Trip Types of Community Malls

Benchaya Pimcham [1], Winai Raksuntorn [1*], Boonsap Witchayangkoon [1], Nareenart Raksuntorn [2], and Songrit Chayanan [3]

[1] *Department of Civil Engineering, Thammasat School of Engineering, Thammasat University, THAILAND.*
[2] *Faculty of Industrial Technology, Suan Sunandha Rajabhat University, THAILAND*
[3] *Bureau of Highway Safety, Department of Highways, Ministry of Transportation, Royal Thai Government, THAILAND*
Corresponding Author (Email: rwinai @ engr.tu.ac.th).

Abstract

This research studies the factors affecting the proportion of types of trip generation from six community malls of different sizes and locations in Thailand. An analysis of results from the interview data reveals that the type of trip generation does not depend on the size of community malls, but it depends on the day of the week and its location. Most trips to a community mall near a community or urban area are primary trips. These primary trips tend to be higher on the weekend. Moreover, the proportion of primary trips for community malls located in the nation's capital is higher than those located in the regional urban areas. The data also suggests that a community mall located on a major road will have a significantly higher proportion of pass-by trips than primary and diverted trips. In particular, the community mall sited on the main road away from a community will generate pass-by trips as high as 98 percent of all trips.

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1. Introduction

A community mall is one type of land development that is a convenient and fulfilling center for consumers. It consists of restaurants, food courts, convenience stores, supermarkets, shops, banks, fitness, and much more. In Thailand, the community mall is the second-largest service after retail stores, with a growth rate of 30% per annum (Kongcheep, 2019). It spreads over urban areas, suburban areas, and main provincial routes. As a result of this expansion, a community mall is one of the land developments that generates more trips on the road network. To minimize traffic

problems on the road network around the community mall, Therefore, a traffic impact study is required before the project is developed (Namwong et al., 2021).

Trips generated by a new development consist of three types: primary trips, pass-by trips, and diverted trips. The pass-by trips are already part of the existing traffic pattern (pass-by trips) while others are completely new trips (Institute of Transportation Engineers, 2005). Traffic impact assessments will be precise and close to actual conditions, depending on the accuracy of the forecast of type of trips. The study in the US (Institute of Transportation Engineers, 2014) suggests that type of trips depends on the type of development. The study also recommends ranges of pass-by rates for each development types. Brehmer and Butorac (2003) studied trip generation characteristics of supermarkets in the US. They found that, on average, 52 percent of the trips generated by the supermarket stores were primary trips. Moreover, there were some variations between the pass-by and diverted percentages based on the location of the store. In another study in New Zealand, Steedman et al. (2016) studied the type of trips of five supermarkets in New Zealand. The data suggested that the proportion of primary, pass-by, and diverted trips depended on the location of the supermarket and the distance to the nearest competitors. Additionally, the distance to the nearest major road also affected the proportion of diverted trips.

Based on the literature, there is no study on the trip types of community malls both in Thailand and foreign countries. However, this area of study is important for the traffic impact study, in Thailand, to represent actual traffic conditions. Therefore, this study intends to give a finding and detailed analysis of the type of trips of community malls in Thailand.

This study investigates the proportions and factors that affect three types of trip generation: primary trips, pass-by trips, diverted trips of six community malls in Thailand.
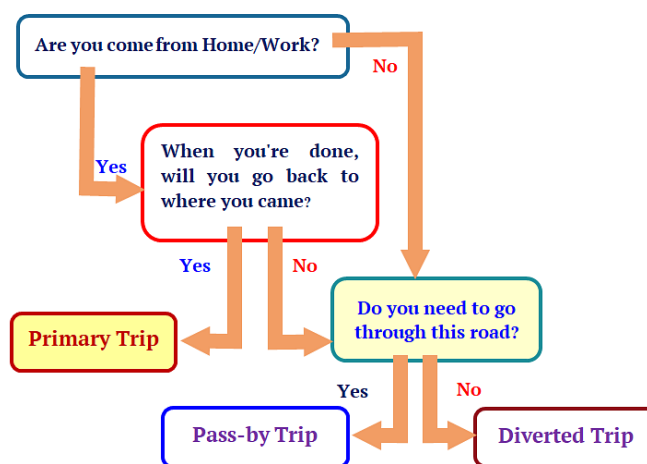
Figure 1: Process flowchart of the questionnaire and result

