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Urban Transport and Sustainable Transport Strategies: A Case Study of Karachi, Pakistan*

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Abstract: The uncontrolled growth in urbanization and motorization generally contributes to an urban land use and transportation system that is socially, economically, and environmentally unsustainable. This paper uses Karachi as a case study, which is the largest urban and economic centre of Pakistan, passing through an uncontrolled phase of rapid urbanization and motorization. The paper first reviews research related to sustainable transportation systems to comprehend the concept of sustainable development and transportation. The paper then evaluates the existing transportation and infrastructure system, national transportation policies, and urban transportation projects to determine if the current paradigm is moving toward or away from sustainable transportation. Furthermore, the principles for sustainable urban transportation are developed to see what significance national transportation policies have given to urban transportation from a sustainable transportation point of view. Finally some strategies are suggested, adoption of which may lead to a sustainable urban development and transportation system in Karachi.

Key words: sustainable development; urbanization; motorization; socio-economic; integrated land use and urban transportation system

Introduction

Urban transportation is a pressing concern in mega cities around the world. The rapid urbanization and motorization in these cities have a direct impact on sustainable development. The transport sector's energy consumption and greenhouse gas emissions will likely be doubled by the year 2025[1]. Moreover, the environmental and social impacts of urban transportation are increasingly being seen as a menace to the sustainability of the global ecology[2].

The mitigation of transportation externalities requires a shift towards sustainable transportation systems. The idea of sustainable transportation emerges from the concept of sustainable development in the transport sector and can be defined as follows[3], "Sustainable transportation infrastructure and travel policies that serve multiple goals of economic development, environment stewardship and social equity, have the objective to optimize the use of transportation systems to achieve economic and related social and environmental goals, without sacrificing the ability of future generations to achieve the same goals".

Adoption of the principles of sustainable transportation has become more important in Karachi, where the inefficient public transportation system and rising incomes have stimulated the demand for personal mobility with increased automobile ownership and use. Growing motorization combined with inadequate traffic management strategies, an aging and ill maintained vehicle stock, and inadequate land use and transportation planning, has all led to a significant level of traffic congestion resulting in longer travel times, additional

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fuel consumption, high pollution levels, and a deteriorating urban environment that has a direct bearing on sustainable development.

The concept of sustainable development and sustainable transportation systems can be understood by exploring their evolution. In the 18th century economist and philosopher Thomas Malthus hypothesized that improvements in the quality of life would stimulate population surges that would outpace increases in the means of subsistence[4]. The term sustainable development was first used by World Conservation Strategy (WCS) in 1980 to emphasize the significance of resource conservation without which humanity has no future[5]. Sustainable transportation is an expression of sustainable development in the transport sector. A review of the literature has shown a growing emphasis on developing sustainable transportation systems as well as policy-oriented studies[5-7] to address transportation related negative externalities such as air and noise pollution, accidents, congestion and social exclusion, and to meet current and future mobility and accessibility needs without creating excessive negative externalities. The reviews also established that sustainable transportation systems require a dynamic balance between the main pillars of sustainable development, i.e., environmental protection, social equity, and economic efficiency for current and future generations[8-10]. Balancing of the various economic, social, and environmental factors is difficult so various attempts have been made[8,11,12] to list indicators that may assist examination of the sustainability of transportation systems. However, one deficiency in the literature seems to be the lack of consensus on which policies or initiatives will result in a sustainable transportation system, while another deficiency is the lack of social aspects/indicators because of a lack of knowledge and of techniques for assessing the social impact of transportation system changes.

The research is based on a case study of Karachi, Pakistan. Karachi is a mega city having a population of over 14 million. The city is the financial and business hub of Pakistan and being the only port city, serves Pakistan and the landlocked central Asian countries. The study using available data evaluates the city's urban development, transport and infrastructure systems, environmental situation, transport policies, and transport projects. This evaluation seeks to identify if the current paradigm is moving the city towards or away from sustainable transportation. Some strategies are suggested based on the evaluation.

1 Overview of Karachi's Urban Development

Karachi is characterized by an accelerating rate of suburban growth. Its growth rate has been phenomenal as shown in Table 1. The city has seen a 35-fold increase in its population and an almost 16-fold increase in its spatial expansion since the emergence of Pakistan. Moreover, estimates are that by the year 2015, the city may reach a population of 19.2 million with an annual growth rate of over 5%[13].

Table 1 Karachi metropolitan population and area growth rates

Year	Population (million)	Area (km^2)
1947	0.4	233
1981	5.3	1994
1998	9.8	3527
2004	14.0	3566

The population density of the city according to the 1998 census is tabulated in Table 2, which shows that the density of different areas varies from the central city (33 014 persons/km^2) to the outskirts (433 persons/km^2). Karachi is basically a mono centric city where over 70% of the business services and about half

Table 2 Area, population, and population density of Karachi in 1998[14]

Location	Area (km^2)	Population (persons)	Density (persons/ km^2)	Urban proportion (%)
Karachi East	139	2 746 014	19 756	100.0
Karachi West	929	2 105 923	2267	90.7
Karachi South	122	1 745 038	14 304	100.0
Karachi Central	69	2 277 931	33 014	100.0
Malir	2268	981 412	433	67.3
Total	3527	9 856 318		