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Addressing the Need for Car Parking Lot Shortage in Addis Ababa City Administration

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Abstract

Parking plays an important role in mobility, access and the economic development of Addis Ababa. Now a day, parking in the city of Addis Ababa is becoming a crucial service, this is due to rapid growth of vehicles and the demand for parking is increasing. Parking service now a day faces different challenges in Addis Ababa. The general objective of this study is to assess the need for addressing parking lot shortage in Addis Ababa in some selected on street and off-street parking facilities. This research employed both probability (multi stage stratified sampling) and non-probability (purposive) sampling techniques for selecting representative sample for the study. Hence, a total of 400 sample units were included in the study which has been taken from Bole and Yeka Sub cities. This study also employed a concurrent mixed triangulation method and data were collected using appropriate data gathering techniques such as survey questionnaire, interview and observation methods. Moreover, this research has used secondary data from parking management office. The data gathered is analyzed to answer the research questions using appropriate statistical methods such as descriptive analysis of questionnaire data as well as narrative analysis of interview data. Findings in this research work show mainly iproper use of on street parking and inadequate off-street parking that absorb the demand of parking that leading to illegal parking, double parking also resulting in narrowing road carriage way width and aggravating bad traffic flow. In conclusion the existing on street parking places in the selected routes are not properly used and inadequate to accommodate the existing demand and leading to traffic flow problems and traffic congestions. As a recommendation, the researcher forwarded a combined solution of legislative, economic, engineering and technological measures,

***Key words**: parking, on-street, off-street, parking accumulation, traffic flow*

Background of the study

The rapid population expansion in major cities has brought the significant contradiction between urban traffic supply and demand (China City, 2010; Wu et al., 2017). The challenges of parking spaces seen in urban cities are claimed to be caused by urbanization, rapid increases of car dependence, high densities of the city and economic transition (Shoup, 2005). Parking plays an important role in the transport system since all vehicles require a storage location when they are not being used.

The availability of less space in urban areas has increased demand for parking space especially in central business area. Hence, failure to meet parking demand of people in a city result to on-street parking which later brings to traffic congestion (Shoup, 2007). To this end, it is essential to modify the operation system for parking based on user's demand and space availability. Traffic congestion caused by vehicles is an alarming problem at a global scale and it has been growing exponentially. Car parking problem is the major contributor to congestion in the city. The rapid growth in the number of vehicles worldwide is raising the problem of the scarcity of parking space. According to industry data, 30% of the traffic congestion occurs due to the struggle of vehicle drivers to find parking space (Dharma et al, 2013). Moreover, a survey made by White (2007) also shows that during rush hour in most big cities, the traffic generated by cars searching for parking spaces takes up to 40% of the total traffic. Searching for a parking space is a routine activity for many people in cities around the world. This search burns about one million barrels of the world's oil every day. The problem will get worse as the global population continues to urbanize without a well-planned car parking management.

A study conducted by Shoup (2006) clearly shows that in a business district of Los Angeles, vehicles looking for parking burn 47,000 gallons of gasoline and produced 730 tons of carbon dioxide, which is equivalent of 38 trips around the world. This study clearly indicated that the problem associated with parking imposes significant societal, economic and ecological costs.

Lack of public parking is the major parking problem in Africa and this can be easily observed in major cities. According to the survey conducted by Step & Mint (2011a) in Nigeria reported that, Cairo's public parking infrastructure could only accommodate 5.2% of its cars, Lagos 6.7% of its cars and Johannesburg had a ratio of 8 cars per public parking space. Like most African cities, Addis Ababa, has been experiencing huge rapid population growth and Urbanization. The overall growth of car far exceeds public parking infrastructures. In Ethiopia, the total number of vehicles increased by 65% on average from 2013-2020 (FTA, 2020). Due to the dynamic change and the life style of the city dwellers, people in the city prefer to travel by vehicles from place to place since major facilities and public services like market area, schools, religious centres, offices and the like are concentrated in the city centre. This demand has led to the development of transportation but adversely affect the effective uses of road due to lack of parking space in city.

Generally, parking problem is nowadays one of the major issues in urban transportation planning and traffic management research. Thus, in order to address these problems associated with parking, the present study tries to assess the need for addressing car parking lot shortage in Addis Ababa City Administration.

Proliferation in the number of vehicles in Ethiopian in general and Addis Ababa in particular is leading to problems of vehicles parking at an appropriate place especially in the city centre. Shoup*et al.*(2005) reported that searching a parking space becomes a common challenge, faced by millions of city-dwellers every day due to the significant and substantial increase in the demand for parking space in cities and urban areas. Similarly, according to the report of Litman (2006),the quantity of available parking spaces close to the users' destination is becoming a challenging issue on one hand while the efficient use of the available parking places is still a nightmare; that means, it is very difficult to find a free parking space during the day time in all the streets close to the city centre.

In the recent years, a large number of new registered vehicles were reported by FTA in Ethiopia compared to the previous years, which indicates 65% increase in a span of 7 years. The current transportation infrastructure and car parking facilities are believed to be insufficient in sustaining the influx of vehicles on the road. Thus, the overall growth of vehicles far exceeds parking infrastructure, particularly public parking. Moreover, the parking spaces that are supplied in most areas are not necessarily used as efficiently as they could be. Public parking spaces that are available in the city often do not have time limits. This indicates a space in a high demand area for parking may be taken by some individuals for most of the working hours.

Based on the researcher casual observation, large number of cars was parked on streets. Moreover, there is also inadequate car parking supply in the city centre particularly near to high story buildings and public areas like hotel, market malls, hospitals, schools/colleges, religious centres, offices, cinemas, apartments, stations and others. This serious scarcity of parking spaces in the city might be due to less attention is given during the

preparations of local development plans, rapid urbanization, high densities of the city and economic transition. Moreover, a sharp rise in vehicular ownership, rapid increases of car dependence and insufficient transit system give rise to the huge on-street parking demand leading to a reduction in effective carriageway width and creating unnecessary traffic congestion. These in turn leads to long travel time or delay to reach destination that affect business users' time productivity. Moreover, due to shortage of available parking spaces in the city, drivers' are forced in searching parking lot for long time and thus vehicles are consuming more fuel and emitting high amount of CO_2 to the environment as well as it also decrease the average traffic flow speed of vehicle in peak hour. Furthermore, as a result of inefficient on street parking space management, vehicle drivers are involved in illegal parking blocking roads which in turn drivers become idle by waiting the parking lot. In short, due to inadequacy of convenient and affordable parking supply in the city centres, social, economic, and environmental impact are still prevail.

In order to counterpoise the problem, recently technical/organizational and regulatory improvement has mainly focused on public and private transport mobility within urban areas; however, parking has been given less attention. Although measures like on-street parking and surface parking supplies are established in few pocket areas of the city by the concerned authorities, it remains that these solutions do not absorb all of the demand which is constantly increasing.

To date, there are few published and unpublished researches that have been attempted by scholars dominantly as part of partial fulfilment of master's degrees in Ethiopia. For instance to mention few: Ashenafi had conducted a research under the title "Challenges and Opportunities of Car Parking in Addis Ababa city" in 2014 with the objective to assess the Situation of Car Parking which is the fundamental challenge facing the city of Addis Ababa. Moreover, Mengistu had conducted a research under the title "Analysing and Optimization the Car Parking Space in Addis Ababa: The Case of Addis *Ketema* Sub-city" in 2018 with an objective to analyse the current car parking system of Addis Ababa and optimize of parking space by developing the space optimization Mathematical model to improve parking service. Furthermore, Sofiya had also conducted research under the title "Problems Associated with On-Street Parking Lots in Addis Ababa: The Case *Nifas silk* Sub city, Wereda 1" in 2019 with the objective to assess the problems associated with parking problems in Addis Ababa city.

