

## Chapter 4.15

# Bike Transportation System Design

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### ABSTRACT

*The main objective of this chapter is to address the facility design and location issues in a public bike transportation system. The major decisions in introducing a public bike transportation system include determining the number of bike facilities and their locations. The present chapter considers a case study from city of Vancouver bike transportation system to demonstrate the importance of these decisions through a real world application. The city intends to decide the number and location of bike terminals. Addressing these two decisions is the main focus of the present chapter and the chapter employs linear programming and center of gravity approaches to arrive at the solutions. The chapter also provides a basic introduction to bike facilities and discusses the sustainability benefits of bike transportation mode.*

### BACKGROUND

Public transport represents an essential component of urban transportation system development. Public transportation sets the development theme of a city and reflects a city's preferences and priorities towards environmental sustainability. Therefore, sustainability is a major objective in the design of public transportation systems. Most public

transportation systems face certain challenges in terms of accessibility, social acceptability, convenience, availability and affordability. Despite these challenges, a rapid population growth and commercialization has led to a sharp increase in the demand for urban transport services. Major cities around the world depend on public transportation to alleviate their day to day problems. The main problems encountered in these cities include higher traffic congestion, pollution, poor accessibility and others. In some congested cit-

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ies (e.g. Bangkok and New Delhi), the weekday peak-hour traffic speeds average about 10 km per hour or less and the average one-way work commute is more than 60 minutes for reasonable commuting distances (Iyer, 2001; Habitat, 2001). A study (OCMLT, 1998) estimated that the direct annual economic costs of congestion in Bangkok at 163 billion baht. This included 27 billion for the costs of extra vehicle operations, 20 billion for additional labor, and 116 billion for lost time of passengers. This cost does not include the cost of damage to the environment and health of mankind (OCMLT, 1998). In some cities, the level of traffic congestion is so high that even small improvements result in significant health and financial benefits. A World Bank study estimated that a 10 per cent reduction in peak-hour trips in Bangkok would provide benefits of about US\$ 400 million annually (ESCAP & ADB, 2000).

Most countries address these challenges by increasing road-lengths, building bridges and city by-pass perimeter roads and developing complementary public transport systems. Towards this end, bicycle transportation has emerged as a viable transportation mode. Recreational purposes remain the main use of bicycling, but people are becoming increasingly more aware of the usefulness of this energy efficient, cost effective, healthy and environmental friendly mode for other purposes. In recent times, we have witnessed a significant rise in the number of people using bicycle mode for work commute and other travel. In order to further promote this trend, different tiers of Governments must encourage more bicycle-related programs and considering bicycle mode during all phases of transportation planning, roadway construction and infrastructure capacity increments. Expanding opportunities for cyclists has numerous benefits not only for individuals but for the society as a whole. The lack of bicycle facilities and the integration of these facilities with existing transportation infrastructure remains a serious concern.

Some of the negative aspects of bike transportation include the safety of bike rider especially on shared-tracks, lack of integration with other modes and inability to travel over longer distances and under severe weather conditions. Despite these concerns, bicycling offers significant benefits to both individual users as well as the society. Bicycle mode is well-suited to urban situations as it opens up numerous possibilities for commuters and recreational bikers by providing access to remote areas that otherwise could not be served by other modes. Moreover, there is no denying the fact that increased use of bicycling will substitute auto trips yielding benefits to society in terms of decreased congestion, improved air quality and less dependency on non-renewable sources of energy. This mode of transportation emits no harmful emissions into the environment and is cheaper to own and maintain (NCHRP, 2006). The cost of providing bicycle facilities is small when compared to the money spent on developing other modes of transportation (Marlin, 2008; Bowman & Vecellio, 1994). Public health and obesity issues remain a major concern to many governments. Biking provides a healthier transportation option. The relationships between community design, transportation facilities, and physical activity levels have been well documented in various studies (Handy, 2002; Sallis, 2004).

Bike transportation also provides benefits in terms of efficient land development. There has been a mad rush for sprawling land development which increases the travel distance for work, shopping and recreational activities and forces people to use autos (Frank, 2000; Wilkinson, 2002; Pucher & Dijksra, 2003). Incentives for bike ridership may mitigate the negative effects of urban sprawl by efficient land development. Therefore, bicycling may very well emerge as a viable mode of transportation for everyday commute provided the right infrastructure is developed. Public and private development agencies prefer to acquire the land for various projects well in advance. Land acquisition at later stages is an expensive

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