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Trips Generated by Night Markets in Thailand

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Abstract

This research studies the proportion of types of trip generations causes for trips of five night-markets with different sizes and locations in Thailand. This study surveys trip types of visitors during 16.00-19.00 on weekdays and weekends. The results find that the primary trips are 50%, pass-by trips 40%, and diverted link trips 10%. The average pass-by trip for night markets on Sunday drops to 32%. The days of the week affect the proportion of trip types. On Sunday, the diverted link trips are double. Also, the market location is an important factor affecting the proportion of trip types. Because the same market type, but at different locations and road networks, causes different proportions of trip types, such as the night market near the industrial estate. The area size of the market does not affect the proportions of trip types of primary trips and pass-by trips. The number of parking lots affects the proportion of the primary trips and pass-by trips that the primary trips raise with the increased parking spaces whereas the pass-by trips are the reverse.

Disciplinary: Civil Engineering (Transportation and Traffic Engineering).

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1. Introduction

Many land developments such as a resort, amusement park, hotel, or market, create attractions for visitors to travel to these locations. Markets are places where people come to sell and buy things, goods, and services. With urbanization, many new markets appear in many

locations as part of land development throughout the country. Generators of a market include the factors of people, conditions, or surrounding factors that cause the market to happen.

1.1 Characteristics of Night Markets in Thailand

A lot of people come to a night market to sell or exchange goods for a particular day of the week, especially on Friday, Saturday, and Sunday. Reflecting demands and supplies, night markets are popular marketplaces thus become a market economy as they create jobs and help money circulations, forming sustainable and livable communities. Most night-markets open from 16.00 to midnight, comprising many small shops (Figure 1) from you can eat to you can buy.

Figure 1: A typical night market in Thailand.

1.2 Traffic and Land Development

Land development attracts more road traffic into the neighborhood, as people come to use the services. Traffic causes from one of three types of trip generations. A primary trip is a journey starting from the beginning to the destination, and when done, returns to the starting point. A pass-by trip is a journey between getting to a point where you want to go, with a stop at another place along the route without changing your route from your starting point. A diverted link trip is a journey from the main route to the point on another route, and then going to the destination.

The proportion of each type of trip generation depends on the type of land development, time, and location of that land.

This research focused on night markets as land developments that are easily seen and are scattered throughout Thailand. Night markets also have high impacts on travel causing traffic jams. Learning the type of trip generation more clearly, the characteristics of different night market locations can be used for more accurate traffic impact assessments.

It is unavoidable that markets cause traffic problems to the road network (Thiangpungtham et al., 2020). This study, therefore, concentrates on night markets by collecting the visitors' data for analyzing types of trip generation from five different night markets around Thailand.

2. Literature Review

Chik and Shankar (1998) studied the trip generation of four large shopping complexes with an area larger than 600000 ft^2 in Klang Valley, Malaysia. They found a good fit of the size of the

shopping complex area and traffic volume. The study focused on pass-by and diverted trips to establish math models. Brehmer and Butorac (2003) collected site-specific 24hr data on weekdays and weekends for assessing traffic impacts based on the trip rate (trip generation) and trip type associated with a US major discount supermarket firm in the western USA, which is greatly lower than that of the standard ITE supermarket.

Steedman et al. (2016) studied three types of supermarket trip generations in Christchurch including primary trip, pass-by trip, and divert-link trip. The study found that the location of the supermarket is the main cause of different trips and affecting road traffics. The pass-by trips on weekdays accounted for 50% while the primary trips accounted for 50% on a weekday. The distance between the main road and the supermarket affects the trip type that the farther the shop from the main road, the less the divert link trips.

A study on types of trip generation of seven large retail/wholesale stores in Thailand (Namwong et al., 2021), during the rush hours 16:00-19:00 on a weekday and a weekend, include the studied variables of locations, number of parking spaces, areas of the large retail/wholesale stores, weekday, and weekend. The result found that trip types did not depend on the shopping area size and the number of parking spaces. Most of the trip generations were primary trips, up to 80 percent on weekdays, and be likely to increase on the weekend, while pass-by trips and diverted link trips decrease.

Pimcham et al. (2021) conducted a study on the proportion of types of the trip of six community malls in Thailand. The results found that the type of trip generation did not depend on the size of community malls, but influenced by the day of the week and its location. primary trips dominate for trips to a community mall near a community or urban area, especially higher on the weekend. The proportion of primary trips for community malls located in the capital is higher than those located in the provincial urban areas. A community mall located on a major road would have a significantly higher proportion of pass-by trips than primary and diverted trips. Interestingly, the community mall located on the main road away from a community generated pass-by trips 98% of all trips.

2.1 Thailand Traffic Impact Assessment (TIA)

The Thailand Office of Transport and Traffic Policy and Planning has set a standard for traffic impact assessment (TIA) (OTP, 2019), classifying the land development projects into real estate, condominium, large retail shop/wholesale shop, restaurant, office building, market, auditorium, hotel, housing estate, shopping mall, elementary school, secondary school, university, hospital, and stadium. The initial report must include the detail of development, detail of road network, current traffic status, a forecast of future traffic after the development, project traffic management, traffic impact, and measure to reduce traffic impact. Project development that has 50-300 Passenger Car Unit (PCU) per hour must send a brief TIA report while a project with a higher than 300 PCU must send a full TIA report.

