Types of Trip Generation of Large Retail/Wholesale Stores in Thailand

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Abstract

This research study determines the types of trip generation of visitors who visit a large retailer/wholesaler, located in Bangkok and other provinces in Thailand. With the face-by-face survey, data are collected from seven retailers/wholesalers during the rush hours 16:00-19:00 on a weekday and a weekend. Studied variables are locations, number of parking spaces, areas of the large retail/wholesale stores, weekday, and weekend. Statistic analysis has been used to test relationships between variables. The result finds that types of trip generation neither depend on the shopping area size nor the number of parking spaces. This study also finds that most of the trip generations are primary trips, up to 80 percent on weekdays, and tend to increase on the weekend, while pass-by trips and diverted trips decrease.

Disciplinary: Civil Engineering (Transportation and Traffic Engineering).

Cite This Article:

1. Introduction

The developments and growth of the city are rapidly expanding, resulting in more forms of trip generation. Without good planning to control the city's growth will have greater impacts, especially in terms of traffic. Supermarkets create great attractions to form trip generations of people. This is because supermarkets tend to in areas close to crowded communities. Locations of supermarkets in Thailand are mostly on the main road network to facilitate the visitors.

However, traffic problems arise from the personal cars entering and exiting supermarkets, particularly car queueing on the main road to get entering to the parking of the supermarket/community malls (Pimcham et al., 2021). This has resulted in traffic impacts on major roads, or even causing road capacity beyond what can be accommodated. Therefore, the Traffic Impact Assessment should be performed together with business/construction permission.

1.1 Types of Trip Generation

Trip generation is used to assess the number of site-generated trips related to a given type of land use (ITE, 2020). There are three types of trip generation.

A primary trip is a form of travel that travels from the starting point to the destination and returning to the starting point, such as traveling from Home-Work-Home.

A pass-by-trip is a form of travel from one point and then stop at a point along the way before going to the destination, such as travel from Work-Retail store-Home.

A diverted trip is a form of travel from one point and making a diversion route to visit a specific point before going to the destination, such as travel from Work-Market-Home. The diverted trip is off from the normal route.

2. Literature Review

Brehmer & Butorac (2003) studied trip generation characteristics of 10 discount supermarkets in the USA. They found that trip rate and trip type associated with a major discount grocer were found to be much lower than the standard ITE grocer.

Comparing New Zealand with UK, USA, and Australia results, Abley & Douglass (2011) studied trips and parking related to land use, reviewing trip generation surveys to learn the travel patterns with daily trips by all modes and purposes. The research considered surveyed seasonal traffic and parking variations.

Steedman et al. (2016) analyzed primary, pass-by, and diverted trip data of five supermarkets in New Zealand, at three different times including weekend peak, weekday peak, and weekday off-peak. The result found that most trips are pass-by and diverted trips. They were able to discover possible factors/reasons for differences between each of the surveys. The supermarket's location affected the proportion of primary, pass-by, and diverted trips as proximity to roads with high daily traffic volumes greatly influence the trip generation. Other influent factors were the time of day, size of a supermarket, type of supermarket, and proximity of competitors.

As changes from daily shopping at fresh markets, food stalls, and local shops to modern stores (i.e. department stores, supermarkets, and hypermarkets, Panurat (2012) studied changes in consumer behavior in Thailand and investigated consumer behavior and influences affecting the choice to shop. The study found two key factors influencing consumers' choice of the mall including physical location and consumer behavior. Consumers go to community malls located in the neighborhood within 3 km distance or a 10-minute drive. Consumers prefer to go to

community malls that have plenty of parking with many types of stores including supermarkets, restaurants, cafés & bakeries, and banks.

Brahmahitadara (2010) studied trip rates and factors influencing trip rates for 15 large retailer stores in Bangkok and suburban areas. The analysis found that that trip rates and parking demands depended on the gross service areas of the retailer stores. Also, trip rates and parking demands were lowest on a weekday and highest on Sunday.

3. Method

This study focuses on the three types of trips including the primary trip, pass-by trip, and divert trip. The visitors' survey was conducted at a selected location of seven large retail and wholesale stores. The interview survey was conducted on a weekday and weekend (Saturday and Sunday) from 4 pm-7 pm (peak road traffic). This study collected data from 500 participants at each store, a total of 3500 participants from all seven stores. Statistical analysis is used to analyze the collected data.

