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# An evaluative study on parking challenges and future demand forecasting at Kano Farm Center Market, Nigeria.

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## Abstract

Parking involves stopping and disengaging a vehicle and leaving it unoccupied. Commercial centers require assistance in providing adequate parking facilities for vehicles to transport people, deliver goods, or conduct business transactions. Failing to meet the expected demand for parking can lead to frustration, safety concerns, and accidents. Our study involved conducting reconnaissance and surveys to assess parking demand and duration in the area. The objective was to provide valuable insights into the current urban transportation system, focusing on parking patterns and proposing a parking system specifically for Kano Farm Center Market. Our findings indicate an estimated annual growth rate of 10%, suggesting that in 15 years, the number of daily parkers will rise to 3,308. This means that more than the existing parking space of 2710 stalls will be required, and we recommend providing a larger area of 300m x 300m. This underscores the importance for urban planners and commercial center managers to invest in expanded and innovative parking solutions to enhance efficiency, safety, and accessibility for all users.

**Keywords:** Reconnaissance; Surveys; Parking demand; Parking duration; Urban transportation system; Kano farm center market

## 1. Introduction

Parking facilities were developed as a result of the necessity for vehicle storage at the start of the 20th century [1]. The physical part of any transportation system has three basic elements, the road, the vehicle and the terminal. A parking space is simply an area or piece of land available to store an automobile temporarily whether short-time or long-time. Parking facilities are terminal facilities that perform a short-time storage for vehicle [2]. The more the city is urbanized, the more serious the parking situation is for the city. In the current parking practice, the allocation of the off-street parking facility is often based on the ratio between forecast parking demand and supply [3].

Despite its importance to cities and individuals, parking is usually disregarded in travel pattern research. When people think about travel, they prefer to focus on the act of travelling, and the visuals of automobiles which are more closely associated with streets and motorways than with parking lots [4]. The A-logit application was utilized by [5] to create a parking demand and supply model in greater Athens, Greece. The model factored in various influences on both off-street and street parking facilities, such as parking fees, time spent during the parking process, and driver behaviors. The study revealed that parking cost is the primary determinant of driver's choice of parking space, outweighing other factors. In essence, the higher the parking cost, the less appealing the space and vice versa. In her study on parking management and analyzing parking cost benefits in Dharwad city, a parking demand model was constructed using built-in linear regression analysis within SPSS software packages [6]. The findings of this model highlighted that among the three

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examined parking durations—long-term, medium-term, and short-term—short-term parking emerged as the most advisable option. This is due to its ability to generate higher revenue for the proposed parking facility projects. The researcher also emphasized that, when effectively implemented, parking management could substantially reduce the need for parking spaces in specific scenarios, offering diverse economic, social, and environmental advantages. Considering all impacts, enhanced management frequently emerges as the preferred approach to addressing parking challenges. Furthermore, [7] adopted a logistic regression model to predict and estimate parking demand based on socio-economic factors and the level of attraction to commuters. This study concluded that the cost associated with parking, especially for long-term parking, is relatively high and warrants reduction.

According to [8], an optimized bi-level model was designed to critically examine the relationship between parking charges and the supply for various users and parking facilities. This model introduced time-varying parking fees to address parking duration and demand discrepancies, thereby guiding forward-looking parking policies. Furthermore, by employing a dynamic system approach, the study elucidated the correlation between travel costs across distinct trip types and transportation modes within the subsystem. This was instrumental in forecasting the impact of parking tariffs and policy measures on road traffic velocity. The findings suggest that a reduction in parking availability is likely to precipitate delays and degrade the overall service quality on the road network.