Hence, based on the researcher assessment all of the above listed studies in Addis Ababa had limitation in approach, methodology and coverage. In terms of approach they are largely focused to on-street parking problem from the demand side point of view and fully relied using primary (questionnaire) data collected from customers only. Moreover, the studies were not guide by conceptual framework/theory. In terms of Methodology, they were mainly employed quantitative analysis; the application of mixed research method was absent. In terms of coverage and scope, those studies were limited only in single Sub-city or Woreda. Thus, none of the above scholars have explored to address the need for car parking lot shortage in Addis Ababa City particularly by focusing to wards to: evaluate the current car parking strategies and practice, assess the perception of users on the existing car parking facilities, explore the main factor that affects car parking supply as well as analyse the impact of car parking limitation on traffic flow/ driving time in the city of Addis Ababa.

Therefore, the present study wants to dig out/address the need for car parking lot shortage in the city of Addis Ababa and provide feasible solutions to the existing problem. The research comprises both the general and specific objectives that will address the existing parking problem of the city.

Research Methodology

Research Approach /Design

Taking in to account of the description of different world views, this research adopts the pragmatist approach so as to make use of different data type, methods, techniques and procedures in the light of the objective of the study. As a research that adopts the pragmatist world view, this study will follow the mixed research approach because pragmatism is a philosophical underpinning for mixed method studies. The mixed approach method is methods that combine both qualitative and quantitative approaches in the study and thus the overall strength of the research process is by far greater than using only either of the two.

Research Method/Type

This study employed both explanatory and descriptive research types by establishing concurrent triangulation to complement strengths and overcome their weakness. The selected approach will help the researcher to confirm, cross-validate and corroborate findings within the study. In terms of time span, the study will be conducted using cross-sectional survey design and hence quantitative data will be gathered at one point in time from sample drivers while at the same time qualitative data will be collected from key informants (operators and transport managers) to get several views about the issue under discussion. The assessment of the need for car parking issue is a comprehensive examination in the light of universally accepted principles of transport management approaches by taking in to account a descriptive and explanatory research types; because using descriptive and explanatory types of study will provide a better ground to describe and explain the problem.

Data Type

The types of data that were collected to provide adequate and sufficient answer to the research questions will be both qualitative and quantitative data in nature. The Quantitative data derived from structured questionnaires administered to the target sample road users. Qualitative data were extracted through document analysis and review (example policy, regulation, reports and others) as well as through in-depth key informant interviews to corroborate the quantitative results. Regarding scale measurement, the main type of data included in the study will be nominal, ordinal and interval scale in nature.

Data Source

The main sources of data for this study are primary and secondary data. Primary sources of data are the observable reality in the field, responses of sample drivers and interviews with car parking operators-managers and wardens as well as transport authority managers. Data will be collected with the help of closed ended and open ended questionnaires prepared for drivers and interview will be formally held to discuss and share about their experiences to contribute a lot to the research. The secondary sources of data are a range of documents including policies, laws, regulations, car parking operators' records, police records, census data and data from different institutions as well as publications from the libraries.

Method of Data Collection

A strategy combining different methods of data collection is required to effectively address the research objectives and research questions. Moreover, it will be important to employ a combined data collection strategy since car parking management practice involves relation with different stakeholders. As such, multiple sources of evidences and various methods of data collection will be used. These include document review, field observation, interview and questionnaires.

Sampling Technique

In this research, both probability and non-probability sampling techniques will be employed. A stratified sampling followed by convenient sampling technique will be used to select sample survey respondents (drivers who used car parking boxes) from each of the purposively identified car parking sites. A non-probability sampling (purposive) techniques will be employed to determine the study key informants or interviewees from operators/parking enterprise and transport authorities. Therefore, in this survey research about 384 samples will be drawn using the unknown population sample size determination formula which includes all the respondents from the four car parking sites/traffic analysis zones.

Sample Size

The sample size depends on the type of study, size of the population and the level of confidence set and acceptable error. The most commonly used is 95% level of confidence with 5% error margin will be selected for this type of study. In order to determine the sample size for the questionnaire survey respondents, the population in the study is unknown. Hence, for a population that is not known precisely, the sample size (n) will be determined using Equation given below:

$$n = \frac{z^2 * p * (1-p)}{e^2} = \frac{(1.96)^2 * 0.05 * (1-0.5)}{(0.05)^2} = 384$$

Where: n = sample size, z= standard normal variable at the required confidence interval (CI), e = Margin of error and p = the estimated characteristics of target population standard deviation (degree of variability). Using the commonly used value of 95% CI (Z-score = 1.96) with margin of error e = 5% and a standard deviation of p = 0.5 would yield a sample size of 385. However, in order to increase the representativeness of the sample and to secure the minimum sample size, given that there would be always "no returns" and "lost case", the survey

will be administered with sample size (385) by 5% increase to get 400. The increase also served as another significant purpose; first the variable addressed in the study are many that need increased sample size to detect significant relationships or differences; second, increase sample size will decrease sampling error; third, descriptive studies needs larger samples for finally improving the credibility of the entire survey process.

The 400 sample size will be divided in to four in order to get equal number of sample respondent drivers from each of the identified car parking operation sites or analysis zones. Here, the researcher conveniently assigned 100 drivers that could be included in the study as a sample for each of the traffic analysis zone. As it is clearly depicted in the table 3.2 given below, the number of questionnaire will be equally distributed to the entire sample in each of the study sites.

Table 3.1: Distribution of Sample Driver for Survey

Sub city	Selected Parking Site (Traffic Analysis Zone)	No. Sample Drivers
Bole Sub city	Friend Ship Off-street Parking	100
	Atlas to Sheger Building On-street Parking	100
Yeka Sub city	Megenagna Off-Street Parking	100
	Shola Gebeya On-Street Parking	100
Total		400

Source: Researcher, 2021

For qualitative data, eight interviewees were included in the qualitative studies from the two sub cities particularly from four car parking facilities; more specifically two on-street and two off-street parking facilities were included. Moreover, four transport planners/managers will be purposively selected and interviewed from AATMA. These target interviewees' are chosen purposively because they are expected to be more experienced and knowledgeable to provide relevant information to the study based on their level of administrative position and duty. The process of collecting data will be carried out during February 2021. The interview process is based on an interview guide to all interviews with a range of 30-45 minutes so as to manage time and allow participant to discuss the issue in detail.

Table 3.2: The Selected Key Informants for In-Depth Interview for Qualitative Data

Subject	No. of Key Informants
Car Parking Operation Managers/Chairs	4
Wardens/Parking Controllers	4
Transport Planners/Managers/Heads	4
Total	12

Source: Researcher, 2021

Method of Data Analysis

Both Qualitative and quantitative analytical tools are used to analyse the collected data. For a more accurate and reliable outcome, the concurrent triangulation procedure that includes aspects of the two main tools will be followed. Qualitative data analysis is started in the field and information was checked daily on a continuous basis. Answers to the research questions were offered based on the themes.

Quantitative data Analysis tools is used to analyse data gathered through questionnaires. The response to each item in the questionnaire are organized and stored electronically in recognizable data formats with relevant codes. Using SPSS software, the process to each closed ended questions was tallied and percentages obtained to describe the result. Descriptive statistical tools such as tables, charts, and graphs will be used to present the basic characteristics of data.

Validity, Reliability and Ethical Consideration

Validity: To insure construct validity, the variables included in this research will be operationally defined by taking in to account the concepts from literature on car parking market/economy. Moreover, to maintain internal validity, careful sampling, appropriate instrumentation and appropriate statistical

treatment of the data will be done. Furthermore, to minimize the threat of external invalidity, the studies will analyses data from various research components to derive objective outcomes and inferences.

Reliability: To insure reliability in this research, all the data gathering instruments will also be attached at the end as annex. Moreover, Cronbach Alpha or coefficient of alpha will be calculated to measure the reliability of the data gathering instrument (i.e. questionnaire).

Ethical Consideration: The respondents will be informed about the intention of the instrument and the objective of the research; and hence they will be free to express their opinion and willingness. Moreover, personal opinion will be treated with anonymity and confidentiality. In addition to this, the questions will be expressed in the way that the respondents' privacy is reserved and that they will be treated with respect. Furthermore, maximum care will be taken during data coding and analysis.

