

The Parking Problem: Case of Thammasat University

EE489: Seminar in Industrial Economics

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Abstract

This research paper concerns parking lot scarcity problem of Thammasat University. Students at Thaprachan campus usually have trouble finding available parking space, making cost of education high. It tries to find a way that Thammasat University can benefit from solving this problem. It is assumed that the University operates its own parking lot service. A basic cost-revenue model is set up to find profitability of the project. The analysis is done in two separate parts: the demand and supply analysis. Supply analysis tells cost of operating this business. Willingness to pay of customers comes from demand analysis. Two economic pricing models, third-degree price discrimination and two-part tariff, are used in parking pricing. Together, 30-year profit is calculated from here. Net present value concept is applied. Detailed calculation is shown in context. It is shown how the second pricing model yields higher return for the project and should be adopted. The project should get a green light as it has high chance of success and can generate profit to the university. The project creates positive externality as there are more benefits than providing convenience of students who drives to the university. Profit generated can be used to reinvest and develop Thammasat University in many other aspects.

I. Introduction

Infrastructure is a basic fundamental of an economy. Transportation is essential especially if you live in a big city like Bangkok. Usually, big cities around the world have great transportation system to provide convenience for the people. In Bangkok, however, things are quite different. BTS sky train and subway systems do not cover all parts of the city. Buses and boats are dangerous and inconvenient. So what would people do if public transportations are not available for them? For a lot of people, they choose to drive their own cars.

Big cities are where people come to, mainly for business purpose. At one point, it becomes over-crowded. Land price increases considerably. This brings us back to our problem of parking space. Of course, every major city around the world has been facing the same problem of parking lot allocation, which is scarce and high price. Major cities usually have great transportation system to compensate. The case of Bangkok is different. Bangkok does not have good city planning to begin with. Good transportation system covers only the inner business district part of the city. Development of the project has been sluggish.

This research paper concentrates on the parking lot allocation problem of Thammasat University students at Tha Prachan campus. This problem has been prolonged for decades. Public transportations available to the university are buses and boats, which is very inconvenient. Taxis are available at high cost. The parking spaces inside the campus are reserved for the professors and authorities. Students can park at nearby private parkings at a very high price. They can choose to park on the road, but they risk getting their wheels locked by the police. Sometimes, students are able to bribe the university's guard to access the university. The price, however, is insanely high. The problem should not be settled at this point in which there are several alternatives to solve the problem.

II. Overview

Scarcity of parking lot has been a problem faced by Thammasat University, Thaprachan campus for a long time. Thammasat University is the second oldest university of Thailand. At the time, it was located in the heart of the city. As of today, the location has become the old town. The city planners did not expect the future days to be as developed as of today. Things are quite stuffy. It is hard to find blank space of land available. If one manages to find it, land price can be pricy. Parking lot, therefore, is very hard to find and cost is high. Numbers of Thammasat University students are having a hard time travelling to the university. There are several means of transportation that students can choose from, including public transportation and driving. This research paper focuses on students who drive to the university. According to a survey conducted, which will be discussed in to detail further in the paper, it turns out that most of the students take 15 to 30 minutes in driving around finding open parking spots. When converting the number into fuel consumed, we can see that these are resources that is wasteful. It could be used in something that is more productive.

Currently, there are 7 common parking spaces that students are likely to park. Fees and distance are displayed in table (1) which can be found in the appendix. We can see that the price range is quite high and the place is quite far from the campus. Only half of the space is in walking distance. Students who park on-street have only limited parking time and risks of getting their wheels locked by the police.

According to the survey, it turns out that the most famous parking space among the students is bribing the university guard. Thammasat University's regulation states clearly that the only groups of people authorized to park in the university are instructors and university officers. Students are prohibited. Practically, students often give money to the guards in exchange for parking rights. The bribery is made in both gifts and monetary terms. Students,

however risks of getting caught by high level officials. Space in the university is fixed, so they also risk of not being able to find free parking space. The main problem of this mean is inefficiency. Economically speaking, it is a practice of first degree price discrimination. Bribery price can range between 300 up to 2000 baht per month. Guards observe willingness to pay of each student and charge them accordingly. There is no common market price. Practically speaking, the money that the students pay goes to the security guards. It is late spent on private use. In the reality, it should go to the university itself as it is the owner of the parking spaces. Later on, it can be spent on something productive such as education. From the problem above, we come up with our research question: *“Can Thammasat University benefit from operating parking lot service.”*

The main objective of the research paper is to determine if it will be profitable if Thammasat University were to operate its own parking lot. Basic cost-revenue model will be constructed to roughly estimate the profitability.

