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ORIGINAL ARTICLE

Area traffic capacity in centeral areas – Alexandria city center as a case study

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Travel demand management

Abstract In many cities, worldwide, city centers are highly congested. The reason is that the Area Traffic Capacity (ATC) becomes constrained; i.e. the traffic and parking demands (mainly motorized), continually, increase within a finite roads' and car parks' capacity. The central Area Traffic Capacity (ATC) could be either the capacity of the internal road network, the parking capacity, or the capacity of the approach roads leading into the area. One of these three elements limits the overall traffic capacity. Therefore, the main objective of this paper is to develop a planning process which can be used as a tool for determining the ATC, and producing and evaluating different solutions (or scenarios) that can improve a central area traffic capacity. The proposed planning process is based on a combined analysis of traffic and parking situations which result from the travel demand and the traffic supply in a city center. If the travel demand is greater than the area traffic capacity, the process reflects feedback effects of parking and traffic situations on the desired supply or demand. Thus, it can be used to analyze different possible improving strategies, which might be needed to achieve favorable situations (formulating scenarios). The proposed planning process is then applied to estimate the area traffic capacity of Alexandria city center and to analyze the impacts of applying some traffic strategies in order to improve the ATC.

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1. Introduction

A city center of a metropolitan area is the heart of the city where urban functions are intensively concentrated [1]; i.e. the social, cultural, business and entertainment activities. It is the economic engine of an urban area, and it suffers from even worse congestion conditions than the rest of the city [2]. Traffic congestion in central areas is one of the significant problems in many cities worldwide, due to the rapid economic and demographic growths within a finite area traffic capacity [3]. Too much traffic on a given traffic infrastructure negatively influences the city center urban image and functions, causing

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traffic congestion, noise, pollution, frequent accidents, safety risk and stressed nerves. Consequently, the quality of urban life in central areas is starting to deteriorate. Actually, the city center has become hostile, and its urbanity is in danger. In order to develop strategies to alleviate city center congestion, it is necessary to identify the Area Traffic Capacity (ATC) then it could develop suitable strategies to increase this capacity. Area Traffic Capacity (ATC) for a central area is an expression that can be defined as the maximum number of vehicles that can, at a given time, move or park in that area. It could be either the capacity of the internal road network, or the parking capacity, or the capacity of the approach roads leading into the area i.e. the one which produces a lower level of service in the central area than the others. For relieving the current ATC two approaches can be applied:

1. Traffic management strategies can submit modern technologies to match traffic flow with traffic infrastructure; such as co-ordinated traffic signals, car park guidance systems, congestion pricing, and automated enforcement systems. These activities are useful for increase area roads capacity to improve an area traffic capacity.
2. Travel Demand Management hypotheses (TDM) can be used to reduce travel demand to fit the actual available area traffic capacity. TDM hypotheses seek to modify travel behavior and mode choice decisions so as to reduce the negative impacts of car use. There are numerous TDM hypotheses; such as parking restriction, public transportation developments, congestion pricing, introducing park and ride facilities, land use policies, as well as setting alternative work schedules and carpooling.

In order to achieve maximum benefits, a set of scenarios of traffic management strategies and travel demand management hypotheses must be formulated and evaluated to achieve the best scenario which achieves the maximum ATC. In this paper, a planning process for determining central area traffic capacity is proposed. It can also be applied to assess the impacts of traffic and travel management strategies on traffic demand and traffic supply. One of the most important emphases here is the prediction of the service level of the traffic system which encourages the usage of public transport, and at the same time prevents losses of the city center activities that can be the result of traffic jams and parking shortages. The planning process is then tested and applied to estimate the traffic capacity of Alexandria central area.

2. Area traffic capacity

2.1. Definition

Area Traffic Capacity (ATC) can be defined as the maximum number of vehicle trips which have their destinations in a given area or cross that area in a certain time interval. This means, the maximum number of vehicles that can, at a given time, move or park in the area. It should be clearly stated what is understood by "maximum number". It is not the absolute "maximum number" corresponding to full saturation of roads and car parks, but the practical "maximum" which satisfies a pre-specified level of service. The central area traffic capacity could be either the capacity of the internal road network, the parking capacity, or the capacity of the approach roads leading into the area (Fig. 1). One of these three elements limits the overall traffic capacity, i.e. the one which produces a lower level of service in the central area than the others [4]. In the framework of this idea, a procedure for determining the traffic capacity for central areas is developed. The procedure is based on a combined analysis of traffic and parking situations which result from expected traffic demand and projected traffic supply in a city center. The traffic and parking situations (supply/demand ratios) define the overall central Area Traffic Capacity (ATC). This means that the area traffic capacity can be determined by multiplying the lowest value of the different supply/demand ratios by the actual unrestrained internal traffic volumes.

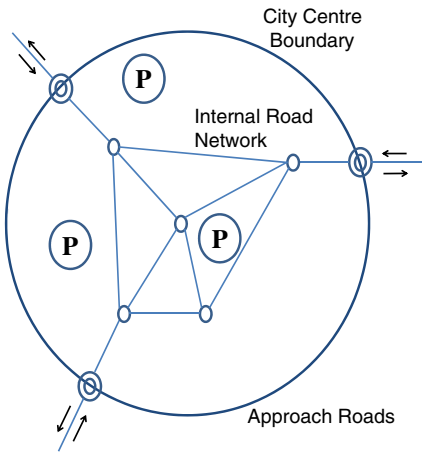

Figure 1 Area traffic capacity elements.

2.2. Impacts of traffic management and travel management on ATC

The main objectives of this paper are to present a procedure for determining Area Traffic Capacity (ATC) and developing possible strategies for alleviating current capacity restriction where the demand is higher than the area traffic capacity. In such case, the lowest of parking situation, internal road network situation and approach roads situation are controlling the area capacity. Therefore, in order to improve the area's situation; the lowest situation should be improved by increasing the capacity using traffic management strategies, decreasing the demand using travel demand management hypotheses or using the two approaches in order to conduct an effective solution (Fig. 2). Generally, the proposed strategies mentioned above, may be an effective tool in order to relieve the existing ATC, but the individual application of any of them may achieve a limited improvement for ATC. Thus, in order to achieve maximum benefits, a set of scenarios of traffic management strategies and travel demand management hypotheses will be formulated and evaluated to realize the best scenario which achieves the maximum ATC.

2.2.1. Proposed traffic management strategy

Modern traffic management systems can submit modern technologies to meet the challenges of increasing travel demand on a limited traffic (to match traffic flow with traffic infrastructure); such as co-ordinated traffic signals, car park guidance systems, congestion pricing, and automated enforcement

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