Additionally, based on research by [9] across three distinct parking facilities, a bi-level program model was formulated and resolved using a sensitivity-based algorithm. This model projected the parking rates for various lots under diverse operational scenarios. The upper layer of this model focused on assessing the characteristics of the drivers and parking prices. In contrast, the lower layer prioritized the most preferred strategies that commuters utilize to facilitate their journeys, including modes of transportation, travel routes, and parking facilities. Simulation outcomes indicate that only two analyzed facilities will attain the anticipated profit margins [10]. In many urban contexts, implementing parking fees is a crucial strategy for enhancing conditions in areas where parking demand surpasses the available supply. This is accomplished by applying and comparing three optimized parking policies, thus offering valuable insights to policymakers and traffic regulation authorities. In the realm of educational research, [11] employs multiple linear regression analysis in a study titled "A Study on Multiple Linear Regression Analysis" to explore the correlation between students' scores in various courses (measurement and evaluation, educational psychology, program development, counseling, and instructional techniques) and their 2012 KPSS scores. The aim is also to utilize the model to predict KPSS scores based on the student's course grades. Furthermore,[12] applies multiple regression analysis to predict the physical fitness levels of Turkish secondary school students, considering variables such as gender, age, body mass index (BMI), body fat, and the number of curl-ups and push-ups completed in 30 seconds. Another study, "Student's Performance Prediction using Multiple Linear Regression and Decision Tree"[13] implements multiple linear regression analysis to forecast student academic performance based on independent variables. Additionally,[14] utilizes multiple regression analysis to evaluate performance indicators within the ceramic industry, selecting profit as the dependent variable alongside predictors such as self-financing capacity, return on equity, technical equipment level, personnel costs per employee, and investment per employee.

### 1.1. Study Area

Despite its agricultural connotations, the Kano Farm Centre Market serves as a thriving center for technology enthusiasts, operating consistently from 8:00 AM to 6:00 PM year-round. Situated within the Tarauni Local Government Area in Kano State, Nigeria, this market has transcended its origins to become a pivotal commercial hub for an extensive range of phone accessories, computers, and various electronic devices. This vibrant marketplace has emerged as a crucial meeting point for retailers and consumers passionate about tech. Whether pursuing the latest smartphones, searching for computer components to enhance your setup, or scouting for a diverse selection of tech accessories, including protective cases and chargers, the Kano Farm Centre Market offers a comprehensive array to fulfill your technological requirements. The market's diverse product offerings are complemented by competitive pricing, making it a favored destination for those looking to make savvy purchases. In addition to being a source for new products, the market also facilitates a range of services, like repairs, software installations, and technical support, delivered by proficient technicians stationed within the premises. The market's strategic significance lies in its ability to adapt to the ever-evolving technological landscape, serving as an instrumental link between technology suppliers and end consumers. Moreover, its established reputation as a comprehensive technology marketplace draws visitors from adjacent areas and substantially contributes to the local economy.

Furthermore, the Kano Farm Centre Market fosters a community of tech enthusiasts exchanging knowledge, experiences, and guidance, enriching the consumer experience. This communal aspect, combined with the vast array of available products and services, ensures that the market retains its appeal as a premier destination for individuals seeking to stay abreast of the latest technological offerings or requiring assistance with tech-related matters. In essence,

the Kano Farm Centre Market in Kano State, Nigeria, exemplifies the dynamic nature of contemporary commerce, seamlessly blending traditional market values with modern technological needs. Its ongoing adaptability to market demands and its pivotal role in the local tech ecosystem position it as an invaluable asset for the tech community within the region.

**Figure 1** Kano farm center market

## 2. Materials and Method

In the comprehensive study of off-street parking demand at the Kano Farm Centre Market, an empirical investigation of survey data elucidated the current parking conditions. A reconnaissance survey initially furnished a visual appraisal of the site, essential for identifying pertinent commercial activities and delineating the scope for subsequent parking studies, thus augmenting an understanding of parking management practices within the vicinity. Sequential to this preliminary survey, an extensive parking investigation ensued over a seven-day continuum, employing a dual-faceted methodological approach. The first facet, Parking Demand, sought to quantify the vehicular occupancy within the precincts, facilitating an informed estimation of the requisite parking allocations in the proposed infrastructure. This involved a stratified sampling across four designated zones (A, B, C, and D) with vehicular counts conducted over eight-hour intervals, each vehicle observed for a thirty-minute duration and its presence extrapolated based upon a Passenger Car Unit (PCU) of 1.00, as per Samson (2012). The second facet, the Parking Duration Data, aimed to delineate the parking tenure, distinguishing between short, medium, and long-term parking engagements. This was achieved by noting the recurrence of vehicles beyond the initial hour, with subsequent observations at hourly intervals to record vehicles persisting over two hours, thus providing a nuanced perspective on parking duration patterns. Collectively, these methodical surveys yield critical insights pivotal for designing and providing adequate parking facilities at the Kano Farm Centre Market, embodying a substantive contribution to urban planning and infrastructure development paradigms.

