

Chapter 4

Sustainable Transport Infrastructure: Perspectives for Sustainable Urban and Transport Development

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ABSTRACT

Many economic, social and environmental sustainability problems associated with typical urban transportation systems have revealed the importance of three domains of action: vehicle, infrastructure and user. These domains need to be carefully reconsidered in search of a sustainable urban development path. Although intelligent transportation systems have contributed substantially to enhancing efficiency, safety and comfort of travel, questions related to users' behaviors and preferences, which stimulate considerable environmental effects, still needed to be further examined. In this chapter, options for smart urban transportation infrastructure development and the technological means for achieving broader goals of sustainable communities and urban development are explored.

INTRODUCTION

The sustainability concept has become a prevalent policy underpinning both developed and developing countries' planning agendas. This is the result of externalities (for example, climate change, non-renewable fuel depletion, air, water and land

pollution, rapid and sprawling urbanization, social inequalities, and so on) that are often not considered until they reach the level where disregarding consequences of these externalities may jeopardize the overall wealth of the citizens. The trend of growing urban population and associated citizen needs has highlighted the importance of actions which should be taken to reach the goals of sustainable communities. In particular, transport activities have

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presented the most distinctive issues for academic and governance inquiry because of their substantial contribution to pollution problems and climate change (Newman et al., 1999; Banister et al., 2000; Low & Gleeson, 2003).

While it is well documented that petroleum-based fuels create the most hazardous emissions, these are also non-renewable energy resources. Once depleted, future generations will need to seek out new resources, and these may present their own challenges. This highlights a contradiction between the consumption pattern of the current generation and a central tenet of sustainability: intergenerational equity. Further, petroleum is an imported good for most countries, is priced globally and sustains significant market volatility. Thus, energy security is an issue for most national economies. On the positive front, growing interest in the use of renewable energy resources can lead to technological developments that help to create solutions for two main problem areas: CO₂ and other hazardous gas and particulate emissions, and energy security (Anderson et al., 1996).

Urban traffic congestion causes inefficient use of time and energy resources, leading to an increase in social cost impacts and economic inefficiency. This may be considered a most tenacious problem, even if the problems of pollution and non-renewable energy use were able to be ameliorated. A globally pervasive increase in vehicle numbers and vehicle kilometers travelled means that solutions to the congestion problem are rather challenging when compared to the other externalities (Kanninen, 1996). Further, due to an increase in the volume of urban traffic, a growing number of traffic crashes resulting in injuries and fatalities have occurred. Thus, the monetary and social costs of crashes are further elements that need to be addressed through sustainable transport system policies.

A considerable number of studies have investigated how the externalities of the current surface transport system (non-renewable fuel use and greenhouse gas emissions, traffic congestion,

low and unequal mobility, pollution, accidents and fatalities, degradation of ecosystems) may be minimized and/or internalized, while benefits of mobility are maximized and shared equitably through sustainable urban and transport development means. Therefore, planning and management of transport infrastructure are central foci in the consideration of how the movement of people and goods might be configured according to a sustainable transport framework. In this regard, the efficient use of resources requires particular attention to economic, environmental and social dimensions. In practice, three action domains or elements of any transport activity – vehicle, infrastructure and user – need to be considered in the search for sustainable urban transport solutions (Figueiredo et al., 2001).

Betterment strategies for the first two elements (vehicle and infrastructure) mostly rely on technological improvements in alternative fuels, vehicle systems and surface transport infrastructure. Examples of such improvements include sensor and control technologies, communications, informatics, and so on. Users of the system will benefit from all marginal/incremental improvements made in these elements.

With respect to the third (user) domain, alteration of users' travel behavior in the interests of sustainability necessitates travel demand management (TDM) policies. The primary function of TDM is to reduce automobile travel demand, and it has become ubiquitous in urban transportation policies in Europe, Canada, Australia, and many areas of the United States. While the necessity to curtail unsustainable personal travel patterns cannot be denied, telling people how they are supposed to act challenges the ideal of individual freedoms in a democratic society. This is why TDM policies can incorporate a wide range of contestable measures. So as not to violate individual freedom of choice in travel, or appear to be doing so, some governments have applied indirect TDM measures, such as:

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