



PROJECT TITLE: TOWARDS SOCIALLY AND ECONOMICALLY SUSTAINABLE URBAN DEVELOPMENTS: IMPACTS OF TOLL PRICING ON RESIDENTIAL DEVELOPMENTS

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Road pricing has gained more research attention due to its effectiveness in managing traffic congestion and financing transportation infrastructure during recent years. Most research efforts focus on the functionality of road pricing in managing traffic congestion and raising revenue. In contrast, little is known about the impact of such pricing policies on urban development over time. In this context, there is an urgent need to develop a modeling tool that investigates not only how road pricing affects the short-term mobility and reliability of transportation systems, but also how it would influence the sustainability and equity of urban development.

To meet the need, this study investigates the impact of toll pricing on a residential land use choice in urban areas with Greater Buffalo-Niagara metropolitan area as the study case. Various data sources were compiled for the analytical purpose, including the parcel-level tax map, the American Community Survey data, the American Housing Survey data, the employment information from OnTheMap.com, and the transportation cost of the buffalo region. The fused information was then used to generate the potential factors such as housing price, housing size, population age group, population income, and employment that influence the land use choice decision of residents. As a main factor tested, toll charges that are combined with the number of employees were used as the determinant to calculate the accessibility to an area. Using the data collected, a series of multinomial logit models were developed. We related the decision of residential land use choice to the aforementioned factors at the census-tract level. Four residential land use types—single-family houses, multiple-family houses, apartments and others—are main choice alternatives. With various criteria, the best choice model was selected; this was then used to test several hypothetical toll pricing scenarios where we tried to identify the plausible pricing policies to promote sustainable residential development in the study area. Three groups of toll pricing scenarios include

the uniform toll, the density-based toll and the zone-based toll, were evaluated for their impacts on residential land use choice. As found, when imposing tolls, the alternative of single-family house was usually positively affected, while the alternative of multiple-family house was always negatively affected. Uniform toll price appeared to be the most effective strategy, but not necessarily the most rational one. The density-based toll pricing and zone-based toll pricing offered more sensible approaches to achieve the goal of land use and transportation sustainability.

Accessibility was proven to have profound impacts on the residential land use choice, and it is also one of the most important affecting factors in land use planning as well as toll pricing policy design. Toll pricing was also verified as a promising approach to better shape the urban land use.

The main contribution of this study includes: 1) addressing the impact of toll pricing policies on land use patterns in urban areas which has not actively been investigated; 2) connecting deep insights of toll pricing policies to sustainable residential land use in urban areas through the test of various toll pricing scenarios; and 3) laying the foundation for a more appropriate approach to evaluating toll pricing policies, i.e., the integrated land use and travel demand forecasting method that has the capacity of examining both the short-term and the long-run effects of toll pricing on urban residential development.