## 3. Results and Discussions

### 3.1. Parking demand analysis

Over seven consecutive days, a buildup of vehicles was observed. The data collected revealed that 980 vehicles were parked at station A throughout the week. This figure was derived from the cumulative count of parked vehicles observed over the seven days. The corresponding totals for stations B, C, and D were determined to be 481, 1198, and 522, respectively. Based on this data, it can be inferred that station C had the highest number of parked vehicles, while station D had the lowest.

### 3.2. Parking duration analysis

The primary goal of the duration survey is to determine the length of time vehicles are stored within the survey areas, allowing us to differentiate between long-term, mid-term, and short-term parkers. In this instance, we will identify the four critical days with the highest vehicle occupancy at each station. Data from stations A and B, which are off-street, are combined, as are stations C and D, which are on-street. For analysis, we will select the four critical days with the highest number of parked vehicles from these consolidated stations. This analysis will involve the four critical days from

both on-street and off-street locations, as shown in Table 4-1 below. The overall survey data is presented in Appendix A.

**Table 1** Summary of the total number of vehicles and their parking durations observed at each station for 4 critical days.

| Stations | Total Number of Vehicles | Total number of short-time parkers | Total number of mid-time parkers | Total number of long-time parkers |
|---|---|---|---|---|
| A&B | 1325 | 790 | 79 | 231 |
| C&D | 1385 | 844 | 215 | 37 |
| TOTAL | 2710 | 1634 | 294 | 268 |

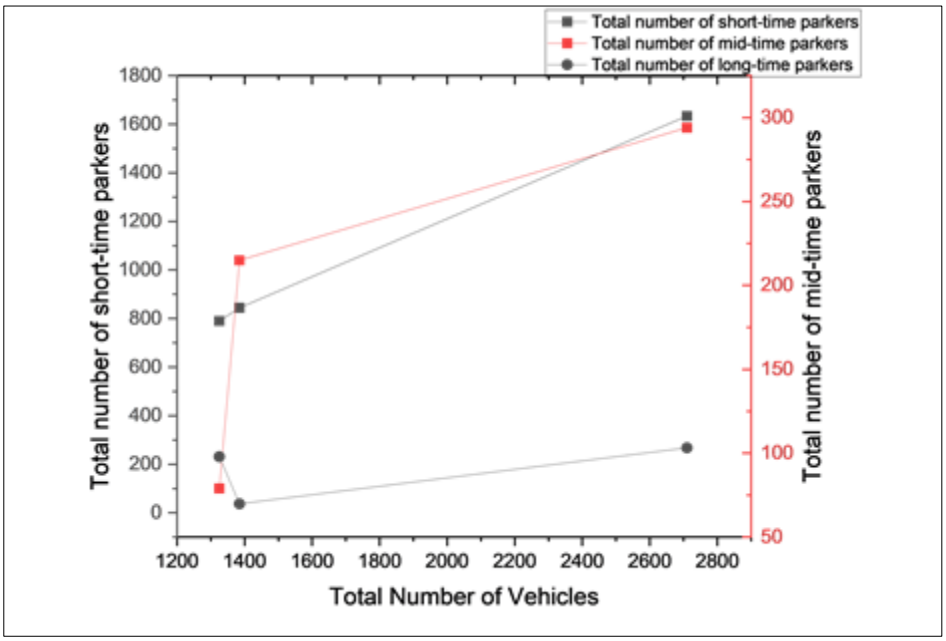


**Figure 2** Parking Durations for 4 Critical Days

The graph above illustrates the parking durations for vehicles over four crucial days, categorized into short-term, mid-term, and long-term parkers. The x-axis represents the total number of vehicles, while the y-axis depicts the total number of short-term parkers (left axis) and the total number of mid-term and long-term parkers (right axis). The red line for short-term parkers shows a significant spike, indicating that most parked vehicles belonged to this category. The increase in mid-term parkers is evident but at a much lower rate, while long-term parkers, represented by the black line, showed the smallest increase. Short-term parking was notably more prevalent during these critical days, while mid-term and long-term parking was less frequent, with a noticeable difference in the rate of increase for each category.