3. Method

It is found that there are traffic congestions around the market due to the entrance and exit of the market customers' cars especially during the rush hours (TDOH, 2020). It was found the traffic road rush hours coincide with the market's rush at 16.00-18.00. This study finds the proportion of trip generations of five different markets on weekdays and weekends. The data are collected via the interview of the market's customers during 16.00-19.00 on Friday, Saturday, and Sunday, as it is expected to have the highest traffic impacts. The interview is conducted with 400 samples who drive their personal cars to the market. The interview questions are to find out the types of trip generation of the sample (primary trip, pass-by trip, or diverted link trip). The interviewed data are recorded in the Google Form.

Table 1: Details of markets used in this study.

Night-Market	Area (m^2)	Type of Market	Province	Geolocation
Tegn Terdteung Night Vintage	6,890	In tourism town	NakhonNayok	14.24699,101.25194
Plane Night Market	31,326	Near the industrial estate	Samut Prakan	13.59733,100.74527
Immortal Ninja Market	45,900	Near the industrial estate	Chonburi	13.41678,100.99659
Liab Duan Night Market	53,000	In the city center area	Bangkok	13.84734,100.63881
SaveOne Night Market	68,000	In the suburban area	Korat	14.95735,102.04402

4. Analysis and Results

4.1 Effects of Types of Trip Generation on the Day of Week and Location of Night-Markets

Tables 2, 3, 4 show the market visitors' interviewed survey for Friday, Saturday, and Sunday, respectively, classified for each market. This study finds and compared that proportions of trips are different for each day. The highest proportion of the trip generations are primary trips with an average at 50%, pass-by trips 40% (32% on Sunday), diverted link trips only 5%, for all markets.

Table 2: Visitors' survey results classified according to the type of trip generation for Friday

Market	Number of interviewees	Type of trip generation		
		Primary Trips	Pass-by Trips	Diverted link Trips
Tegn Terdteung Night Vintage	420	186 (44.3%)	203 (48.3%)	31 (7.4%)
Plane Night Market	557	242 (43.4%)	301 (54.0%)	14 (2.5%)
Liab Duan Night Market	448	182 (40.6%)	243 (54.2%)	23 (5.1%)
Immortal Ninja Market	575	205 (35.7%)	324 (56.3%)	46 (8.0%)
SaveOne Night Market	469	428 (91.3%)	25 (5.3%)	16 (3.4%)
Average	494	249 (51.1%)	219 (43.7%)	26 (5.3%)

Table 3: Visitors' survey results classified according to the type of trip generation for Saturday.

Market	Number of interviewees	Type of trip generation		
		Primary Trips	Pass-by Trips	Diverted link Trips
Tegn Terdteung Night Vintage	484	233 (48.1%)	224 (46.3%)	27 (5.6%)
Plane Night Market	545	295 (54.1%)	227 (41.7%)	23 (4.2%)
Liab Duan Night Market	494	242 (49.0%)	229 (46.4%)	23 (4.7%)
Immortal Ninja Market	630	222 (35.2%)	357 (56.7%)	51 (8.1%)
SaveOne Night Market	577	495 (85.8%)	63 (10.9%)	19 (3.3%)
Average	546	297 (54.5%)	220 (40.4%)	29 (5.2%)

Table 4: Visitors' survey results classified according to the type of trip generation for Sunday.

Market	Number of interviewees	Type of trip generation		
		Primary Trips	Pass-by Trips	Diverted link Trips
Tegn Terdteung Night Vintage	483	239 (49.5%)	169 (35.0%)	75 (15.5%)
Plane Night Market	579	305 (52.7%)	202 (34.9%)	72 (12.4%)
Liab Duan Night Market	597	240 (40.2%)	180 (30.2%)	177 (39.6%)
Immortal Ninja Market	602	238 (39.5%)	342 (56.8%)	22 (3.7%)
SaveOne Night Market	581	490 (84.4)	35 (6.0%)	56 (9.6%)
Average	568	302(53.2%)	186(32.6%)	80(14.2%)

4.2 Relationship Market Area Size and the Day of Week

To investigate the relationship between the area size of the market and the day of the week, the correlation test is used. The test considers only the pass-by trips and primary trips, as the diverted link trips are only a small amount. For pass-by trips Table 5, the results find moderate inverse correlations between market area size and weekday and Saturday. For primary trips, the results find moderate correlations between the day of the week and market area size, with the lowest on Sunday.

