

EFFECT OF DIFFERENT PRICING SCHEMES ON ROADSIDE PARKING  
CHARACTERISTICS: CASE OF NECATIBEY AVE, ANKARA

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CHARACTERISTICS: CASE OF NECATIBEY AVE, ANKARA**

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## **ABSTRACT**

### **EFFECT OF DIFFERENT PRICING SCHEMES ON ROADSIDE PARKING CHARACTERISTICS: CASE OF NECATIBEY AVE, ANKARA**

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A Central Business District (CBD) is defined as “the place of privileged exchanges” such as, goods, information, etc. Parking management is required in CBD areas in order to serve the land (roadside area) effectively to more vehicles for parking purpose. It is not possible to meet the urban parking demand by only off-street parking facilities especially at the CBDs; the concept of “roadside parking (also referred as on-road parking) management” has been developed since its first use in the 1950s. Parking management will be a major problem for most of the cities in developing countries, including Turkey, as the motorization rates have been increasing rapidly. Pricing schemes has powerful effect on parking duration of roadside parking vehicles. In Necatibey Ave, it was observed that free usage of roadside parking does not disturb drivers to move their vehicles for a long time whereas variable pricing of roadside parking increase the circulation of parking vehicles. After replacing variable parking pricing with low flat rate pricing, on Necatibey Ave, circulation is observed to decrease highly, and this application created an overload situation for parking demand.

**Keywords:** Roadside Parking, Parking Pricing, Parking Duration

## ÖZ

### **FARKLI FİYATLANDIRMA TABLOLARININ YOL KENARI PARKLANMA KARAKTERİSTİKLERİ ÜZERİNDEKİ ETKİSİ: NECATİBEY CADDESİ ÖRNEĞİ, ANKARA**

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Merkezi İş Alanı (MİA) ticaret ve bilgi alışverişlerinin yapıldığı özel alanlar olarak tanımlanır. Park yönetimi, yol kenarı alanlarının MİA’da fazlaca araç tarafından park alanı olarak efektif kullanılması için elzemdir. Yol dışı otoparklarla şehirdeki özellikle de MİA’daki otopark ihtiyacının karşılanması mümkün olmadığından dolayı yol kenarı parklanma yönetimi 1950 yılında ilk kullanıldığından beri geliştirilmiştir. Parklanma yönetimi Türkiye gibi gelişmekte olan ülkelerde motorlu taşıt sayısının artmasıyla ciddi bir problem haline gelmektedir. Fiyatlandırmanın yol kenarı park sürelerinde etkisi büyüktür. Necatibey Caddesi üzerinde yol kenarı park alanının ücretsiz olması durumunda sürücülerin araçlarını uzun süre hareket etmediği fakat değişken fiyat tarifesi uygulamasının sirkülasyonu arttırdığı gözlemlenmiştir. Necatibey Caddesinde değişken fiyat tarifesinin yerini gün boyu düşük ve tek ücret uygulaması aldığı anda sirkülasyonda yüksek bir düşüş olduğu ve kapasitenin çok üzerinde bir park talebi olduğu gözlemlenmiştir.

Anahtar Kelimeler: Yol Kenarı Parklanma, Park Ücretleri, Park Süresi

This thesis is dedicated to my dear Bitter

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## TABLE OF CONTENTS

ABSTRACT .....	v
ÖZ .....	vi
ACKNOWLEDGEMENTS .....	viii
TABLE OF CONTENTS .....	ix
LIST OF TABLES .....	xi
LIST OF FIGURES .....	xii
LIST OF ABBREVIATIONS .....	xv
CHAPTERS	
1. INTRODUCTION .....	1
1.1. Aim and Scope of the Study .....	3
1.2. Layout of the Thesis .....	3
2. BACKGROUND .....	5
2.1. Parking Management and Pricing Policies .....	5
2.2. Concept of Roadside Parking Pricing .....	7
2.3. Roadside Parking Performance Measures .....	10
2.4. Parking Pricing Schemes .....	11
2.4.1. Flexible Rates .....	11
2.4.2. Flat Rate .....	11
2.4.3. Free Parking Limit .....	12
2.5. Willingness to Pay for Parking .....	12
3. ROADSIDE PARKING IN TURKEY .....	13
3.1. Experience of Roadside Parking in Turkey .....	13

3.2. RPP Experience in Ankara.....	15
3.2.1. Off-road Parking Pricing in CBD of Ankara.....	17
4. WILLINGNESS-TO-PAY (WTP) FOR PARKING IN ANKARA .....	21
4.1. WTP for Parking Research among METU Campus Users .....	21
4.2. Parking Pricing WTP in the CBD .....	23
5. CASE STUDY: DIFFERENT PARKING PRICING SCHEMES FOR PARKING PRICING ON NECATIBEY AVE, ANKARA .....	27
5.1. CBD of Ankara .....	28
5.2. Study Corridor.....	28
5.3. Parking Data Collection .....	29
5.3.1. Manual Parking Survey Data .....	30
5.3.2. AFCS Data .....	35
5.4. Effectiveness of Roadside Parking under Free Parking Policy.....	37
5.5. Roadside Parking Effectiveness under VPP .....	41
5.5.1. Stated vs Actual Parking Durations.....	48
5.6. Roadside Parking Effectiveness under Very Low Flat Rate.....	51
5.6.1. Stated vs Actual Parking Durations.....	55
5.7. Comparison of different RPP Schemes.....	64
6. CONCLUSION .....	65
6.1. Conclusion .....	65
6.2. Further Recommendations .....	66
REFERENCES .....	69

## LIST OF TABLES

### TABLES

Table 2.1. Parking Permit Fees in Sanibel .....	10
Table 3.1. Price Scheme of İzmir Municipal Parking Areas.....	14
Table 3.2. Flat Rate Parking Schemes .....	18
Table 3.3. Flexible Rate Parking Schemes (Linear Increasing).....	18
Table 3.4. Flexible Rate Parking Schemes (Changing-Linear Increasing).....	18
Table 3.5. Flexible Rate Parking Schemes (Non-Linear Increasing) .....	20
Table 3.6. 24h Parking Prices of FPP Schemes .....	20
Table 4.1. Interview Structure* .....	22
Table 4.2. Interview Respondent Profile.....	22
Table 4.3. Recommended pricing scheme and prices (in TL) in CBD .....	25
Table 5.1. Different Types of Collected Data .....	30
Table 5.2. Variable Parking Pricing Scheme (Anpark).....	30

## LIST OF FIGURES

### FIGURES

Figure 3.1. Anpark Parking Pricing Scheme for Whole City .....	16
Figure 3.2. Roadside Parking Pricing Areas (A, B, C, D).....	17
Figure 3.3. Private Parking Areas in CBD Region .....	19
Figure 5.1. Study Corridor Necatibey Ave. ....	29
Figure 5.2. Manual Data Collection (a), Template for Manual Data (b), Digitalization of Manual Collected Data (c) .....	31
Figure 5.3. Manual Collected Data Table (B1) .....	32
Figure 5.4. Manual Collected Data Table (B2) .....	33
Figure 5.5. Manual Collected Data Table (B3) .....	34
Figure 5.6. AFCS Data Records .....	35
Figure 5.7. Roadside Parking Duration, Circulation and Average Parking Duration for Each Parking Spot on the L1 (top) and L2 (bottom) (a) and Occupancy by Time (b) .....	38
Figure 5.8. Roadside Parking Pattern on Bestekar St. (July ,2019-FPP).....	39
Figure 5.9. Roadside Parking Pattern on Bestekar St. (July ,2019-FPP).....	39
Figure 5.10. Roadside Parking Pattern on John F. Kennedy St. (July ,2019-FPP) ...	40
Figure 5.11. Roadside Parking Pattern on Meşrutiyet St. (July, 2019-FPP) .....	40
Figure 5.12. Cumulative Daily Vehicle Entrance Profile (8-12, Jan. 2018) .....	42
Figure 5.13. Cumulative Daily Vehicle Entrance Profile (13.01.2018 Saturday).....	42
Figure 5.14. Cumulative Daily Vehicle Entrance (22-26, Jan 2018) .....	43
Figure 5.15. Cumulative Daily Vehicle Entrance (27 Jan 2018 Saturday) .....	43
Figure 5.16. Cumulative Daily of Vehicle Entrance (29.01-02.02 2018) .....	44
Figure 5.17. Cumulative Daily of Vehicle Entrance (03.02.2018 Saturday) .....	44
Figure 5.18. Cumulative Entrance vs Parking Duration (08.01.2018 Monday).....	45
Figure 5.19. Cumulative Entrance vs Parking Duration (09.01.2018 Tuesday).....	45

Figure 5.20. Cumulative Entrance vs Parking Duration (10.01.2018 Wednesday)...	46
Figure 5.21. Cumulative Entrance vs Parking Duration (11.01.2018 Thursday) .....	46
Figure 5.22. Cumulative Entrance vs Parking Duration (12.01.2018 Friday) .....	47
Figure 5.23. Cumulative Entrance vs Parking Duration (13.01.2018 Saturday) .....	47
Figure 5.24. Stated and actual frequencies of stays (2 Months) .....	48
Figure 5.25. Overstay duration under VPP (2 Months) .....	48
Figure 5.26. Stated and actual frequencies of stays (1 Week) .....	49
Figure 5.27. Overstay duration under VPP (1 Week) .....	49
Figure 5.28. Stated and actual frequencies of stays (One Day 08.01.2018) .....	50
Figure 5.29. Overstay duration under VPP (One Day 08.01.2018) .....	50
Figure 5.30. Cumulative Daily Entrance of Vehicles by Time (16-21 April 2018) ..	51
Figure 5.31. Cumulative Vehicles vs Parking Duration (16.04.2018 Monday) .....	52
Figure 5.32. Cumulative Vehicles vs Parking Duration (17.04.2018 Tuesday) .....	52
Figure 5.33. Cumulative Vehicles vs Parking Duration (18.04.2018 Wednesday) ...	53
Figure 5.34. Cumulative Vehicles vs Parking Duration (19.04.2018 Thursday).....	53
Figure 5.35. Cumulative Vehicles vs Parking Duration (20.04.2018 Friday) .....	54
Figure 5.36. Cumulative Vehicles vs Parking Duration (21.04.2018 Saturday).....	54
Figure 5.37. Necatibey Ave Parking Demand (July, 2019) .....	55
Figure 5.38. Illegal Parking on Necatibey Ave (July, 2019) .....	56
Figure 5.39. Illegal Parking on Necatibey Ave (July, 2019) .....	56
Figure 5.40. Illegal Parking on Necatibey Ave (July, 2019) .....	57
Figure 5.41. Illegal Parking on Necatibey Ave (July, 2019) .....	57
Figure 5.42. Illegal Parking on Necatibey Ave (July, 2019) .....	58
Figure 5.43. Illegal Parking on Necatibey Ave (July, 2019) .....	58
Figure 5.44. Stated and actual frequencies of stays (2 Months) .....	59
Figure 5.45. Overstay duration under FPP (2 Months: April-May 2018).....	59
Figure 5.46. Stated and actual frequencies of stays (One Week: 16-21.04.2018).....	60
Figure 5.47. Overstay duration under FPP (One Week: 16-21.04.2018).....	60
Figure 5.48. Stated and actual frequencies of stays (One Day: 16.04.2018) .....	61
Figure 5.49. Overstay duration under FPP (One Day: 16.04.2018 Monday) .....	61

Figure 5.50. Overstay duration under FPP (Tuesday: 17.04.2018).....	62
Figure 5.51. Overstay duration under FPP (Wednesday: 18.04.2018).....	62
Figure 5.52. Overstay duration under FPP (Thursday: 19.04.2018) .....	63
Figure 5.53. Overstay duration under FPP (Friday: 20.04.2018) .....	63
Figure 5.54. Overstay duration under FPP (Saturday: 21.04.2018) .....	64

## **LIST OF ABBREVIATIONS**

### **ABBREVIATIONS**

AFCS : Automated Fare Collection System

AMM : Ankara Metropolitan Municipality

APDur: Average Parking Duration

CBD : Central Business District

CIRC : Circulation

FHWA: Federal Highway Administration

FPP : Flat-rate Parking Pricing

APDur: Average Parking Duration

FP : Free Parking

RPP : Roadside Parking Pricing

VPP : Variable Parking Pricing

WTP : Willingness to Pay





## **CHAPTER 1**

### **INTRODUCTION**

A Central Business District (CBD) is defined as the “center which is the place of privileged exchanges: exchange of goods, exchange between people, and exchange of information. CBD regions are mostly commercial areas where some mix-land use is (residential and commercial) observed as well. That means all urban organization is subject to the CBD and especially to the design and size of its accesses” (Cakan, 2004). Namely, CBD address to economic, social and accessibility issues. Furthermore, with increased traffic congestion, especially at peak hours (Hilvert et al., 2012; Litman, 2018), due to people have tendency to park vehicles near to the destination as well as insufficient public transit system.

It is not possible to meet the meet the urban parking demand by only off-street parking facilities especially at the CBDs, city centers, historical parts, etc., where the demand is high. After a long-term experience in tackling parking management in most of the developed countries, the concept of “roadside parking (also referred as on-road parking)” management has been developed since its first use in the 1950s. Roadside parking is employed especially in high demand areas, such as downtown, etc., with pricing or other management policies, though the former is the most commonly used one. Parking demand in these regions is served by both off- and on-street capacity, almost with equal share in European cities. Also, 50% of these parking places are privately operated in many European countries (De Wit, 2005). Different roadside parking management policies and systems have been developed over the years, to address local needs in the meantime, thus, they are usually handled by authorities. Local factors include affordability, pricing, management corridors, alternative options etc., which have to be defined and addressed in local legislations as well.

Parking management will be a major problem for most of the cities in developing countries, including Turkey, as the motorization rates have been increasing rapidly as well as continuing growth in the size of the cities due to large migration from rural areas to the urban ones. In addition, due to uncontrolled land use change creating crowded and squatter settlement regions, it is even harder to enforce parking rules and regulations in many parts of the cities, creating a shift of paradigm in the concept of “parking rights” among the vehicle owners, which led to parking illegally or for long durations even at the most demanded and critical parts of road network, such in the CBD regions.

In Turkey, the increase in private car usage has caused parking problems in major cities. Adding the pressure for parking by residents, local business owners and customers together on top of the fact that there is limited parking capacity (on- and off-street) in the CBD, tension is increased in the parking management within CBDs around the world. Ankara, a metropolitan region and the capital city, currently leads in the rate of car ownership with 243 cars/1000 people (TurkStat, 2017). Despite the sudden population growth in Ankara since the 2000s, lack of concurrent development in public transit network resulted in automobile dependency, even in accessing the CBD.

As early as 2000s, roadside parking pricing (RPP) was first implement at selected locations in the CBD region, despite a critical gap in legislative framework about implementation details (Ceylan et al., 2017). While the RPP corridors were rather short segments, they were located at the hearth of the CBD with high parking demand. However, the management of the RPP was awarded to private entities without requiring any technological infrastructure investment, thus, led to rather primitive management system of manual fee collection for parking based on parking duration measurement via mobile devices of parking fee collectors, which was not socially well-perceived.

## **1.1. Aim and Scope of the Study**

Aim of this study is to study the performance of RPP schemes by observing measurable parameters; such as total number of vehicles served in a day or turnover values at each roadside parking space. Long term data collection from automated fare collection system also enables stated versus actual parking durations of vehicles which is used in order to determine parking behaviors of CBD visitors in Ankara. This study emphasizes the importance of parking management especially in CBD areas. CBD areas have high dense traffic and parking demand and this study shows that this demand can be managed by parking policies if they applied correctly.

Scope of this study is limited with the observations at the roadside parking places on Necatibey Ave data via different data sets (manual and automated collections). While a manual parking survey data collection was performed during the free of charge service period, AFCS data were obtained for two bi-monthly periods with different pricing schemes: a) variable parking pricing scheme (Jan and Feb 2018) and b) very low flat rate parking pricing scheme (April-May 2018).

## **1.2. Layout of the Thesis**

There will be evaluation of parking roadside parking pricing and some examples from worldwide and from Turkey rather than Ankara case in Chapter 2 (Background). Parking pricing policies and parking pricing schemes are discussed, and parking pricing scheme types are defined. In Chapter 3, roadside parking in Turkey is investigated. Legislation for roadside parking and pricing in Turkey, parking pricing experiences and municipal parking pricing schemes in some cities of Turkey are given in detail. In Chapter 4 a separate willingness to pay study is summarized for CBD. In Chapter 5, case study Necatibey Ave is discussed. Starting from definition of CBD, study corridor, data collection and data types are given. Comparison of different roadside parking pricing schemes are provided, effects are discussed and analyses are provided. Effectiveness of each pricing scheme are analysed and discussed. Chapter 6 presents conclusions as well as further recommendations for future studies.



## CHAPTER 2

### BACKGROUND

#### 2.1. Parking Management and Pricing Policies

Parking is directly related to sustainable urban mobility as well as usage of public transit and pedestrian movements. In CBDs, there is a major parking problem due to high demand and limited parking supply, and parking management contributes as the main issue for transportation planning (Lim et al., 2017). Providing high parking capacities (especially free on-street parking) encourages more car usage and cruising (Shoup, 2006). Cruising leads to congestion and queue in traffic, which cause air pollution (Shoup, 2011). Thus, parking supply and demand need a balanced and efficient policy. For effective use of off- or on-street parking capacity, time-dependent charging (pricing) makes an important parking management policy (Litman, 2018; Shoup, 2011; Nourinejad and Roorda, 2017). Strategies vary among off-street and on-street parking management: Off-street parking management includes parking lot management, often run by private companies. On-street parking can be managed by pricing systems, which are mostly self-paid systems (coin-based, smart cards, etc.). The success of parking management policies eventually depends on transit modes variability, walkability and bicycle lane improvements (Litman, 2018).

The behavior and perception while choosing a parking location are mainly influenced by i) the availability of parking spaces (Teknomo and Hokao, 1997), ii) income level and access to parking space (Anastasiadou et al, 2009; Shoup, 2011), iii) trip purpose (Teknomo and Hokao, 1997; Chalermpong and Kittiwangchai, 2008; Yun et al, 2008), iv) search and queue time (Teknomo and Hokao, 1997; Shoup, 2006), v) walking time and distance (Brooke et al, 2014; Yun et al, 2008), vi) parking fee (Anastasiadou et al, 2009; Shoup, 2011), vii) security (Mo et al, 2008), viii) parking duration (Barter,

2016), ix) local parking facility (Teknomo and Hokao, 1997; ) and x) comfortability (Anastasiadou et al, 2009). Parking enforcement and fines for illegal parking were also detected as influencing factors (Brooke et al, 2014).