2. Method

The data was collected and used to analyze three types of trips generated by six community malls in Thailand. The data collection method was done through interviews with community mall customers who came by private cars. The interviews were conducted from at least 400 samples at each location on weekdays and weekends during two time periods, morning and afternoon peak

hours. The questionnaire survey needs to be simple and easy to answer. However, it must be possible to determine what type of trip each person made. The questions used to interview are shown in Figure 1.

3. Analysis and Results

3.1 Community Malls Characteristics and Proportion of Types of Trips Generation

3.1.1 Community Mall Characteristics

Characteristics observed at each community mall are

- Location 1: It is a medium-sized community mall with a gross service floor area of 12,000 square meters and 285 parking spaces. This community mall is sited in the capital city of Thailand, Bangkok, and open to service daily from 10:00-22:00. There are few nearby competitors and alternative routes.

- Location 2: It is a large-sized community mall with a gross service floor area of 24,400 square meters and 565 parking spaces. This community mall is sited in the capital city of Thailand, Bangkok, and open to service daily from 10:00-22:00. There are many competitors in the adjacent area. Its customers use a nearby major road as an alternative route accessed this community mall.

- Location 3: It is a large-sized community mall with a gross service floor area of 19,900 square meters and 187 parking spaces. This community mall is sited in the urban area of a province in the northern part of Thailand and open to service daily from 10:00-22:00. There are many competitors in the adjacent area. Adjacent roads are used as alternative routes accessed to this community mall.

- Location 4: It is a small-sized community mall with a gross service floor area of 5,000 square meters and 187 parking spaces. This community mall is sited in the urban area of a province in the eastern part of Thailand and open to service daily from 10:00-22:00. There are many nearby competitors. Adjacent roads are used as alternative routes entering the premises.

- Location 5: It is a large-sized community mall with a gross service floor area of 16,000 square meters and 420 parking spaces. This community mall is sited on a major road near a community and open to service daily from 10:00-22:00. There are many competitors in the adjacent area. Adjacent roads may be used as alternative routes entering the premises.

- Location 6: It is a small-sized community mall with a gross service floor area of 3,200 square meters and 300 parking spaces. This community mall is sited on a major road away from a community and open to service 24/7. There are many competitors in the adjacent area. There is no alternative route to enter the premises.

Based on the characteristics of six community malls describes above, they could be divided by their locations into 4 groups: in the capital city (Location 1 and 2), in the regional urban areas (Location 3 and 4), on a major road near a community (Location 5), and a major road away from a community (Location 6). The statistical summaries will be discussed in the next section.

3.1.2 The Proportion of Trip Generation

According to the interview data from six community malls during two time periods on weekdays and weekends, primary trips and pass-by trips are dominant. The data also shows that the proportion of trips generated by the community mall customers depends on its location. The results, in Figure 2, can be summarized as follows.