III. Literature Review

The first research paper on “Parking Facilities Outside the Traffic Zone” (Macdonald, 1927). The author starts off by stating different means of travelling. According to him, there are three different ways: to leave your car at home and find another way of travelling, to drive to the destination and find a good parking space, and to drive to the rim of traffic congestion, park, and continue by another means. In this paper, we focus only on the second method, to drive your own car to the destination, and find a decent parking spot. The story, however, is not that simple. Good parking spot in the capital city like Bangkok is not that easy. Especially in a place considered as old town where city planning was done centuries ago. Parking lot

was not an important thing that city planners at the time considered important and prepared a large piece of land for.

“The Allocation of the Commons: Parking on Public Roads” (Epstein, 2002) talks about negative effects of allocation of common resources. As little administrative control over resources is preferable if the demand for that resource has low intensity, too restricted allocation of good creates inefficiency. Privatization could create negative outcome to the society. Both situations of inefficient allocation of resources could apparently decrease social welfare. This theory also applies to parking industry around the world. As said earlier, big cities around the world face problem of insufficient parking space. When the demand for parking space is well above the supply, the race for space emerges. Competition for space arises. There are two types of competitions, which is top-down and bottom-up. The type that applies to the research is top-down, or the race between the authorities and the ones without power. As a result, the people without authoritative control are worse off and it is possible that the resource, parking space, is not allocated in the most efficient way possible. The author suggests that there are several alternatives to remedy this problem including granting complex forms of licensing and allow auction. Permit parking is a great way of resolving the problem. By applying permit parking, the land owner sells license to park to the people who are willing to pay at the stated price. As the space is limited, however, available parking space is not guaranteed at all times. Advantage to this strategy is to create revenue to the land owner and to eliminate competition that would arise as a result of the excess demand for parking. On the other hand, it rewards low and high demanders equally. Another method that could possibly be applied to Thammasat University’s situation is parking meter. To simplify that, parking fee could be charged at hourly rate. The author also mentions about nature of parking fee. Usually, parking fee is not set at market price. If it is, the poor will not be able to afford the facility.

According to “A Probabilistic Model for Analyzing Campus Parking Policies” (Narragon, Dessouky, DeVor, 1973), the easiest solution of insufficient parking lot is to expand parking facility and to improve the currently existing ones. Universities around the world provide convenience for their student by building parking lot buildings or renting space only for parking. Even so, it seems like the parking facility is always in shortage. High demand is usually not met by the first solution. On the other hand, many universities are trying to improve the existing facility. Nevertheless, one-space-per-user basis does not only not maximizing the usage of the parking space, but also creates deadweight loss. By granting one space for a specific user, the space will not be used at all times. It is not possible that the owner of the lot is present at all time. When the person is not present, the space should be occupied by someone else. There should be a way to allocate the parking space more efficiently. Schedule and time management is a possible solution to this parking scheme, if continued. Additionally, a way that could solve inadequate parking space is carpooling.

From the papers two papers above, we come up with some important point. For parking of Tha Prachan campus of Thammasat University case, it seems impossible to expand the parking facility. The campus is placed on a part of city that is quite congested and land price is fairly high. At the same time, the current parking scheme of Thammasat University is not efficient. This point seems to be easier to tackle the problem. As we all know, some parking space in the campus is reserved for some important administrative figure. Additionally, there is always free parking spots vacant at all times. Meaning, the parking lot resources is not used at its full capacity. Parking permit should be applied. There are several parking lot services around Tha Prachan campus area, but the demand is sky high that the available service seems to never be enough. By adopting parking permit scheme, university can sell license to park to students. It would help resolve the deficient parking lot problem significantly. It is understood that the supply of parking lot is fixed as the land

cannot be generated further. On the other hand, demand for parking lot is high. Pricing strategy of the parking permit has to be set strategically so that demand will equilibrate the supply reasonably. There are several economic models to be considered.