Todd (1991) suggested a need for controlling parking management applications to ensure the effectiveness of all parking regulations on the streets. For instance, parking permits for dwellers; limited-period parking and parking charges are means to maintain equilibrium parking supply and demand. Parking prices directly affect travel choices, such that high parking fees could reduce the number of trips, and indirectly, reduce private car usage and traffic congestion, increase the efficiency in land use, the revenues to the agency, the equity and reduce emissions (Shoup, 2011). Anastasiadou et al. (2009) described the parking fee as a function of the quality of service, economic strategy and demand, especially during the peak periods. Therefore, determination of pricing scheme is not straightforward and there are many different approaches. Maternini et al. (2017) defined three variable schemes:

- i) variable pricing (fee depends on the duration, time of the day and day of the week to park),
- ii) performance-based pricing (fee depends on the ratio of occupied to total number of parking spaces)
- iii) dynamic pricing, a system supported with Intelligent Transportation System (ITS) that provides real-time data to determine hourly fare.

Willson and Irish (2016) suggested dynamic parking pricing based on location and time, which led to efficient space usage, reduction in cruising, and user satisfaction. In practice, Victoria Transport Policy Institute (2011) set parking fees for short periods and applied no discounts for longer periods.

Parking pricing means that drivers pay directly when they park instead of paying monthly, annually or hidden parking prices under different purchases and parking pricing is applied in order to gain revenue, to improve transportation infrastructure, to increase efficiency of parking area or to encourage public transportation (Litman,

2006). Hidden parking prices are likely to be paid subscription fees of buildings or rents, people pay for parking without even realizing the situation. This type of pricing has no positive effect on parking management since driving habits are not influenced if it is not paid directly at each parking. According to FHWA underpriced and/or no priced parking options has impact on travel mode selection and end with 50% increase on driving to CBD areas even if driver is alone in the car.

The goal for pricing of parking is affecting the driving behaviors. This make pricing very important because decision makers of pricing must consider it differently for every single CBD, for weekdays and weekends and for different daytimes. Technological devices recording parking data enable analyzing demand and helps decision makers to determine and update the prices for a quality parking management. Also, in following section of this thesis, recorded parking data of Necatibey Ave (Ankara) is analyzed and derived results helped to make comment on parking pricing effectiveness. Analyzing of parking data regularly is crucial to observe if parking pricing policy is still effective or not. Price tables may lose their effectiveness and may not serve as purposed (Barter, 2016).

## **2.2. Concept of Roadside Parking Pricing**

Tremendous car ownership brings parking problems with it in metropolitans which is especially and frequently faced in CBD areas by drivers. Since CBD areas hold denser commercial and governmental facilities than any other suburban areas, parking becomes a problem to be solved by decision makers and parking management for CBD areas becomes inevitable. Also housing areas have the parking problems in today's world, a lot more people suffer from parking problem in CBD areas. CBD areas serve a lot of people during any time period of day. Since supplying parking area to all drivers whose destinations are CBD areas is impossible, multiple usage of parking areas should be provided by parking management in CBD areas. Thus, parking management becomes an essential topic in Transportation Engineering and Litman (2018) determines that parking facilities to be an essential part of transportation

systems. Parking management is defined by Litman (2018) as effective use of parking spaces by several programs and policies.

Roadside parking makes life easier for people whose destinations are CBD only if parking management is well organized. In other words, CBD areas are hard to find parking places while time is critically important to lose by cruising for parking. Roadside parking management should focus on giving opportunity to maximum people to get benefit from roadside parking. Circulation of parking vehicles increase the chance of finding free parking space in CBD areas. This means parking management of CBD areas also increase the usefulness of the CBD area. Travel choice of shoppers are directly affected by easiness of finding free parking space (Sisiopiku, 2001). Roadside parking has advantages for people whose destinations are CBD but also disadvantages for traffic flow by occupation of one lane. Roadside parking is highly concentric with traffic flow on the next lane (Sisiopiku, 2001) and it needs to be well examined for Central Business District to be applied. Occupation of one lane in a Central Business District has great impact on traffic flow. Moreover entry-exit maneuvers of parking vehicles decrease the flow speed to zero at the lane next to parking lane which will create safety problems (Sisiopiku, 2001). Effective use of roadside parking areas can only be managed by well examined and calculated parking management systems.

Parking management can be defined as the effective usage of current parking spaces rather than supplying more and more parking spaces as a solution of parking problems. Thus, parking management may include different perspectives according to different circumstances. Main point of parking management is reducing the occupation of parking spaces by one single vehicle for a long duration. For this purpose, increasing the reputation and convenience of public transport may be a subject of parking management as well as parking pricing. People who must go to CBD areas may use different transportation modes and people who must go to CBD areas by car may use roadside parking for a fee which worth for parking and driving to CBD areas. In other words, willingness to pay for parking in CBD areas is the main idea behind roadside



parking management. Parking pricing is a principle under the parking management concept which reduces the choice of driving if drivers pay directly for parking rather than paying annually or monthly (Litman, 2018).

Since demand is over the limits in CBD areas for parking, decision makers result with parking management which consists of pricing, time limits and special permits. Pricing is the most successful tool to avoid drivers from driving to CBD areas but not enough solely. Time limits for parking is also combined with pricing in CBD areas (Barter, 2016). The first roadside parking pricing application is implemented in Oklahoma in 1935 with parking meters (<http://parkingokc.com/2012news1>). Barter (2016) indicates that the purpose of the first parking meter application is eliminating the shop owners' parking in front of their shops. This reason is also underlying reason of this study in Necatibey Ave, Ankara case for roadside parking. Unless the cost of parking avoids shop owners for parking, almost all parking spaces are condemned to occupied by shop owners all day long. Barter (2016) also indicates that if it is not priced for parking, it becomes an open resource for people and who comes first has the right of use it as long as they need. Thus, unmanaged CBD areas for parking are compelled to face with chaotic parking problems.

### ***Sanibel City Example***

Sanibel, a city in Florida, share information about roadside parking regulations on the website of the city. This sharing contains forbidden areas for roadside parking, exceptional cases for roadside parking and enforcement in case of a violation. Sanibel City accepts parking permit applications from drivers. First, a current vehicle registration is a must to be able to get a parking permit. There are six different types of parking permit in Sanibel as follows; A, B, C, AC, BC, TP. Price table of these parking permits decals fees are given in Table 1. To be able to get permit type A one of the followings are needed; driving license, Lee County voter registration card, resident, property ownership or homestead exemption for property with a Sanibel address ([www.mysanibel.com](http://www.mysanibel.com)). This application form includes which permit type can

park where and general parking fee as \$3/h. Certain streets can be parked by only permitted cars and hourly parking fee is not applicable among these streets. Any violation of parking among Sanibel is punished with a \$50 ticket.

Table 2.1. *Parking Permit Fees in Sanibel*

Type of Permit	Fee	Type of Resident
Resident A	\$12	Taxpayer/Property Owner
Restricted B	\$90	Non-Resident
Restricted C	\$90	Resident/Non-resident
Restricted A/C	\$102	Resident
Restricted B/C	\$180	Non-resident
Transfer or reissue	\$3	Residential or Restricted

### ***Oxford Shire Example***

Oxfordshire County Council determines zones for where to park in Oxford, Abingdon and Henley and applies different parking pricing policy for each zone. In the web page of Oxfordshire it is stated that parking prices different across the county and these prices are determined also related with parking duration. Roadside parking is only allowed on designated parking areas and Oxfordshire County Council is responsible for parking permits in Oxford, Abingdon and Henley.

### **2.3. Roadside Parking Performance Measures**

This study considers some measurements for roadside parking performance as turnover, utilization, capacity, circulation, and occupancy. Turnover is the usage of parking area by different vehicles during the investigated time period. In other words, how many different vehicles use the certain parking area. Utilization is occupied parking areas along the investigation corridor. Capacity is the maximum vehicle parking availability at the same time during the corridor. Circulation is usage of a certain parking lot by different vehicles. In other words, predecessor parking vehicle

leaves the parking lot and new arrival to the parking lot means circulation for that parking lot. Occupancy is the existence of a parking vehicle in the parking area during investigation period.

## **2.4. Parking Pricing Schemes**

Parking pricing is essential for parking management since it directly affects parking behavior of drivers. Thus, pricing scheme becomes one of the most important criteria in parking management. According to Barter (2016) some cities price higher unit price for following hours of parking rather than pricing only for arrival or linear increase of parking price. Barter (2016) recommends that parking pricing scheme should be determined related with parking duration rather than pricing per arrival in other words flat rate pricing. Barter (2016) also recommends avoiding pricing period to be long and recommends pricing intervals for parking duration as hourly based, minutely based or per 30-minutes. This study also goes in details how parking prices on Necatibey Ave affects parking duration and occupancy of parking lots in cases free of charge, flat rate and flexible rate pricing schemes.

### **2.4.1. Flexible Rates**

Flexible rates are based on parking duration and occupants pay for how long they use the parking area. Barter (2016) states that flexible rate pricing schemes should be simple, but some cities use higher unit price for long-stay parking than short-stay parking and/or free of charge parking for a reasonably short-term parking. Non-linear incremental pricing which cost more per unit-time for long-term parking also encourages drivers move quickly from parking area and give chance to other people for using the parking lot.

### **2.4.2. Flat Rate**

Flat rate pricing schemes are determined regardless of parking duration. This application charge drivers if they use parking area but not interested with the duration. This type of pricing scheme only affects the first decision of drivers to park or not.

Drivers who do not want to pay may choose a walkable distance with free of charge parking by this pricing scheme. Once drivers park they do not worry about moving quickly from parking area. Parking area is occupied for long durations and less drivers benefit from the parking area.

### **2.4.3. Free Parking Limit**

The concept of free of charge for first reasonable time interval directs drivers to move quickly from parking area which constitutes the foundation of parking management. According to data received from Beltaş A.Ş. and used for this study, most of the drivers declare that they will occupy the parking lot less than 15 minutes which is in free of charge zone in the flexible rate pricing scheme. Although a clear majority of short-stay declarations are not end up with less than 15 minutes parking, there is an obvious difference for occupancy of parking lots with the advantage of free short-term parking in terms of circulation.

### **2.5. Willingness to Pay for Parking**

The concept of Willingness to Pay (WTP) is defined as the maximum price a consumer accepts to pay for a given quantity of goods or services (Le Gall-Ely, 2009). It was noted that WTP was closer to price judgments and was linked to other variables that influence decision-making. WTP is a part of the price perception process and was defined as “a value that encompasses consumer surplus” by Anastasiadou et al. (2009). Jeihani et al. (2015) proposed a WTP model for parking based on the criteria of fairness and equity in the use of payment. Results showed that WTP for parking was directly related to parking duration as well as parking conditions and lot, parking fee, location (CBD or not), purpose and time of day. Newmark and Shiftan (2007) stated that WTP depended on income level and gender. While some drivers were reported to have WTP to decrease travel time, they were not willing to pay for parking for short durations (Malik et al., 2017) and in cases of long walking distances (Litman, 2018). Trip purpose and nature (i.e. shopping/commute trips, urgency or event-based trips) and destination choice are other factors in parking preferences (Hilvert et al., 2012).

## CHAPTER 3

### ROADSIDE PARKING IN TURKEY

Roadside parking area is defined in Official Journal of Turkey as; special areas that are reserved for motorized and non-motorized vehicles on the rightmost section of a road that are isolated from pedestrian way with horizontal and vertical signs, usage duration is shown discernibly, terms of use are determined by local government. Roadside parking prices in Turkey are determined by local governments (municipalities). Some local governments apply flat rate price table for whole city while other municipal governments apply different variable price tables among different parts of the whole city.

#### 3.1. Experience of Roadside Parking in Turkey

Among limited studies on experience/practices in parking management strategies, pricing or WTP is not investigated much. A study on parking needs in Denizli mentioned parking pricing without focusing on on-street parking concept (Haldenbilen et al., 1999). A draft legislation in 2005 raised “on-street parking pricing” to increase municipality incomes (Hurriyet, 2009). In 2006, ISPARK Inc., a municipal agency, released a parking regulation and introduced on-street parking pricing in 27 regions. Istanbul Parking Master Plan (IPMP, 2016) included on-street parking capacity. For Istanbul, Yalciner-Ercoskun and Ocalir-Akunal (2017) recommended higher prices for on-street parking to encourage off-street ones. Cirit (2014) studied the parking price expectation of drivers and perception on on-street parking. Ceylan et al. (2017) indicated that parking pricing provided fairness and equity usage for on-street parking, and the majority of municipalities employed on-street parking pricing without technical study/planning and therefore faced court cancellations.

## İzmir

Parking management is controlled by İzelman A.Ş. whose partner is also İzmir Metropolitan Municipality. According to data on their webpage they serve a total of 13341 parking spaces among İzmir Metropolitan. Their parking pricing scheme is prepared by municipal council (See Table 3.1). This table shows that every single parking area is evaluated separately.

Table 3.1. Price Scheme of İzmir Municipal Parking Areas

Parking Lot Location	Duration(hours)			
	0-3	3-6	6-12	12-24
Tam Otomatik Alsancak O.	9,00 ₺	13,50 ₺	20,00 ₺	25,00 ₺
Bostanlı & Borrnova Pazaryeri O.	6,50 ₺	8,50 ₺	11,50 ₺	17,00 ₺
Hatay Pazaryeri Katlı	6,50 ₺	8,50 ₺	11,50 ₺	17,00 ₺
Alsancak Atatürk Spor Salonu O.	9,00 ₺	11,50 ₺	14,00 ₺	17,00 ₺
Kültürpark Yeraltı O.,Bahriye Üçok O.	9,00 ₺	11,50 ₺	14,00 ₺	17,00 ₺
Alaybey Katlı Otoparkı	9,00 ₺	11,50 ₺	13,50 ₺	17,00 ₺
Alsancak -Çankaya Katlı -Konak O.	9,50 ₺		11,50 ₺	17,00 ₺
Mimar Kemalettin Katlı Otoparkı	9,50 ₺			19,00 ₺
Kahramanlar Katlı Otoparkı	5,50 ₺	7,50 ₺	10,00 ₺	15,00 ₺
Buca Kasaplar Meydanı Yeraltı Otoparkı	5,00 ₺	7,00 ₺	8,00 ₺	14,00 ₺
Gaziemir Katlı Otoparkı	4,50 ₺			
Hakimevleri Katlı Otoparkı	5,00 ₺	7,00 ₺	10,00 ₺	14,00 ₺
Açıkalan Otoparklar	10,00 ₺			20,00 ₺
Açık Kapalı Alanlar Engelli Araç O.	4,50 ₺			6,50 ₺
Karşıyaka Nikah Sarayı	9,50 ₺	11,50 ₺	14,00 ₺	19,00 ₺
Bostanlı Vapur İskelesi	9,00 ₺			18,00 ₺
Karşıyaka Anayasa Otoparkı	10,00 ₺			20,00 ₺
Karşıyaka Vapur İskelesi Otoparkı	7,50 ₺	10,00 ₺	17,50 ₺	20,00 ₺
İnciraltı Anfi Tiyatro	9,50 ₺			19,00 ₺
İnciraltı Çınar	9,50 ₺			19,00 ₺
Kocakapı ve Güneşli Otopark	6,00 ₺			12,00 ₺

### 3.2. RPP Experience in Ankara

In the early 2010s, roadside parking pricing (RPP) was first implemented at selected locations in the CBD region (see figure 3.2), despite a critical gap in legislative framework about implementation details (Ceylan et al., 2017). While the RPP corridors were rather short segments, they were located at the heart of the CBD with high parking demand. However, the management of the RPP was awarded to private entities without requiring any technological infrastructure investment, thus, led to rather primitive management system of manual fee collection for parking based on parking duration measurement via mobile devices of parking fee collectors, which was not socially well-perceived.

After a fatal conflict between a driver and a fee collector in Ankara in 2015, all RPP applications were canceled and free parking policy was applied for about 2 years, which created occupation of parking spaces by long term parkers (residents, local business owners, etc.) which led to severe illegal parking behavior combined with almost no enforcement. A second round of RPP with variable pricing schemes application started in the summer of 2017.

Ankara Metropolitan Municipality (AMM) established its parking management company (Hurriyet, 2009) and provided paid on-street parking services until 2011. As fee collection was performed by personnel with mobile devices, it did not give a clear image of the management institution and reminded the previous low-quality “unofficial parking fee collector (*değnekçi*)”. Alas, the service was terminated abruptly due to a fatal conflict between a customer and fee collection personnel. A 2-year no parking pricing duration led to excessive illegal parking. In 2017, on-street parking pricing started again in the CBD region with a variable pricing scheme of

- i) a free parking for the first 15 minutes,
- ii) 5 TL for < 1hour,
- iii) 7 TL for 1-2 hours
- iv) 9 TL for 2-4 hours,

- v) 12 TL for 4-8 hours and
- vi) 15TL for >8 hours (Batikent.org, 2017).

However, it lasted only for a very short duration, until April 2018 when a drastic change was observed in the RPP with employment of very low daily flat rate at 1 TL/day (0,18\$/day), which was accepted anonymously by the City Council as citywide single rate for all municipality-operated parking places, even valid today.

Ankara Metropolitan Municipality has priced parking areas among the city both roadside and off-road. Unlike previous examples like İzmir or Sanibel City, Ankara Metropolitan Municipality applies only one single price scheme for whole parking areas but there is no conventionality for parking pricing schemes in Ankara. Transformations of pricing schemes in Ankara is unconsciously developed. Finally, meaningless pricing policy application is started in order to gain sympathy from citizens of Ankara. In Ankara, except private parking companies, municipal parking areas are free up to 1 hour and 1 TL from 1 to 24 hour parking for whole city (See Figure 3.1).



Figure 3.1. Anpark Parking Pricing Scheme for Whole City





Figure 3.2. Roadside Parking Pricing Areas (A, B, C, D)

### 3.2.1. Off-road Parking Pricing in CBD of Ankara

Parking areas under the control of Ankara Metropolitan Municipality applies same tariff for whole city whereas private companies apply their own pricing schemes. Private parking areas are off-road parking areas that some of them underground and some of them are private land used as parking area. In CBD area of Ankara 23 private parking companies (see figure 3.3) selected randomly and their pricing schemes are collected (see tables 3.2- 3.6).