Trips generated by the community malls sited in the urban area (Location 1-4) are primary trips range between 26 and 94 percent as shown in Figure 2. These primary trips tend to be higher on the weekend. The proportion of primary trips for community malls located in the capital city (Location 1 and 2) is higher than those located in the regional urban areas (Location 3 and 4) during two time periods on weekdays and weekends. It is because the density of the community surrounding the community mall areas (at Locations 1 and 2) is much higher than the community mall area (in Locations 3 and 4.) Moreover, Locations 1 and 2 are the center of most activities such as office buildings, hospitals, schools, and so on. Therefore, Locations 1 and 2 generate more primary trips than the other Locations.
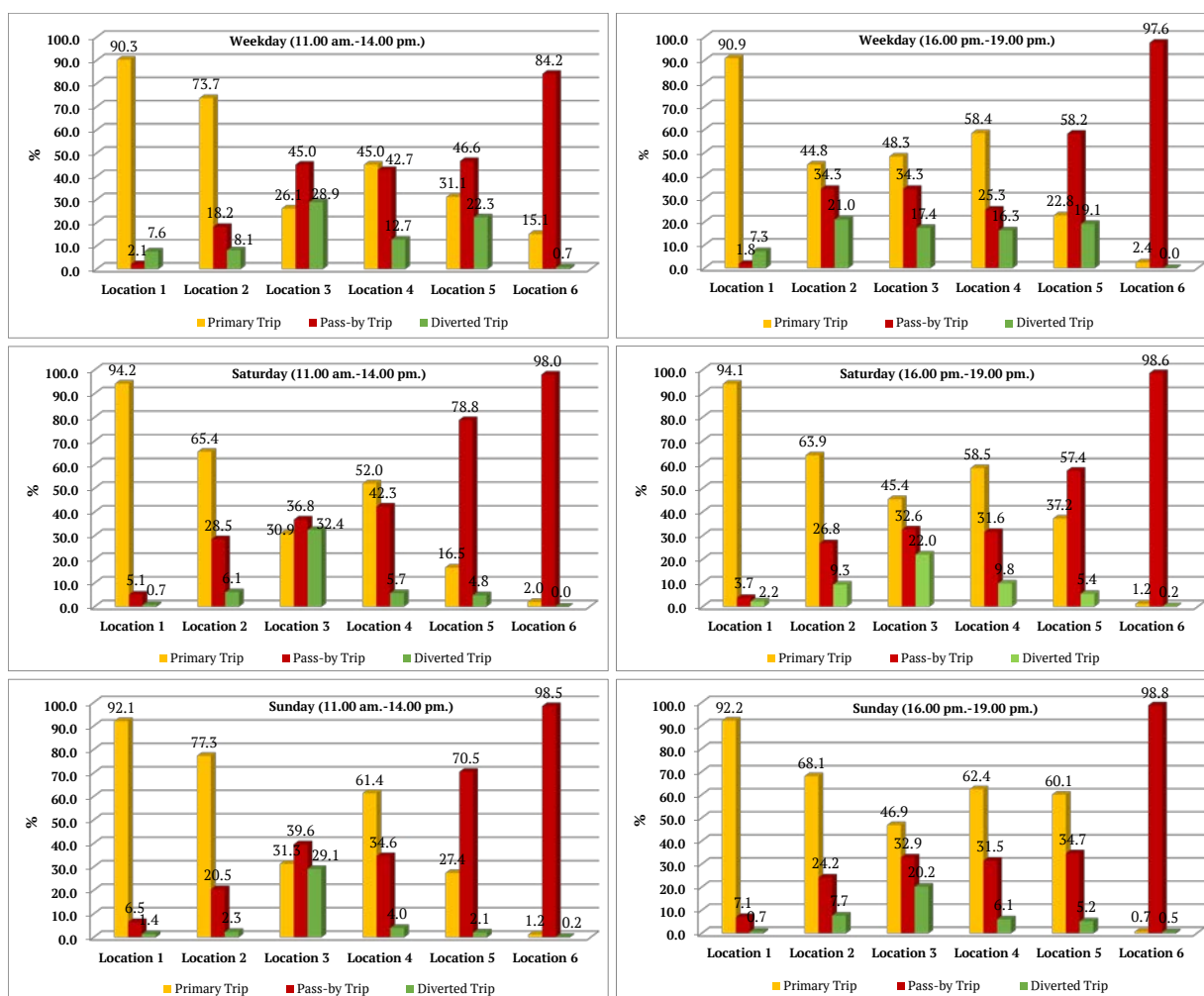

Figure 2: Proportion of Trip Generation during Weekday and Weekend

The data, in Figure 2, also suggests that a community mall located on a major road (Location 5 and 6) will have a significantly higher proportion of pass-by trips than primary and diverted trips, especially during the weekend. In particular, the community mall sited on the main road away from a community will generate pass-by trips as high as 98 percent of all trips.

3.2 Relationship between Proportions and Time Periods

Chi-square at a significance level of 0.05 was used to test the similarities of proportions of trip generation between times of the day. The p-value for chi-square tests comparing the primary,

pass-by, and diverted trips at each location, given in Table 1, indicates the likelihood that the differences were observed between the sets of data.