According to the paper “Product Differentiation in the Parking Market” (Ross, 1958), parking lot is not always homogeneous service. The only case that it is almost homogeneous is two consecutive lots. Generally, parking lots give different levels of utility. Hence, it should be priced differently. There are four factors that determine price of parking lot service including parking space, location of the parking lot, input to the service (almost zero, only little maintenance fee applies), and labor (cheap, unskilled, and homogeneous.) There are two addition determinants of the success of the parking industry. First is the market area, or the range of the area that the service would cover. Another is the urban rent theory. This is an economic theory that explains the land price behavior. The real estate price would decrease as the distance from central business district or important landmark increases. The above theories and factors are essential in parking fee determination. The author suggests that the most important factor determining price and success of parking industry is location. Different location results in different economic rent. Parking lot that is placed on better location would yield monopolistic returns.

In addition to the previous paper, “Congestion: Market Pricing for Parking” (Banister, 1989) also agrees with the parking lot pricing strategy written above. The author states that off-street parking lot which is run by private sector charge parking fees at nominal value. The price does not reflect the true value of the space occupied. Parking service should be charged at economic rate. The fees should be in accordance with office rental rates of the buildings in the same area.

To sum up, this is how the story goes. The aim of doing this literature review is to allocate parking lot of Thammasat University, Tha Prachan campus more efficiently. First, we analyze the nature of the problem. First, we found out that there are 3 types of commuting. We focus on people who travel to the university by car. To be exact, we focus on the students who drive to the university. Next we analyze the current parking policy of the campus, including the behavior and effects. We found out that it is inefficient. Several research papers suggest different alternatives ways of resolving deficient parking space. The best solution by far is granting parking permit. To apply this format, we need to determine the appropriate parking fee. A number of researches suggest factors of that determine parking price. In this research, we would apply the theories and format suggested in the literatures studied and would take a step further in determining an effective price for parking.

IV. Methodology



The best way to determine whether Thammasat University can benefit from operating its own parking lot is to set up a cost-revenue model. In this paper, some assumptions are needed to be made. First of all, we are going to assume that there is 1 rai of land available for rent. The contract is 30 years, as it is a common contract length. The university is going to build an eight storey parking lot building. According to Thai law, eight storeys is the maximum number of floor allowed to build a low-rise building. Constructing an edifice

exceeding this height needs special permission. On the other hand, as land price in around the campus area is so pricy, it is inefficient to build just a few floors. Operating hours is between 6am and 10pm. For simplicity, we will assume that only Thammasat Students are able to park in the building. Now, the hardest part, price determination. By doing so, we need to do two things: demand and supply analysis. This is the most theory in economics. This paper is going to adopt this into the study. Demand and supply analysis is done in order to determine the appropriate market price.

5.1) Supply Analysis

Supply in this model is the amount of parking lot. As said earlier in the paper, amount of land around Thaprachan campus is scarce. This is the case of fixed supply. Upon doing the supply analysis, we will be trying to find the cost of constructing the parking lot building. First off, costs are needed to be determined.

Investment

Rent 1 rai with 30 years contract	43,200,000
Construction Cost	<u>86,400,000</u>
Total initial investment	<u><u>129,600,000</u></u>

The table above shows initial investment needed for construction. Thirty-year rent fee is calculated from rental rate. From the observation, the market rental rate is stated to be around 120, 000 baht per month. Another 86 million is the construction cost. Normally it costs 9,000 baht per square meter. In this case we have 1 rai of land, which equals to 1,600 square meters. The building on the land is around 1,200 square meters in area. (1200 square

meter x 8 floors x 9000 = 86,400,000 baht) Then we can come up with total initial investment of 129,600,000 baht.

The building will have total area of 9,600 square meters (8 floors). Total usage area of the building will be around 60 percent of the total area. The rest of the space will be for road lens, stairs, and poles. This left the usage area to be around 5,760 square meters. Each parking spot takes 12 square meters. So roughly, the building will be able to park almost 500 cars.

5.3) Demand Analysis

As said earlier, this parking lot scarcity problem emerged from fixed supply. When facing fixed supply, price is determined solely by demand. So in demand analysis, the main information needed from this part is the willingness to pay of the students. Questionnaire is distributed to collect information via social media, facebook and line. (Please see Appendix) It is targeted for Thammasat University students in Thaprachan Campus. The questionnaire was distributed for 5 days with total 124 responses. The sample size is assumed to be large enough to represent the whole group of student in the campus.