However, based on the data in Appendix A, the comprehensive analysis has revealed the total number of vehicles accumulated over a week. This allowed us to calculate the average daily vehicular presence, which provided insight into the average hourly vehicular occupancy. Additionally, we carefully documented the daily distribution of vehicle parkers, shedding light on vehicular traffic patterns. This systematic approach to data analysis emphasizes the importance of meticulous data collection and systematic interpretation to extract actionable insights.

$$980 + 481 + 1198 + 522 \; = \; 3181 veh/week \tag{1}$$

$$\frac{total\ number\ of\ vehicles\ parked\ for\ a\ week}{number\ of\ days\ observed} = \frac{3181}{4} = 795 veh/day \tag{2}$$

$$\frac{total\ number\ of\ vehicles\ parked\ per\ day}{number\ of\ hours\ observed} = \frac{795}{8} = 99veh/hour \quad (3)$$

$$99x8 = 792veh/day \quad (4)$$

### 3.3. Estimation of future parking demand

Assuming we are projecting for the next 15 years, we assumed alternatively annual growth rate of vehicles as 10% on the basis of compound formula.

$$\underset{e}{P} = Po(1 + r)^n \quad (5)$$

To find the expected number of parkers per hour after n years, we use the following values:

Where Pe = expected number of parkers per hour after n years, Po = Present number of parkers per hour, r = Growth rate, n = number of years for which the forecast is made. Given: Po = 99 vehicles/hour, r = 10%, n = 15 years

By substituting these values into the equation above, we can calculate the expected number of parkers per hour after 15 years.

$$\underset{e}{P} = 99(1 + 0.1)^{15} = 414\text{parkers/hour} \quad (6)$$

Now to estimate the future demand of parkers under the same condition, where, $P_o$ = number of parkers per day = 792veh/day

$$\underset{e}{P} = 792(1 + 0.1)^{15} = 3{,}308\text{parkers/hour} \quad (7)$$

### 3.4. Proposal for parking space

The assessment of the study area indicates that the existing spaces need to be improved to meet the current parking demand and meet required standards. As a result, we have decided to implement 90-degree angle parking, also known as perpendicular parking. This choice was made because it maximizes the available space and provides the advantage of a two-lane circulation roadway, facilitating easier maneuvering and movement.

### 3.5. Calculating parking stalls within the existing space

Therefore, to determine the number of parking stalls that can be provided in the existing facility, the total area of the existing space reserved for parking of cars is measured as follows:

Area of the existing parking space = 6474m$^2$

Area of a single space of $90^0$ parking stall is 8.5ftx18ft

Where 8.5ft = 2.59m and 18ft = 5.4m, 2.59 x 5.4 = 13.99m$^2$

Number of stalls of the existing parking space =

$$\frac{6474m^2}{13.99m^2} = 463\text{stalls} \quad (8)$$

Calculating parking stalls for four critical days in off-street areas

The area of one stall is 8.5ftx18ft = 2.59m x 5.4m =13.99m$^2$

1 vehicle is equivalent to 13.99m$^2$

The total number of vehicles parked in off-street is: 1325veh/day

$$\text{The Number of stalls } = \frac{13.99x1325}{13.99} = 1325stalls \tag{9}$$

Calculating parking stalls for four critical days in on-street areas

The area of one stall is 8.5ftx18ft = 2.59m x 5.4m =13.99m$^2$

The total number of vehicles parked in on-street is: 1385veh/day

$$\text{The Number of stalls } = \frac{13.99x1385}{13.99} = 1385stalls \tag{10}$$

The total number of parking stalls for both off-street and on-street obtained above is

$$\text{Total Number of parking stalls } = 1325 + 1385 = 2710\text{stalls} \tag{11}$$

The current area has 463 parking stalls, while the total number of off-street and on-street parking stalls combined is 2710. Based on these numbers, off-street and on-street locations have the highest number of stalls. After analyzing the survey data, we found that the counts for short-term, mid-term, and long-term parkers for stations A are 790, 79, and 231, respectively. For stations C&D, the corresponding counts are 844, 215, and 37, as detailed in Appendix A. The average number of parkers per day, the total number per hour, and the adjusted number of parkers per day were calculated as 795 vehicles/4 days, 99 vehicles/hour, and 792 vehicles/day. The study area's results showed an annual average growth rate of 10%. We used this rate to estimate future demand over 15 years, projecting that the number of daily parkers will increase to 3,308 parkers/day in fifteen years. The current parking space's capacity was calculated to be 463 stalls. However, considering only four critical days, the off-street parking capacity was calculated to be 1325 stalls, while that of the on-street was 1385 stalls. Its existing parking space must be sufficient for vehicles parked off-street and on-street areas.

