-minute cities and 6) to answer the research question: do different levels of land use intensity, land use mix, and street network connectivity result in 15-minutes neighborhoods for areas surrounding high-capacity transit stations? We will examine internal trip capture and nonmotorized trips for nonwork trips around transit station areas for surrounding high-capacity transit stops. We will examine data from two metropolitan areas with distinctive built environments and socioeconomic characteristics. Methods used will include 1) a literature review of the literatures on internal trip capture and 15-minute cities 2) leveraging travel behavior surveys (and perhaps large-scale GPS data) to identify nonwork trips, trip origins, and trip destinations 3) developing various measures of the built environment using GIS, including the D's of density, diversity, design, and destination accessibility 4) statistically analyzing the relationship between the dependent variables of internal trip capture and nonmotorized trips relative to built environment variables, employing both traditional statistical and machine learning techniques. Include applicable control variables such as socioeconomic characteristics

and vehicle ownership and 5) using machine learning to analyze non-linear relationships and thresholds among the independent variables and the outcomes of internal trip capture and nonmotorized trips. For example, increasing mixed use may increase internal trip capture, but only up to a point; after that further mixing of uses has no marginal benefit. Traditional linear regression techniques cannot determine such a threshold, but machine learning techniques can.

USDOT Priorities: This project aligns with the USDOT goal of transformation by facilitating coordination of transportation and land-use planning and promoting the collaboration of regional transit agencies with local land-use planning jurisdictions. It also promotes the USDOT's goals of facilitating multimodal travel by supporting built environment patterns that integrate well with public transit, therefore supporting walking, bicycling, and micromobility as supplemental modes, as well as access and egress modes, to public transit.
This project aligns with CETOC's goals of promoting multimodal travel needs and preserving the environment by facilitating built environment and land use patterns around transit stations that promote multimodal travel and allow residents of transit-station areas to live without having to own a personal vehicle. The project also promotes CETOC's Tech Transfer goal by developing a Policy Brief that summarizes the main findings of the research and is easily digested by local land-use planning authorities as policy guidance.

Outputs: 1) One or more peer-reviewed publications. Example title: Built environment thresholds for optimal 15-minute neighborhood design around transit stations. 2) One conference presentation 3) One webinar 4) One policy brief for the CETOC website. The policy brief will elaborate desirable built environment variable targets for facilitating 15-minute neighborhoods around transit stations. It will explore if there are any differences between the performance of neighborhoods with surface and subterranean transit systems, i.e. light rail vs. heavy rail.

Outcomes/Impacts: This project may result in improved policies concerning the development of transit-oriented communities, including new zoning laws or standards to promote the fusion of 15-minute city and transit-oriented development concepts. The focus of this project will be guidance for land-use planning in the vicinity of transit station areas. The guidance will address the density, mix, and connectivity of land-uses surrounding transit-station areas.

Final Research Report: (Link to be provided after project completion).