

In Partial Fulfillment of the Requirements for the Degree of

## **Doctor of Philosophy**

**Liou Xie**

Will defend her dissertation

### **Sustainability Implications of Mass Rapid Transit on the Built Environment and Human Travel Behavior in Suburban Neighborhoods: The Beijing Case**

#### **Abstract**

The sustainability impacts of the extension of Mass Rapid Transit (MRT) services to suburban Beijing are explored. The research focuses on the neighborhood level, assessing sustainability impacts in terms of greenhouse gas emissions, air pollution, and energy consumption. By emphasizing suburban neighborhoods, the research targets the longest commuting trips, which have the most potential to generate significant sustainability benefits. The methodology triangulates analysis of urban and transportation plans, secondary data, time series spatial imagery, household surveys, and field observation. Three suburban neighborhoods were selected as case studies.

Findings include the fact that MRT access stimulates residential development significantly, while having limited impact in terms of commercial or mixed-use (transit-oriented development) property development. While large-scale changes in land use and urban form attributable to MRT access are rare once an area is built up, adaptation occurs in the functions of buildings and areas near MRT stations, such as the emergence of first floor commercial uses in residential buildings. Near stations can be found street vendors, tricycles, illegal taxis and unregulated car parking, often impeding access and making immediate surroundings of MRT stations unattractive, perhaps accounting for the lack of significant accessibility premiums (identified by the researcher) near MRT stations in suburban Beijing.

Household-based travel behavior surveys reveal that public transport, i.e., MRT and buses, accounts for over half of all commuting trips in the three case study suburban neighborhoods. Over 30% of the residents spend over an hour commuting to work, reflecting the prevalence of long-distance commutes, associated with a dearth of workplaces in suburban Beijing. Non-commuting trips

surprisingly tell a different story, a large portion of the residents choose to drive because they are less restrained by travel time.

The observed increase of the share of MRT trips to work generates significant benefits in terms of lowered energy consumption, reduced greenhouse gas and traditional air pollution emissions. But such savings could be easily offset if the share of driving trips increases with growing affluence, given the high emission intensities of cars. Bus use is found to be responsible for high local conventional air pollution, indicating that the current bus fleet in Beijing should be phased out and replaced by cleaner buses. Policy implications are put forward based on these findings.

The Intellectual Merit of this study centers on increased understanding of the relationship between mass transit provision and sustainability outcomes in suburban metropolitan China. Despite its importance, little research of this genre has been undertaken in China. This study is unique because it focuses on the intermediate meso scale, where adaptation occurs more quickly and dramatically, and is easier to identify.

Thursday, July 19th, 2012

9:00 am

Wrigley Hall, Room 323

Faculty, students, and the general public are invited.

Supervisory Committee:

Douglas Webster, Chair

Jianming Cai

David Pijawka

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