## 4. Conclusions

In conclusion, a meticulous analysis of parking durations observed across four distinct temporal periods reveals a classification into three categories: short-duration parkers (n=1634), medium-duration parkers (n=294), and long-duration parkers (n=268). Employing these data points and applying an annual average growth rate of 10%, projections elucidate an escalated demand for parking, estimated to reach approximately 3,308 parkers per day over the next 15 years. This projected increase substantially surpasses the existing capacity of the parking area, highlighting the current infrastructure's inadequacy in accommodating future demands. Moreover, an aggregate total of 2,710 parking stalls, as discerned from both off-street and on-street parking analyses, corroborates the insufficiency of the present parking facilities. Consequently, allocating a significantly enlarged area, 300m by 300m, is recommended to address and fundamentally lessen the identified parking capacity dilemma. Implementing this solution is paramount in catering to the anticipatory parking demand and ensuring the efficient utilization of parking spaces. To effectively address the critical parking issues identified, it is imperative to commence the construction of the proposed infrastructure project immediately. It is crucial to allocate an ample area for parking meticulously designed to accommodate the influx of vehicles efficiently over the ensuing 15 years. Adopting a rigid pavement design within the envisaged facility ensures durability, while integrating interlock bricks for pedestrian pathways enhances safety and aesthetic appeal. Additional recommendations include instituting a prohibition on parking along adjacent roadways to guarantee the effective usage of the facility and strategically installing signposts to adeptly guide motorists. Such initiatives are projected to optimize the occupancy of the newly constructed parking spaces. Extensive landscaping within the project is also recommended, as the provision of shaded areas is anticipated to attract users, blending functionality with visual appeal. Lastly, executing a cost-benefit analysis is advocated to acquire insights into the project's economic viability, with the potential to augment its comprehensive value and efficacy. This holistic strategy is expected to substantially mitigate the prevailing parking challenges, facilitating long-term development and promoting convenience.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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## Appendices

*Appendix A*

Table A1 Presentation of Results for the Various Stations (Stations A, B, C &D)

Data Obtained on Day 1

Location: Kano Farm Center Market

Observers: B & U and three others employed

Station: A

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 7 | 15 | 10 | 10 | 9 | 13 | 12 | 10 | 10 | 2 | 2 | 10 | 4 | 2 | 0 | 4 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs(PCU) | | | 5 | 3 | 2 | 4 | 7 | 2 | 2 | 2 | 3 | 3 | 1 | 1 | 2 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 6 | 3 | 2 | 1 | 4 | 3 | 0 | 2 | 3 | 1 | 2 | 1 |

DAY: 2

| **STATION** | **OBSERVED TIME (10am-6pm)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 5 | 15 | 10 | 9 | 3 | 5 | 4 | 5 | 2 | 6 | 7 | 6 | 8 | 3 | 5 | 3 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 2 | 2 | 3 | 1 | 1 | 2 | 0 | 0 | 3 | 3 | 2 | 1 | 1 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 8 | 4 | 5 | 2 | 1 | 1 | 3 | 4 | 3 | 2 | 1 | 2 |

DAY: 3

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 19 | 10 | 25 | 17 | 11 | 8 | 9 | 11 | 6 | 7 | 15 | 12 | 12 | 6 | 7 | 5 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 4 | 1 | 3 | 1 | 2 | 2 | 3 | 1 | 1 | 3 | 1 | 1 | 0 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 8 | 6 | 4 | 3 | 2 | 1 | 3 | 1 | 1 | 5 | 6 | 2 |

DAY: 4

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 13 | 8 | 7 | 9 | 9 | 8 | 10 | 5 | 10 | 9 | 15 | 10 | 2 | 3 | 4 | 3 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 5 | 3 | 4 | 2 | 1 | 4 | 1 | 1 | 1 | 3 | 4 | 5 | 2 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 7 | 1 | 3 | 2 | 1 | 2 | 3 | 2 | 1 | 5 | 6 | 3 |

DAY: 5

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 25 | 5 | 15 | 11 | 17 | 11 | 7 | 5 | 7 | 13 | 12 | 7 | 8 | 7 | 3 | 2 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 6 | 4 | 1 | 1 | 3 | 4 | 2 | 1 | 2 | 1 | 1 | 4 | 2 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 5 | 4 | 3 | 2 | 1 | 4 | 2 | 2 | 1 | 2 | 1 | 1 |

DAY: 6

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 22 | 17 | 14 | 14 | 12 | 8 | 5 | 11 | 15 | 5 | 11 | 8 | 7 | 9 | 5 | 1 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 3 | 4 | 2 | 1 | 4 | 2 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 6 | 3 | 1 | 2 | 2 | 3 | 1 | 4 | 5 | 6 | 3 | 4 |

