

An Analysis to Challenges of Sustainable Urban Transport in Metropolitan Areas

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ABSTRACT

The historical patterns of urban development strongly had paved the way for achievement of sustainability regarding issues of energy and water use, food production, waste generation and disposal, biodiversity and equal opportunity. The traditional urban pattern was a cluster of human activities in city downtowns and neighborhood centers surrounded by residences in a density gradient. But, increasing mobility as a consequence of longer distances, caused by the growth of cities and urban areas and the consequent traffic problems all have contributed to decline of sustainability in urban areas and that is why during the last few years new modes of urban transport systems have been speculated in order to reach urban sustainability in most countries, while in others, existing lines and networks have been expanded.

In this paper, the intention is to research the role of transport systems in sustainable urban development in Iran from a planning point of view emphasizing the various planning aspects.

KEYWORDS: Sustainability, Transport, Urbanization

INTRODUCTION

The automobile has had a dramatic impact on society during the twentieth century. Its proliferation has altered the design of cities, accelerated further technological growth, opened up mass tourism industries, and changed the way in which people go about regular activities, such as shopping, travel to work and basic social interaction. Nevertheless, as significant concerns are raised about the sustainability of modern society, the extent of automobile usage stands out as a particularly crucial issue (Newman & Kenworthy 1999; Kennedy, 2002). Consequently there is a renewed interest in alternative forms of transportation and perhaps a need for greater use of public transportation systems, especially in urban areas (Kennedy, 2002).

Public transport continues to be seen as an important component of transportation planning in metropolitan regions. With increased emphasis on achieving sustainability and decreasing congestion, public transport is put forth as the potential solution to many of the ills of urban regions and modern transportation systems. Significant attention is being placed on strategic and operational analysis of public transportation systems in order to make transit more desirable and to increase utilization. At the strategic level, planners and policy makers have focused on expanding service to a larger percentage of the urbanized area (Murray, 2003).

The past three decades have witnessed the extraordinary growth of Iran's urban areas. Rapid expansion of cities in Iran has been caused by many factors including regional conflicts, industrialization, uneven distribution of health, education and infrastructure services in the country and many other palpable and hidden factors (Nadim et al., 2009). While Iran's large cities suffer from atmospheric pollution and its associated health impacts along with the often ignored road traffic accidents, urban transport is turning into a serious challenge for policy makers and transport authorities and in long-term, air pollution control and congestion control will be two main environmental challenges facing metropolitan areas in Iran.

This paper addresses the role of transport systems in sustainable urban development. The central aim is to inquire into how different aspects of urban transport have affected metropolitan areas in Iran since the end of the 20th century. The analyses are carried out with special attention given to the broader environmental role of urban transport in planning processes, including the shift toward high speed buses and railways, the occurrence of market and government failures in land markets, and private-public partnerships in the development of public transport in urban areas.

RESEARCH METHODOLOGY

The overall objective of this paper is to present an assessment of the sustainability of transportation systems in urban centers focusing on Metropolitan areas in Iran. In examining the sustainability of transportation systems in

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urban areas the work draws upon other scientific studies and government statistics. Focusing upon this literature, this paper takes a narrower descriptive approach and resorts mostly on documentary data on specific issue of public transportation and assesses the sustainability of the different alternatives from urban, environmental and social perspectives. In doing so the work attempts to better define the links between urban sustainability measures and transportation systems.

Sustainability and Urban Transportation

While there are several definitions of sustainability, for the purposes of this paper, sustainability shall be defined according to one of the most accepted and cited definitions. That is, sustainability refers to that which meets the needs of the present generation without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). Consistent with opinions of other researchers, sustainability is defined in terms of three dimensions: environmental, social, and economic/financial. Examples of environmental sustainability include efforts to conserve and reuse the resources and materials, while examples of social sustainability include efforts to promote equity, diversity, and social justice. And finally, examples of economic sustainability include efforts to eliminate poverty and promote fair trade. There is always a constant overlap between and among these dimensions of sustainability and according to the UNESCO (2004), any attempt must cover all three parts of sustainability – social, environmental, and economic – because this allows all people to achieve the necessary knowledge, skills, and perspectives to make decisions with the aim of improving quality of their lives at all levels.

