Advanced Science and Technology Letters
Vol.69 (Architecture and Civil Engineering 2014), pp.26-29
http://dx.doi.org/10.14257/astl.2014.69.07

Study on Establishment of On-Street Parking Demand Model According to Total Building Floor Area

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Abstract. Parking problems caused by large increases in the number of vehicles have become a serious traffic issue in urban cities. On-street parking, in particular, has resulted in the loss of local road function, interference with the movement of emergency vehicles, deterioration in the walking environment, conflicts among residents, and other problems. This study examined the establishment of an on-street parking demand model according to total building floor area.

Keywords: On-Street Parking, Parking Demand, Total Building Floor Area, Regression Analysis, Correlation Analysis

1 Introduction

Large increases in the number of vehicles have led to severe parking problems. To resolve the parking problems, a range of efforts have been undertaken to secure parking spaces, including projects for having my own parking space, public parking area plan using vacant land, residential preferential parking program, designation of overnight parking areas, etc. However, despite the continuous supply of parking lots due to the inconvenient parking, temporary parking, and other reasons, problems of on-street parking have been consistent. In particular, disordered illegal on-street parking has emerged as a serious problem in urban cities. Taking those circumstances into consideration, this study is carried out about an on-street parking demand calculation that is useful for the establishment of parking policies and district unit planning in the construction of on-street and public and public parking area. Resulted in a review of previous theories, Different parking demand estimation methods include the extension of past trends, parking basic unit model, origin destination matrix estimation, parking space factor method, estimation of parking accumulation profile, and others. When previous parking-related studies were reviewed, the theme of these studies could be divided into two main categories: parking demand estimation and basic parking generation data. Park G.H(1997) was carried out a study on analysis of the parking demand in multiunit housing complexes. Park J. H(2003) identified the parking demand-influencing various factors necessary in developing a parking demand estimation model through and on-site investigation and survey in apartment complexes. Ahan W. Y(2010) analyzed the problems on an existing

ISSN: 2287-1233 ASTL

parking demand forecast in factories in an industrial complex district through an on-site investigation, and suggested solutions by designing a parking demand estimation model considering the facility uses and sizes. Consequently, a regression model applicable to large floor areas was proposed. Oh J. H et al. (2006) calculated the parking basic unit by regression analyses according to the city size and land use, and suggested the construction criteria for the annexed parking lots considering the characteristics of the cities and land use. A minimum parking basic unit was used to compare with the construction criteria in the Parking Lot Act. Lee Y, W (2008) established a new parking demand calculation model to modify the existing parking basic unit model with potential problems through an on-site investigation, and proposed the applicable criteria for parking basic unit reflecting the parking demand in a large number of facilities. Previous studies mostly established parking demand estimation models for specific land uses, including townhouses or factory facilities and suggested new models that modify the problems in existing parking basic unit.

2 Data Collection and Methods

Survey on the actual conditions of on-street parking is crucial for establishing on-street parking demand estimation model in this study. Therefore, the survey involved 19 out of 45 legal precincts in Dong-gu, Daegu, Republic Korea, excluding 26 legal precincts with green land for conservation and inadequate urban features. Investigators generally perform a field investigation on the current parking situation. The results of daytime on-street parking are shown in Table 1.

Table 1. Survey results

			illegal parking				
		parking area	no-parking area	sidewalk	Set-back area	Side street	total
jurisdiction vehicle	parking lot(ea)	1,194	3,364	270	713	7,095	12,636
	rate(%)	9.4	26.6	2.1	5.6	56.1	100.0
outside the jurisdiction vehicle	parking lot(ea)	1,072	3,366	268	490	4,689	9,885
	rate(%)	10.8	34.1	2.7	5.0	47.4	100.0
total	parking lot(ea)	2,266	6,730	538	1,203	11,784	22,521
	rate(%)	10.1	29.9	2.4	5.3	52.3	100.0
	parking lot(ea)	2,266		20,255			22,521
	rate(%)	10.1		89.9			100.0

3 Establishment of On-Street Parking Demand Model

This investigation was conducted using the PASW Statistics 18.0 software to establish a multiple regression model having more than two explanatory variables based on the results of correlation analysis. Correlation, multicollinearity, and others among explanatory variables were taken into account to design an optimized model, and then a multiple regression model was established using a stepwise method that chooses explanatory variables. Multi-unit housing with a relatively high correlation, but insignificant at a 95% confidence interval was excluded from explanatory variables. Table 3 shows the results of model establishment.

Table 3. Result of Multiple Regression Analysis

	Non-standard factor		Standard factor β	t	Significance probability
	B	Standard error			
Detached house (1000 ㎡)	15.609	4.840	.517	3.225	.005
Neighborhood-convenience (1000 ㎡)	8.780	3.040	.463	2.888	.010
	About B 95% confidence interval		Correlation coefficient		
	Lower bounding	Upper bonding	Zero-order	Partial correlation	Partial correlation
Detached house (1000 ㎡)	5.398	25.820	.927	.616	.240
Neighborhood-convenience (1000 ㎡)	2.367	15.194	.921	.574	.215

Unstandardized coefficients denoting the coefficients of regression model were 15.609 in detached houses and 8.780 in neighborhood-convenience facilities. The results indicate that the number of on-street parked cars has to be taken into consideration according to the total floor area of detached houses and neighborhood-convenience facilities.

4 Conclusion

The investigation was performed in the actual field by classifying and comparing subjects according building uses and total building floor areas based on the data for the current status of parking facilities owned and managed by administrative agencies

The summary of this study is as follows:

1. Multiple regression analysis was performed using a stepwise method considering applicability, usability, and multicollinearity. Multi-unit housing was excluded, and detached houses and neighborhood-convenience facilities were selected as explanatory variables. Consequently, a model was established with a high coefficient of determination of 0.895.

2. According to unstandardized coefficients of the developed model, 15.609 vehicles were parked on streets every 1000m² of gross floor area of detached houses, and 8.780 vehicles were parked on streets every 1000m² of gross floor area of neighborhood-convenience facilities

3. T-test revealed that the developed model was statistically significant at a 95% confidence interval in estimating on-street parking demand. Since the fitted values of the values of on-site investigation and designed model are distributed close to a straight line of y=x, they are identified to satisfy the hypothesis of normality.

This study established on-street parking demand estimation model by comparing and analyzing the on-site investigation of current on-street parking conditions and total building floor areas by use. The developed model will be utilized in forecasting on-street parking demand and suggesting alternative measures for the estimation and implementation of parking policies, district unit planning and others.

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