Finding, Result and Discussion

Demographic characteristics of the study population

A total of 386 motor vehicle drivers participated in the study and respondents were asked to indicate their background information. Of the total of 386 respondents, majority 324 (83.9%) were male drivers whereas the remaining 62 (26.1%) were female drivers. This clearly shows that the proportion of male drivers was significantly greater than female in the study. With a spectrum of age, majority 178 (46.1%) of sample respondents falls in the ranging between 30 and 39 years and followed by 18 to 29 years constituted 117 (30.3%). About 65 (16.8%) were between 40 and 49 years and also 26 (6.7%) were between 50 and 59 years. This indicates that majority of the sample drivers included in the study tend to be young between the age of 18 and 39 years.

Majority 175 (45.3%) of sampled respondents were recorded as degree holder and above followed by Diploma/Level 1-5 and High school accounting 96 (24.9%) and 90 (23.3%) respectively. This shows that majority of the sample drivers were degree holders and above which could contribute to the best understanding of the parking facility problems.

Regarding the type of vehicles driven, majority 228 (59.1%) of sample drivers were driving their own private car, 59 (15.3%) of them were driving public bus, 48 (12.4%) of them were operated freight vehicles and the remaining 23 (6%) of drivers were driving other types of vehicles (government owned vehicles). This indicates that majority of the sample drivers operated their own private car.

Analysis off- Street Parking

Megenagna Off-street Parking Facility

This facility is located in the heart land of *Yeka* Sub city near to *Zemnesh* Grand Mall at *Megenagna* area. The total area of parking facility is about 3387.33m^2 which has a total parking capacity/occupancy space of 150 vehicles at a time. The surface level of the facility is made of cobel stone. The land use system of the area is commercially dominated where there are a number of commercial buildings, hotels, cafeterias, shops, banks, malls as well as some public offices.

The parking inventory has been carried out for 12 hours by trained data collectors to provide context to the levels of parking service in each of the survey time/period. A summary of the results from the parking surveys of *Megenagna* surface parking on three days of the week are summarized in figure 1, 2 and 3 given below.

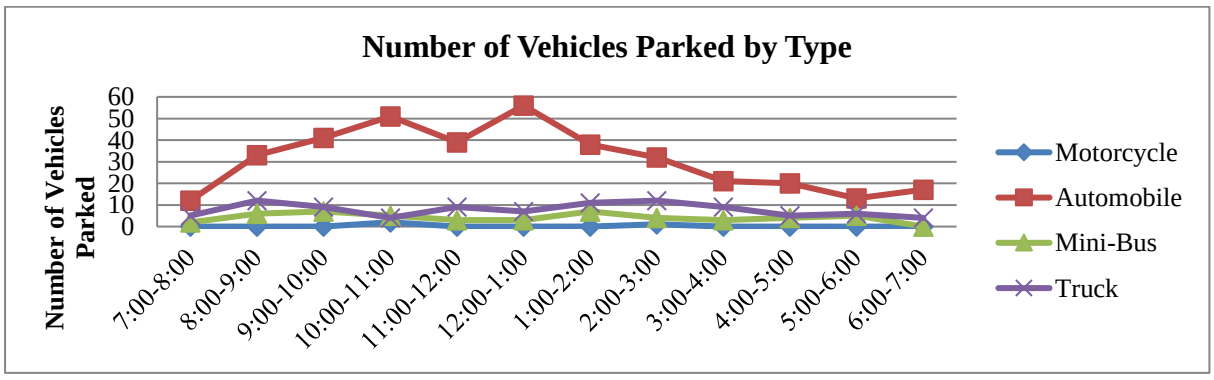

Figure 1: Parking Survey Results of February 16th, 2021 (Tuesday) at *Megenagna* Surface Parking

Source: Field Survey, 2021

The number and types of vehicles parked in *Megenegna* surface parking at an hourly interval on Tuesday, February 16th, 2021 are realized as shown in the figure above. Figure 1 clearly indicated that, the highest parked vehicles are identified 12:00am to 1:00pm followed by 10:00am to 11:00am. More specifically, the highest deposit of automobile, mini-bus and trucks are observed at 12:00am to 1:00pm followed by 10:00am to 11:00am; highest parked mini-bus are identified at 9:00am to 10:00am and 1:00pm to 2:00pm while the highest parked trucks are observed at 8:00am to 3:00am and 2:00pm to 3:00pm. Very small parked motorcycles are existed throughout the whole survey time period.

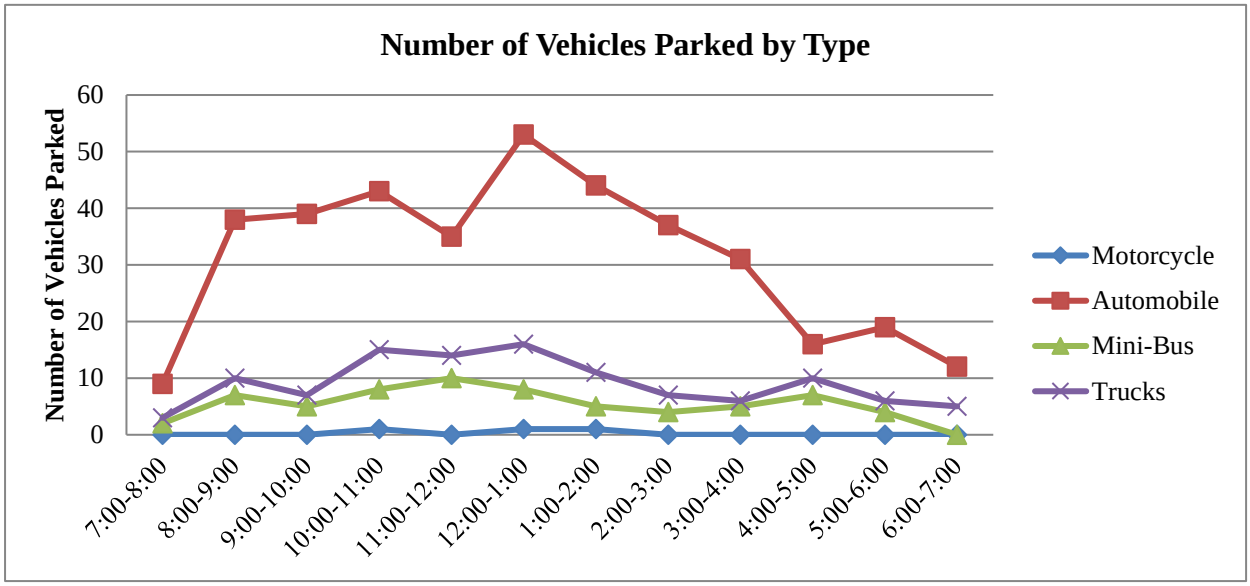

Figure 2: Parking Survey Results of February 18th, 2021 (Thrusday) at *Megenagna* Surface Parking

Source: Field Survey, 2021

The number and types of vehicles parked in *Megenegna* surface parking at an hourly interval on Thursday, February 18th, 2021 are realized as shown in the figure above. Figure 2 clearly indicated that, the highest parked vehicles are identified 12:00am to 1:00pm followed by 10:00am to 11:00am. More specifically, the highest deposit of automobile, mini-bus and truck are observed at 12:00am to 1:00pm, 11:00am to 12:00am and 12:00am to 1:00pm respectively. Very small parked motorcycles are existed throughout the whole survey time period.