Table 3.2. Flat Rate Parking Schemes

<b>Parking Area (Private Company)</b>	<b>Flat Rate Price</b>
KUBAŞIK OTO PARKI (P1)	9,00 ₺
MALTEPE PAZARI OTO PARKI (P2)	5,00 ₺
SARAR İLKÖĞRETİM OKULU (P3)	10,00 ₺
HOTEL DESTİNO (P4)	10,00 ₺
TANDOĞAN OTO PARKI (P5)	10,00 ₺
İRAN CAD (P6)	15,00 ₺
MEGUIARS OTO PARKI P(7)	15,00 ₺
BESTEKAR OTO PARK P(8)	15,00 ₺

Table 3.3. Flexible Rate Parking Schemes (Linear Increasing)

<b>Parking Area (Private Company)</b>	<b>0-1 hour</b>	<b>Per Hour</b>
AYMA OTO PARKI P(9)	12,00 ₺	+3,00 ₺
KIZILAY AVM P(10)	11,00 ₺	+3,00 ₺
NERGİS OTO PARK P(12)	10,00 ₺	+2,00 ₺
MENEKSE OTO PARK P(13)	10,00 ₺	+2,00 ₺
ANKO OTO PARKI P(14)	12,00 ₺	+2,00 ₺
TİRYAKİ OTO PARK P(15)	12,00 ₺	+2,00 ₺
MODA OTO PARK P(16)	12,00 ₺	+1,50 ₺

Table 3.4. Flexible Rate Parking Schemes (Changing-Linear Increasing)

<b>Parking Area (Private Company)</b>	<b>Duration (hrs)</b>			
	<b>0-1</b>	<b>1-2</b>	<b>2-3</b>	<b>Per Hour</b>
AS OTO PARK P(11)	12,00 ₺	14,00 ₺	16,00 ₺	+2,00 ₺ (btw 3-10) +1,00 ₺ (after 10 hrs)
ADALET BAKANLI O. P(17)	7,00 ₺	8,00 ₺	9,00 ₺	+0,50 ₺
KARUM AVM O. P(18)	15,00 ₺	18,00 ₺	20,00 ₺	+1,00 ₺



Figure 3.3. Private Parking Areas in CBD Region

Table 3.5. Flexible Rate Parking Schemes (Non-Linear Increasing)

Duration (hrs)											
0-1	1-2	2-4	4-6	6-8	8-10	11	12	13	13-16	16-20	20-24
<b>Tunus 2 P(19)</b>											
8 ₺	9 ₺	10₺	11₺	12₺	14₺	14₺	17₺	17₺	20 ₺	25₺	30₺
<b>Tunus 3 P(20)</b>											
10₺		15₺		20₺							
<b>Ankara Tren Gari P(21)</b>											
5 ₺	8 ₺	10₺	14₺	16 ₺				20₺			
<b>Hotel Abro Otopark P(22)</b>											
15₺		20₺									
<b>Tunus 1 P(23)</b>											
10₺		15₺									

Table 3.6. 24h Parking Prices of FPP Schemes

Parking Area (Private Company)	24h Price
TUNUS 2 P(19)	30,00 ₺
TUNUS 3 P(20)	20,00 ₺
ANKARA TREN GARI P(21)	20,00 ₺
HOTEL ABRO OTOPARK P(22)	20,00 ₺
TUNUS 1 P(23)	15,00 ₺
AYMA OTOPARKI P(9)	81,00 ₺
KIZILAY AVM P(10)	80,00 ₺
AS OTOPARK P(11)	44,00 ₺
NERGİS OTOPARK P(12)	56,00 ₺
MENEKSE OTOPARK P(13)	58,00 ₺
ANKO OTOPARKI P(14)	58,00 ₺
TİRYAKİ OTOPARK P(15)	58,00 ₺
MODA OTOPARK P(16)	46,50 ₺
ADALET BAKANLIĞI O. P(17)	20,00 ₺
KARUM AVM O. P(18)	41,00 ₺

## CHAPTER 4

### WILLINGNESS-TO-PAY (WTP) FOR PARKING IN ANKARA

While studying the user behavior under different parking pricing schemes in Ankara, it is helpful to understand very correlated phenomenon of “willingness-to-pay” for parking which was studied in detail by Ipekyuz et al. (2018) as a separate study. Car user commuters were questioned through a semi-structured interview about their perspectives on parking preferences in the CBD as well as the Campus. While the original study included both WTP for parking in the CBD of Ankara and the METU Campus, here, the results regarding the CBD are summarized briefly to shed light into further discussion on RPP on Necatibey Avenue.

#### 4.1. WTP for Parking Research among METU Campus Users

The face-to-face interview was divided into three parts as

- (i) Socio-Demographics
- (ii) Parking Pricing and WTP in the CBD,
- (iii) Parking Pricing and WTP for the METU Campus (see Table 4.1).

Respondents were asked to reveal their parking experience and duration as well as the amount they paid/were willing to pay in the CBD with open-ended questions. Despite no parking pricing scheme application in the Campus, respondents were asked to comment on where and how much fee would be fair hypothetically.

The respondents were volunteers involving academicians, students, employee, and personnel of METU (see Table 4.2 for participant profiles). Interviews took no longer 30 minutes and were voice recorded. Verbatim deciphering enabled determination of basic concepts and keywords regarding parking preferences, pricing, and WTP. Responses are saved anecdotally to fortify perspectives clearly.

Table 4.1. *Interview Structure\**

Part 1	Socio-Demographics (age, gender, income, etc.)
Part 2	Parking Pricing and WTP in the CBD
	Conditions to drive to CBD; Factors affecting private car preference Preferred parking location (parking lot vs on-street; paid vs free of charge, etc.) Average parking duration and paid amount Willingness to Pay (amounts and factors affecting WTP)
Part 3	Parking Pricing and WTP for METU Campus
	Conditions to drive to Campus; Factors affecting private car preference Parking problem experience Preferred parking location (department parking lot, central parking lot, satellite parking lot, etc.) Willingness to Pay (amounts and factors affecting WTP) Recommendations for the parking problem
*The interview received ethical permission from Ethical Committee of Department of Psychology in METU.	

Table 4.2. *Interview Respondent Profile*

	<i>Respondents</i>						
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>
Gender <sup>a</sup>	M	M	F	M	F	F	M
Age	23	29	22	29	26	34	33
Status <sup>b</sup>	U	A	U	E/G	G	A	O/G
Income <sup>c</sup>	II	IV	I	IV	V	IV	V
	<i>Respondents</i>						
	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>14</i>
Gender <sup>a</sup>	F	F	M	M	M	M	M
Age	28	27	24	22	22	28	22
Status <sup>b</sup>	E/G	G	U	U	U	E/G	U
Income <sup>c</sup>	IV	V	V	I	I	IV	I
<sup>a</sup> Gender: Female (F), Male (M). <sup>b</sup> Educational Status: Undergraduate (U), Graduated (G), Academic personnel (A), Employed (E), Other (O). <sup>c</sup> Income levels as I : < (1000TL); II : (1000-2000TL); III: (2000-3500TL); IV (3500-5000TL); V: > (5000TL).							

## 4.2. Parking Pricing WTP in the CBD

The responses regarding access to the CBD in Ankara showed that parking problem came to a drastic level. Many respondents stated unwillingness to go by private car. However, some mentioned the need to use of private car in their visits in the evening, due to lack of public transit services in their return trips. When such conditions were indexed with generalized keywords used in the literature. Respondents mentioned various concepts regarding on-street parking (i.e. parking violations, trip frequency, high parking demand at peak hours, etc.) as well as off-street parking aspects (i.e. walking time to destination, parking lot type, location, etc.). Commenting on specifically “on-street parking pricing”, respondents used many factors listed in the literature (i.e. time of day, location, duration, walking time/distance to destination), some of which were repeated in their responses to WTP. This suggested that parking pricing and WTP are interlinked (almost inseparable), thus, must be studied jointly.

Parking duration was a significant concept repeated in the responses. Moreover, people have experienced different parking duration in CBD related to their trip purpose. R8:

*“It changes according to what I go for work; it can be 1-2 hours. I guess I'm having a hard time for 4 hours or so if we are going to meet friends or something”.*

Therefore, limitations in parking duration will help in to manage effective usage of parking lots. It was also referred to in questions regarding WTP. R13:

*“When I go to the evening, it is for 3 or 4 hours for a social event... I think it is between 5 TL and 10 TL. For 3-4 hours, it is 7-8 TL.”*

Another important part is socio-demographics directly affecting the pricing and WTP. For example, younger people rejected pricing or parking fee because of considering them high. Contrarily, relatively older respondents are willing to pay more than common pricing tariff, if pricing policy was to be implemented especially on-street

parking at peak hours. It should be noted that the education level of respondents is high. Regarding parking pricing policy in CBD, a consensus was not observed among participants. Some of them claimed that it should be paid (R9):

*“I think it should be paid in city centers because I think it can abuse if it is free. If it is paid after that, I think that 10 TL is probably now; I think it should be 10-15 TL or something. Daily. That's enough. People do not let go.”*

Some of them expressed that pricing was an effective tool for turnover depending on parking duration. R5:

*“If the parking areas are not enough, it is more reasonable to increase the fee. The parking lot's usage duration is, of course, important, so there is different parking duration. Range change from 10 minutes to 5-6 hours of parking. According to this, because lunch time is more intense than the rest of the time of the day, maybe it might be a change with a high parking fee.”*

Table 4.4 summarizes the preferences for different on-street parking pricing schemes and WTP levels among different respondents. While some respondents expected on-street parking was initially to be free of charge, they expressed different options based on parking duration (for short-term, a few hours or all-day, etc.) stemming from their experiences on paid parking lots. It is noteworthy to mention the variability in the concept of “short-term parking” duration. R11:

*“I think at least the first hour should be free of charge (R11)”*

R13:

*“It can be free up to 15 minutes. It can start with 3-4 TL and the scheme can be increased with 1-2 TL amount.”*

Some statements had destination specific comments such as (R9):

*“It depends on where I go. For example, if I go to Tunali surroundings, I pay; I leave it there for a certain fee. Other than that, AVM is possible.”*



Table 4.3. Recommended pricing scheme and prices (in TL) in CBD

Response	CBD					
	<15m	15-30m	30-60m	1h-2h	3h- 4h	>4h
R1	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	5
R2	<i>f</i>	<i>f</i>	5/h	5/h	5/h	5/h
R3	<i>f</i>	<i>f</i>	<i>h</i>	<i>h</i>	<i>h</i>	<i>h</i>
R4	<i>f</i>	<i>f</i>	5	7	---	---
R5	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	10	10
R6	<i>f</i>	<i>f</i>	2/h	2/h	10	20
R7	<i>f</i>	<i>f</i>	6-7	10	15	20
R8	<i>f</i>	<i>f</i>	3	5/h	5/h	5/h
R9	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	10	15
R10	<i>f</i>	<i>f</i>	---	10	---	---
R11	<i>f</i>	<i>f</i>	<i>f</i>	3/h	3/h	3/h
R12	<i>f</i>	<i>f</i>	5	7	10	15
R13	<i>f</i>	1-2	2-3	4-5	7-8	2/h
R14	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	1-2

*“f” stands for free*  
*“h” represents not signifying value but prefer hourly pricing, while “/h” stands for “per hour”, “m” stands for “minute”.*

Female respondents mentioned a willingness to pay for parking in the municipal and private parking lots due to the existence of personal and vehicle security (R3, R5, R6, R8, and R9). The issues regarding unofficial parking pricing (via unlicensed personnel) included concerns about undesired behavior during fee collection triggered preference towards paid parking lots as well as security concern (R4, R6, R7, R8, and R13). However, some also mentioned off-street parking location choice as in (R5):

*“I generally prefer paid parking lots, especially exterior ones. I think they are safer than the on-street parking.”*

Some respondents insisted on free parking as (R14):

*“I park at times I find empty. I mean, I prefer parking without paying. I'm trying to get away from paid parking lots as far as I can.”*



## CHAPTER 5

### **CASE STUDY: DIFFERENT PARKING PRICING SCHEMES FOR PARKING PRICING ON NECATIBEY AVE, ANKARA**

After a fatal conflict between a driver and a fee collector in Ankara in 2015, all RPP applications were canceled and free parking policy was applied for about 2 years, which created occupation of parking spaces by long-term parkers (residents, local business owners, etc.) which led to severe illegal parking behavior combined with almost no enforcement. A second round of RPP with variable pricing schemes application started in the summer of 2017. However, it lasted only for a very short duration, until April 2018 when a drastic change was observed in the RPP with employment of very low daily flat rate at 1 TL/day (0,18\$/day), which was accepted anonymously by the City Council as citywide single rate for all municipality-operated parking places, even valid today.

All these drifts indicate a lack of experience and understanding of this basic concept of RPP in Turkey and gives a mixed message to the users in the system. Experience such inappropriate and conflicting RPP schemes within a decade, a rather short period of time for societal change but long enough to adapt personal behaviors resulted in creation of a natural “social experiment” enabling observation of different responses to various RPP schemes within the same region. What makes it even more interesting is that, even though everyday users may be different, it is quite possible to assume them to be drawn somewhat randomly from the same user population that either lives, works or has business in the CBD of Ankara, which has not faced a major change in the last 2 decades.

## **5.1. CBD of Ankara**

CBD of Ankara is a rather elongated region in the north-south direction and is composed of mainly two parts: (i) the fully commercial corridors along the main arterials serving the north-south travel corridor, and (ii) commercial areas located in the first (or a few ) floors of multi-story housing units creating a mix land-use around the first part. The CBD includes a) the historical city center and the citadel at Ulus (northern part), b) a very dense business and shopping region in Kızılay in the middle section, and c) an upper-class shopping zone in the southern end, circled with embassies and international units. The RPP corridor monitored is located on the east of Kızılay region, which has mostly small shops, government institutions, a military guesthouse and a police station in addition to many Point-of-Interest (POI) locations along it.

## **5.2. Study Corridor**

The Necatibey Ave., which is an urban minor arterial along which business district is developed. It is the main parallel to Ataturk Boulevard, the major arterial serving the Kızılay region in in the north-south direction. The avenue is currently operated in one direction (from north to south), which allows a 4-lane road capacity, only one of which was reserved for parking. The length of the RPP corridor on Necatibey Ave. is approximately 1640 m. Parking pricing is applied between Atatürk Blvd. intersection and GMK Blvd. intersection of Necatibey Ave. Parking pricing area is divided into three parts as parking regions B1, B2 and B3 naturally due the crossings of the streets connecting to the avenue (see Figure 5.1). Lengths of each segment are 190 m, 130 m and 220 m, and provide total of 27, 21 and 35 roadside parking spots, respectively (when parked in parallel to the curb). Furthermore, there is a small off-street parking lot at the south end of the B1 segment, which is also operated currently by the municipality owned parking management company

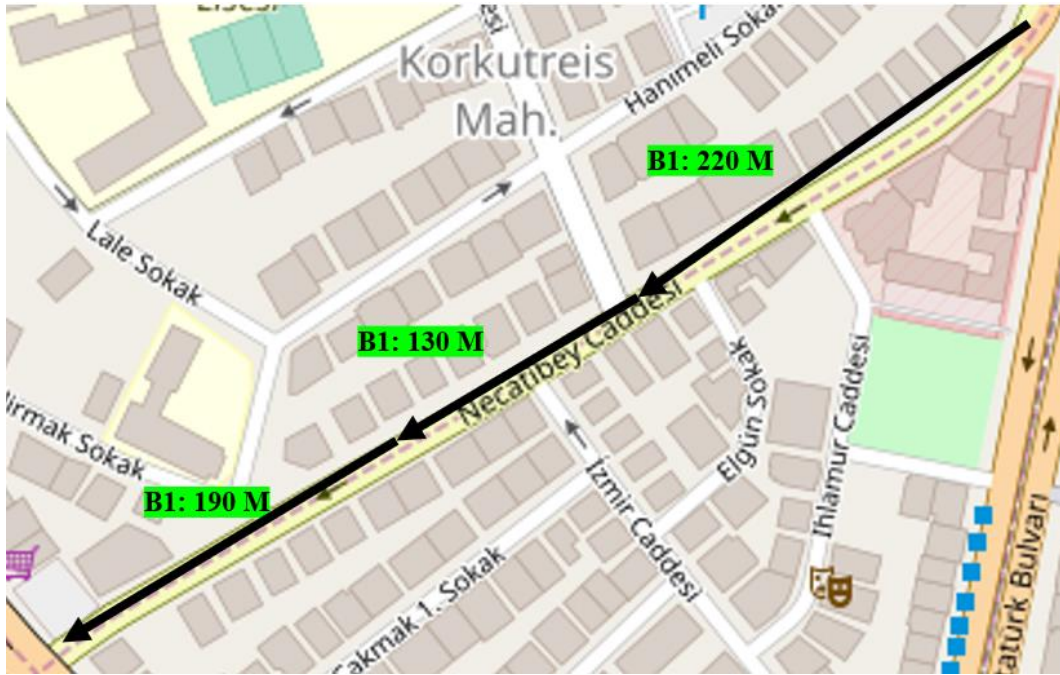


Figure 5.1. Study Corridor Necatibey Ave.

### 5.3. Parking Data Collection

Parking data was collected for the three different RPP stages as shown in Table 5.1. Firstly, a one-day data at 83 roadside parking spots was collected manually on the 25<sup>th</sup> of November 2018 (Saturday) under free parking policy. During the parking survey, license plates of vehicles at each parking spot were manually recorded at every 30-min interval from 7:00 a.m. to 4:30 p.m. The plate numbers are digitized in Excel and MATLAB with the time and parking spots. Since this period experienced a very high illegal parking, the second and the third lines (illegally parked) were also recorded as an augmentation of the designated parking spots and kept in the analysis.

The second set of data was obtained for the period of Jan-Feb 2018, during the VPP application; the short stays (< 15 minutes) were free (see Table 5.2), while the stays up to 1-hr were charged 5TL and increased incrementally up to 18 TL/day eventually. The hours of RPP was from 7 a.m. to 7 p.m., after which pricing was held until the start time in the next morning. The entry and exit times of the vehicles were recorded by the parking toll collector using an Automated Fare Collection System (AFCS)

machine, which also recorded the stated (sttd) time of parking requested at the time of parking. method in January and February months, was collected.

Table 5.1. *Different Types of Collected Data*

<b>Observation Periods</b>	<b>Data Collection Type</b>	<b>Existing Price Scheme</b>	<b>Notes</b>
One Day	Manually Collected Data	Free Parking	License Plate Records @30-min intervals
January-February (2018)	AFCS Data	Variable Pricing	Hourly Scheme
April-May (2018)	AFCS Data	Very Low Flat Rate Pricing	Daily Scheme

Table 5.2. *Variable Parking Pricing Scheme (Anpark)*

<b>Duration (hrs)</b>				
<b>&lt;15 min</b>	<b>15-60 min</b>	<b>1hr- 4hrs</b>	<b>4hrs-8hrs</b>	<b>8+ hr</b>
<b>Variable Pricing (Jan-Feb 2018)</b>				
Free	5₺	7₺	10₺	15₺
<b>Daily Flat Rate (April-May 2018)</b>				
Free	1₺			

The last round of data collection included parking data again from the AFCS, during the very low daily flat rate pricing scheme (See Table 5.2). The first hour of the parking was free, which was charged only 1TL/day after regardless of the stay time. Although the same system was in use, the quality of the data was poor due the fact that toll collectors were not motivated to collect the very low parking price with the same tenacity.