DAY: 7

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>A | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 7 | 7 | 13 | 14 | 13 | 11 | 7 | 5 | 13 | 9 | 8 | 4 | 9 | 8 | 11 | 1 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 4 | 3 | 2 | 1 | 0 | 2 | 3 | 2 | 3 | 1 | 1 | 1 | 3 | 2 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 9 | 7 | 5 | 3 | 4 | 2 | 2 | 2 | 5 | 3 | 2 | 1 |

Table A2 Presentation of Results for the Various Stations (Stations A, B, C &D)

Location: Kano Farm Center Market

Station: B

DAY: 1

| **STATION** | **OBSERVED TIME (10am-6pm)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 15 | 4 | 2 | 3 | 4 | 2 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 | 2 | 3 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 5 | 6 | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Number of repeatedly | | | | 4 | 4 | 1 | 2 | 3 | 2 | 3 | 1 | 1 | 0 | 2 | 0 | 1 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| observed 2hrs & above (PCU) | | | | | | | | | | | | | | | | |

DAY: 2

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 7 | 9 | 6 | 7 | 2 | 3 | 2 | 7 | 5 | 2 | 8 | 2 | 5 | 1 | 2 | 3 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 2 | 1 | 2 | 0 | 0 | 3 | 1 | 0 | 2 | 1 | 0 | 2 |

DAY: 3

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 15 | 10 | 6 | 4 | 15 | 5 | 10 | 3 | 4 | 3 | 6 | 7 | 4 | 5 | 2 | 3 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 8 | 4 | 3 | 1 | 2 | 3 | 0 | 2 | 2 | 1 | 0 | 2 |

DAY: 4

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 7 | 2 | 13 | 9 | 5 | 7 | 5 | 8 | 4 | 0 | 7 | 2 | 3 | 2 | 4 | 0 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 2 | 2 | 3 | 4 | 1 | 0 | 0 | 2 | 1 | 2 | 1 | 0 |

DAY: 5

| **STATION** | **OBSERVED TIME (10am-6pm)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 7 | 8 | 8 | 7 | 7 | 5 | 4 | 0 | 6 | 2 | 3 | 4 | 3 | 4 | 1 | 0 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 2 | 2 | 4 | 3 | 2 | 1 | 2 | 0 | 1 | 0 | 0 | 0 |

DAY: 6

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 6 | 8 | 8 | 3 | 6 | 2 | 6 | 7 | 1 | 3 | 7 | 2 | 3 | 2 | 4 | 1 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 2 | 1 | 0 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 2 | 1 | 0 | 3 | 0 | 4 | 0 | 3 | 4 | 3 | 0 | 2 |

DAY: 7

| **STATION** | **OBSERVED TIME (10am-6pm)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION B | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 2 | 9 | 2 | 4 | 6 | 3 | 2 | 2 | 1 | 2 | 3 | 0 | 1 | 3 | 0 | 0 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 0 | 0 | 3 | 2 | 1 | 0 | 0 | 3 | 1 | 0 | 0 | 4 |

Table A3 Presentation of Results for the Various Stations (Stations A, B, C &D)

Location: Kano Farm Center Market

Station: C

DAY: 1

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 23 | 23 | 12 | 14 | 12 | 14 | 9 | 11 | 4 | 9 | 8 | 5 | 9 | 6 | 13 | 4 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 11 | 6 | 5 | 2 | 3 | 4 | 3 | 1 | 2 | 3 | 3 | 0 | 1 | 0 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 |

DAY: 2

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 11 | 14 | 20 | 20 | 18 | 15 | 22 | 21 | 23 | 24 | 24 | 22 | 22 | 13 | 9 | 4 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 4 | 2 | 3 | 2 | 3 | 0 | 5 | 0 | 7 | 9 | 3 | 5 | 3 | 3 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 0 |

DAY: 3

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 7 | 8 | 12 | 15 | 6 | 18 | 10 | 10 | 7 | 18 | 13 | 14 | 10 | 12 | 6 | 2 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 2 | 1 | 2 | 3 | 0 | 2 | 7 | 0 | 1 | 2 | 1 | 2 | 4 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