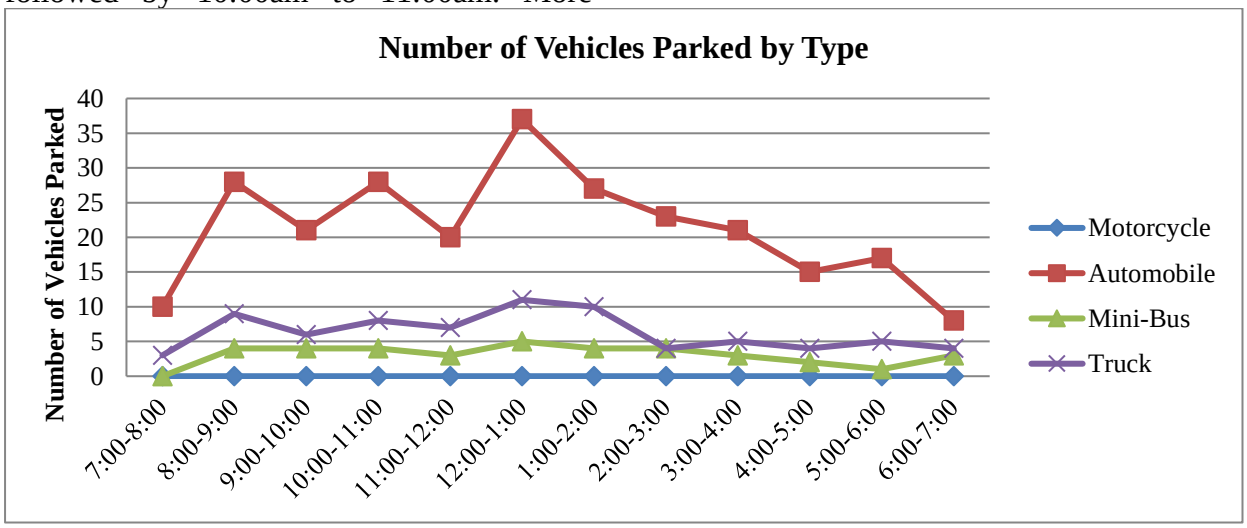

Figure 3: Parking Survey Results of February 20th, 2021 (Saturday) at *Megenagna* Surface Parking

Source: Field Survey, 2021

The number and types of vehicles parked in *Megenegna* surface parking at an hourly interval on Thursday, February 20th, 2021 are realized as shown in the figure above. Figure 3 clearly indicated that, the highest parked vehicles are identified 12:00am to 1:00pm. More specifically, the highest deposit of both automobile, mini-bus and truck are observed at similar time of the day, i.e., 12:00am to 1:00pm. No motorcycle is existed throughout the whole survey time period.

Addis Hiwot Off-street Parking Facility

This facility is located at Bole Sub city on the main road to Bole International airport next to Friendship Grand Mall (in front of Millennium Hall). The total area of parking facility is about 8340.27m^2 which has a total parking capacity/occupancy space of 176 vehicles at a time. The surface level of the facility is made of red ash. The land use system of the area is commercially dominated where there are a number of commercial buildings, malls, hotels, cafeterias, supermarkets, shops, cinema hall and banks. The parking inventory has been carried out for 12 hours by trained data collectors to provide context to the levels of parking service in each of the survey time/period. A summary of the results from the parking surveys of *Addis Hiwot* surface parking on three days of the week are summarized in Figure 4, 5 and 6 below.

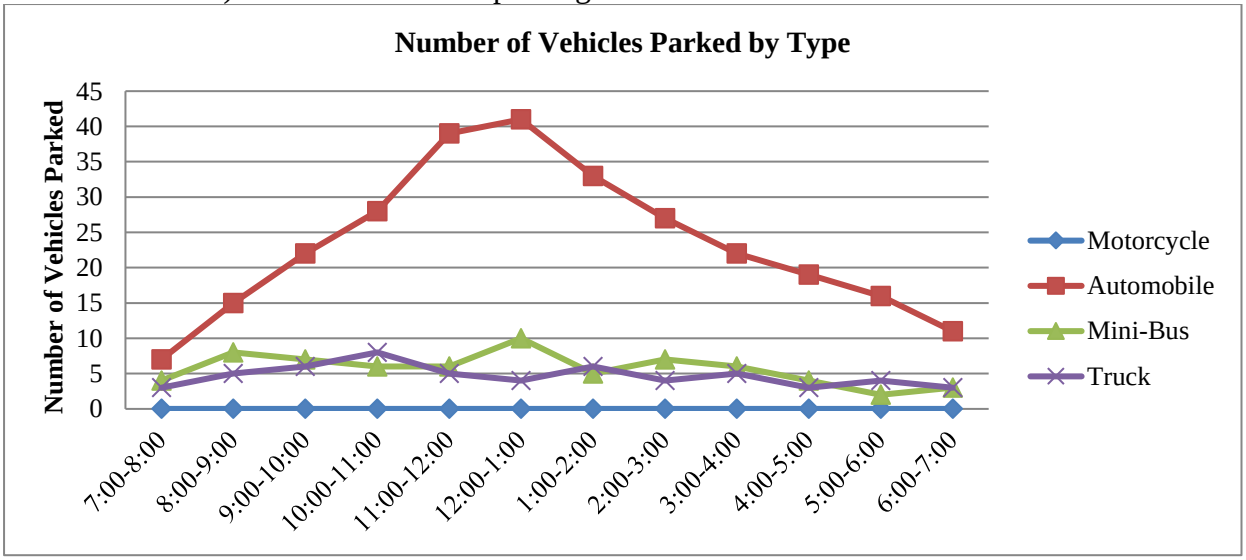

Figure 4: Parking Survey Results of February 16th, 2021 (Tuesday) at *Addis Hiwot* Surface Parking
Source: Field Survey, 2021

The number and types of vehicles parked in *Addis Hiwot* surface parking at an hourly interval on Thursday, February 16th, 2021 are realized as shown in the figure above. Figure 4 clearly indicated that, the highest parked vehicles are identified 12:00am to 1:00pm followed by11:00am to 12:00am. More specifically, the highest deposit of automobile are observed at 12:00am to 1:00pm followed by 11:00am to 12:00am; highest parked mini-bus are observed at 12:00am to 1:00pm followed by 8:00am to 9:00am while the highest parked trucks are identified 10:00am to 11:00am. No parked motorcycle is existed throughout the whole survey time period.

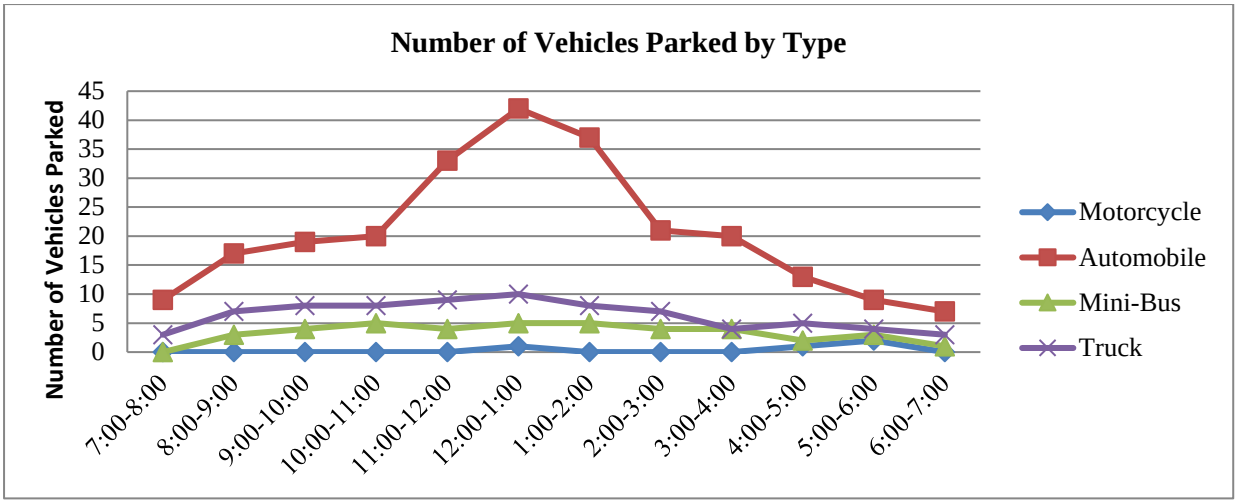

Figure 5: Parking Survey Results of February 18th, 2021 (Thrusday) at *Addis Hiwot* Surface Parking
Source: Field Survey, 2021

The number and types of vehicles parked in *Addis Hiwot* surface parking at an hourly interval on Thursday, February 18th, 2021 are realized as shown in the figure above. Figure 5 clearly indicated that, the highest parked vehicles are identified 12:00am to 1:00pm followed by1:00pm to 2:00pm. More specifically, the highest deposit of automobile are observed at 12:00am to 1:00pm followed by 1:00pm to 2:00pm; highest parked mini-bus are observed at both 10:00am to 11:00am, 12:00am to 1:00pm and 1:00pm to 2:00pm while the highest parked trucks are identified 12:00am to 1:00pm. Very small number of parked motorcycle is existed throughout the whole survey time period.

