



Establishing parking generation rates/models of selected land uses for Palestinian cities



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ABSTRACT

Estimating parking demand in Palestine requires more oriented studies towards parking generation to enrich transportation planning, design, and management. Using regional or international models and rates of parking demand may not be appropriate for Palestine. This research is conducted to establish a reference for provision of parking supply for three major types of land uses, which are residential, office, and retail.

Seventy-three sites of different land uses were selected through field investigations, interviews, and availability of information for each site. The study covered all main cities in the West Bank, Palestine. Data collection was conducted manually, which contains site characteristics and average of two-day parking counts during three periods (AM, PM, and Peak of the Development).

Numerous models and rates were investigated yielding variable statistical accuracies. Most appropriate statistical models/rates were summarized and highlighted for each type of land use, and parking generation models with acceptable statistical significance were recommended, otherwise, parking generation rates were recommended. Simple linear regression, natural logarithmic linear regression, and power were the forms of the recommended models for the studied land uses.

This study forms the first step of a future Palestinian "Parking Generation Manual" that should contain various local land use types.

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1. Introduction

Parking and trip generation rates/equations are used to evaluate the requirements of transportation network such as the right of way adjacent to specific land use or the maximum traffic volume that should not be exceeded on the adjacent street, as well as size of parking facilities for each type of land use. Excessive on-street parking supply may negatively affect the level of service of road network due to the resulted obstructions from parked vehicles. Furthermore, deficiency in providing sufficient off-street parking spaces for certain land uses creates negative economic impacts. On the other hand, the size of parking supply might exhaust road network and negatively affect its operating level of service. In essence, establishing parking generation for different land uses contribute in managing and controlling real estate and parking supply for each land use, and consequently avoiding congestion generated by parking.

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Trip and parking generation contributes in the formation of urban areas (Urban Morphology) and supports the decision makers in the planning of urban areas. For example, changing the land use pattern of specific area from residential to commercial will affect traffic on the adjacent road network system; but at what level this effect will be?

Main cities in Palestine suffer from congestion at critical sites due to improper planning for parking facilities, among others, for new developments. As a result, this guides transportation planners in managing the transportation system and assists them in their planning decisions. Furthermore, this study assists the key stakeholders (i.e., government agencies) to institutionalize the adoption of Traffic Impact Studies (TIS) and update any available regulations regarding parking facilities.

The State of Palestine has some standards/regulations related to parking spaces required for certain new developments, and these standards were set by municipalities, the Ministry of Local Government (MoLG), and Engineers Association (AE). These standards are not based on specialized studies and may not consider the detailed characteristics of land use types; furthermore, they are outdated as they are based on old requirements.

In this study, Parking Generation for residential, retail, and office land uses were undertaken. Similar work has been done in several cities, states, provinces, etc. around the world, but in Palestine it is still lacking of this type of study. Studies conducted abroad cannot be applied as a whole locally due to some factors such as travel habits, economic size, developments types, sizes, political conditions, and others.

The State of Palestine has unique characteristics. It is a state under establishment with an economy in transition. Income level is modest and the Palestinian National Authority has limited control on land, and no control on border, air, and sea. It is simply a state with severe political and economic constraints; at the same time car ownership has rapidly increased in recent years due to banks financial facilitation, among others. Furthermore, necessary information is generally limited or lacking. Therefore, it is necessary to conduct and establish local parking generation rates/equations for Palestinian cities in order to form an initial stage of developing a local parking generation guide or manual.

As such, this is the first study in the country of its type, and it is comprehensive as it covers major land uses and all main cities in the West Bank (see Fig. 1). In addition, this research assists in developing strategies for mitigating their adverse impacts.

2. Literature review

The 4th edition of the Institute of Transportation Engineers (ITE) Parking Generation manual involves 69 land use classifications; it represents a collection of data since 1978 (ITE, 2010).

Parking generation produced various levels of statistics ranging from poor to good. For example, when using the gross floor area (GFA) with parking demand it produces high coefficient of determination; however, when using number of employees it produces low coefficient of determination. The ITE concluded that homogeneous data sets or small data sets may produce low coefficient of determination and does not necessarily mean more reliable relationship (ITE, 2010).

The ITE (2010) also provides information and guidelines about site selection, permissions, procedure, background, and independent variables. For example, parking generation for residential land uses is expressed in terms of dwelling units, persons, vehicles, and areas as independent variables; office land use in terms of employees and area; and retail land use in terms of employees and areas.

Douglass and Abley (2011) prepared a research study to compare New Zealand, Australia, UK, and USA information on trip and parking related to land uses, and reviewed current trip generation survey and data manuals from these four countries. The research considered seasonal traffic and parking variations and identified the practical parking design demand for a whole year as the 85th percentile satisfaction, which is also the 50th highest hour. Independent variables such as GFA, gross leasable floor area, which is commonly 80% of the GFA, site area, employees, and activity units were derived from survey process. The study concluded that the most practicable unit for most district plans is still spaces per 100 m² GFA (Douglass and Abley, 2011).

Regidor and Regin (2010) assessed some issues pertaining to local trip and parking rates in Philippine. Parking generation in Philippines used a number of relevant laws pertaining to the provision of off-street parking for different types of developments, and among these is the National Building Code of the Republic of the Philippines. The study identified several parameters for parking requirements for such developments such as gross floor area, gross saleable area, floor area ratio (density), parking slot cost, and distance from the central business district (CBD).

The Roads and Traffic Authority (2002) of Australia established a guide that outlined various considerations of traffic generation relating to developments. This guide sets out the range of parking demands likely to occur at an isolated site, recognizing the impact it may have on transport policy and travel demand. Parking provision should be viewed as the minimum desirable requirement, while Councils' Parking Codes are considered to be minimum mandatory requirements. The parking provisions recommended are based, wherever possible, on physical characteristics of the proposed development, particularly the gross floor area. The Roads and Authority used 85th percentile level of demand in parking demand estimation.

The Department of Transport of Abu Dhabi prepared a manual for estimating the parking and trip generation rates for several local land uses through the survey on nearly 400 different sites throughout the Emirate. Parking generation rates covered all types of predominated land uses in Abu Dhabi. The manual covered three locations in the Emirate, which are Abu Dhabi City, Al-Ein City, and Others for sites in the CBD and non-CBD areas (The Department of Transportation Abu Dhabi, 2012).

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