### **5.3.1. Manual Parking Survey Data**

On 28<sup>th</sup> of November (2018) manual parking data collection was performed along Necatibey Ave with previously numbered parking lot sheets by writing license ID of

each vehicle between 30 minutes intervals (see Figure 5.2). Starting from Atatürk Blvd. intersection of Necatibey Ave, roadside parking vehicle's license ID were collected till GMK Blvd. intersection. Vehicles which parked on second and third lane of the Necatibey Ave illegally were also recorded for analyses of this study.

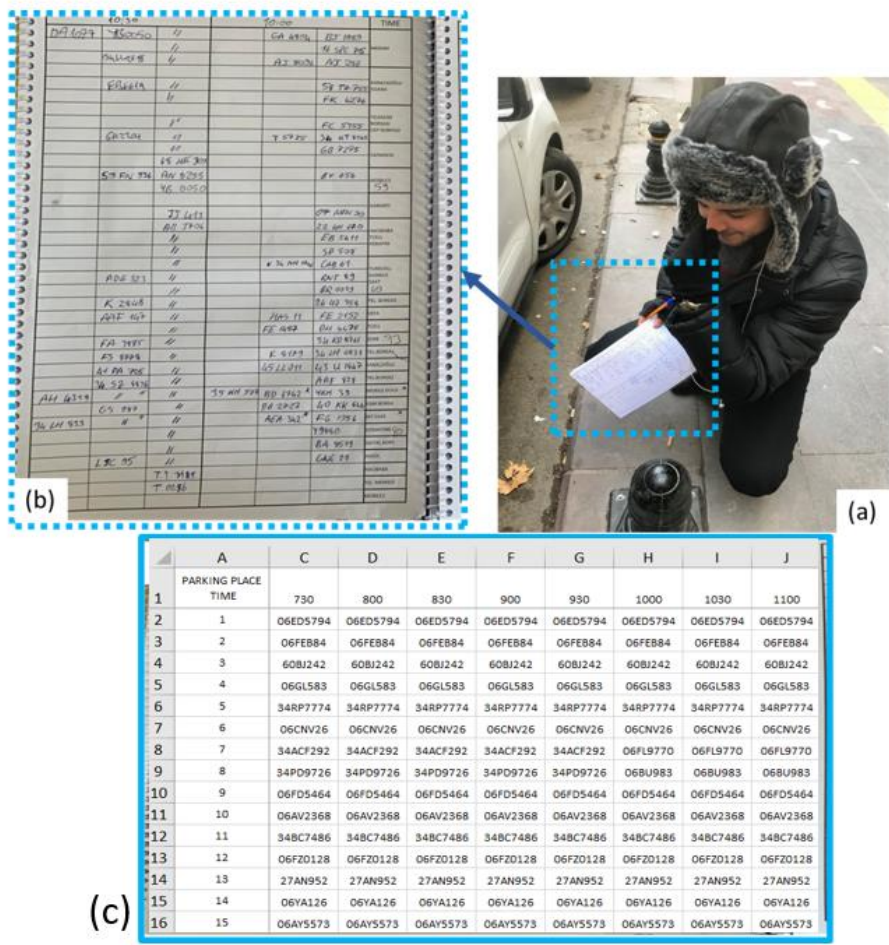


Figure 5.2. Manual Data Collection (a), Template for Manual Data (b), Digitalization of Manual Collected Data (c)

16.30		16.00		TIME
✓	6N91	71L54	6N91	PRESTIGE
BT6331	//	DUN98	07KAT61	MORGI
✓ VME20	//		BL7781	LIZE CAFE
//	//	DC2346	3KPB963	
✓	//	BULH7556	MUR464	DÜNYA
BE5021	//		ER481	BİGBANG
//	//	HC0079	DT402	KBC
29XHS95	//		2FA21	
DE5478	//	AB7973	KUH23	DAB96
35ET049	//		DE5478	DH7872
ET430	//		LC165	F2920
34FU6545	//		DTF4490	LCM87
AACT20	//	T0503	68DN7571	03PA04T
K2073	//		70E0030	3UH0959
DE9336	//		DE5473	NC908
FC2869	//		AET168	KS212
KAM24	//		DS665	BN724
GB2914	//		ABE296	BT7954
VML20	//		ML22	MA6854
YK983	//		FJ9629	FG067
HS739	//		SU320	KE815

Figure 5.3. Manual Collected Data Table (B1)



10:30			10:00			TIME
DA 1077	BS0050	//		GA 4804	BJ 1989	MERAM
		//			16 SPC 75	
	3411878	//		AJ 5036	NJ 2886	
	EB6619	//			58 T2755	KARACAÖĞLU ADANA
		//			FK 4276	
		//			FC 5755	TELEKOM BORSASI CEP DÜNYASI
	GAR24	//		T 5735	34 UT 8145	
		//			GB 7275	YAPIKREDI
		68 HE 309				
	53 FN 936	AN 8255			BY 656	MOBILE3 59
		4B 0050				
		JJ 413			07 MFV 50	GARANTI
		AB 3706			22 WH 670	HACIBABA
		//			EB 5411	TCELL KEBAP49
		//			SP 508	
		//		34 NH 5748	CAB 61	TURKCELL
	ADG 323	//			RNT 89	GURBUZ SAAT
		//			BR 0223	63
	K 2848	//			26 42 356	TEL. BORSAA3
	AAF 147	//		HAS 11	FE 2152	VEFA
		//		FE 1487	DH 4678	TCELL
	FA 3885	//			34 KD 5761	ZORE 73
	FS 8778	//		K 8179	34 LH 4831	TEL. BORSAA1
	41 DA 725	//		45 LLO11	43 U 1847	SARAÇOĞLU
	3A 52 8836	//			AAF 829	TEL. BORSAA2
AH 4319	// *	//	35 WH 577	BD 6742 *	4KH 39	MOBILE GOLD *
	ES 987	//		DB 2727	40 KK 646	GSM BORSA
34 LH 833	// *	//		AEA 342 *	FG 1356	INT CAFE *
		//			49880	VODAFONE 80
		//			BA 9519	DJITAL KOPY.
	LSC 95	//			GNC 21	ASGÜL
		//				HACIBABA
		T 9 3185				TEL. MERKEZI

Figure 5.4. Manual Collected Data Table (B2)

16:30		16:00		TIME
	6		4	SAMSUNG
	//	BURUN 21	//	
	//		YM 841	
BUM 029	//		GL 550	BOŞ DÜKKAN
BULUN 96	//		BURUN 774	
ABOK 22	//		CN 476	BEKO
	//		FL 970	BOŞ DÜKKAN
//	//	BUMUN 59	JPP 30	YAVUZ MERMİ
DSS 530	//	DSS 530	BUN 63	YEŞİLİRMA K SOKAK KÖŞESİNDE EN BİNA OTOPARKI GİRİŞİNE KADAR
	//		AV 2368	
	//		DL 653	MUSTI'den HANIMELİ SOKAK KÖŞESİNE KADAR
	//	ZUP 70	FP 20128	
FL 638	//		YAN 772	HIRDAVAT
BUR 2900	FL 5287		YA 126	
BUS 49	//		AM 553	VODAFONE
	YDT 494			
BIDA 18	//	BUN 68	DT 308	EFTAL
MID 6	//	SYAC 67	YN 58	
	//	HJ 747	PPA 31	YENİGÜN-TCELL
	//		FL 249	
GB 128	//	AR 1151	EB 34	24
ARE 20	//		AU 2006	
	//	AEV 965	KRC 85	ÇAĞDAŞ
//	//	505603	EM 6512	
ZL 54	GC 127	EL 7807	GC 127	27
	//	PT 1574	AF 101	
	FC 606		BUM 2506	

Figure 5.5. Manual Collected Data Table (B3)

### 5.3.2. AFCS Data

Automated Fare Collection System is used by Beltaş A.Ş. for recording arrival and departure time of parking vehicles (see Figure 5.3). Records for two different price scheme seasons (02.01.2018-28.02.2018 flexible rate pricing season and 02.04.2018-31.05.2018 flat rate pricing season) were received from Beltaş A.Ş. (Anpark). These data sets include arrival time, departure time, stated parking duration and actual parking duration of each registered vehicle in AFCS system.



PARK BİLETİ HAREKETLERİ						
ARAÇ PLAKASI	PARK ADI	BAŞLANGIÇ ZAMAN	SÜRE	AŞ SÜRE	ÇIKIŞ ZAMANI	
06FD3890	Necatibey1	2.04.2018 08:14:23	60	391	2.04.2018 15:26:13	
06FV3852	Necatibey1	2.04.2018 08:14:58	60	0	2.04.2018 08:15:40	
06FM1851	Necatibey1	2.04.2018 08:16:07	60	193	2.04.2018 12:29:46	
06CNV26	Necatibey1	2.04.2018 08:16:53	60	420	2.04.2018 16:17:10	
34VB9416	Necatibey1	2.04.2018 08:17:23	1.440	0	2.04.2018 08:17:35	
06FY4924	Necatibey1	2.04.2018 08:18:06	60	514	2.04.2018 17:52:21	
06AH9543	Necatibey1	2.04.2018 08:18:34	60	536	2.04.2018 18:14:22	
06KFS15	Necatibey1	2.04.2018 08:19:06	60	566	2.04.2018 18:45:38	
06AL4265	Necatibey1	2.04.2018 08:19:51	60	62	2.04.2018 10:22:23	
06ZB412	Necatibey1	2.04.2018 08:20:26	60	268	2.04.2018 13:48:20	
06FL6091	Necatibey1	2.04.2018 08:21:01	60	58	2.04.2018 10:19:27	
06EJK77	Necatibey1	2.04.2018 08:21:15	60	536	2.04.2018 18:17:24	
06DD7488	Necatibey1	2.04.2018 08:21:41	60	535	2.04.2018 18:17:19	
06BJ1989	Necatibey1	2.04.2018 08:21:25	1.440	0	2.04.2018 08:58:19	
06AG4228	Necatibey1	2.04.2018 08:22:12	1.440	0	2.04.2018 08:58:27	
06FK4276	Necatibey1	2.04.2018 08:22:38	60	165	2.04.2018 12:07:50	
	Necatibey1	2.04.2018 08:23:03	60	258	2.04.2018 13:41:36	
(b) 5	Necatibey1	2.04.2018 08:23:31	60	149	2.04.2018 11:52:39	

Figure 5.6. AFCS Data Records



#### **5.4. Effectiveness of Roadside Parking under Free Parking Policy**

Using the manually collected one-day data, circulation (Circ), average parking duration (APDur) and number of parked vehicles by time were obtained (as seen in Figure 6.1). According to results;

- The designated roadside parking spots were almost always occupied for the whole duration of the survey. But, analysis of the license plate-based stays showed that the first line (L1) of parking were occupied by long-term parked vehicles arriving early in the morning (or maybe left from the previous day), which most likely belong to either residents or store owners on the corridor.
- Parking circulation on the second, but illegal, line (L2) was more with average parking times less than 1 hr (mostly likely due to illegal status of the parking despite the lack of strong enforcement)
- There were vehicles forming a third line of parking, L3, especially close to the norther part of the corridor, which is the entrance from the major arterial of the CBD.
- This free parking policy allowed parking of only 80 vehicles during the day, but, the formation of illegal parking lines created an additional parking capacity (though illegal) up to 60 vehicles/day. But, formation of 3 lines of parking created a severe bottleneck in the minor arterial with only one lane in operation; thus, created long queues at the beginning of the RPP corridor.

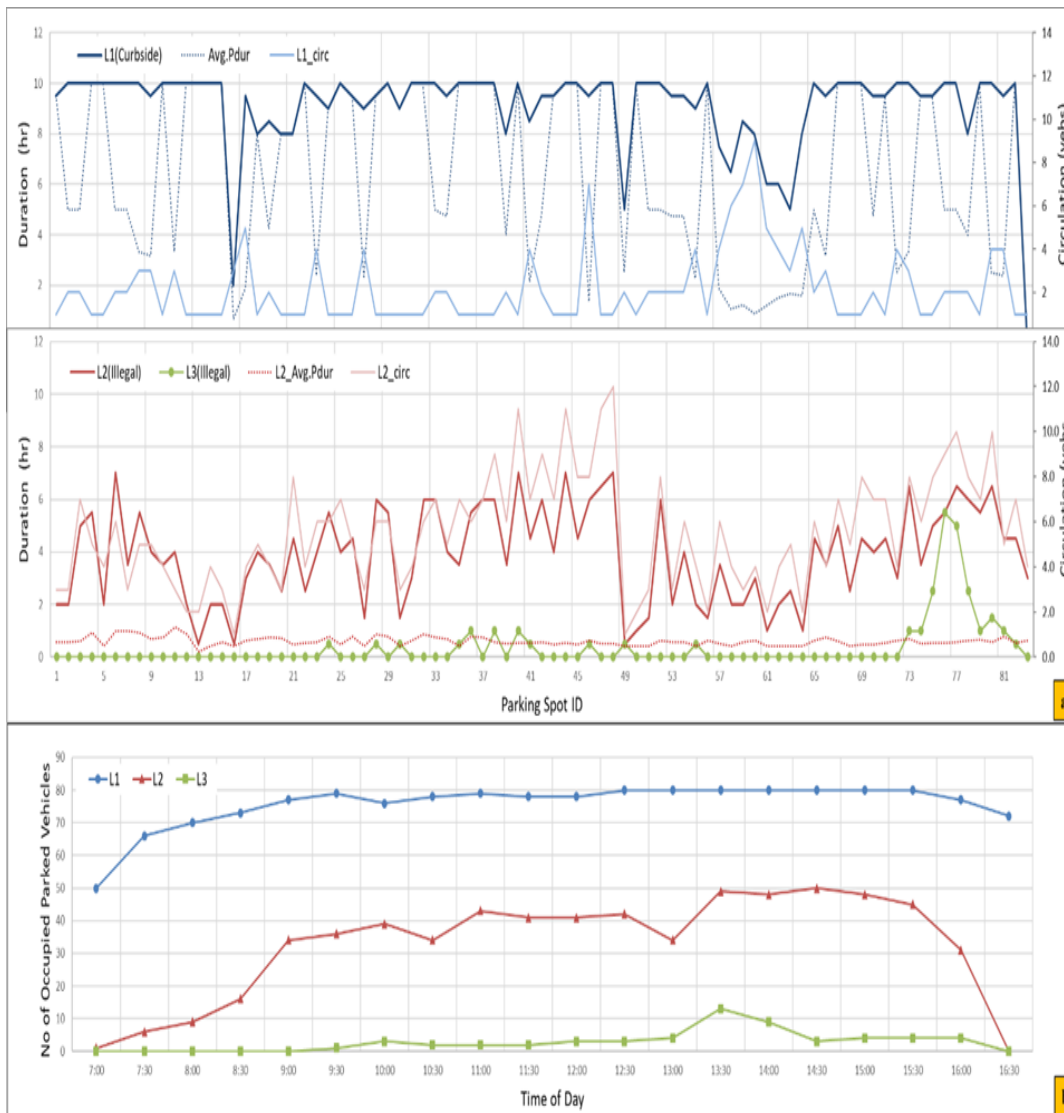


Figure 5.7. Roadside Parking Duration, Circulation and Average Parking Duration for Each Parking Spot on the L1 (top) and L2 (bottom) (a) and Occupancy by Time (b)



Figure 5.8. Roadside Parking Pattern on Bestekar St. (July ,2019-FPP)



Figure 5.9. Roadside Parking Pattern on Bestekar St. (July ,2019-FPP)



Figure 5.10. Roadside Parking Pattern on John F. Kennedy St. (July ,2019-FPP)



Figure 5.11. Roadside Parking Pattern on Meşrutiyet St. (July, 2019-FPP)



### **5.5. Roadside Parking Effectiveness under VPP**

The variable parking pricing (VPP) system motivated drivers to finish up their business in 15 minutes, if they do not want to pay parking pricing at all. In-depth analysis of a week in January (08.01.2018-13.01.2018) for each day showed that;

- The circulation of the RPP corridor reached up to 500 vehicles per day (see figures 6.8-6.11), which is much higher than 140 vehicles/day without any parking pricing.
- Comparison of the parking duration of vehicles during the Monday, showed that there were very few vehicles left unpaid in the system until the next day (parking durations of 1440 minutes). While there were still many vehicles that stayed up to 10 hours, at least they were charged 18 TL fine for their long-term use of the capacity and create a revenue. (Note: current daily parking rates in the vicinity of the study corridor starts with 11 TL/hr for short term parks and reach a value of 32 TL/day).