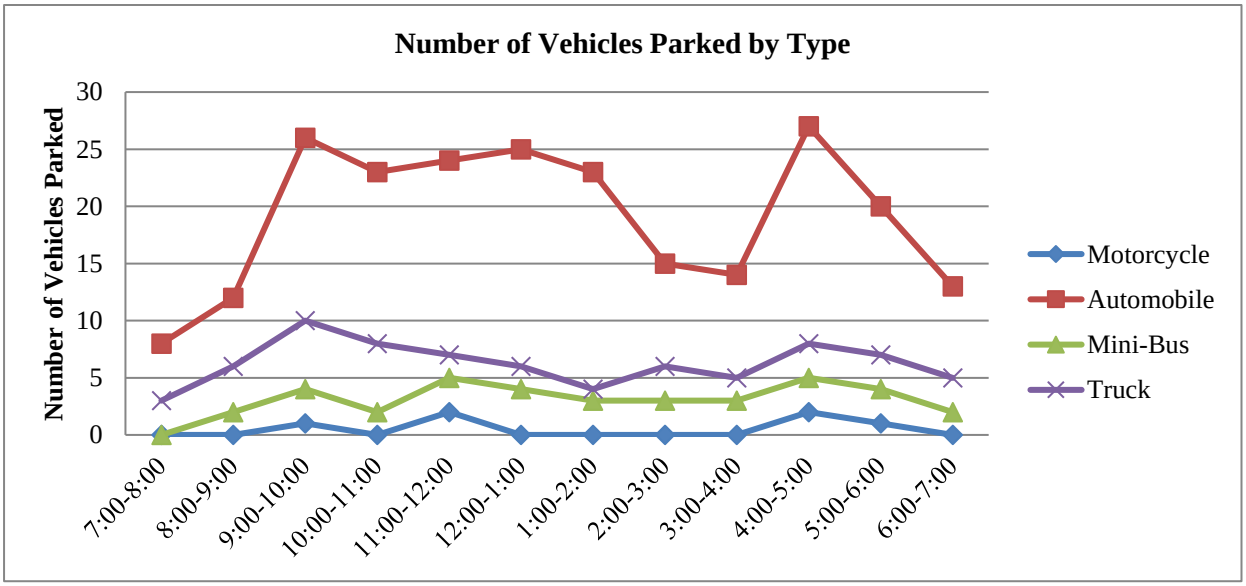

Figure 6: Parking Survey Results of February 20th, 2021 (Saturday) at *Addis Hiwot* Surface Parking

Source: Field Survey, 2021

The number and types of vehicles parked in *Addis Hiwot* surface parking at an hourly interval on Thursday, February 20th, 2021 are realized as shown in the figure above. Figure 6 clearly indicated that, the highest parked vehicles are identified 4:00pm to 5:00pm followed by 9:00am to 10:00am. More specifically, the highest deposit of automobile are observed at 4:00pm to 5:00pm followed by 9:00am to 10:00am; highest parked mini-bus are observed at both 11:00am to 12:00am and 4:00pm to 5:00pm while the highest parked trucks are identified 9:00am to 10:00am. Very small number of parked motorcycle is existed throughout the whole survey time period.

Analysis on Street Parking

Street Shola Gebeya

The section is located in between the main streets along Yeka Subcity Traffic Police Building to Leme Hotel Controlled Trafic Light with both ends left and right sides. The total stretch length from start to end is about 400.08 meters. Most of the land use system in the left and right side of the streets are Shola Gebeya Market and types of different shops.

In order to analyse the parking survey results, a calculation has been carried out to provide an estimate of the total parking capacity of each segments left and right side of the route. The estimate is based upon the kerb length of each segment minus areas where parking restrictions and/or and junctions that prevent parking. The parking length is then divided by 5.9m to convert the length into an approximate number of parking spaces since the parking configuration is parallel. The estimated parking capacity along the road section has then been used to provide context to the levels of parking recorded in each of the survey time/period. A summary of the results from the parking surveys on the selected street on three days of the week are summarized in figure 7, 8 and 9 below.

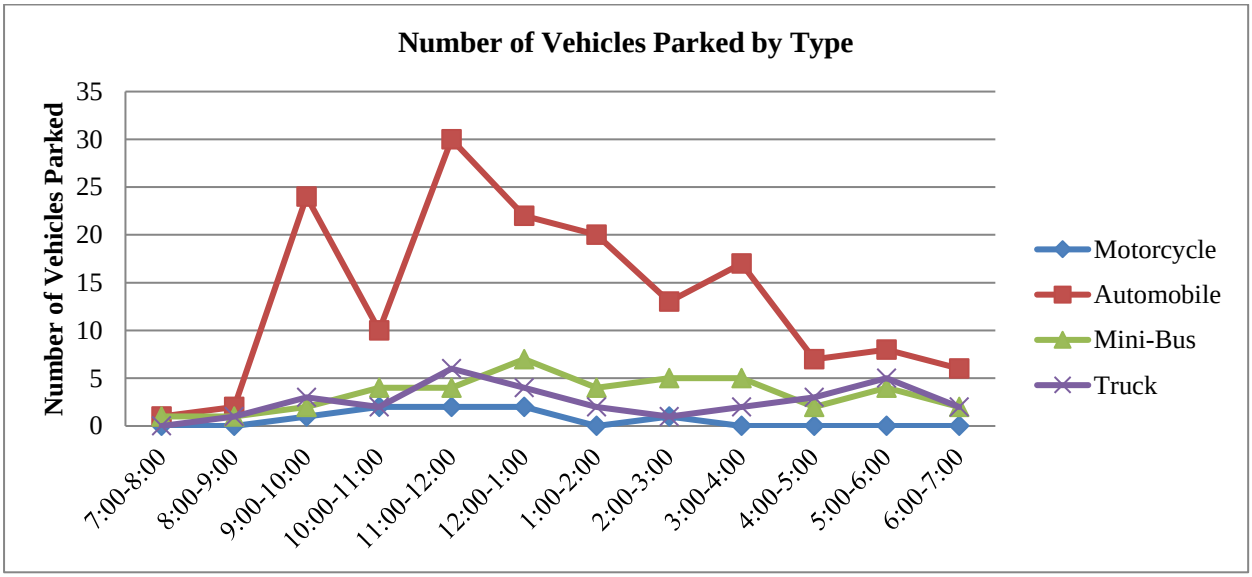

Figure 7:Number of Vehicles Parked along a selected route *Shola Gebeya*
Source: Field Survey, 2021

The number and types of vehicles parked at an hourly interval on Tuesday, February 16th, 2021 are realized as shown in the figure above. Figure 7 clearly indicated that higher deposit of Automobiles and trucks were recorded in the morning between 11:00am to 12:00am where as higher numbers of mini-bus were recorded between 12:00am to 1:00pm. In this selected route almost majority of the parking spaces where occupied by Automobile. During the survey period, very few parked motorcycles are observed.

Shola Gebeya Market acts as a center gravity that attracts different types of automobile, taxi and light trucks including pickup and *Isuzu* in the area. Thus, a number of taxis and trucks were parking on the street for loading and unloading of goods for those people who came to the market. The trucks and taxis reason for parking is for waiting place till they get a market opportunity to work.