Most of the implications of urban life with regard to sustainable development can be grouped under one or more of these three aspects: ethical, environmental and social. In relation to science and research, universities have responded to changing perceptions of them as social institutions, and of their shaping functions in society. “To meet the challenges head on, universities will need to develop a fuller, more historically informed sense of their own institutional missions, not only as incubators for the production of new scientific knowledge and technological know-how, but also as sites of capacity-building for social analysis, critical reflection and, not least, democratic citizenship” (Jasanoff, 2008; Maldonado et al., 2009).

Sustainable urban development is a broader concept. Richardson (1989) defines it as “a process of change in the built environment which fosters economic development while conserving resources and promoting the health of the individual, the community and the ecosystem.” While assessment of urban sustainability primarily involves analysis of a specific urban region, such an assessment also has to include interactions beyond the city region, such as trade and contribution to global air pollution. This perspective is captured by Houghton and Hunter’s (1994) definition of a sustainable city as “one in which its people and businesses continuously endeavor to improve their natural, built and cultural environments at neighborhood and regional levels, whilst working in ways which always support the goal of global sustainable development.” (Kennedy, 2002).

On the other hand, spatial developments over the past decades indicate a trend towards a more diffuse settlement pattern usually defined as urban sprawl. In a number of countries national policies were set out to explicitly counter sprawl, but in most, sprawl has become pervasive (Bruinsma et al., 2010). Among different aspects of urban sprawl, transport-related issues have always been very significant, especially regarding sustainability. Urban transport is of considerable concern from a global warming standpoint too.

Urban transport operations consume an estimated 2.0 million tons of gasoline/diesel fuel per year, releasing about 5 million tons of CO₂. Transport system alone generates about twice as much carbon per capita as the overall average carbon per capita for developing countries. Partly, this high level of CO₂ emissions is due to a weak public transport system, causing an excessive reliance on the private vehicle which accounts for about 60 percent of all passenger trips in the city. By comparison, in Mexico City which also suffers from severe air pollution, private automobiles account for less than 30 percent of passenger trips (Hastaie, 2009). This indicates a total change from traditional society which was completely sustainable from an urban point of view.

According to Sjoberg (1960), pre-industrial cities in various areas of the world and at different times had much in common, despite their dissimilarities especially compared with the metropolis of today – and compact, generally built no more than three or four storey high. The pre-industrial transport system left its mark: the town became the domain of pedestrians, carts, pets, beasts of burden, and horse-riders. Where towns were sited on waterways, from an early date, ships were used to move people and goods. Ships and carts carried mainly goods; not until later did we see the advent of the horse-drawn coach, which was designed to carry the relatively well off. During the Middle Ages towns and transport infrastructures were well integrated: while there were some differences between through traffic and local traffic, the variations in street layouts and speeds were not substantial. Horses, donkeys and other beasts of burden were usually stabled on the ground floor of houses. The residential and work functions of buildings were still integrated, as was also customary on farms in rural areas (Vance, 1966). The speed of traffic was very slow, both within and outside towns. On long journeys, travelers and animals needed adequate rest periods in order

to replenish with food and drink. Towns often developed at the intersections of a number of transport routes, perhaps only roads, as with many, but also roads and waterways (Bruinsma et al., 2010).

In recent decades, due to rapid population growth in the cities by utilization of personal cars, the impact on public transportation and spaces related to them have gained greater attention for the inner city transportation systems. Having an efficient public transportation system is required as one of the components of a sustainable city. Many find public transportation as the key for the construction of a sustainable city. Therefore, it seems that the network plan prepared in the 1960s and prior to that along private transportation is not compatible with objectives of a sustainable city. There is always an important relation between the form of the city and its transportation system (Cliff and Shirley, 2008; Kashani Joo, 2011).