This study also explores characteristics of the studied large retail/wholesale stores' areas and their effect on the nearby traffic. The study also observes the number of parking of each store. For example, the geo-map (Figure 1) shows the city location of TL Rangsit.

Figure 1: Geo-charateristic of TL Rangsit (geolocation 13.9936465,100.6132019).

Table 1: Location and GPS

Large retail/wholesale store	Location	Geolocation
TL Rangsit	In the city	(13.9936465,100.6132019)
TL Saraburee	In the city	(14.5218229,100.9198623)
TL Korat	In the city	(14.9789275,102.005983)
TL Khonkean	Suburban	(16.4008898,102.8140649)
BC Ayuthaya	Suburban	(14.3192691,100.6093891)
BC Chiangmai	In the city	(18.7700192,99.0313125)
MK Ramintra	In the city	(13.8113362,100.6923097)

4. Analysis and Results

4.1 Effects of Types of Trip Generation on Locations of Large Retail/Wholesale Store

This study finds the relationship between types of trip generation and large retail/wholesale locations. Most large retails/wholesalers are located in the city or suburb, on the main road network. For stores in the community city, 80 percent of types of trip generation are primary trips both on weekdays, and weekends, see Figures 2-4. For suburban locations stores, for example, TL Khon Kaen situated on the main road network that people go through to work in the city, pass-by trips are higher compared to other locations. For all cases, diverted trips are small proportions.
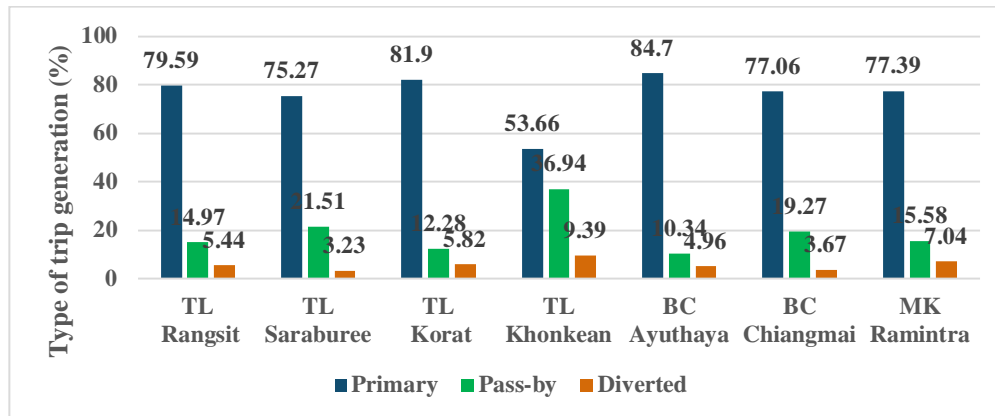

Figure 2: Proportions of types of trip generation on locations of each large retail/wholesale (weekday).
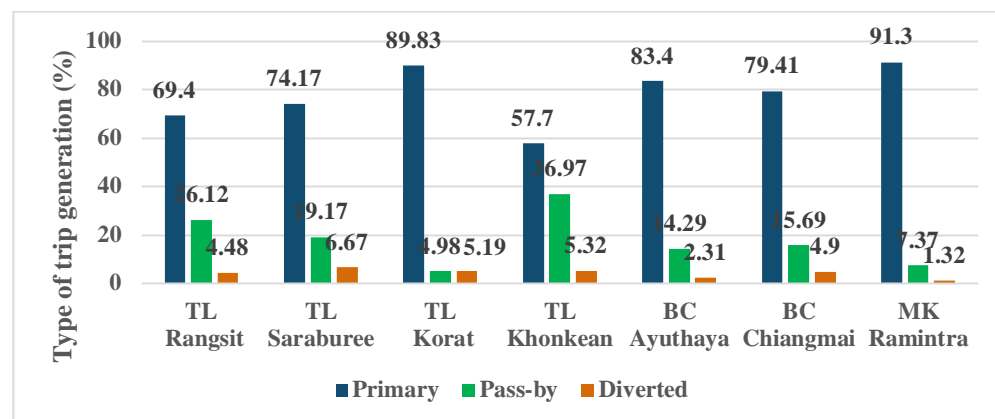

