

## Chapter 3.3

# A Decision Support System for Sustainable Urban Development: The Integrated Land Use and Transportation Indexing Model

**Fatih Dur**

*Queensland University of Technology, Australia*

**Tan Yigitcanlar**

*Queensland University of Technology, Australia*

**Jonathan Bunker**

*Queensland University of Technology, Australia*

### ABSTRACT

Broad, early definitions of sustainable development have caused confusion and hesitation among local authorities and planning professionals. This confusion has arisen because loosely defined principles of sustainable development have been employed when setting policies and planning projects, and when gauging the efficiencies of these policies in the light of designated sustainability goals. The question of how this theory-rhetoric-practice gap can be filled is the main focus of this chapter. It examines the triple bottom line approach—one of the sustainability accounting approaches widely employed by governmental organisations—and the applicability of this approach to sustainable

urban development. The chapter introduces the ‘Integrated Land Use and Transportation Indexing Model’ that incorporates triple bottom line considerations with environmental impact assessment techniques via a geographic, information systems-based decision support system. This model helps decision-makers in selecting policy options according to their economic, environmental and social impacts. Its main purpose is to provide valuable knowledge about the spatial dimensions of sustainable development, and to provide fine detail outputs on the possible impacts of urban development proposals on sustainability levels. In order to embrace sustainable urban development policy considerations, the model is sensitive to the relationship between urban form, travel patterns and socio-economic attributes. Finally,

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the model is useful in picturing the holistic state of urban settings in terms of their sustainability levels, and in assessing the degree of compatibility of selected scenarios with the desired sustainable urban future.

## **INTRODUCTION**

The concept of sustainability and its applicability to real settings has been one of the most discussed issues in the urban planning literature. As rapid urbanisation and growing urban population are considered, the implications of changing life-style related sustainability problems and their remedies could be considered as the most pressing focus of the urban planning profession. The complex natures of both cities and politics force urban planners to analyse contemporary urban problems more carefully and to produce more effective policy recommendations. It is evident that a framework is needed to analyse these issues and to determine policies, in particular when considering urban development strategies. In this respect, the emerging concept of sustainable urban development (SUD) can be tied to the policy and procedures development responsibility of urban planners. Initially, however, problems should be analysed with respect to their effects on urban sustainability.

While SUD encompasses a wide range of urban planning interests—for example, sustainable urban economy, infrastructure and services, integration of communities, green attitudes, public participation, and governance—most of the SUD issues discussed in the literature focus on spatial considerations, particularly with respect to the urban form and its effects on mobility patterns. This interdependence between the urban form and travel patterns of individuals and households could make it possible to address the causes of, and intervention options for, pressing sustainability problems. These problems consist of urban sprawl, high vehicle kilometres travelled

(VKT), auto dependence, low public transport patronage, transport-related pollution, excessive land consumption, disruption of ecosystems, and so on. The main focus of this study will be the connection between urban form and mobility, and how this connection can be assessed.

An indexing model will be employed in the case of the Gold Coast, one of the most rapidly developing cities in Queensland, Australia. After the identification of the sustainability problems and their relationship with the selected urban formation, determination of policy development will be discussed. In order to avoid replacing the decision maker, the policy development process will be scrutinised together with the planning decision support system framework. This will give the decision maker the opportunity to change decision parameters or relative weights of decisions, and to test the sensitivity of the designated interventions. Policy formulation and evaluation issues will be discussed according to various relevant indicators/variables included in the model, regarding both spatial and attribute data (for example, demographics data). Geographic information systems (GIS) tools will be used in the modelling and visualisation of the variables in terms of spatial sustainability level.

The spatial indexing model will be used for analysis, and to produce relatively fine detailed model output for policy formulation. The proposed model consists of four sequential modules, each of which processes information from the preceding module. Initially, in order to clarify key concepts and consolidate the model structure, theoretical debates on definition and measures of urban sustainability will be identified. This procedure will provide a relevant, policy-laden and predictable set of indicators employed by other studies. Then, respective data related to these indicators will be collected from various sources; for example, from the Australian Bureau of Statistics (ABS), Gold Coast City Council (GCCC), and Queensland Transport. Via the indexing module, factors affecting transportation demand will be calculated

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