Challenges of Urban Sustainability in Iran

With the emergence of negative effects of domination of private cars on the structure of cities from the 1970s, a new approach was formed towards reuse of public transportation in different societies. Thus, in the ending decades of the twentieth century, a new concept was propounded as transit related development (TRD), which is known with other expressions such as transit joint development (TJD) and transit adjacent development (TAD) too. Finally, in the ending years of the twentieth century, a new concept was propounded with the name of transit oriented development (TOD) or transit friendly development (TFD) as the most supplementary approach concerning development around public transit. Therefore, one of the most complete definitions stipulate that transit-oriented development (TOD) is compact, with mixed use development close to new or existing public transportation infrastructure that serves housing, transportation and neighborhood goals (Kashani Joo, 2011).

In Iran, provision of public transport facilities usually takes the form of a strong fleet of buses, but recently most cities are equipped with efficient rail systems. While metro systems have the advantages of higher efficiency and being more environmentally friendly, the capital investment needed for the construction of an urban railway system is often enormous. While the capital cost depends on local conditions, traffic, geology and complexity of the system (Loo and Li, 2006). In most cities of Iran, air pollution problem is severe according to world standards and the government of the Islamic Republic of Iran as a high priority environmental and health issue has identified it. An important cause of air pollution is the exhaust from about 1.4 million motor vehicles, including about 0.5 million motorcycles, operating in an extremely congested road space (average vehicle speeds below 18 Km/h) and 70,000 industrial units. It is known that between 65 to 70 percent of total emissions are related to urban transport operations. Reported average concentrations of pollutants such as carbon monoxide (CO), particulate matter less than 10 micron diameter (PM-10) and sulfur dioxide (SO₂), in the city center in 1998, were two to three times above average levels recommended by WHO/USEPA. The growth in number of vehicles over the last two years has made the situation even more severe (Hastaie, 2009).

Aging fleet of motor vehicles, lack of emission reduction devices (catalytic converters) for internal combustion engines in most newly manufactured cars in Iran, presence of major industrial plants in the suburban areas, low annual precipitation rates, geographical location and atmospheric inversion are some of the main factors contributing to the degradation of air in urban areas of Iran. A recent study has placed Tehran among the most polluted cities of the World, ranking with Mexico City, Beijing, Cairo and Bangkok (Khaksari, 2002). While in long-term, air pollution control and congestion relief are two main environmental challenges facing large Iranian cities, traffic accidents pose a more imminent threat to Iran's national economy and public health. Traffic accidents are not spatially confined and affect urban and rural residents of all ages. They are the first cause of violent death and the second cause of overall mortality in Iran (Nadim et al., 2009).

Major air pollutants in urban areas of Iran have been identified as CO, SO₂, oxides of nitrogen (NO₂), ozone, soot and particulate matter (Tait, 2009). Studies related to measurement of air toxics (including toxic metals, toxic volatile and semi-volatile organic compounds) in Iran's urban atmosphere are very limited and demand more investigation and research. The city council of Tehran estimated that 80% of the toxic gases in the city's air were caused by motor vehicles including large numbers of motorbikes generating emissions known as white smoke. A report by Tehran's Controlling Air Quality Company estimated that on average motor vehicles in the city emit 4,400 t of pollutants each day (Asadollah-Fardi, 2009). Motor vehicle ownership in Iran has had a significant increase in the past 20 years. The major traffic and air quality issue facing Iran is that the majority of motor vehicles that enter the market end up in only a few large cities of the country (Nadim et al., 2009).

In Iran, the last five decades of population growth, urbanization and economic growth have resulted in unprecedented motorization of transportation. Many harmful effects including social inequalities, congestion, safety, pollution and non-renewable resource depletion, have accompanied the extraordinary rise of motorization. Several studies have concluded that special user groups of the poor, the young, the elderly, the careless and the handicapped suffer serious accessibility and mobility disadvantages from not being adequately served by the vast automobile-based urban transportation systems (Vaziri 1986). In many cities, urban poor cannot afford private cars or

motorcycles; on the other hand, they bear unfair shares of motorized urban transportation adverse effects (Barter 1998; Vaziri and Naseer, 2009).