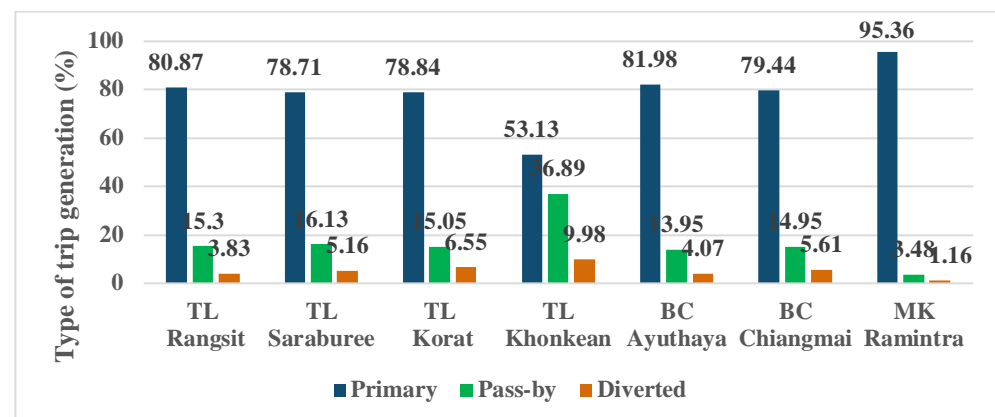**Figure 3**: Proportions of types of trip generation on locations of each large retail/wholesale (Saturday)

Figure 4: Correlation of travel type proportions with large retail/wholesale locations (Sunday)

4.2 Relationship of Types of Trip Generation and Store's Size and the Number of Parking Spaces

From the study results of Figures 5 and 6 on parking spaces and store's size of large retails/wholesalers, this study finds no relationship between types of trip generation and store size and the number of parking spaces on all days of the weeks.
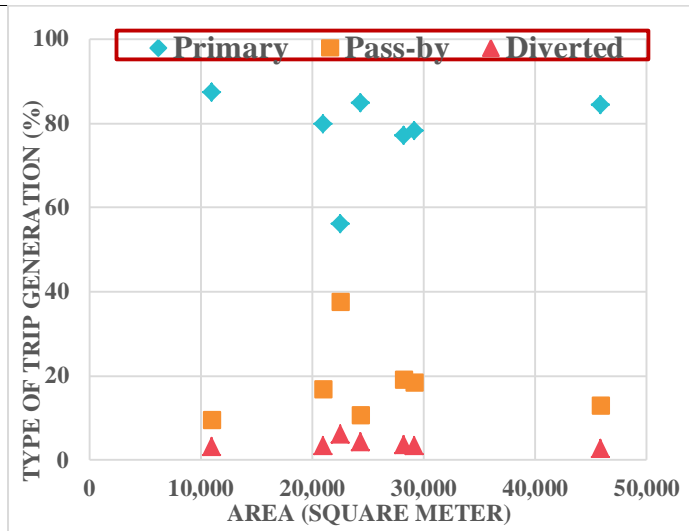

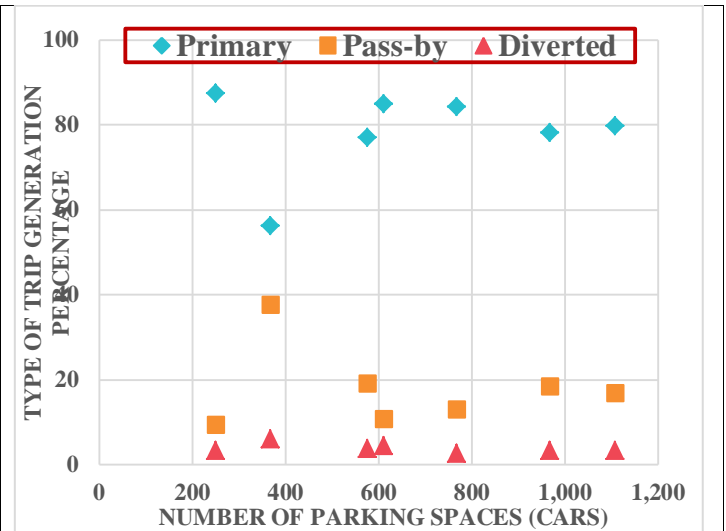**Figure 5**: Types of trip generation (%) and store size.

Figure 6: Types of trip generation (%) and the number of parking spaces.