DAY: 4

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 | 10:30 | 11:00 | 11:30 | 12:00 | 12:30 | 1:00 | 1:30 | 2:00 | 2:30 | 3:00 | 3:30 | 4:00 | 4:30 | 5:00 | 5:30 |

| | - 10:30 | - 11:00 | - 11:30 | - 12:00 | - 12:30 | - 1:00 | - 1:30 | - 2:00 | - 2:30 | - 3:00 | - 3:30 | - 4:00 | - 4:30 | - 5:00 | - 5:30 | - 6:00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of observed vehicle (PCU) | 4 | 1 | 7 | 9 | 13 | 10 | 12 | 11 | 13 | 9 | 12 | 5 | 11 | 13 | 10 | 4 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 0 | 0 | 2 | 3 | 0 | 0 | 3 | 0 | 1 | 2 | 0 | 3 | 2 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |

DAY: 5

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 5 | 8 | 7 | 9 | 6 | 6 | 10 | 6 | 7 | 8 | 7 | 6 | 14 | 8 | 10 | 3 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 1 | 1 | 2 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 5 | 2 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |

DAY: 6

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 - | 10:30 - | 11:00 - | 11:30 - | 12:00 - | 12:30 - | 1:00 - | 1:30 - | 2:00 - | 2:30 - | 3:00 - | 3:30 - | 4:00 - | 4:30 - | 5:00 - | 5:30 - |

| | 10:30 | 11:00 | 11:30 | 12:00 | 12:30 | 1:00 | 1:30 | 2:00 | 2:30 | 3:00 | 3:30 | 4:00 | 4:30 | 5:00 | 5:30 | 6:00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of observed vehicle (PCU) | 6 | 6 | 8 | 8 | 12 | 11 | 4 | 16 | 8 | 7 | 9 | 8 | 7 | 20 | 14 | 6 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 0 | 0 | 0 | 6 | 2 | 1 | 2 | 3 | 1 | 1 | 4 | 0 | 2 | 5 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |

DAY: 7

| ROAD | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION C | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 20 | 14 | 8 | 7 | 12 | 11 | 12 | 3 | 7 | 10 | 9 | 5 | 14 | 11 | 11 | 4 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 5 | 5 | 5 | 2 | 1 | 7 | 1 | 5 | 1 | 4 | 0 | 1 | 6 | 2 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |

Table A4 Presentation of Results for the Various Stations (Stations A, B, C &D)

Location: Kano Farm Center Market

Station: D

DAY: 1

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 8 | 6 | 8 | 2 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 4 | 6 | 3 | 2 | 6 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 2 | 3 | 4 | 2 | 1 | 2 | 1 | 0 | 0 | 2 | 0 | 1 | 3 | 3 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

DAY: 2

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 10 | 6 | 15 | 4 | 2 | 2 | 4 | 6 | 2 | 6 | 6 | 2 | 0 | 10 | 2 | 3 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 3 | 4 | 5 | 7 | 2 | 0 | 1 | 0 | 2 | 3 | 3 | 0 | 1 | 4 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

DAY: 3

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 11 | 6 | 3 | 3 | 10 | 6 | 4 | 4 | 5 | 2 | 8 | 4 | 5 | 4 | 3 | 11 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 4 | 3 | 1 | 2 | 3 | 1 | 0 | 2 | 3 | 1 | 3 | 0 | 2 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |

DAY: 4

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 13 | 5 | 6 | 10 | 7 | 5 | 3 | 5 | 5 | 6 | 8 | 5 | 3 | 3 | 3 | 5 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 6 | 3 | 2 | 1 | 4 | 3 | 0 | 2 | 3 | 1 | 3 | 2 | 0 | 1 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

DAY: 5

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 15 | 4 | 4 | 7 | 7 | 5 | 3 | 2 | 5 | 5 | 3 | 4 | 3 | 4 | 4 | 0 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 8 | 4 | 3 | 1 | 2 | 1 | 3 | 0 | 2 | 2 | 1 | 0 | 2 | 1 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

DAY: 6

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 8 | 6 | 9 | 5 | 6 | 3 | 7 | 4 | 3 | 4 | 5 | 2 | 4 | 4 | 3 | 1 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 2 | 2 | 3 | 3 | 2 | 4 | 1 | 0 | 0 | 2 | 1 | 2 | 1 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