From the survey, we also learned that around 50 percent of the total number of student drive to the university regularly. On average, these students drive to the university on the average 4.8 day a week. Each day, they park around 6.2 hours per day. Average willingness to pay is also asked in the questionnaire. However, we can observe that the price range varies. The daily fee ranges between 10 to 130 baht. The average is at 52.3 baht. For month fee, the range is between 200 to 3,000 baht, and the average is at 1,100 baht.

From the information above, we can see that the range of willingness to pay varies quite a lot. It would be appropriate to divide students into two groups by demand: low type and high type. High type customers accounts for 84 percents of all students who drives to university. They are the students who want to park at the university 4 days a week or more. The other group is the low type, who parks less than 4 days a week. They account for 16 percent of total drivers.

5.3) Model Specification

From the information and analysis in the last section, we can come up with different ways to charge the customers. From the research, there several suggested way to charge the customers. In this research paper, we came up with two economic pricing models: third degree price discrimination and two-part tariffs. Noted that prices needs to be high enough to drive out some low willingness to pay customers in this inelastic demand case.

Third degree price discrimination is a pricing model that firms use when they can separate customers into two groups. In this case, firm needs to be able to observe willingness to pay of each group of customers. It is suitable to apply to our case. There are two prices offered. Customers can choose to pay monthly buffet fee of 1,300 baht. Payer has the privilege to park in the building at any time and as long as they want without extra charges. The price needs to be high. If it is too low, there will be too much demand. However, there is another payment available for customers with high willingness to pay but relatively lower demand consumption too. This is the daily fee of 80 baht a day.

The second model suggested is two-part tariffs. In this model, there is only one price available for all types of customers. Everybody who is willing to park in the facility has to

pay fixed amount of 300 baht. This amount of money is permit parking fee. Apart from that, drivers need to spare 10 baht as hourly fee also. In this case, the only thing that separates low and high type parkers is the amount of hourly fees they pay.

V. Result and Interpretation

This section is going to determine whether Thammasat University should or should not invest in the project. The methodology is to determine total initial investment, and then find expected revenue after monthly marginal cost. After that, find net present value of the project. Thammasat University should accept the project if it yields positive NPV, and reject if the NPV is negative as it will incur loss.

Operating Cost

Security Guard (2 shifts = 10 people)	90,000
Other Costs	<u>10,000</u>
Total operating cost per month	<u><u>100,000</u></u>

The table above shows total operating cost per month. Parking lot industry is a high income industry. If an investor has a blank piece of land and is sure that there will be high parking demand, parking lot is one of the best businesses to do. In this case, even though the initial investment of 129,600,000 baht is perceived as quite high, operating cost per is low. Most of the cost goes to security guards. Labor used in this industry is unskilled and homogeneous labor. Wage paid is minimum wage set by the government. Other costs are spent on parking tickets and electricity. So costs are relatively low comparing to other business.

	<i>Model I</i>	<i>Model II</i>
High type's revenue	1,365,000	1,470,030
Low type's revenue	160,000	96,300
(Operating cost)	100,000	100,000
Revenue per month	1,425,000	1,466,330
Revenue per year	17,100,000	17,595,960
PV of project	128,175,674	131,893,218
Initial Investment	129,600,000	129,600,000
NPV of project (30 years)	- 1,424,326	2,293,218

The table above shows the result of the two pricing models. Monthly revenue from high and low type customers is deducted by operating cost. Revenue per month and per year is calculated. Then, revenue per year is used to calculate net present value of the project with 30 years maturity. Upon coming up with the NPV, appropriate interest rate is needed. From the research, it turns out that most of the commercial banks use the rate of MLR or MRR plus 5 percent. In this paper, we are going to assume the worst case. MLR is 6 percent and MRR is 8 percent. MRR plus 5 percent, or 13 percent is the interest rate used in calculation.

Calculation result is shown in the table above. Model I and II represents third-degree discrimination and two-part tariffs. The second model yields higher outcome than the first. In fact, the first model actually gives negative NPV. If Thammasat University is able to find a blank piece of land to operate parking lot service for the students, they should adopt two-part tariffs and reject third-degree price discrimination project.