4.3 Relationship of Types of Trip Generation Proportion to Day of Week

The results in Table 1 compare the statistic test that p-value less than 0.05 (given with a star) indicates the difference between the day of the week. In this study, most Saturdays are different from other days. It is observed that diverted trips on Saturdays are much lower compared to other days.

Table 2: Similarity Test Between Days of the Week

Time period 16:00 - 19:00	Between Weekday and Saturday		Between Saturday and Sunday		Between Weekday and Sunday	
	χ^2	P-value	χ^2	P-value	χ^2	P-value
TL Rangsit	16.21	<0.01*	17.93	<0.01*	1.47	0.48
TL Saraburee	6.30	0.04	2.77	0.25	6.01	0.05
TL Korat	16.16	<0.01*	26.77	<0.01*	1.75	0.42
TL Khonkean	17.59	<0.01*	16.66	<0.01*	0.10	0.95
BC Ayuthaya	7.55	0.02	2.45	0.29	3.24	0.20
BC Chiangmai	2.73	0.26	0.30	0.86	4.25	0.12
MK Ramintra	43.61	<0.01*	17.93	<0.01*	63.29	<0.01*

4.4 Relationship of the Proportion of Types of Trip Generation to the Date of the Place

For location comparisons on weekdays Table 3, it is clearly seen that there are differences between stores located in city and suburban areas, that primary trips to store in the city (TL Rangsit, Saraburee, Korat, BC Chiangmai, and MK Ramintra) is higher than that of stores in suburban.

For location comparisons on Saturday Table 4, the results tend to be different between stores for all locations both city and suburban areas.

For location comparisons on Sunday Table 5, the results are similar to those on the weekdays except and MK Ramintra. This is due to that TL Khonkean is located on the suburban main road network linking suburban and the city. For MK Ramintra, this wholesale store has its specific characteristics to have up to 90% primary trips.

Table 3: P-values for location comparisons on weekdays.

Location	TL Rangsit	TL Saraburee	TL Korat	TL Khonkean	BC Ayuthaya	BC Chiangmai	MK Ramintra
TL Rangsit	-						
TL Saraburee	0.02	-					
TL Korat	0.50	<0.01*	-				
TL Khonkean	<0.01*	<0.01*	<0.01*	-			
BC Ayuthaya	<0.01*	<0.01*	0.52	<0.01*	-		
BC Chiangmai	0.13	0.68	0.01	<0.01*	<0.01*	-	
MK Ramintra	0.54	<0.01*	0.20	<0.01*	<0.01*	0.03	-

Table 4: P-values for location comparisons on Saturday

Location	TL Rangsit	TL Saraburee	TL Korat	TL Khonkean	BC Ayuthaya	BC Chiangmai	MK Ramintra
TL Rangsit	-						
TL Saraburee	0.03	-					
TL Korat	<0.01*	<0.01*	-				
TL Khonkean	<0.01*	<0.01*	<0.01*	-			
BC Ayuthaya	<0.01*	<0.01*	<0.01*	<0.01*	-		
BC Chiangmai	<0.01*	0.14	<0.01*	<0.01*	0.07	-	
MK Ramintra	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	-

Table 5: Correlation of the proportion of types of the trip generation with Sunday

Location	TL Rangsit	TL Saraburee	TL Korat	TL Khonkean	BC Ayuthaya	BC Chiangmai	MK Ramintra
TL Rangsit	-						
TL Saraburee	0.53	-					
TL Korat	0.16	0.64	-				
TL Khonkean	<0.01*	<0.01*	<0.01*	-			
BC Ayuthaya	0.81	0.42	0.19	<0.01*	-		
BC Chiangmai	0.42	0.86	0.84	<0.01*	0.47	-	
MK Ramintra	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	-

5. CONCLUSION

This study focuses on three types of trip generation in Thailand including primary trips (travel from the origin to the destination and back to the origin), pass-by trip (travel from one point and stop at one point as a pass-by point before going to the destination), and diverted trip (travel from a point and stop at a point and go to the destination on a different route).

Data collected from large retails/wholesalers visitors shows trips' habits that primary trips are the highest trip generation. Store size and the number of parking do not affect the types of trip generation. Large wholesalers have the highest primary trips (80-90% of everyday trips).

Typically, for all large retails/wholesalers stores, primary trips are 70-80% while pass-by trips 6-25% for every day of the week. Locations of large retails/wholesalers stores having high pass-by trips are on the suburban road network.

6. Availability of Data, and Material

Data can be made available by contacting the corresponding author.

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