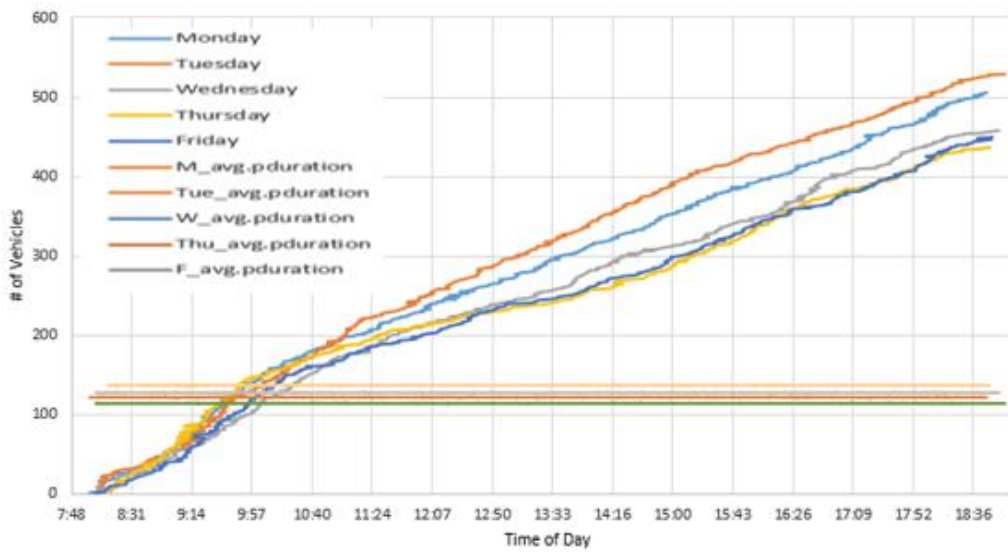


Figure 5.12. Cumulative Daily Vehicle Entrance Profile (8-12, Jan. 2018)

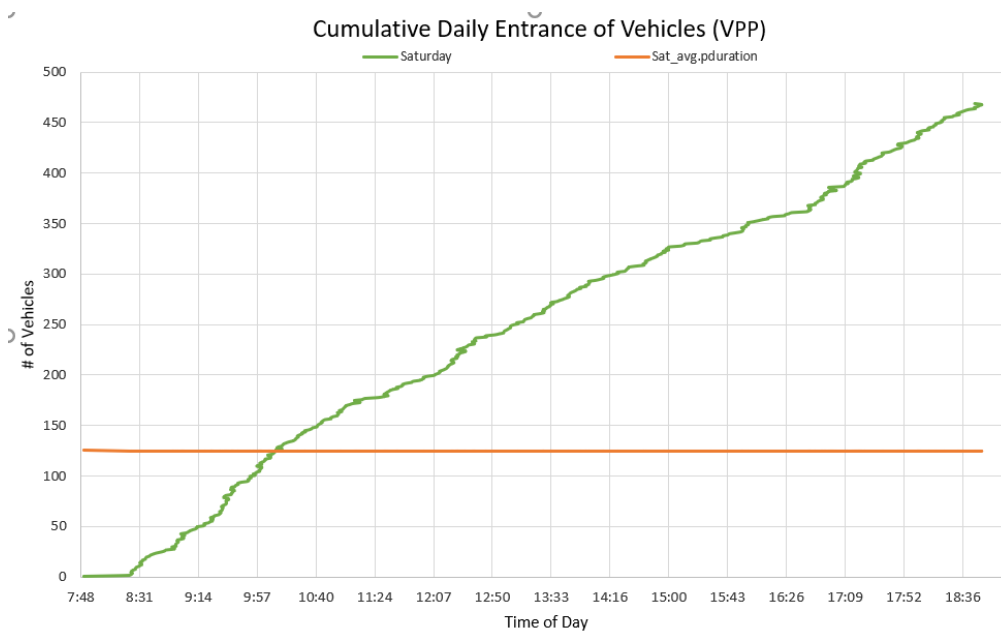


Figure 5.13. Cumulative Daily Vehicle Entrance Profile (13.01.2018 Saturday)

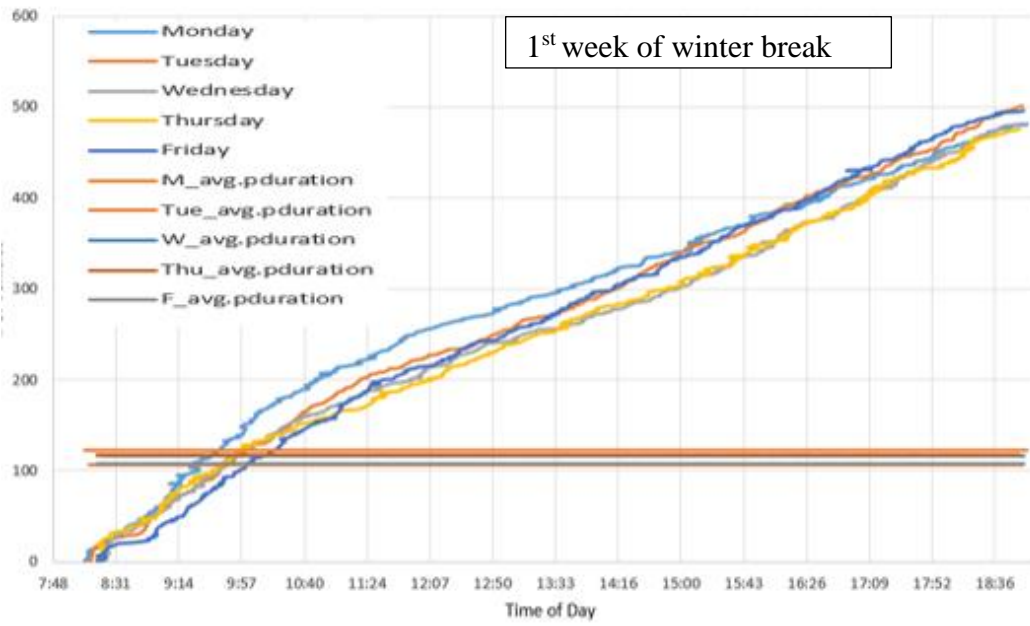


Figure 5.14. Cumulative Daily Vehicle Entrance (22-26, Jan 2018)

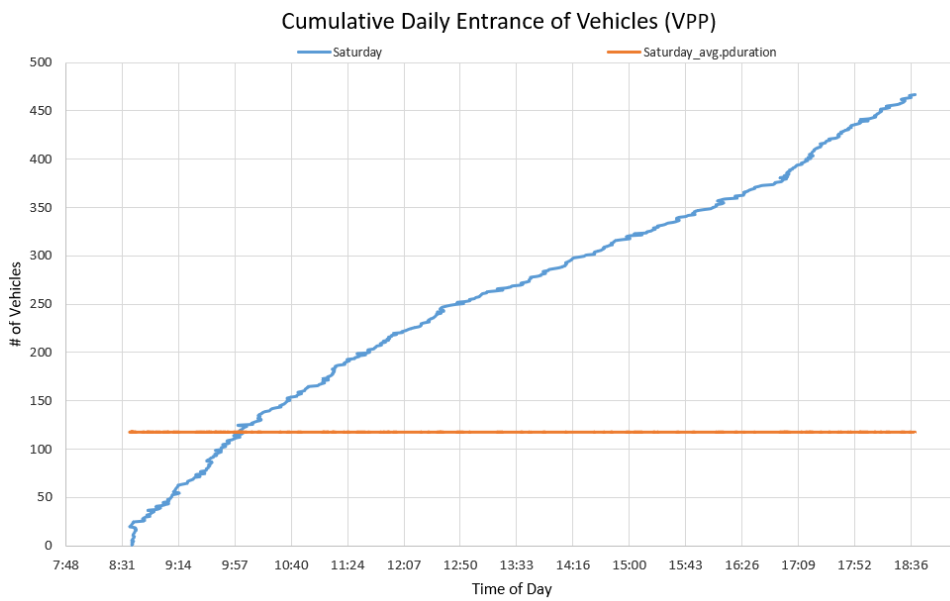


Figure 5.15. Cumulative Daily Vehicle Entrance (27 Jan 2018 Saturday)

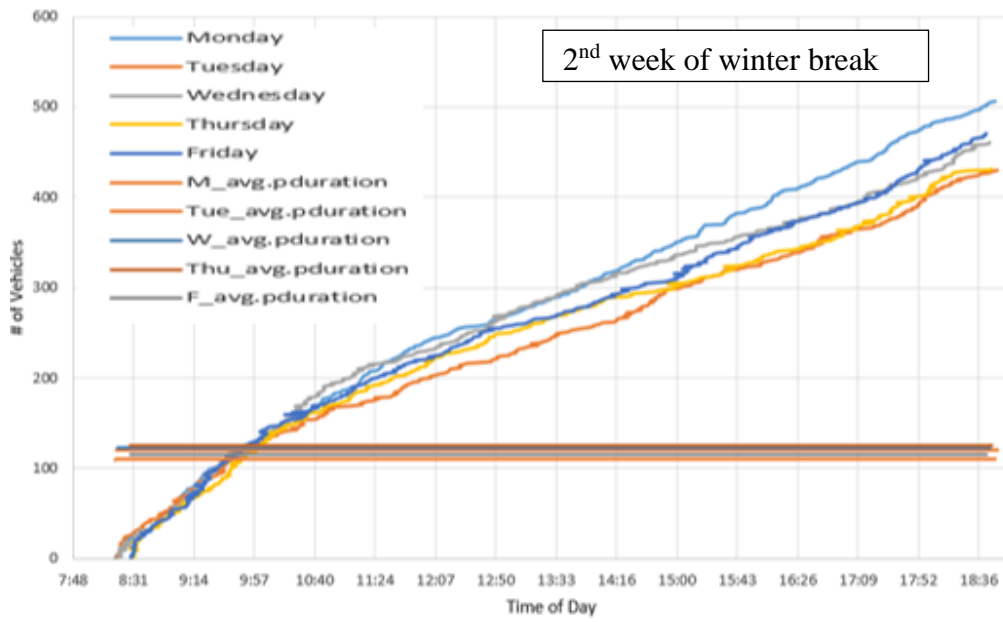


Figure 5.16. Cumulative Daily of Vehicle Entrance (29.01-02.02 2018)

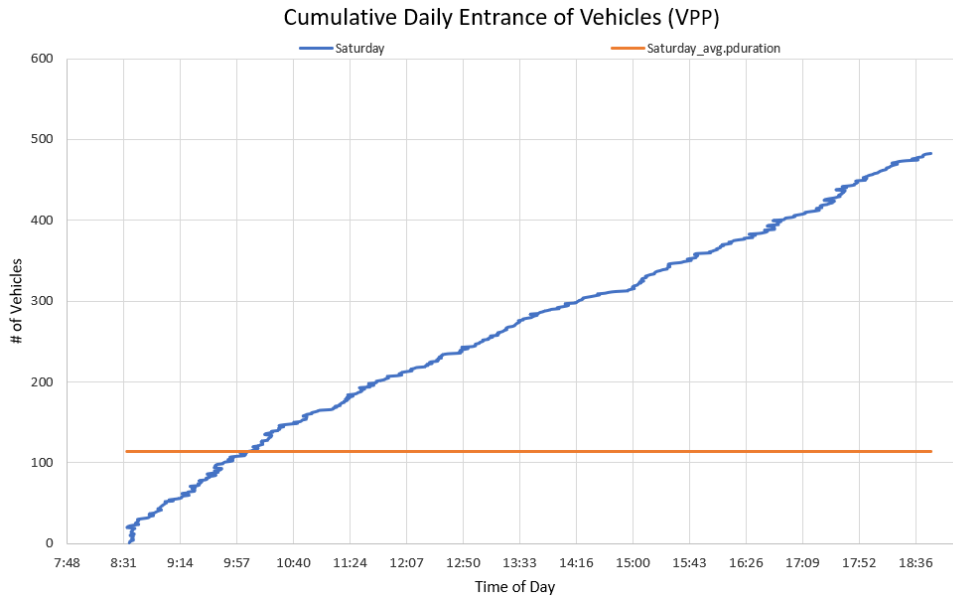


Figure 5.17. Cumulative Daily of Vehicle Entrance (03.02.2018 Saturday)

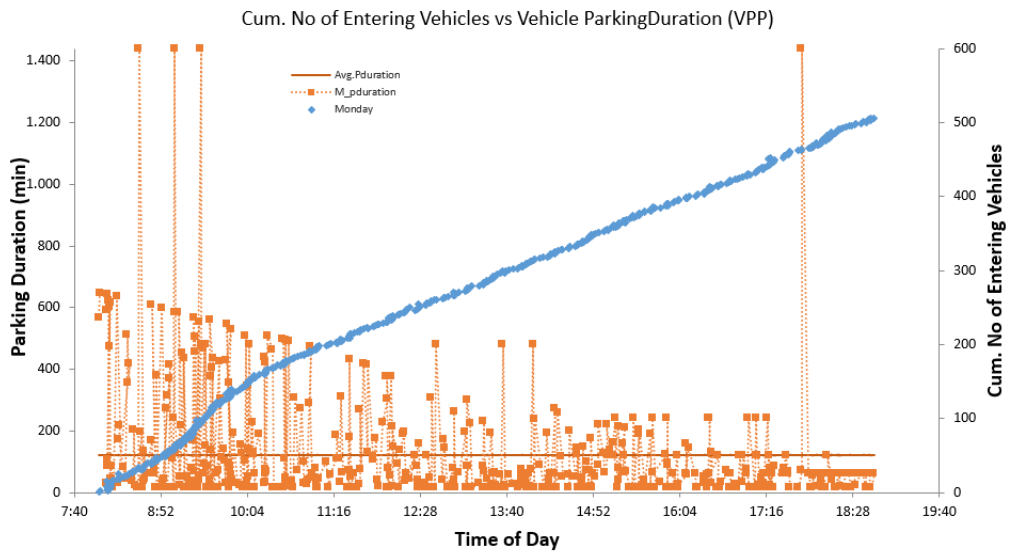


Figure 5.18. Cumulative Entrance vs Parking Duration (08.01.2018 Monday)

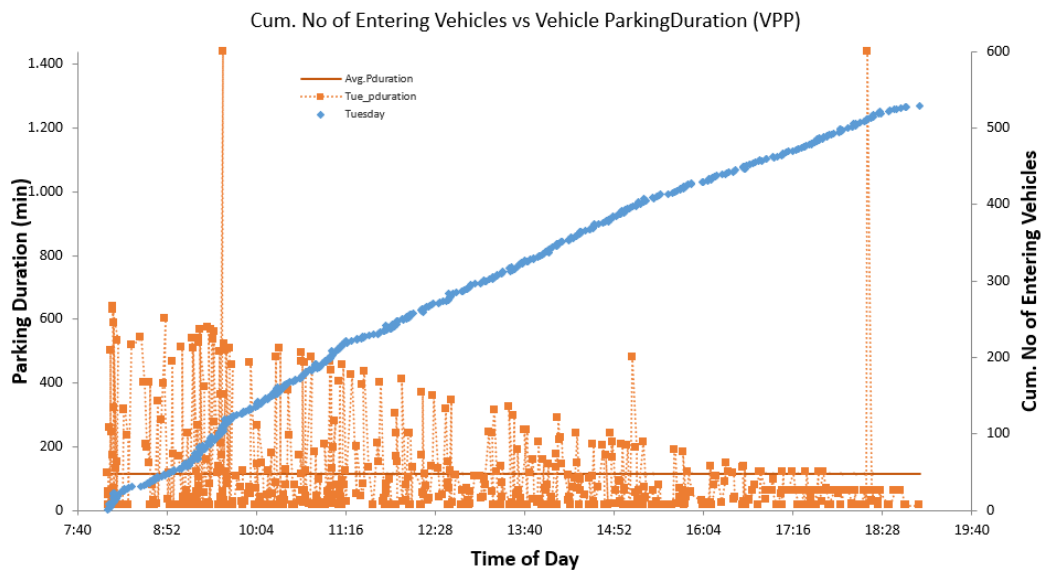


Figure 5.19. Cumulative Entrance vs Parking Duration (09.01.2018 Tuesday)

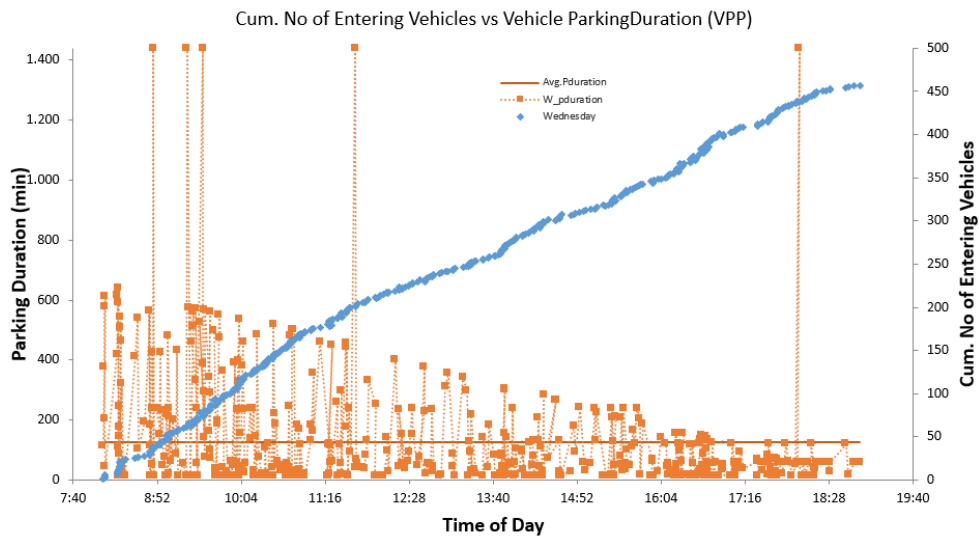


Figure 5.20. Cumulative Entrance vs Parking Duration (10.01.2018 Wednesday)

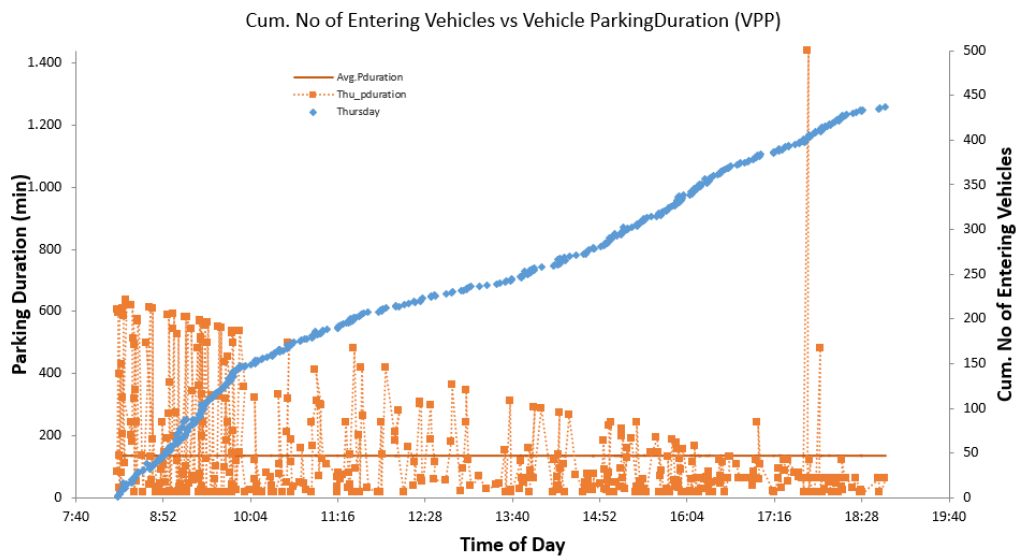


Figure 5.21. Cumulative Entrance vs Parking Duration (11.01.2018 Thursday)