The stars in Table 1 mean that statistically significant differences were found ($p \leq 0.05$). The statistical summary in Table 1 shows statistically different characteristics of trip proportions for most community malls. Therefore, it is most likely that the proportions of trips (primary, pass-by, and diverted trips) depend on the times of the day. During the weekend, however, a community mall located on a major road away from a community (location 6) has the same proportions of trips between PM. peak hour and peak hour of the generator on both Saturday and Sunday since most of its customers are travelers between major cities.

Table 1: The Statistical Summary of Similarity Test of Proportions Between Times of Day (PM. Peak Hour and Peak Hour of Generator) Using Chi-square

Location	Weekday		Saturday		Sunday	
	X^2	P-value	X^2	P-value	X^2	P-value
Location 1	0.14	0.93	4.01	0.13	1.26	0.53
Location 2	73.00	<0.01*	3.19	0.20	16.68	<0.01*
Location 3	27.72	<0.01*	20.36	<0.01*	22.77	<0.01*
Location 4	29.87	<0.01*	12.67	<0.01*	2.67	0.26
Location 5	11.51	<0.01*	47.42	<0.01*	108.91	<0.01*
Location 6	44.74	<0.01*	1.81	0.4	0.85	0.65

3.3 Relationship between Proportions and Days of the week

Chi-square at a significance level of 0.05 was also used to test the similarities of proportions of trip generation between days of the week. The p-value for chi-square tests comparing the primary, pass-by and diverted trips at each location, given in Table 2, indicates the likelihood that the differences observed between the sets of data.

Table 2: The statistical summary of similarity test of proportions between days of the week

Time 11.00-14.00 hr.	Weekday/ Saturday/ Sunday		Weekday/ Saturday		Saturday/ Sunday		Weekday/ Sunday	
	X^2	P-value	X^2	P-value	X^2	P-value	X^2	P-value
Location 1	45.87	<0.01*	28.86	<0.01*	1.79	0.41	26.77	<0.01*
Location 2	29.21	<0.01*	12.61	<0.01*	17.63	<0.01*	15.10	<0.01*
Location 3	6.93	0.14	5.86	0.05	1.15	0.56	3.39	0.18
Location 4	38.46	<0.01*	13.02	<0.01*	7.66	0.02	33.07	<0.01*
Location 5	158.07	<0.01*	100.14	<0.01*	17.61	<0.01*	91.76	<0.01*
Location 6	90.36	<0.01*	48.26	<0.01*	1.70	0.43	53.53	<0.01*
Time 16.00-19.00 hr.	Weekday/ Saturday/ Sunday		Weekday/ Saturday		Saturday/ Sunday		Weekday/ Sunday	
	X^2	P-value	X^2	P-value	X^2	P-value	X^2	P-value
Location 1	45.38	<0.01*	14.10	<0.01*	8.01	0.02	37.58	<0.01*
Location 2	65.33	<0.01*	38.74	<0.01*	1.85	0.40	52.83	<0.01*
Location 3	2.78	0.60	2.73	0.26	0.42	0.81	1.08	0.60
Location 4	24.73	<0.01*	9.49	<0.01*	4.24	0.12	22.51	<0.01*
Location 5	155.12	<0.01*	45.69	<0.01*	45.72	<0.01*	126.18	<0.01*
Location 6	6.53	0.16	2.84	0.24	0.80	0.67	5.81	0.05

The stars in Table 2 mean that statistically significant differences were found ($p \leq 0.05$). The statistical summary in Table 2 shows that the proportions of trips (primary, pass-by, and diverted trips) on the weekday are significantly different from on the weekend for most community malls.

The possible reasons behind this are that many people tend to spend their free and family time (shopping, eating, exercising) on the weekend where they have some extra time.

3.4 Relationship between Proportions and Gross Service Floor Areas

As discussed in the previous section, trips generated by community malls are mainly primary and pass-by trips. Therefore, the Pearson coefficient correlation was used to determine the strength of the linear relationship between proportions of trip generation and gross service floor areas of community malls. Values that are close to +1 or -1 indicate a strong relationship between the two variables.