As can be seen from the table 4.8, the highest number parked vehicles were observed in the right side of the selected route (from Yeka Traffic Police Office to the intersection near Lem Hotel traffic light). Moreover, the high vehicle accumulation on the street spaces is identified from 11:00am to 12:00am, followed by 12:00am to 1:00pm and 3:00pm to 4:00pm.

In all the survey times' considerable amount of illegally parked vehicles are observed. In the area, the available spaces are few while the amount of vehicles parking is more than the allowable capacity which possibly leads to double parking and irregular positioning of vehicles. This illegal parking in turn reduce the capacity of streets which later narrowing the width of the road and hence increased traffic congestion, the journey speed drops down, the journey time and delay increases as well as the operational cost of vehicles increased, causing economic loss to the community. The number of vehicles parked in the

right side of the selected route is greater than the left side.

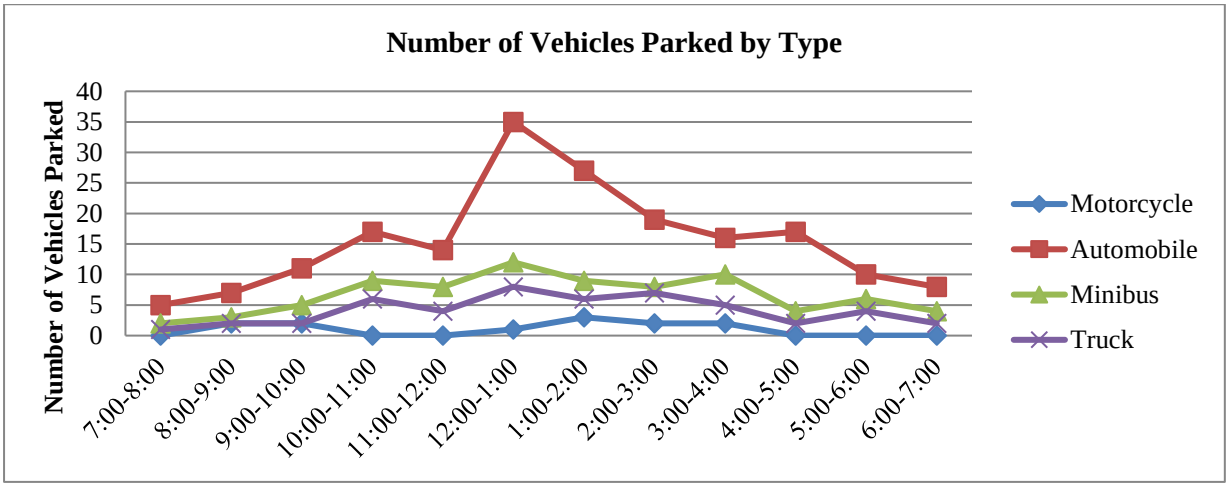

Figure 8: Number of Vehicles Parked along a selected route Shola Gebeya Thursday, February 18th, 2021

Source: Field Survey, 2021

The number and types of vehicles parked at an hourly interval on Thursday, February 18th, 2021 are realized as shown in the figure above. Figure 8 clearly indicated that higher deposit of automobiles; mini-bus and trucks were recorded in the morning between 12:00-1:00am. In this selected route almost majority of the parking spaces where occupied by Automobile. During the survey period, very few parked motorcycles are observed.

As can be seen from the table 4.9, the highest number parked vehicles were observed in the right side of the selected route (from Yeka Traffic Police Office to the intersection near Lem Hotel traffic light). Moreover, the high vehicle accumulation on the street spaces is identified from 12:00am to 1:00pm, followed by 1:00pm to 2:00pm and 2:00pm to 3:00pm (after noon). The number of vehicles parked in the right side of the selected route is greater than the left side.

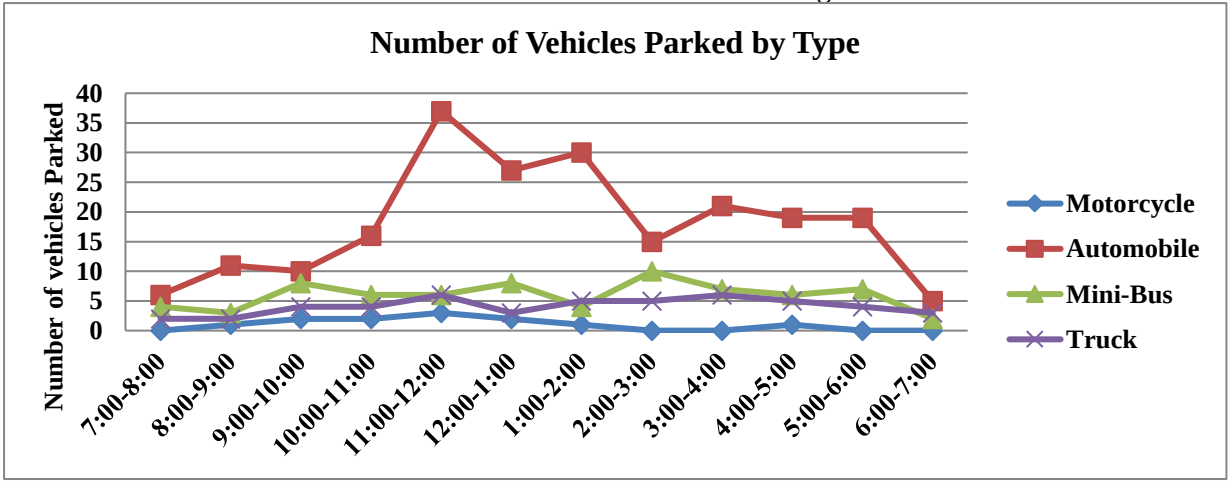

Figure 9: Number of Vehicles Parked

Source: Field Survey, 2021

The number and types of vehicles parked at an hourly interval on Saturday, February 20th, 2021 are realized as shown in the figure above. As can be seen from the figure 9, the highest accumulations of parked Automobiles are observed from 11:00 am to 12:00 am in the morning followed by 12:00 am to 1:00 pm, 1:00 pm to 2:00 pm in the afternoon. The highest numbers of parked Mini-Bus are identified at 2:00pm to 3:00pm followed by 3:00am to 4:00am. Moreover, the highest number of parked trucks are recorded both at 11:00am to 12:00am in morning and 3:00pm to 4:00pm in afternoon. Furthermore, very small number of parked motorcycles is observed throughout the survey time/period.

The survey result clearly indicated that the numbers of arrival vehicles every hour are more than the allowable capacity of the street spaces. This shows that drivers were forced to park illegally, most commonly double parking, which reduces the clear carriageway width of roads and vehicles irregularly parked front of shops and entrance of Shola Gebeya which is the causes for the spill over condition around the street.

Based on the researcher personal observation, illegal way of parking record is high on Saturday February 20th, 2021. This might be due to high market exchange day at Shola Gebeya and thus many private and commercial vehicles used extremely the available parking space around the selected route/street under study; hence, this brought high spill over condition and thus reduced the speed of vehicles as well as created serious crowded street condition around the place when drivers searching a space for parking their vehicles. The number of vehicles parked in the right side of the selected route is greater than the left side.

Street along Atlas – to - Sheger Building

The section is located in between the main streets along Atlas Hotel (beginning to the four legged controlled Traffic Light junction) to Sheger Building with both ends left and right sides. The total stretch length from start to end is about 306.7 meters. Most of the land use system in the left and right side of the streets are recreational places like hotels, clubs or pups, cafeterias as well as malls and several banks.

In order to analyse the parking survey results, a calculation has been carried out to provide an estimate of the total parking capacity of each segments left and right side of the route. The estimate is based upon the kerb length of each segment minus areas where parking restrictions and/or and junctions that prevent parking. The parking length is then divided by 5.9m to convert the Length into an approximate number of parking spaces since the parking configuration/structure is parallel. The estimated parking capacity along the road section has then been used to provide context to the levels of parking recorded in each of the survey time/period. A summary of the results from the parking surveys on the selected street on three days of the week are summarized in Figure 10, 11 and 12 below.