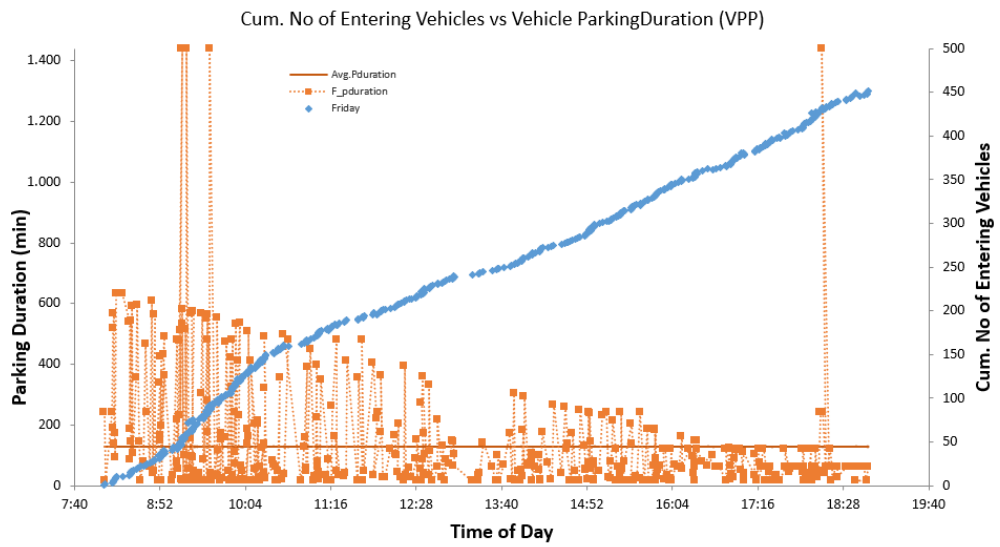


Figure 5.22. Cumulative Entrance vs Parking Duration (12.01.2018 Friday)

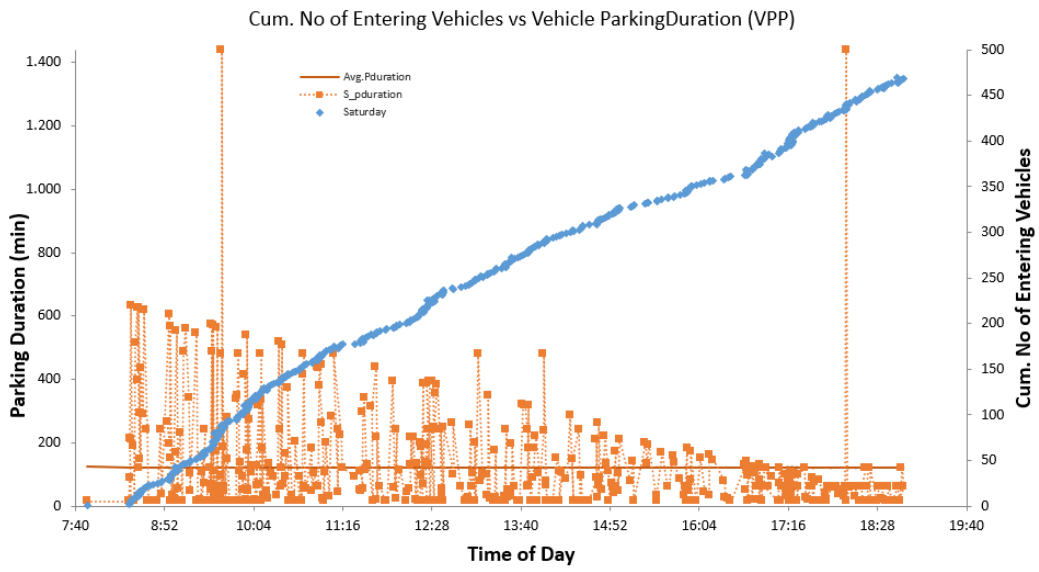


Figure 5.23. Cumulative Entrance vs Parking Duration (13.01.2018 Saturday)

### 5.5.1. Stated vs Actual Parking Durations

The comparison of stated and actual parking durations showed that most of the drivers declared to stay 15 minutes which is in limits of free parking duration (see figures 6.18-6.23) but overstayed up to 10 hours (note: there is no charge in overstaying than the stated time; the fare can be and is generally paid while leaving).

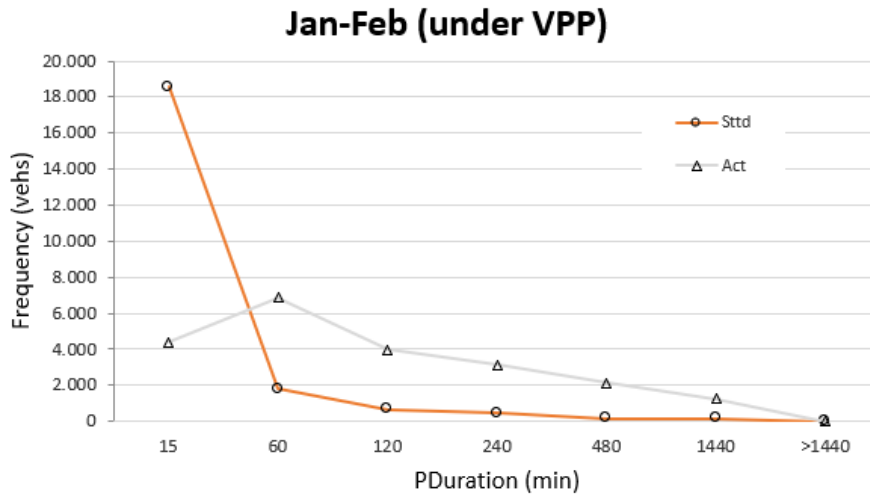


Figure 5.24. Stated and actual frequencies of stays (2 Months)

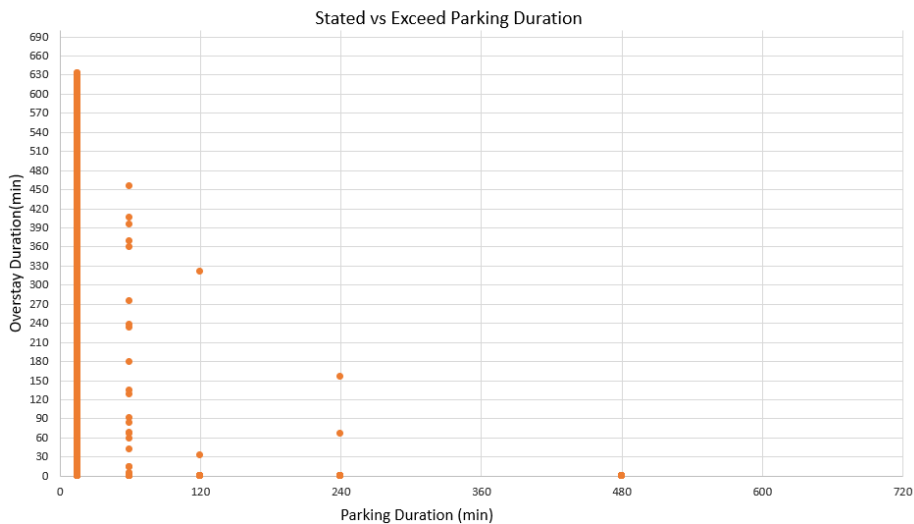


Figure 5.25. Overstay duration under VPP (2 Months)



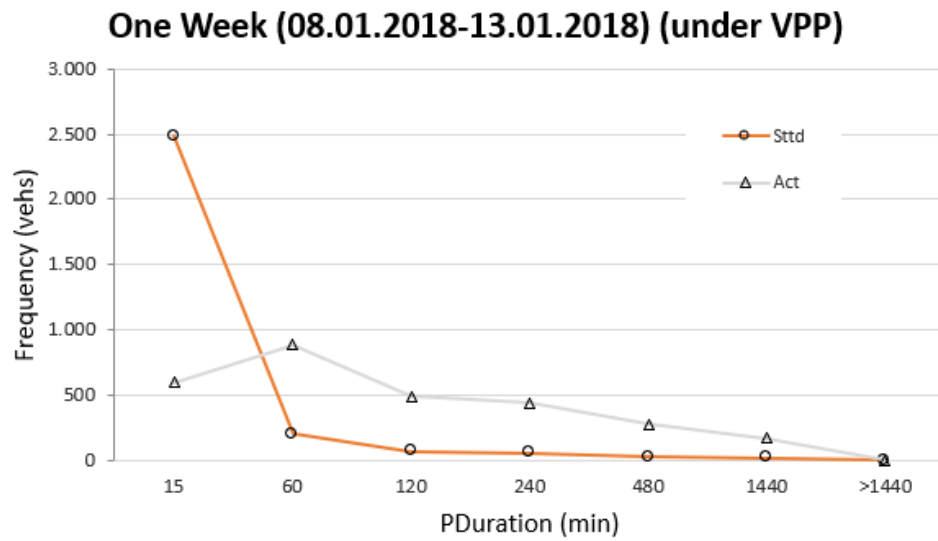


Figure 5.26. Stated and actual frequencies of stays (1 Week)

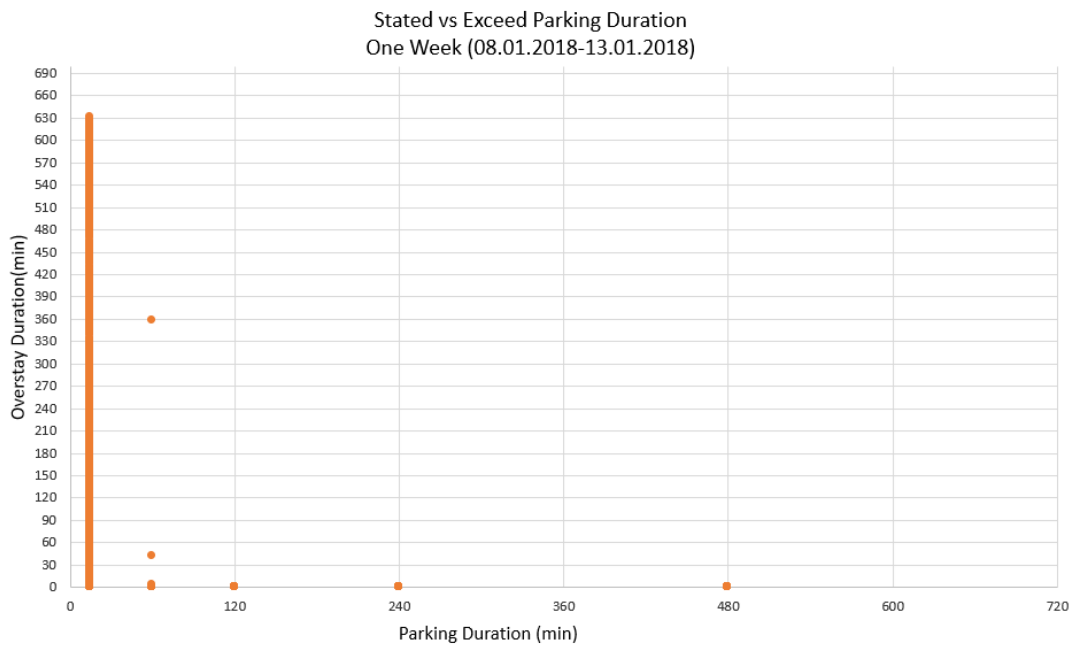


Figure 5.27. Overstay duration under VPP (1 Week)

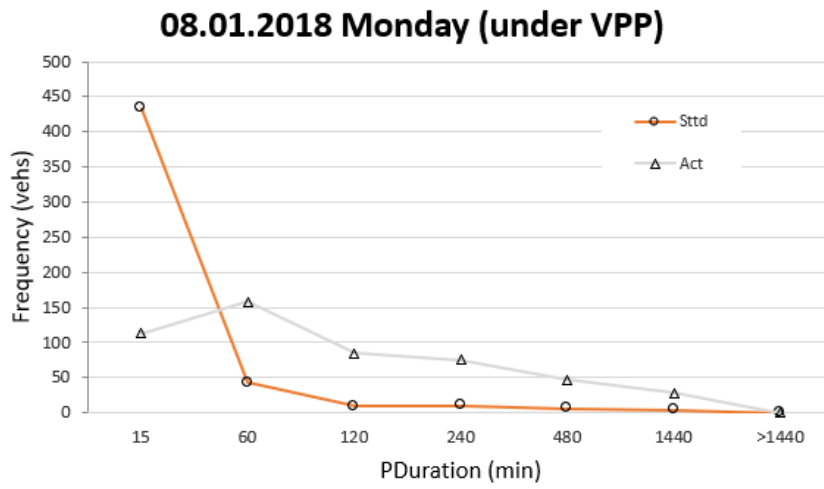


Figure 5.28. Stated and actual frequencies of stays (One Day 08.01.2018)

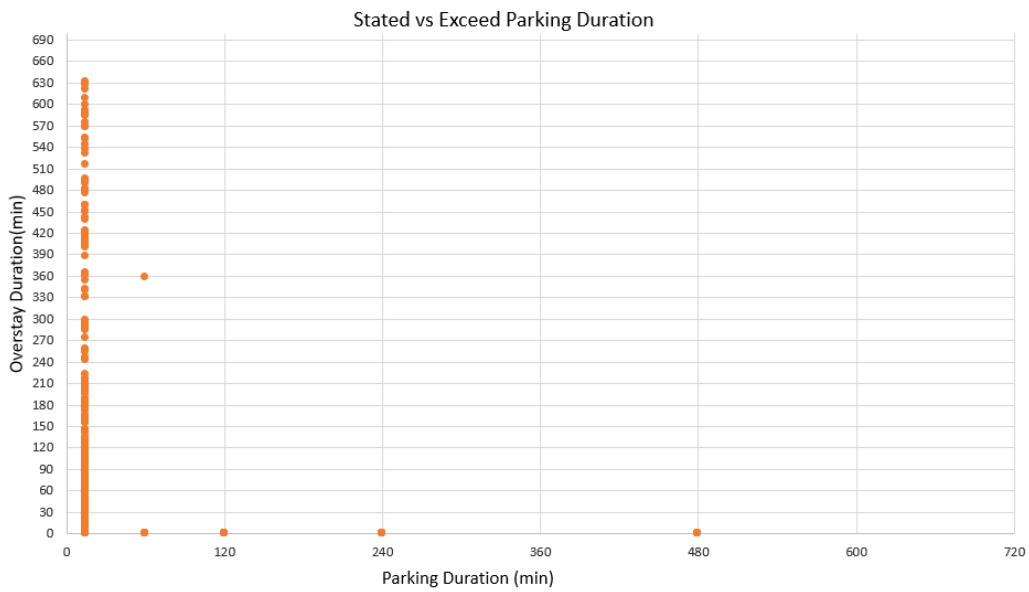


Figure 5.29. Overstay duration under VPP (One Day 08.01.2018)

## 5.6. Roadside Parking Effectiveness under Very Low Flat Rate

Though automatically monitored and managed, RPP under very low flat rate showed low level of effectiveness, which can be seen from the decreased number of circulated vehicles (smaller than 200 vehicles/day). Also, the longer average park time of 360 minutes and higher number of full day parks support the same outcome. The early rise in the cumulative number of vehicles in the system shows that most of the vehicles arrive before 8:30 and stay parked until the end of the day. Note; the meaningless of collecting a very low fare is reported to discourage the fare collectors, which may responsible for the lower circulation numbers; but higher number of long-term parking support the fact that most of the users are either residents or store owners in the neighborhood.

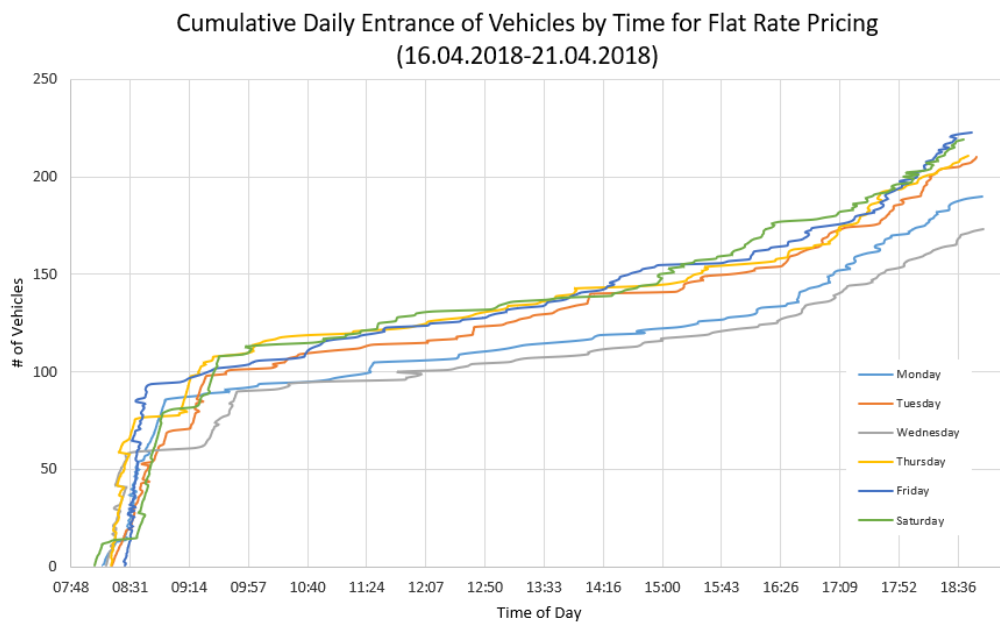


Figure 5.30. Cumulative Daily Entrance of Vehicles by Time (16-21 April 2018)

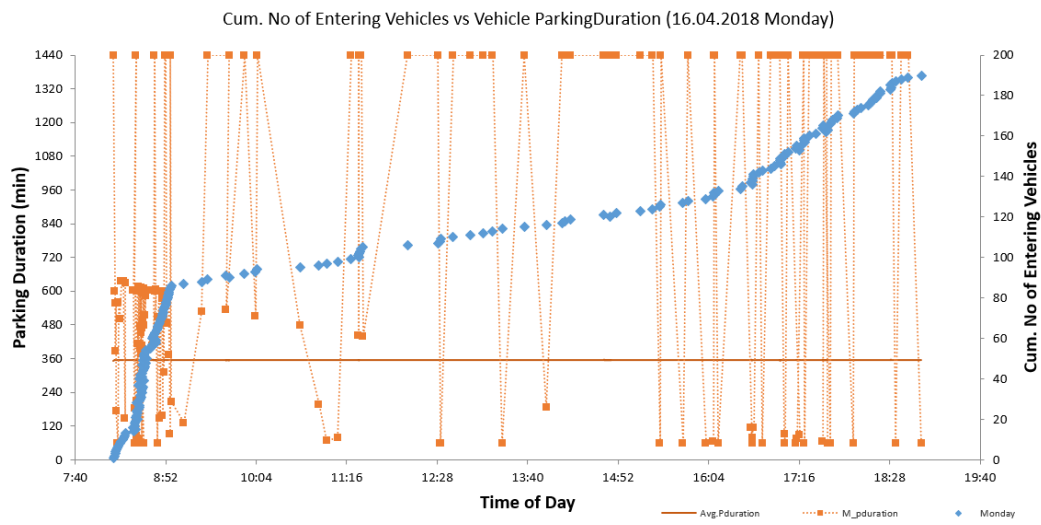


Figure 5.31. Cumulative Vehicles vs Parking Duration (16.04.2018 Monday)