It should be noted that every assumption made in this calculation is based on the worst case scenario. In the reality things would likely be in better situation. First off, land rent is short term rental rate. Longer rent contract could be made with cheaper rent per month. Second, the building can hold more car than stated. The 500 parking space stated are the available parking slots. In the reality, drivers can parallel park. So the building can hold up to

700 cars. Third, the 13% interest rate used in net present value calculation. When businesses deal with banks when asking for loans, they want low interest rate as it is cost of investment. There are many factors to be considered. The project of 129 million baht is medium size project. Deal can be made with lower interest rate than 13%. If the loan is made with collateral, the rate is even less. Apart from that, Thammasat University is a public university with good reputation. It can make loans from Government Savings Banks with lower interest rate than commercial banks. Therefore, if the project receives a go, it has a high chance that it will run with better outcome than projected. It is possible that the first model will generate positive NPV.

VI. Contribution and Recommendation

If there is a blank space of land available for Thammasat University to operate its own parking lot service for its students, they should go ahead with the project. Certainly, first hand benefit goes to students who drive to the university. It provides them with convenience. Resources can be saved as they would not have to spend time driving around finding an opening spot anymore. As shown in the previous section, the project gives positive net present value and generates profit. In return, the profit made from the project could be reinvest and further benefit the university itself and the students. The money made goes to the university. Then, the university can use it to reinvest in education quality. Also, it can be used to improve overall campus surrounding environment. This would benefit all students. Positive externality goes benefit everyone, not only the ones paying for parking. On the other hand, there is high possibility that piece of land is located far from the university or not in walking distance. In that case, revenue generated can be used to buy facilities such as shuttle bus to provide convenience.

There are still a lot of flaws to this research. This study omits growth in student size. There are new faculties opening in Thaprachan campus almost every year. Current faculties are looking forward to expansion. So there are growing in number of student. If the demand is higher, the price might need to adjust. Also there are a lot more ways to price for parking. Further research could be done to find better ways that Thammasat University can benefit from operating its own parking lot service.

Appendix

Table 1

Parking	Distance (meters)	Price
Authorized parking in the Campus	0	0
Bribing TU's security guards	0	500-2,000/month
Wat Mahathat	350	20/hour
On street parkinig @Phra Arthit Road	450	0
Soi Silpakorn	500	40/day
Wat Chana Songkhram	750	60/day
RTN Clubhouse	750	0
In front of Ministry of Defence	1100	0
Central Pinklao	4600	0

Table 2:

แบบสอบถามเกี่ยวกับที่จอดรถบริเวณมหาวิทยาลัยธรรมศาสตร์ท่าพระจันทร์

สำหรับนักศึกษามหาวิทยาลัยธรรมศาสตร์ท่าพระจันทร์เท่านั้น

*** Required**

ปกติคุณเข้รถมามหาวิทยาลัยหรือไม่ *

☐ ใช่

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คุณเข้รถมามาวิทยาลัยเฉลี่ยกี่วันต่อสัปดาห์ *

☐ ไม่เคยเข้รถมามหาวิทยาลัย

☐ เข้รถมานานๆ ที

☐ 1

☐ 2

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☐ 4

☐ 5

☐ 6

☐ 7

ปกติคุณเจอรถที่ไหนมากที่สุด *

- ☐ มีสติ๊กเกอร์สำหรับจอดรถในมหาวิทยาลัย
- ☐ จักรยานมหาวิทยาลัย
- ☐ รถมอเตอร์ไซด์
- ☐ รถยนต์ส่วนบุคคล
- ☐ รถจักรยานยนต์
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- ☐ รถจักรยานยนต์
- ☐ Other:

ปกติคุณเสียเงินค่าจอดรถเมื่อข้ามมหาวิทยาลัยเฉลี่ยวันละเท่าไร *

คุณจอดรถเฉลี่ยวันละกี่ชั่วโมง *

- ☐ 1-2 ชั่วโมง
- ☐ 2-4 ชั่วโมง
- ☐ 6-8 ชั่วโมง
- ☐ 8 ชั่วโมงขึ้นไป

ระยะเวลาเฉลี่ยในการวนหาที่จอดรถ *

- ☐ ต่ำกว่า 15 นาที
- ☐ 15-30 นาที
- ☐ 31-45 นาที
- ☐ มากกว่า 45 นาที

ถ้ามหาวิทยาลัยธรรมศาสตร์ทำพระจันทร์มีที่จอดรถบริการ คุณสนใจใช้บริการหรือไม่ *

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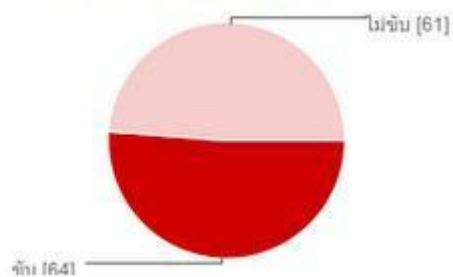
ถ้ามหาวิทยาลัยธรรมศาสตร์ทำพระจันทร์มีที่จอดรถบริการ อะไรคือราคาสูงสุดที่คุณยอมจ่าย *