Table 5: Correlation test results between the day of week and area size of the market

Pass-by Trips	Area size of the market		Primary Trips	Area size of the market
Weekday	-0.54		Weekday	0.55
Saturday	-0.48		Saturday	0.46
Sunday	-0.32		Sunday	0.44

4.3 Relationship of the Day of Week and Number of Parking Spaces

Since the number of parking lots makes it convenient for visitors to park their cars at the night market, the proportion of the trips for considerations include the primary trips and passed-by trips, as the diverted link trips are only a small amount. Table 6, correlations showed that the proportion of pass-by trips tends to decrease while the number of parking spaces increases due to negative correlations close to -1 for all days. On the other hand, the proportion of primary trips tends to increase with the number of parking lots for any day of the week.

Table 6: Correlation test results between the day of the week and the market's parking spaces.

Pass-by Trips	car park lot		Primary Trips	car park lot
Weekday	-0.92		Weekday	0.93
Saturday	-0.88		Saturday	0.86
Sunday	-0.71		Sunday	0.88

4.4 Relationship of Pass-By Trip and Average Annual Daily Traffic

Average Annual Daily Traffic (AADT) of the main roads adjacent to each night market has traffic volumes from 33,390-101,264 cars/day. Through the correlation method, it finds that the average daily traffic volume over the year did not affect the proportion of pass-by trips (see Table 7).

Table 7: Correlation between pass-by trips and AADT.

Pass-by Trips	Average Annual Daily Traffic (AADT)
Weekday	-0.20
Saturday	-0.40
Sunday	-0.49

4.5 Relationship of Travel Type Proportion to Day of Week

To test the relationship between travel proportions and the days of the week by using the statistical Chi-Square Test method, at the significance 0.05. The results Table 8 show that the proportions of trip types are no different for Tegn Terdteung Night Vintage and Immortal Ninja Market Between Weekday and Saturday whereas others are different.

Table 8: A test for the relationship between the days of the week and the types of trip generation.

Night-Market	The proportion of trip type					
	Between Weekday and Saturday		Between Saturday and Sunday		Between Weekday and Sunday	
	Chi-Square	P-Value	Chi-Square	P-Value	Chi-Square	P-Value
Tegn Terdteung Night Vintage	2.06	0.36	30.36	< 0.01	31.52	< 0.01
Plane Night Market	17.66	< 0.01	25.89	< 0.01	47.57	< 0.01
Liab Duan Night Market	6.68	0.04	115.77	< 0.01	140.44	< 0.01
Immortal Ninja Market	0.02	0.99	11.77	< 0.01	13.97	< 0.01
SaveOne Night Market	10.49	0.01	26.27	< 0.01	713.69	< 0.01

4.6 The Proportion of Trip Types Affected the Relationship Between Markets

The proportion of trip types are classified into four groups including in tourism towns, near the industrial estate, in the city center area, in the suburban area. To test the relationship between the proportions of trip types and the location of the market, the Chi-Square Test method is used at the significance of 0.05, Tables 9, 10, and 11. The results find that the trip types for the group near the industrial estate for two markets are different because the spatial locations of markets and road networks are different for weekends.

Table 9: P-value for trip types between markets for weekdays.

Location	Tegn Terdteung Night Vintage	Plane Night Market	Liab Duan Night Market	Immortal Ninja Market	SaveOne Night Market
Tegn Terdteung Night Vintage		< 0.01*	0.14	0.02*	<0.01*
Plane Night Market			0.08	<0.01*	<0.01*
Liab Duan Night Market				0.09	<0.01*
Immortal Ninja Market					<0.01*
SaveOne Night Market					

Table 10: P-value for trip types between markets for Saturday.

Location	Tegn Terdteung Night Vintage	Plane Night Market	Liab Duan Night Market	Immortal Ninja Market	SaveOne Night Market
Tegn Terdteung Night Vintage		0.13	0.80	<0.01*	<0.01*
Plane Night Market			0.25	<0.01*	<0.01*
Liab Duan Night Market				<0.01*	<0.01*
Immortal Ninja Market					<0.01*
SaveOne Night Market					

Table 11: P-value for trip types between markets for Sunday.

Location	Tegn Terdteung Night Vintage	Plane Night Market	Liab Duan Night Market	Immortal Ninja Market	SaveOne Night Market
Tegn Terdteung Night Vintage		0.31	<0.01*	<0.01*	<0.01*
lane Night Market			<0.01*	<0.01*	<0.01*
Liab Duan Night Market				<0.01*	<0.01*
Immortal Ninja Market					<0.01*
SaveOne Night Market					

5. Conclusion

This study surveys the trip types of visitors during 16.00-19.00 of five different night markets located in different provinces on weekdays and weekends. The results find that the primary trips 50%, pass-by trips 40%, and diverted link trips 10%. The days of the week affect the proportion of trip types. On Sunday, the diverted link trips increase to double. The market location is an important factor affecting the proportion of trip types. Because the same market type, but at different location and road network, causes different proportions of trip types, such as the night market near the industrial estate. The area size of the market has no effect on the proportions of trip types of primary trips and pass-by trips. The number of parking lots affects the proportion of the primary trips and pass-by trips that the primary trips increase with the increased parking spaces whereas the pass-by trips are the opposite.

6. Availability of Data, and Material

Data can be made available by contacting the corresponding author.

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