DAY: 7

| STATION | OBSERVED TIME (10am-6pm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION<br><br>D | 10:00 - 10:30 | 10:30 - 11:00 | 11:00 - 11:30 | 11:30 - 12:00 | 12:00 - 12:30 | 12:30 - 1:00 | 1:00 - 1:30 | 1:30 - 2:00 | 2:00 - 2:30 | 2:30 - 3:00 | 3:00 - 3:30 | 3:30 - 4:00 | 4:00 - 4:30 | 4:30 - 5:00 | 5:00 - 5:30 | 5:30 - 6:00 |
| Number of observed vehicle (PCU) | 4 | 6 | 4 | 3 | 3 | 3 | 1 | 3 | 1 | 3 | 5 | 3 | 2 | 3 | 2 | 1 |
| Number of repeatedly observed vehicles ≥ 1hr <2hrs (PCU) | | | 1 | 1 | 2 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 2 | 2 | 0 |
| Number of repeatedly observed 2hrs & above (PCU) | | | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Appendix B1

**Table B1** Conversion factors of passenger's car equivalent for parking lot and minimal standard of parking lots

| | |
|---|---|
| Private cars, Tax, Light goods vehicles | 1.00 |
| Medium/heavy goods | 2.00 |
| Busses, Coaches, Trailer, Lorries | 3.00 |
| Motor-cycle | 0.75 |
| Pedal-cycle | 0.35 |

Source: Samson 2012

| Angle | Dimensions | | | | One Way Traffic | | Two Way Traffic | |
|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I |
| $30^0$ | 8.5 | 17 | 16.4 | 32.7 | 12 | 44.7 | 24 | 56.7 |
| $45^0$ | 8.5 | 12 | 18.7 | 26.5 | 14 | 51.4 | 24 | 61.4 |
| $60^0$ | 8.5 | 9.8 | 19.8 | 22.9 | 16 | 55.6 | 24 | 63.6 |
| $90^0$ | 8.5 | 8.5 | 18 | 18 | 22 | 58 | 24 | 60 |

Source: University of Houston 2014

| | |
|---|---|
| Private cars, Tax, Light goods vehicles | 1.00 |
| Medium/heavy goods | 2.00 |
| Busses, Coaches, Trailer, Lorries | 3.00 |
| Motor-cycle | 0.75 |
| Pedal-cycle | 0.35 |

Source: Samson 2012

**Figure B1** Pictures showing the situation of the study area

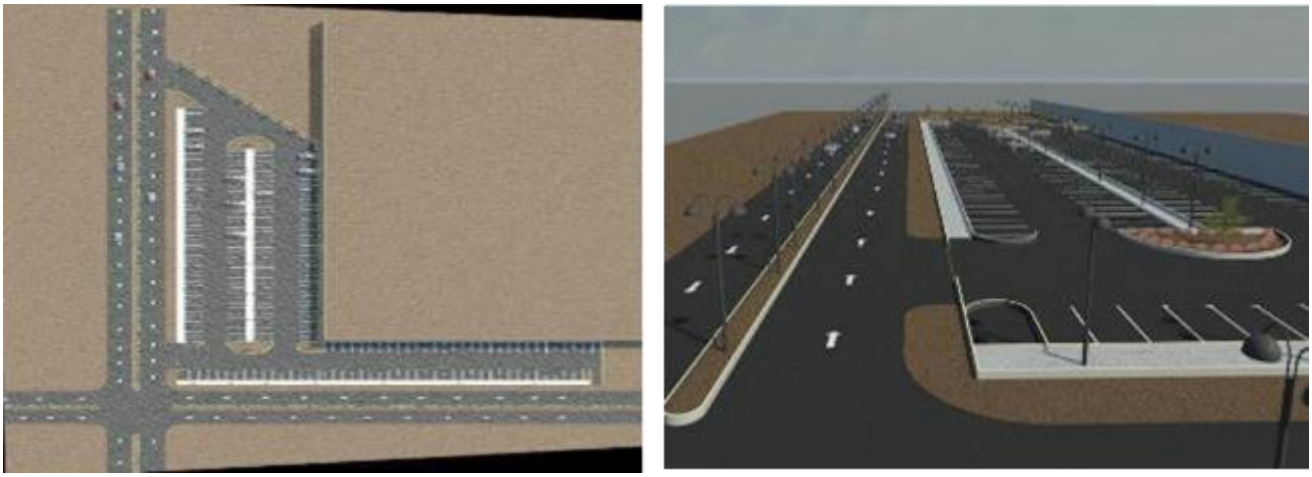

**Figure B2** Proposed parking facility plan