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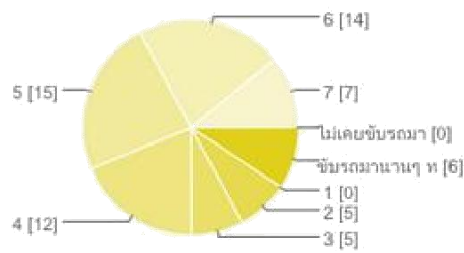
Questionnaire result

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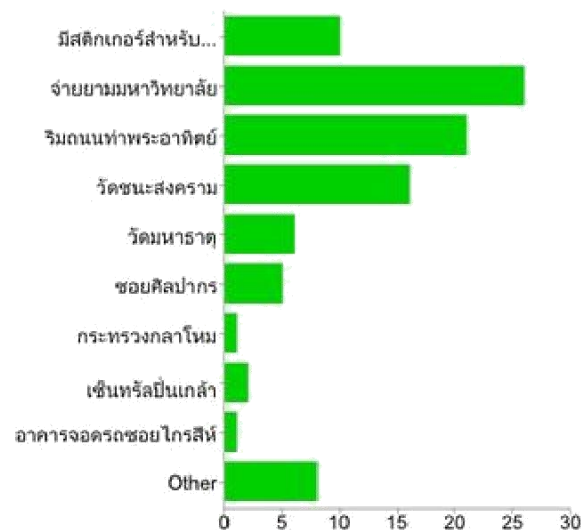
ใช่	64	51%
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คุณช่วยรายนรนามมหาวิทยาลัยเจดีย์แก้ววันต่อสัปดาห์



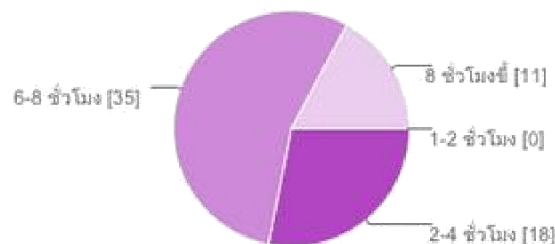
ไม่เคยช่วยรณมามหาวิทยาลัย	0	0%
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1	0	0%
2	5	4%
3	5	4%
4	12	10%
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6	14	11%
7	7	6%

ปกติคุณเจอรถที่ไหนมากที่สุด



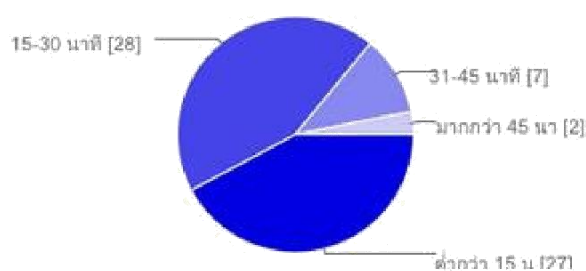
มีสติ๊กเกอร์สำหรับจอดรถในมหาวิทยาลัย	10	8%
จำยยามมหาวิทยาลัย	26	21%
ริมถนนท่าพระอาทิตย์	21	17%
วัดชนะสงคราม	16	13%
วัดมหาธาตุ	6	5%
ซอยศิลปะากร	5	4%
กระทรวงกลาโหม	1	1%
เซ็นทรัลปิ่นเกล้า	2	2%
อาคารจอดรถซอยไกรสิทธิ์	1	1%
Other	8	6%

คุณเจอรถเฉลี่ยวันละกี่ชั่วโมง



1-2 ชั่วโมง	0	0%
2-4 ชั่วโมง	18	14%
6-8 ชั่วโมง	35	28%
8 ชั่วโมงขึ้นไป	11	9%

ระยะเวลาเฉลี่ยในการวนหาที่จอดรถ



ต่ำกว่า 15 นาที	27	22%
15-30 นาที	28	22%
31-45 นาที	7	6%
มากกว่า 45 นาที	2	2%

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