

Street attractiveness enables change to a city structure

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Abstract

The study proposes an agent-based model for urban dynamics, combining locating of a facility for stopping off and measures to promote street attractiveness. The model expresses simplified urban dynamics. It also enables to verify how policies affect the daily travel of urban residents and indirectly change an urban structure towards a desirable formation. As a result, the model clarified that the policy of street attractiveness affected compactification of an urban structure physically and a significant decrease of car users along with CO₂ reduction. Use of this model, reveals significant differences of improvement effects on an urban structure depending on the locations of the facility, the implementation scale of each promotional measure around the facility, and demonstrates the synergy effects of the policy on transportation.

Keywords: Agent-based model, Compact city, Urban design, Urban sprawl

Introduction

Throughout the 20th century, there was a rapid increase in the world's population along with rapid urbanization. Even in this century, there is no decline in the momentum. The urban sprawl structure has been one of the larger themes related to urbanization for decades and recognized as a serious issue in many cities (Haase et al., 2010; Kazepov, 2011). In Japan, residents in towns were assumed to commute by public transportation, but gradually motorization in their daily life progressed. For this reason, the expansion of less-populated urban areas has been progressing until now (Kaido, 2010; Koike et al., 2000). There is a concern that this situation may lead to consequences such as a decline in living convenience of residents due to a lack of public services.

Additionally, another concern is, problems caused by the excessive dependence on automobiles. This results in another chain of reactions such as air pollution and an increase in consumption of fossil fuels. There is a concern that in the near future, such problems will become more serious in many cities like Japan, and also in some emerging countries. Therefore, as a countermeasure to this situation, the transformation into compact cities has been explored (Howley, 2009). In order to analyse urban dynamics and verify how policies that affect the daily travel of urban residents change an urban structure toward a desirable formation indirectly, we conducted an agent-based model (ABM) to verify the possibility of changing an urban structure towards a desirable formation indirectly, by inducing behaviours of autonomous individual residents rather than by forcing them. For this reason, this simulation method is expected to contribute to measure the effects of the policies on a complicated environment (Jager & Mosler, 2007; Taniguchi & Takahashi, 2011).

Simulation model

Figure 1 shows the schematic of the simple urban model. This is the simplified expression of a part of a central commercial area and bedroom towns connected by railway. In the urban model, two domains are located: the residential zone and the