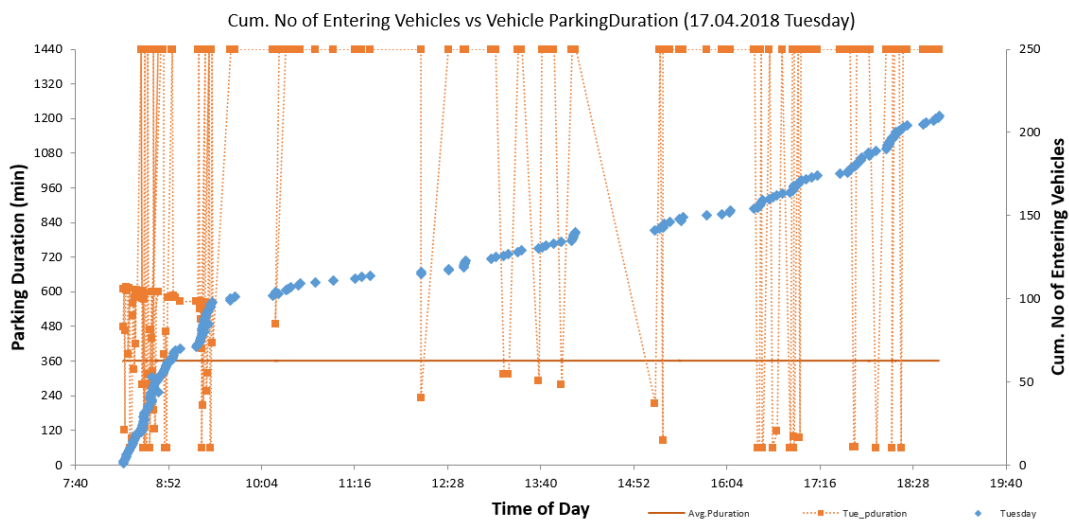


Figure 5.32. Cumulative Vehicles vs Parking Duration (17.04.2018 Tuesday)

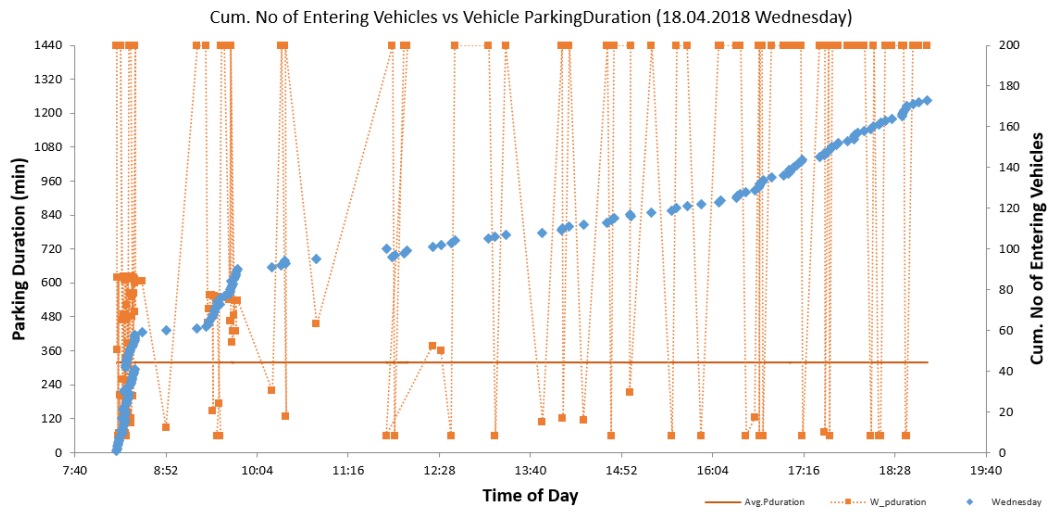


Figure 5.33. Cumulative Vehicles vs Parking Duration (18.04.2018 Wednesday)

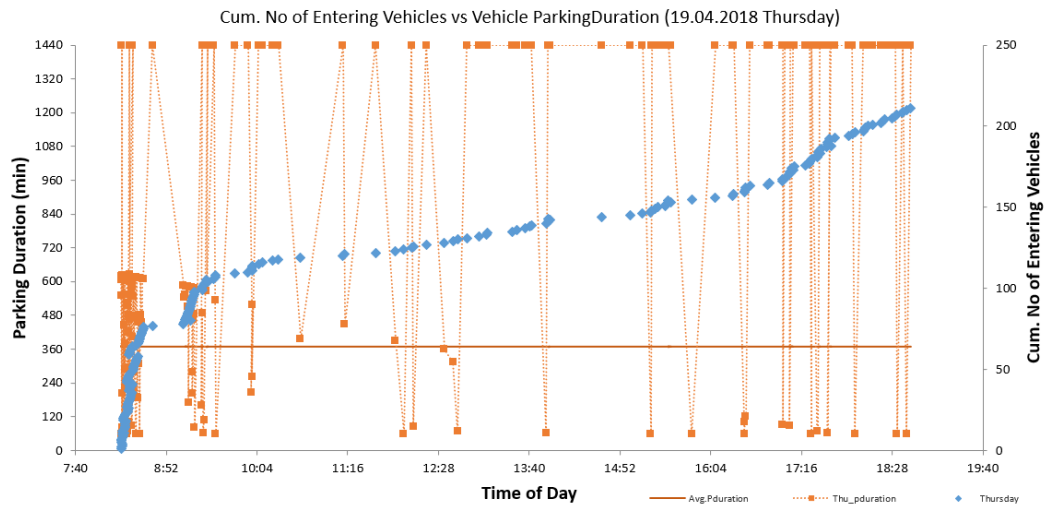


Figure 5.34. Cumulative Vehicles vs Parking Duration (19.04.2018 Thursday)

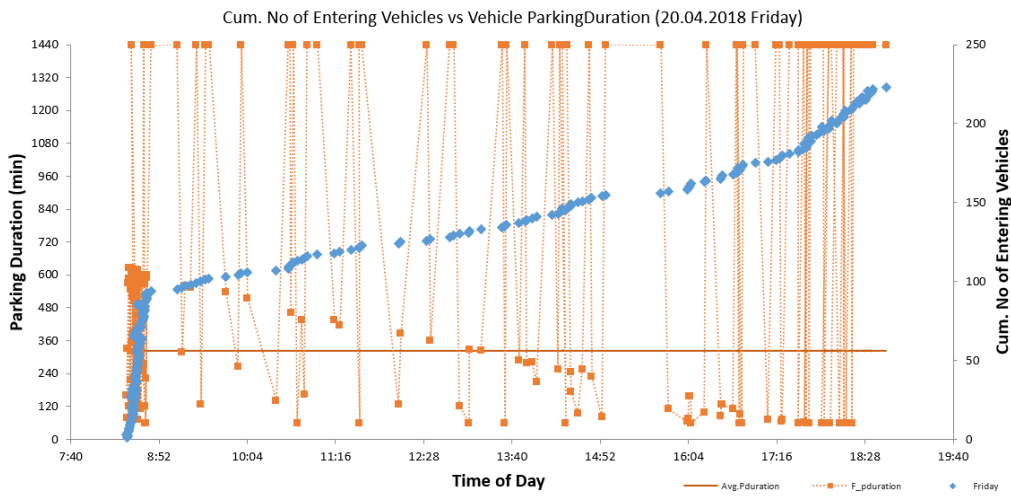


Figure 5.35. Cumulative Vehicles vs Parking Duration (20.04.2018 Friday)

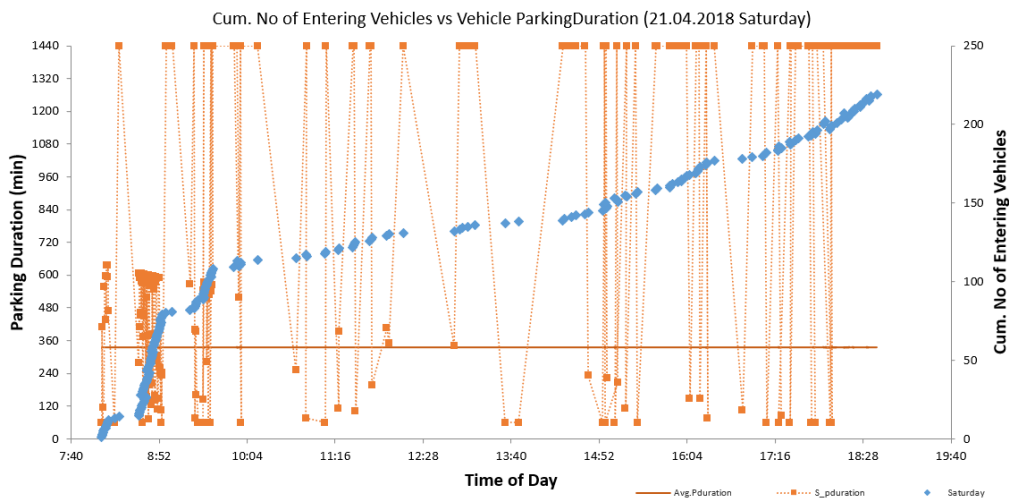
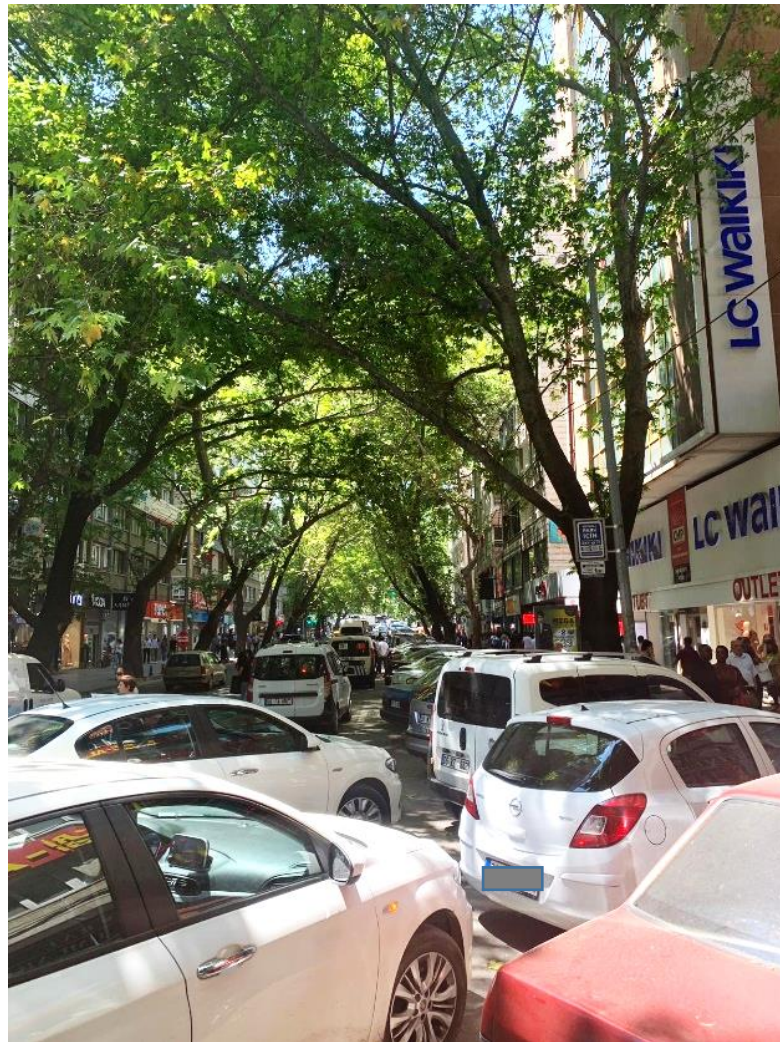


Figure 5.36. Cumulative Vehicles vs Parking Duration (21.04.2018 Saturday)

### 5.6.1. Stated vs Actual Parking Durations

The comparison of stated and actual parking durations showed that more than half of the drivers declared to stay less than 60 minutes (free parking duration) but overstayed more than 10 hours (note: there is no charge in overstaying than the stated time; the fare can be and is generally paid while leaving). FPP conditions are valid in August 2019 and there is an overdemand for roadside parking because of the long stay vehicles around the corridor.



*Figure 5.37. Necatibey Ave Parking Demand (July, 2019)*



*Figure 5.38. Illegal Parking on Necatibey Ave (July, 2019)*



*Figure 5.39. Illegal Parking on Necatibey Ave (July, 2019)*





Figure 5.40. Illegal Parking on Necatibey Ave (July, 2019)



Figure 5.41. Illegal Parking on Necatibey Ave (July, 2019)



Figure 5.42. Illegal Parking on Necatibey Ave (July, 2019)



Figure 5.43. Illegal Parking on Necatibey Ave (July, 2019)

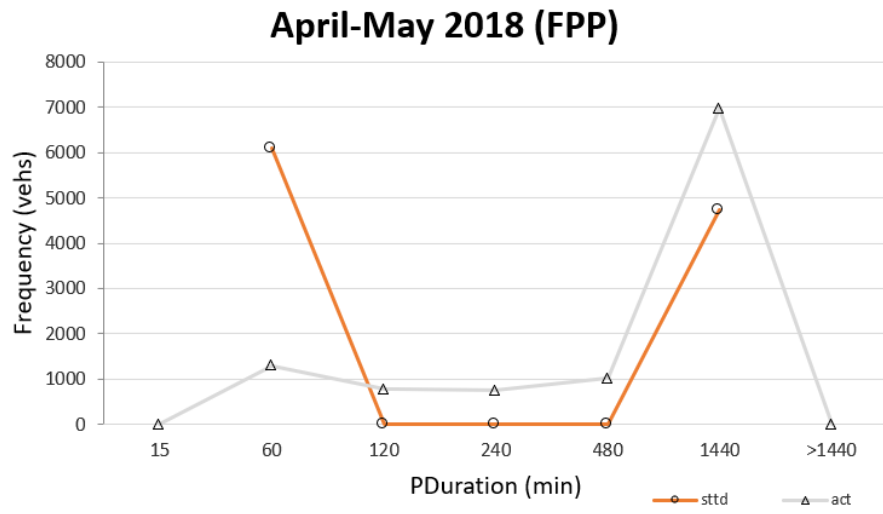


Figure 5.44. Stated and actual frequencies of stays (2 Months)

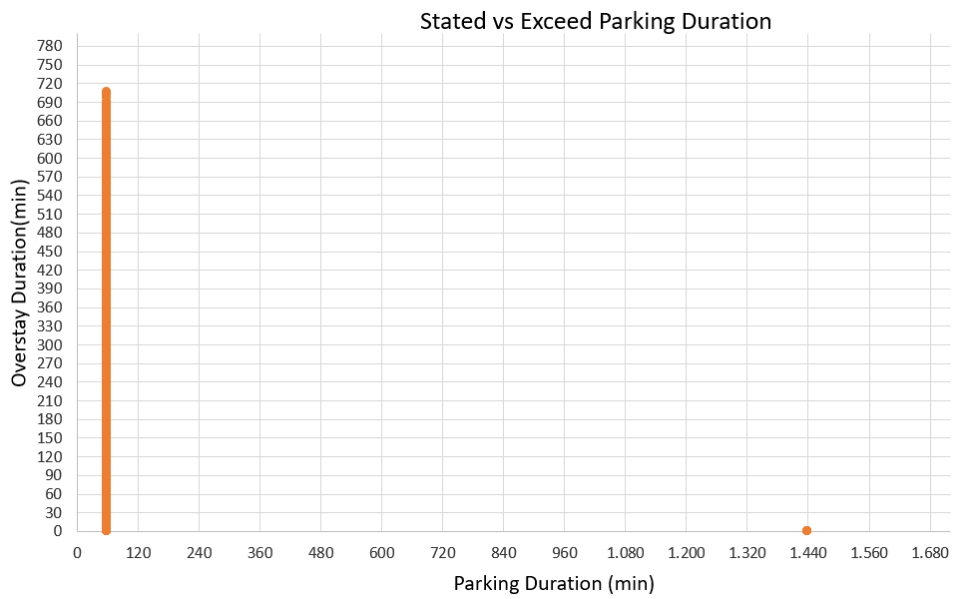


Figure 5.45. Overstay duration under FPP (2 Months: April-May 2018)

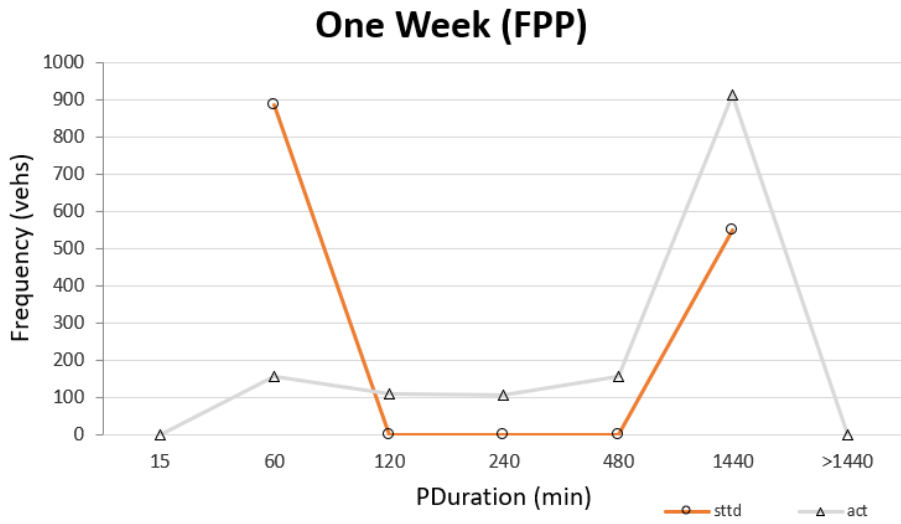


Figure 5.46. Stated and actual frequencies of stays (One Week: 16-21.04.2018)

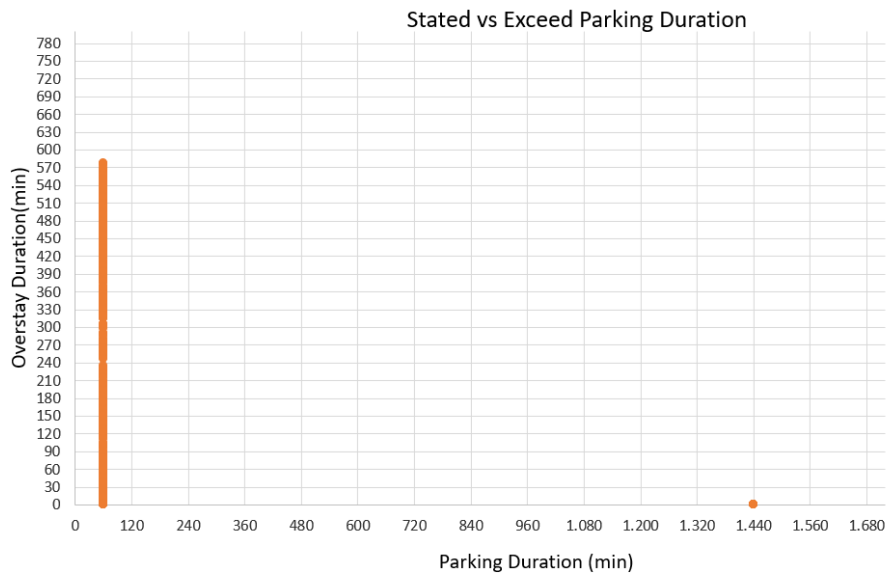


Figure 5.47. Overstay duration under FPP (One Week: 16-21.04.2018)