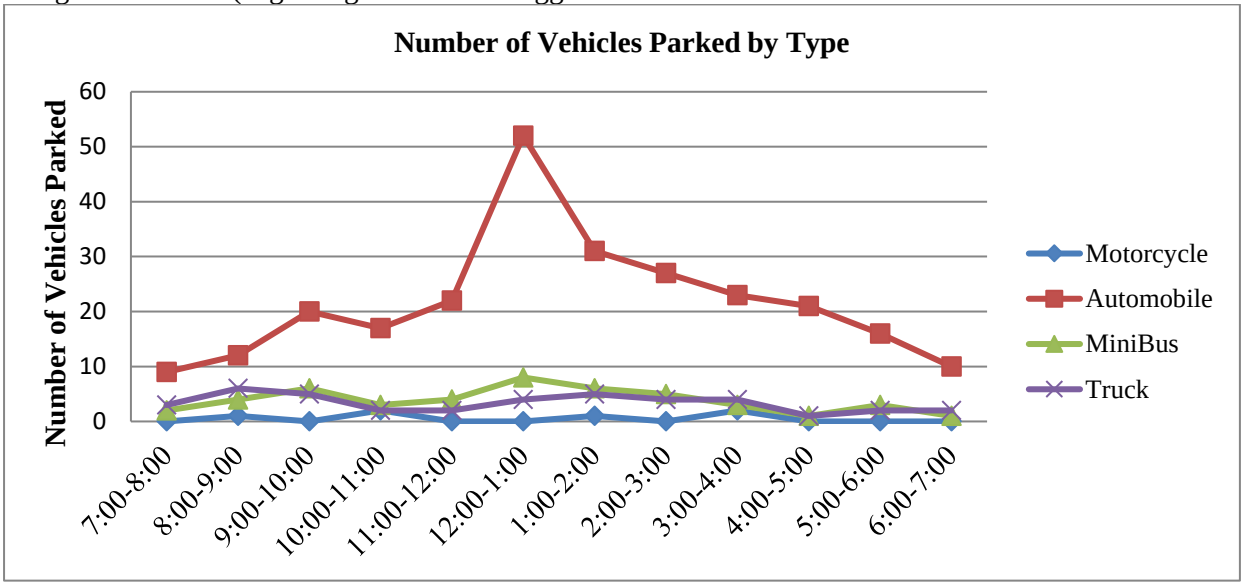

Figure 10 Parking Survey Results of February 16th, 2021 (Tuesday) along a selected route Atlas to sheger Building

Source: Field Survey, 2021

The number and types of vehicles parked at an hourly interval on Tuesday, February 16th, 2021 are realized as shown in the Figure 10 given above. The highest deposit of automobile are observed at 12am to 1:00pm followed by 1:00 to 2:00pm and 2:00 to 3:000pm. Similarly, the highest deposits of Mini-Buses are identified at 12:00am to 1:00pm while the highest number of parked trucks is observed at 9:00am to 10:00am. A very small number of parked motorcycles are observed through the survey period/time. Hence, the parking characteristics of the segment are dominated by the automobile. This might be due

to the area is largely dominated by recreational areas and commercial activities both sides.

The survey result clearly indicates that the hourly accumulation of the arrival and departure of vehicles on street parking spaces are being utilized with in the allowable limit or capacity the whole day, except from 12:00am to 1:00 pm which is the peak flow little more than the capacity of the streets. As such, based on personal observation, few illegal parking or double parking is observed during the survey period/time. The number of vehicles parked in the right side of the selected route is greater than the left side.

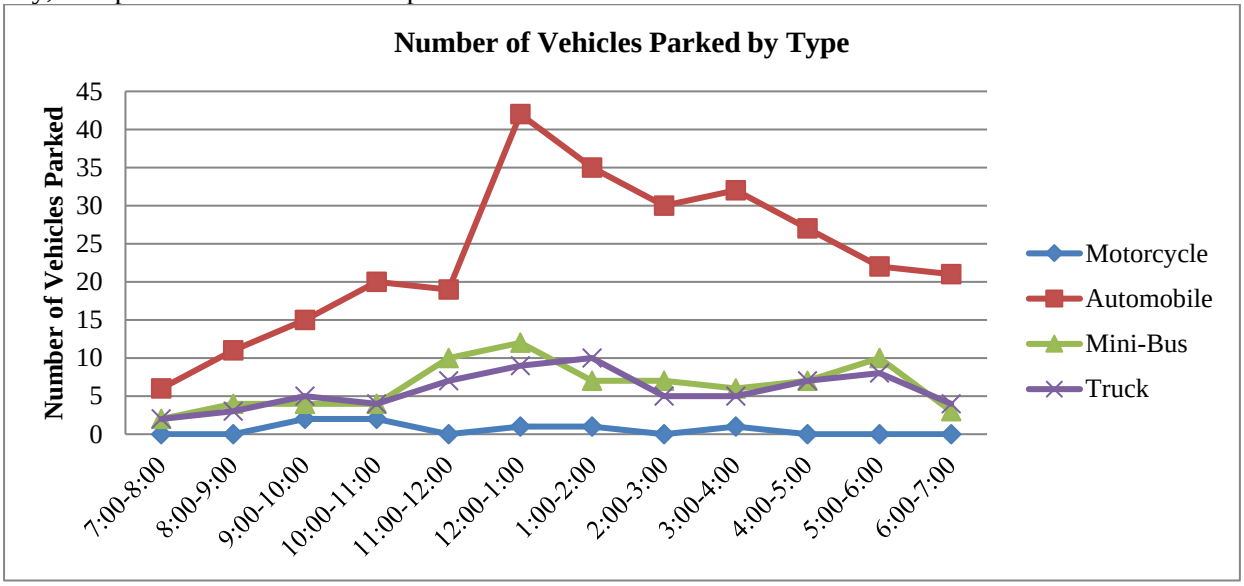

Figure 11: Parking Survey Results of February 16th, 2021 (Tuesday) along a selected route Atlas to sheger Building

Source: Field Survey, 2021

The number and types of vehicles parked at an hourly interval on Thursday, February 20th, 2021 are realized as shown in the figure 11 given above. Higher deposit of parked automobile are identified at 12:00am to 1:00pm and followed by 1:00 to 2:00pm. Moreover, higher parked Mini-Buses are observed at 12:00am to 1:00pm followed by 11:00am to 12:00am and 5:00pm to 6:00pm with equal number for each while higher number of parked trucks is observed at 1:00pm to 2:00pm followed by 12:00am to1:00pm. Very small amount of motorcycle existed during the whole survey time/period. Thus, dominantly the parking space is being utilized by automobile in the whole survey time of day. The number of vehicles parked in the right side of the selected route is greater than the left side. The survey result clearly indicates that the hourly accumulation of the arrival and departure of vehicles on street parking spaces are being utilized with in the allowable limit or capacity the whole day, except from 12:00am to 1:00pm and 1:00pm to 2:00pm which is the peak flow little more than the capacity of the streets. As such, based on personal observation, few illegal parking or double parking is observed during the survey period/time.

