**A planning tool of equity transit-oriented development (ETOD): Evaluating and classifying transit stations based on a node-place-vulnerability model in Austin, TX.**

Transit-oriented development (TOD) is an urban planning strategy that builds a transit-oriented, compact, mixed-use, and pedestrian friendly district around the transit stations. Transit-oriented development is valued for its ability to increase livability, land value, and transit ridership in the vicinity of transit stations. Despite the benefits of traditional TOD, subsequent growth around many of the investments in public transportation drives up rental rates and drives out residents, resulting in further displacement of these communities in Austin.

The purpose of this research is to develop a planning tool for developing a topology based on a node-people-vulnerability model, to achieve better service for investments in transportation, while considering issues of equity. Node-place models are classic models used to analyze the integration of transportation and land use at existing stations. Generally, a node is defined as its connectedness to other places, which can be measured by transit frequency, sidewalk connectivity, etc. The place mentioned is the area around the station, which is normally measured by the number of employees, population, and land use. Previous studies considered the ridership and accessibility as the third index of the node-place model. However, vulnerability is an index which rarely been considered. As a consequence, the first objective of this research is to add the vulnerability index to the traditional node-place model, which consists of a series of sub-indicators, such as income, race, nationality, age, and car ownership.

The discussion of weighting methods on the sub-indicators of each index is rare in previous research. Therefore, instead of simply weight them equally, the second aim of this research is to explore the weight method in a statistical and local way. Based on statistics, these indicators may be strongly correlated with each other, and in a local context, each indicator has a different significance for nodes, places, and vulnerability indices in different cities. Therefore, this research adopted two methods to give the weight of each sub-indicators. The first method is to use principal component analysis to eliminate the collinearity between each sub-indicators, and the second method is to apply entropy weight method to evaluate each sub-factors according to its dispersion.

The third aim of this research is to develop a topology of current metro stops in Austin by using the K-Means clustering algorithm. The result shows that K-Means have good performance on identifying and classifying the most vulnerable station among all metro stops, no matter after weighting by principal component analysis or weighting by entropy weight method. For planning practice, this research can be used as a planning tool to classify the current transit stations with the consideration of vulnerability.