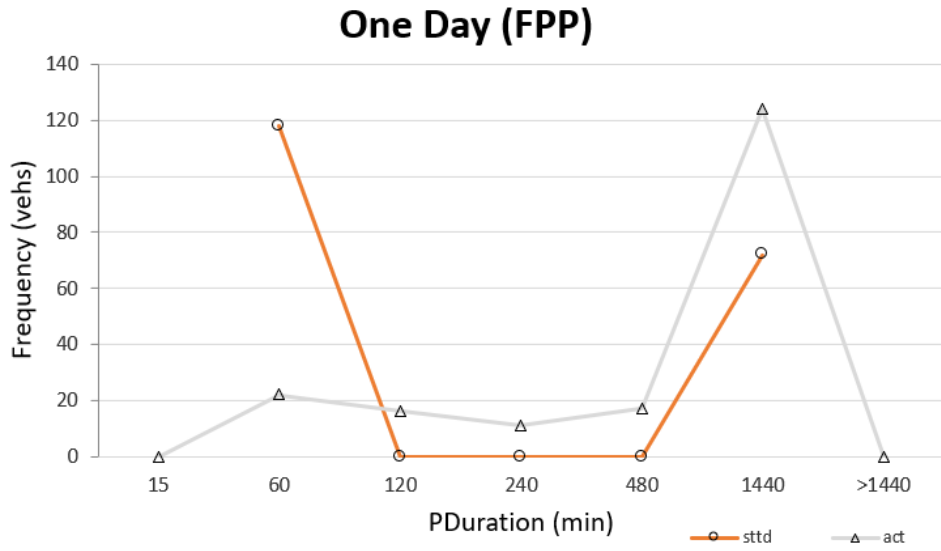


Figure 5.48. Stated and actual frequencies of stays (One Day: 16.04.2018)

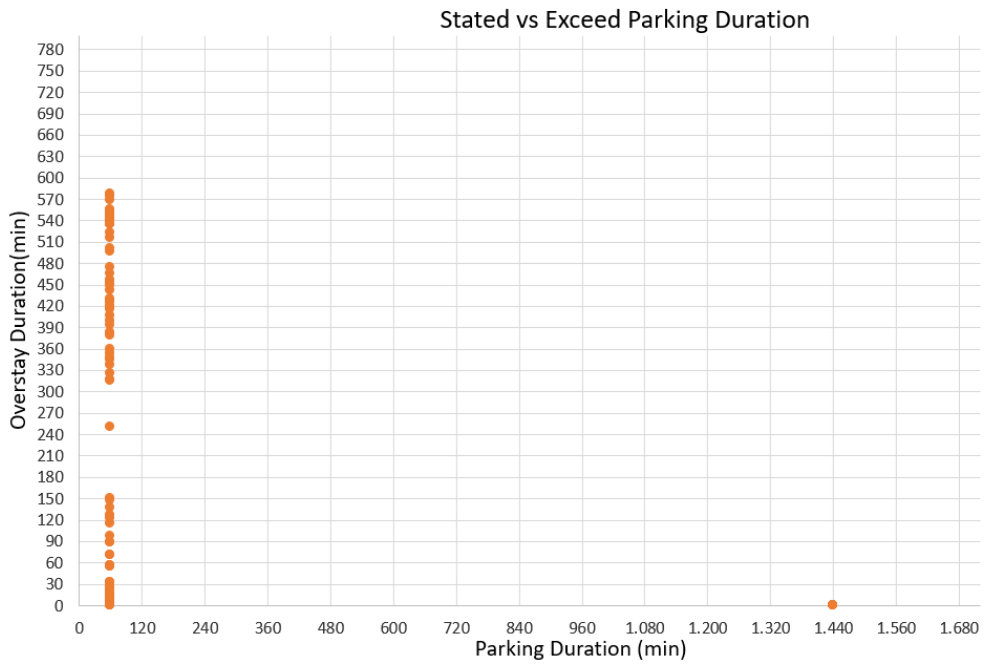


Figure 5.49. Overstay duration under FPP (One Day: 16.04.2018 Monday)

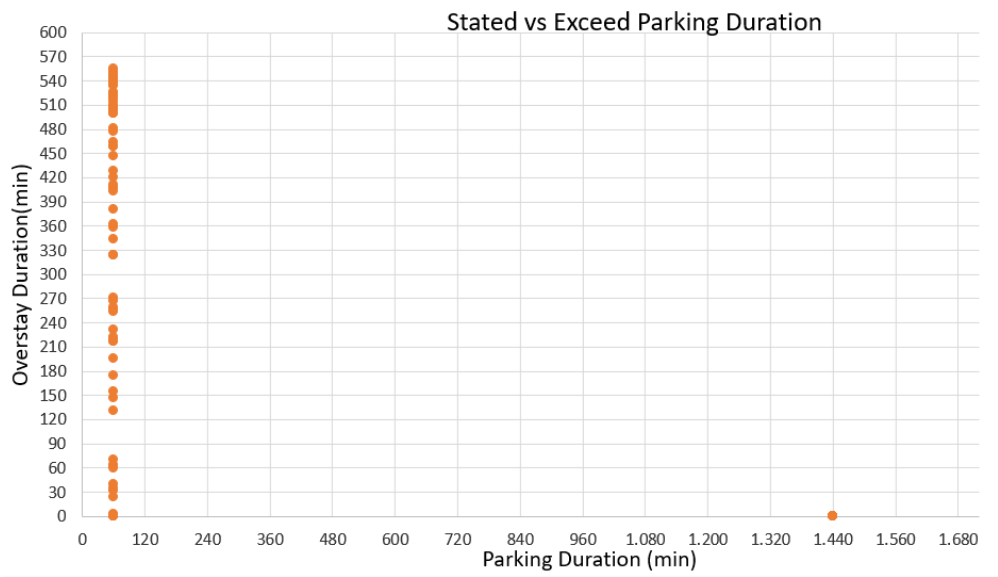


Figure 5.50. Overstay duration under FPP (Tuesday: 17.04.2018)

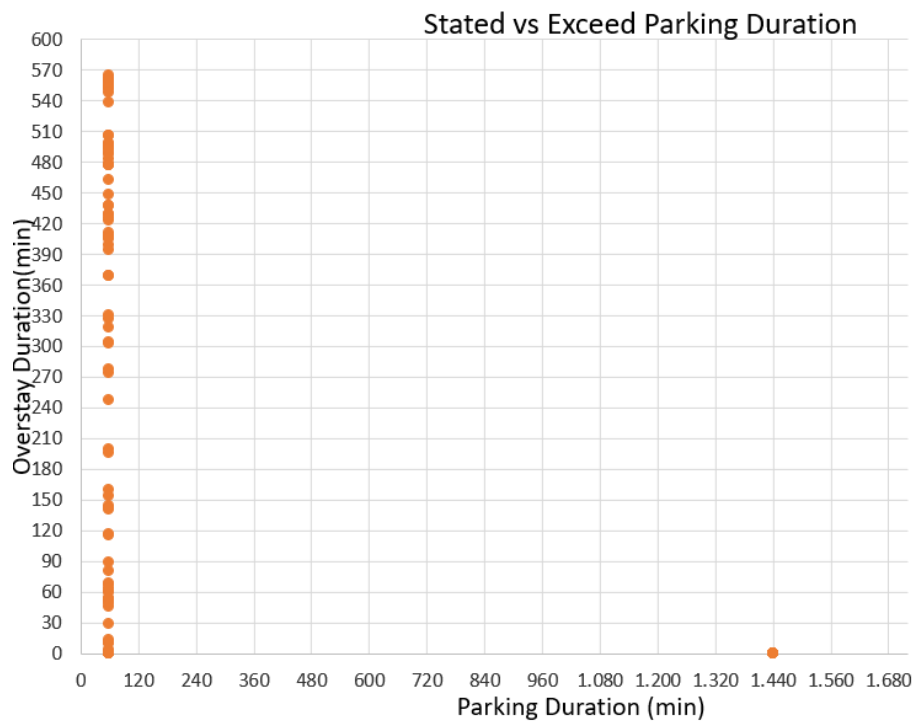


Figure 5.51. Overstay duration under FPP (Wednesday: 18.04.2018)

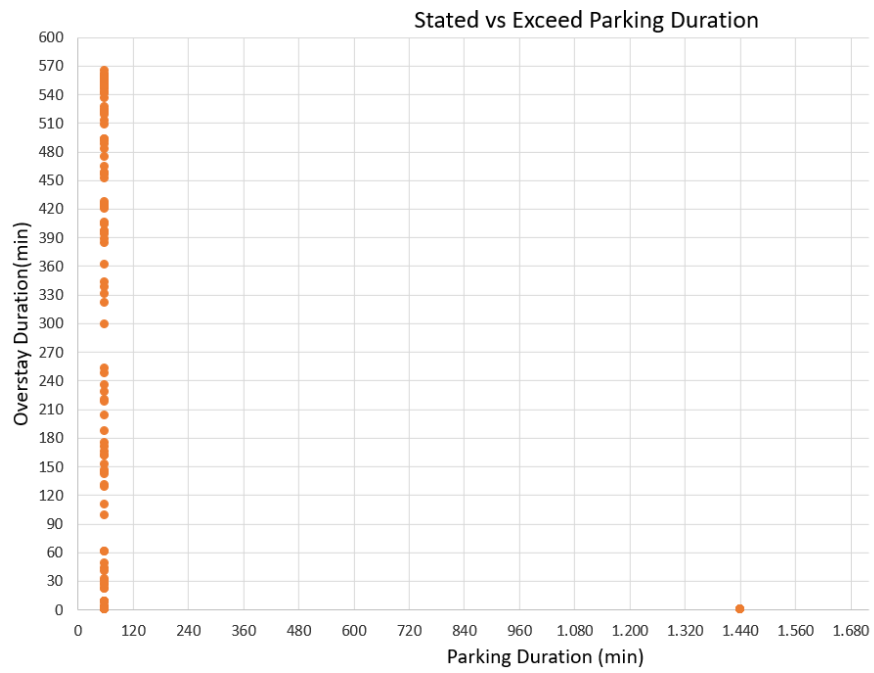


Figure 5.52. Overstay duration under FPP (Thursday: 19.04.2018)

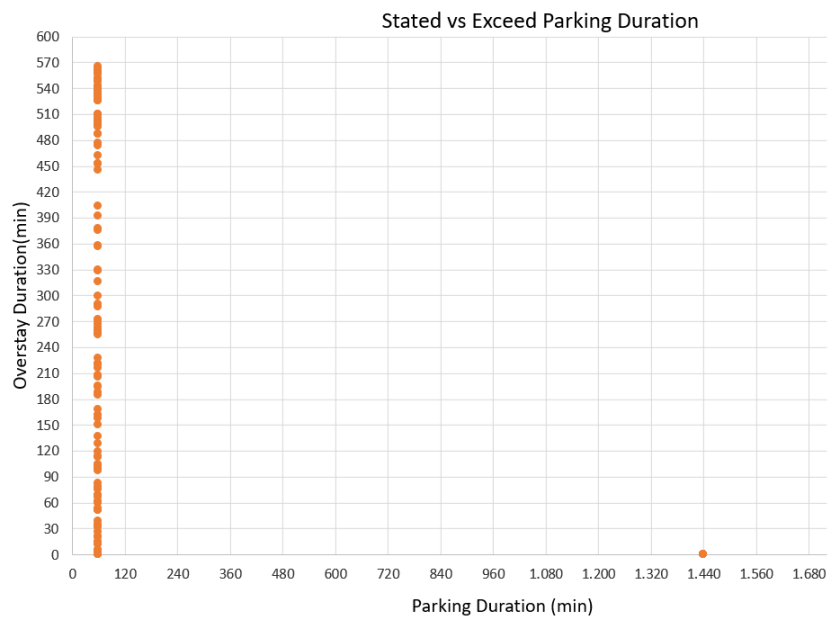


Figure 5.53. Overstay duration under FPP (Friday: 20.04.2018)

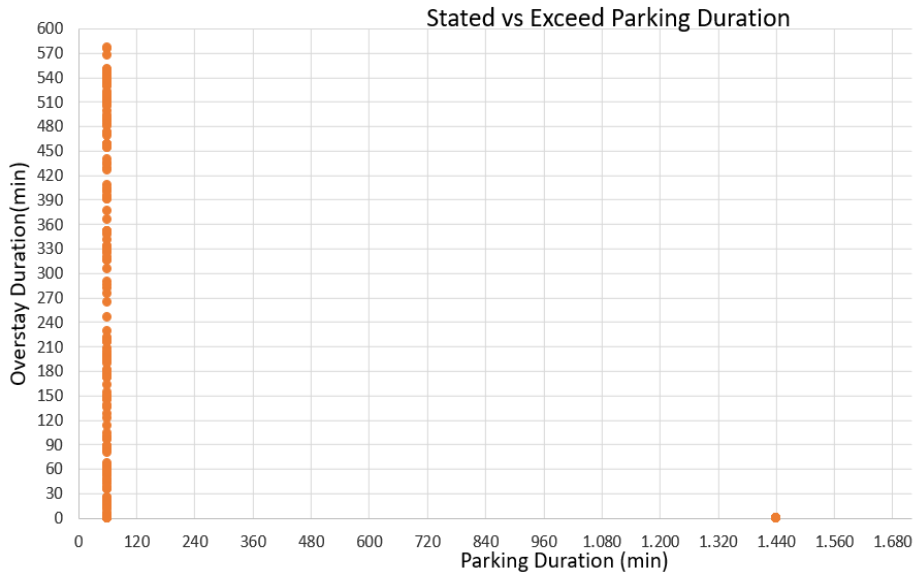


Figure 5.54. Overstay duration under FPP (Saturday: 21.04.2018)

### 5.7. Comparison of different RPP Schemes

The study results indicated that RPP can be a very powerful tool in time sharing the limited parking capacity in the CBD. Low number of parked vehicles (staying almost all day) was increased up to 7-fold when a reasonable parking pricing scheme was applied. Keeping a short duration free of parking pricing is also very effective motivating people to occupy valuable parking spaces as short as possible. The implementation of very low parking pricing schemes overturned the success of the previous term very quickly where long-term parker re-occupied the roadside parking spaces. However, it was still better than free parking policy (accompanied by no enforcement to avoid conflicts with high number of vehicle users) resulted almost lost of 70% of the road network capacity in the CBD.



## CHAPTER 6

### CONCLUSION

#### 6.1. Conclusion

This study investigates effectiveness of different roadside parking pricing at the CBD of Ankara, the capital city in Turkey. Improper establishment of roadside parking pricing operated in a very primitive level of AFCS, which includes a parking fare collected with a handheld machine to enter entry and exit time of a vehicle, led to conflict with the users and toll collectors. The main disadvantage of the existing system was the low education levels of most collectors, often compared to/confused with “unofficial parking fee collectors” who harass drivers before. Such lack of professionalism in the parking fare collection even led to lethal conflicts in Ankara, which caused the cancellation of the system totally in 2015.

By 2017, start of the roadside parking pricing policy with variable pricing schemes (at reasonably high levels) showed the effectiveness of the policy increasing number of vehicles using the same parking capacity while decreasing average parking times. But, change of the pricing scheme to a very low (almost meaningless) level as 1 TL/day due to political concerns within the metropolitan municipality administration, again caused the loss of effectiveness of the parking pricing. This unfortunate real experience with different parking pricing schemes proved the effectiveness level of pricing for Ankara.

The conducted interview study was aimed to identify perceptions of parking pricing and WTP in CBD, despite its limitation to draw statistical results. In-depth analysis of responses in various open-ended questions revealed that respondents were generally aware of parking problems in the CBD of Ankara and were willing to pay for parking especially for urgent trips or trips to certain locations, such as Kızılay, Tunalı, etc.

There was no consensus on a pricing scheme, despite a major expectation of free parking for short stays. The perception of paid parking and WTP showed variability based on socio-demographics, as females preferred paid parking more for security, while high-income participants (as compared to students) found it more affordable. It was clearly inferred that the destination in the CBD and time of day affected WTP, which reflected gained utility to the respondent. Main concerns about the on-street paid parking experience in Ankara stemmed from employed “fee collector personnel” (as compared to self-paid systems), who reminded “unofficial parking fee collectors” more than “official personnel” hired in off-street parking facilities.

Parking pricing has to be employed in CBDs in Turkey with appropriate schemes and required legislative effort describing the details and rules where and how to implement. As a beginning experience, variable pricing schemes should be implemented. WTP should be determined after a large-scale survey study that has to include different pricing policies and schemes in addition to socio-demographics. Later, a dynamic pricing system can be implemented with the support of ITS. ITS-based payment systems can also decrease (or even eliminate) undesired conflict between customers and fee collectors, which seems to be a major problem in the recent on-street parking pricing experience in Turkey.

## **6.2. Further Recommendations**

While the price level may not be valid for other regions, it is certainly possible to carry the information that if the parking pricing is not high enough to discourage private car stay in the CBD, it does not generate enough power to control private demand in accessing to the CBD. Also, for a community with not much experience or enforcement history in illegal parking, it was observed that people do not really plan about their parking duration in advance; always think/wish that they would leave before the free duration but can stay much longer. Advance parking systems such as parking reservations may not be easy to implement in communities like Turkey, due to this untamed and unplanned parking demand.

Within the light of the literature and the interviews, it is determined that any study focusing on parking pricing and WTP has to consider both impacts on the demand and supply sides. Response on demand may vary by user and trip characteristics, which bring the concepts of affordability and utility that would directly affect WTP for parking. On the demand side, parking pricing options can increase the operational capacity of parking supply by increasing turnover, which may also lead to increase parking probability. As well as the equity and fairness in utilizing, the capacity may be maintained. However, in the final stage, WTP (and its sensitivity to pricing level and scheme) determines operational capacity as well as the level of demand. Thus, it is directly interlinked with parking pricing and scheme. Further studies on WTP for parking must consider collecting data regarding the user and trip characteristics, as well as utility properties on equity and fairness in a region.



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