Sustainable Strategies Regarding Urban Transport in Iran

The air pollution problem in Tehran and other large cities of Iran has its roots in social, economical and cultural trends of the country. Between 2000 and 2004, there has been a 100% increase in the number of motor vehicles in Tehran (Nadim et al., 2009). In response to the enhanced environmental and social problems of urban transport, the municipalities of most metropolitan areas in Iran have undertaken a number of initiatives, including improvement of physical infrastructures and management of the operation of urban transport systems. The mentioned strategy is to be implemented by following five actions.

I) Restricted Traffic Zone

In order to manage the ever-increasing traffic in metropolitan areas, the city center or downtown area has been designated as a restricted traffic area, in case of Tehran since 1983. In Tehran, this area, covering about 23 km², is the focal point of current planned traffic management schemes. For the time being, about 10 percent of the all vehicles including government owned vehicles, medical cars, taxis, and other public vehicles have been issued the permission to access this area during restricted hours.

II) Adoption of Alternative Fuels

Energy consumption in transportation sector is rapidly becoming a critical issue all over the world. Recent projection by the U.S. Department of Energy indicates that the overwhelming majority (80 percent) of growth in world oil consumption by the year 2010 could come from the developing countries and in the 15 largest developing countries, about 50 percent of the increase in oil consumption from 1970 to 1984 has been related to transportation. In Iran, due to a national policy to utilize natural gas as an alternative fuel for transportation sector, Municipality of Tehran is planning to convert 4000 diesel fueled buses from the public transportation fleet to Compressed Natural Gas (CNG) and more than 30000 taxis have been converted to LPG.

III) Inspection and Maintenance of Vehicles

In addition to annual inspections of vehicles, Municipality of some metropolises like Tehran enforce a mandatory emission inspection and control program for motor vehicles permitted to pass through the city's Restricted Traffic Zone. This program will soon be implemented for all in-use vehicles all over the city. The inspection program includes safety checks and control of major parts as well as measurement of CO and HC emissions from the vehicle.

IV) Bus Transit Networks

In most cities of Iran, exclusive lanes are dedicated to rapid buses. Tehran has about 60km of dedicated bus lanes which are physically separated from other traffic lanes and have greatly increased bus speeds. Due to some plans urban bus services in Tehran have increased during the last 8 years, indicating an increase of almost 100% in provision of services.

V) Master Plan for Air Pollution Control

The Municipality of Tehran initiated the study on an Integrated Master Plan for Air Pollution Control. The objective of the study is to formulate an integrated master plan for air pollution control based on the research, survey and analysis on socioeconomic activities and the situation of air pollution in Greater Tehran Area (GTA) which is the area within the administrative boundary of Tehran. The study was funded by JICA (Japan International Cooperation Agency) and carried out in cooperation between Japanese Joint Venture and its Iranian counterpart. The study started in April 1995 and finished in November 1997 (Hastae, 2009). This plan, if successful, is supposed to be implemented in all metropolitan areas of the country.

Conclusion

Public transport systems have direct effects on urban structure from spatial, physical and economic aspects. That's why urban planners and designers should consider public transportation systems not only as a necessity for development of metropolitan areas enjoying different facilities, but also as focal points which can modify their adjacent areas. Furthermore, local governments and urban management systems should decide how to improve public transportation systems according to all citizens' benefits and long-term social-environmental dimensions instead of few investors' interests and short-term economical benefits.

Unfortunately, the existing level of understanding of the relationships between sustainability and transportation is very limited in developing countries like Iran and the methods for addressing transportation problems of the poor are severely underdeveloped. In metropolitan areas of Iran, economic and social activities are to a large extent more spatially concentrated than other areas. Therefore, the intense time and location proximity of interactions and activities require more distinctive cyclic behaviors, often on daily basis, and entailing efficacious urban transportation systems. This reflects the importance of attention to public transportation development as a key factor in achieving urban sustainability in metropolitan areas of Iran.

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