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## Affordable and common modes of transportation in developing cities and their effect on the sustainability of streets

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### Abstract

Sustainable transportation – or green transportation – is an important field in terms of generating a healthy environment and upgrading city planning. Street design and modes of transportation are the two main factors that can affect the sustainability of city planning. This paper focuses on designing and planning an efficient, sustainable street using affordable and common modes of transportation, with an emphasis on two cities in Egypt and Lebanon as case studies.

Observing developing cities in the field of transportation planning reveals many weaknesses that have a major effect on citizens, such as traffic congestion, a shortage of pedestrian walkways or cycling paths, a lack of affordable public transportation or its sequential movement, and the new modes of informal transportation that have appeared in recent years and have affected the street transportation movement.

The aim of this paper is to analyse developing cities in terms of modes of transportation, to discover an effective method of planning city streets.

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### 1. Introduction

Sustainable transportation applies sustainability concepts to the field of transportation, including the three basic dimensions of sustainability: social, economic and environmental dimensions.<sup>1,2,3</sup> The transportation sector is very

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important in sustainable design and research as it is inevitably linked to the climate-change challenge, given that it is currently responsible for 13% of Greenhouse emissions worldwide and 23% of the total energy-related emissions<sup>4</sup>. In addition, there has been a tremendous increase in daily trips by private cars in urban areas, estimated to number 6.2 billion by 2025, which represents an 80% rise from 3.5 billion in 2005<sup>5</sup>. However, most research on sustainable transportation focuses on the sustainable mechanisms of the transportation modes, which rely on two dimensions: namely the economic and environmental impacts of the modes. Research somewhat ignores the needs of the users (the social and, partially, economic aspects), who will use and move through the spaces located for different modes of transportation. In addition, there are huge variations between urban and rural morphologies and between different typologies of spaces, different cultures of using public spaces and different locations (developed or developing countries), which should be considered in finding the appropriate planning or transportation modes. The shortage in supplying the demand for the users' needs in street planning heavily affects sustaining these modes.

In literature, the environmental dimension in sustainable transport refers to the impact of human activities on changing the global and local environment, including the impact of transit on air pollution, noise pollution, water pollution, climate change and other related areas. The economic dimension considers the quality of accessibility, infrastructure costs, traffic congestion, accident damage and depletion of non-renewable resources. The social dimension focuses on the human health impact, community livability, affordability and other related issues.<sup>1, 2,3,6,7</sup>

Due to the rapid urban growth, the increasing rate of motorization, which is more than 10% per annum<sup>8</sup>, and the lack of comprehensive planning, developing countries have a less than adequate amount of formal public transportation that is capable of supplying the entire demand for mobility needed within the city, as well as considering the needs of different social strata of society. In addition to the deficiency of the street design elements, which don't always consider the users' behaviour, this problem has resulted in the inevitable emergence of informal public transportation modes, which mainly consider the economic needs of the users at the expense of the other dimensions.

This paper studies the conflicts between modes of transportation (formal and informal) and the street design elements, as the two main factors that affect the transportation sustainability of city planning. In addition, it analyses the informal transportation in two case studies: Giza (Egypt) and Tripoli (Lebanon).

## 2. Modes of transportation

The hierarchy of sustainable transportation modes begins with the most desirable types – pedestrian, cycling and public transportation – and ends with a single vehicle or private vehicle. The concept of sustainability in transportation is reached by decreasing the number of fuel-based vehicles in the city streets, in order to decrease the levels of non-renewable energy consumption (fuel) and air pollution (mainly carbon dioxide and monoxide) as well as increasing mobility flow without causing traffic jams. In addition, sustainable transportation increases the role of public transportation and encourages the community to use it. Transportation modes can be classified into two main types: formal transportation and informal transportation modes.

The formal modes of transportation are traditionally considered to be a government's responsibility<sup>9</sup>. They are the modes that city streets are designed and planned around, such as walking, biking, automobiles, taxis, buses, trucks, heavy rail, light rail transit, trams and other means. Given that the formal transportation services in developing countries are rarely up to the task of satisfying the escalating demands for travel, informal transport modes have started to appear.

The informal modes of transportation are mostly privately operated, small-scale services that are varyingly referred to as 'paratransit', 'low-cost transport', 'intermediate technologies', 'third-world transport', 'artisanal transport' and 'intermediate technologies'<sup>10,11</sup>. 'Informal transportation' is the term used in this study, as suggested by Robert Cervero (2000). It reflects the informal and illicit context in which this sector operates: somewhat in the background and outside the officially sanctioned public transport sector<sup>11</sup>. These modes appear as 'gap fillers'<sup>9</sup> when the governmental public transportation services are unable to meet the demands of the community. These informal transportation modes include different, affordable types that each city and community selects to use according to their user needs, space constraints, transportation distance and street dimensions.

On one hand, the informal transport sector is blamed for a long list of problems in the majority of the literature; on the other hand, it is also seen as a salvation for the incapability of governmental bodies in developing countries to

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