The statistical results Table 3 shows that the proportion of pass-by trips was likely to decrease as the size of the community mall decreased. However, the correlation was still relatively low, so it suggested that the size of the gross service floor area did not change the proportion of the pass-by trips. Additionally, the results in Table 3 also shows the positive relationship between the size of the gross service floor area and the proportion of primary trips. This positive relationship means that the proportion of primary trips was likely to increase as the size of the community mall increased. However, the correlation was still relatively low (not close to 1), so it suggested that the size of the gross service floor area did not change the proportion of the pass-by trips.

Table 3: The Statistical Summary of Correlation Test between Proportions and Gross Service Floor Area

Pass by Trip	Size		Primary Trip	Size
Weekday (A.M.)	-0.52		Weekday (A.M.)	0.33
Weekday (P.M.)	-0.34		Weekday (P.M.)	0.18
Saturday (A.M.)	-0.43		Saturday (A.M.)	0.26
Saturday (P.M.)	-0.46		Saturday (P.M.)	0.35
Sunday (A.M.)	-0.46		Sunday (A.M.)	0.33
Sunday (P.M.)	-0.55		Sunday (P.M.)	0.43

4. Conclusion

Based on questionnaires data collected from visitors to six community malls in Thailand, the study of types of trip generation are

1. The proportion of types of trip generation of community malls is mainly pass-by trips. It also depends on its location. The values of pass-by trips are as follows:
   - 20-40% for a community mall sited in urban areas
   - 35-80% for a community mall sited on a major road near a community
   - 80-98% for a community mall sited on a major road away from a community
2. The proportion of types of trip generation of community malls depends on the days of the week. The primary trip trends to be higher on the weekend.
3. The proportion of primary trips of community malls located in the nation's capital is higher than those located in the regional urban areas or on a major road.
4. The proportion of types of trip generation does not depend on the size of a community mall.

5. Availability of Data, and Material

Data can be made available by contacting the corresponding author.

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Benchaya Pimcham is a Master's degree student of the Department of Civil Engineering, Thammasat School of Engineering, Thammasat University, Thailand. She earned a Bachelor of Engineering and Management, Thammasat School of Engineering, Thammasat University. She is interested in Traffic Modeling Analysis and Management.

Dr. Winai Raksuntorn received his PhD (Civil Engineering) from the University of Colorado, USA. He is an Assistant Professor in the Department of Civil Engineering, Faculty of Engineering, Thammasat University. His research interests include Transportation Safety Analysis, Traffic Operations, and Management, Traffic Impact Studies, Traffic Flow Modeling, Highway Capacity Analysis, Advanced Traffic Management for Intelligent Transportation Systems.

Dr. Boonsap Witchayangkoon is an Associate Professor in the Department of Civil Engineering, Thammasat School of Engineering, Thammasat University. He received his B.Eng. from the King Mongkut's University of Technology Thonburi with Honors. He continued his PhD study at the University of Maine, USA, where he obtained his PhD in Spatial Information Science & Engineering. Dr. Witchayangkoon current interests involve Applications of Multidisciplinary and Emerging Technologies to Engineering.

Dr. Nareenart Raksuntorn is an Assistant Professor at the Faculty of Industrial Technology, Suan Sunandha Rajabhat University. She received the B.Eng. degree in Electronics Engineering from King Mongkut's Institute of Technology Ladkrabang, Thailand, the M.S. degree in Electrical Engineering from the University of Colorado, and the Ph.D. degree in Electrical Engineering from the Department of Electrical and Computer Engineering, Mississippi State University. Her research interests include Remote Sensing Image Analysis, Image Processing, and Pattern Recognition.

Dr. Songrit Chayanan is Head of Traffic and Transportation Surveys, Bureau of Highway Safety, Department of Highways, Thailand. He earned his Bachelor of Engineering degree with Honors from Thammasat University, Thailand. He got his PhD from the University of Washington, USA. His research is related to the Analysis of Highways Transportation and Accidents.