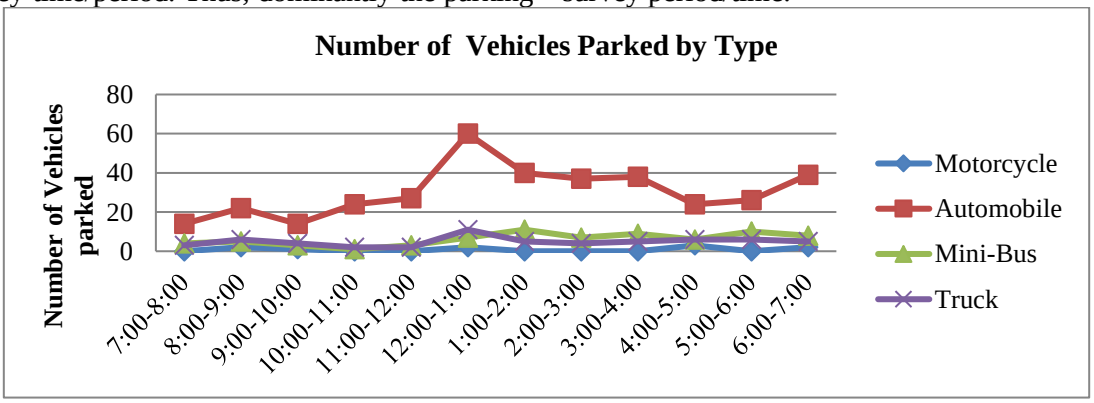

Figure 12: Parking Survey Results of February 16th, 2021 (Tuesday) along a selected route Atlas to sheger Building

Source: Field Survey, 2021

The number and types of vehicles parked at an hourly interval on Saturday, February 20th, 2021 are realized as shown in the figure 12 given above. Higher deposit of parked automobile are identified at 12:00am to 1:00pm and followed by 1:00 to 2:00pm. Moreover, higher parked Mini-Buses are observed at 1:00pm to 2:00pm followed by 5:00pm to 6:00pm while higher number of parked trucks is observed at 12:00am to 1:00pm. Very small amount of motorcycle existed during the whole survey time/period. Thus, dominantly the parking space is being utilized by automobile in the whole survey time of day. The number of vehicles parked in the right side of the selected route is greater than the left side.

The survey result clearly indicates that the hourly accumulation of the arrival and departure of vehicles on street parking spaces are being utilized with in the allowable limit or capacity the in most of survey time of day, except from 12:00am to 1:00pm, 1:00pm to 2:00pm, 3:00pm to 4:00pm and 6:00pm to 7:00pm which is the peak more than allowable limit of the streets. As such, based on personal observation, high illegal parking or double parking is observed during the survey period/time. This might due to the presence of a number of cultural hotels, cafeterias and pups that attract large number of people visited the area for the purpose of recreation during weekend afternoon and evening time. Moreover, there are number parked vehicles in front of U-turns. These conditions critically reduced the speed of the vehicles as well as created high traffic congestion and line-up of vehicles observed for longer duration of time up until 7pm at the evening.

Respondents' opinion on level of parking space problem

Sample drivers were asked question in the survey "do you agree that Addis Ababa is a city which experienced an elevated level of parking space problem?" Majority 378 (97.9%) of sampled respondents reported that they either strongly agreed or agreed (i.e. accepted) that Addis Ababa is a city which experienced a very high level of parking space problem. This indicates that the respondents acknowledge the presence parking supply problem in the city or the level of perception of the problem experienced by sampled drivers in the city were very high. In addition, the interview data from the Addis Ababa city traffic management agency office describes that:

'Recently, it is quite clear that there is an increase in number of vehicles as well as expansion of road network/infrastructure in the city. This in turn leads to rapid increase in mobility. As a result, shortage parking facility has been observed in the inner city from time to time. Moreover, the interviewee also said our annual assessment reports in the year 2020 clearly indicated that, out of 120 buildings in the city, 50% of them fully or partially used the parking spaces for another purpose by changing the designed. Hence, this clearly affect car parking supply to visitors.'

As such, the problem is so huge that drivers always worries so much about their car safety and security. In short, the response from sampled drivers, the response of the interviewee and the annual report of AATMA supports that the seriousness of car parking problem is both wide and deep which needs critical attention to reverse the car parking problem of the capital city.

Response of respondents on severity of shortage of car parking service

Regarding severity of shortage of car parking service, lack of sufficient car parking space were the most often reported problem ranked first. The next highest reported problems of the respondents were inconvenient parking options and inconvenient for loading & unloading ranked second and third respectively. Poor pricing method ranked forth/last. This indicates that there is severe shortage of car parking facility in the study area. Hence, the respondents gave priority for parking service availability than service fee/pricing in their final destination.

Response of respondents on car parking type in their origin

Regarding car parking type in their origin, majority 198 (51.3%) of the respondents were parking their car in their home and followed by on-street parking and surface parkin accounting 115 (29.8%) and 58 (15%) respectively. About 15 (3.9%) were parking in other place particularly in their working place/site. This indicates that majority of the respondents parked their car in their home.

Response of the respondents' on parking purpose/purpose of the trip

Regarding purpose of the trip, majority 214 (55.4%) of the respondents visited the area for work purpose and followed by shopping and entertainment/recreation accounting 55 (14.2) and 52 (13.5) respectively. This implies that most (69.6%) of the respondents visited the areas for business and shopping purposes indicating that the study areas are centre for business and different commercial activities and so attracts customers for work or business, shopping and entertainments purposes due to the presence of Friendship mall,

Zemnesh grand mall, Century mall as well as Alem cinema, etc.

Regarding parking destination, the largest proportion 244 (63.2%) were parking their car on-street and followed by surface parking which account 46 (11.9%). It is only 46 (11.9%) of the respondents were parking their car in their work site. The provision of parking service by organizations for their employees is very low though majority of the sample respondents made their trip for purpose work. The finding clearly indicates that majority of the respondents used on-street parking service in their trip destination.

As can be seen from Figure 4.15, majority 126 (32.6%) of the sampled drivers were parking their car 30 minutes to 1 hour time length and followed by time length between 1 hour to 2 hours accounting 117 (30.3%). About 54 (14%) were parking 3hrs to 4hrs; 52 (13.5%) were parking less than 30 minutes. This indicates that most of the drivers were parking their car within 2 hours interval.

Regarding respondents' response on parking time length in their destination, the largest proportion 239 (62%) of the respondents decided on searching another parking lot to park their vehicle in their destination and followed by parking illegally accounting 101 (26.1%) which is more than one-fourth. It is only 46 (11.9%) of the respondents decide waiting up until they get parking lot in their destination. The finding clearly indicates that nearly two-third of the respondents said searching another parking lot in their final destination to park their car which will increase both drivers parking searching time and led to additional fuel consumption; this again in turn contribute to environment pollution like air prolusion and/or noise pollution.

The study indicated that, from the total of 48 respondents who decided waiting up until they get parking space in their final destination, majority 27 (56.3%) were waiting between 10 to 20 minutes and followed by les than10 minutes accounting 6 (12.5%). This indicates that most of the respondents 33 (68.3%) were waiting up to the maximum of 20 minutes only.

Regarding parking service fee, as can be seen from the table 4.17, most 125 (32%) respondents were paid a price of 10 to 20 ETB for car parking service followed by parking fee between 20-30 ETB accounting 104 (27%) respondents. This clearly indicates that most of the respondents paid car parking service fee up to 20ETB per day.

The study indicated that, majority 209 (54.1%) of the respondents said the hourly car parking service charge is expensive followed by the parking service charge is fair accounting 141 (36.5%). This clearly indicates that largest proportion of respondents said the hourly car parking service charge/fee is expensive.

Regarding security and safety, majority 218 (56.5%) of the respondents mentioned security and safety as their priority criteria in the parking lots and followed by walking time to final destination accounting 85 (22%). This finding indicates that most of the sampled drivers identified security and safety in the car parking plots.

Roadside and illegal parking are common phenomenon in Addis Ababa, especially in the central business district. This is due to limited availability of spaces for parking. The study shows that, majority 373 (96.6%) of the respondents said there is difficulty of parking service at destination while about 13 (3.4%) of sampled respondents replied there is no shortage of parking facility in their destination. This indicates that most of respondents replied that they have got difficulty of parking facility in their destination in the study area. This might be due to number of vehicles increasing from time to time in the city of Addis Ababa. As the data from FTA clearly shows that, the total number of vehicles was 260,837 in 2011 increased to 630,434 in 2020 which was an annual average increase of 10 per cent.

Regarding shortage of parking service, out of the total of 374 respondents who replied to this question most 262 (70.1%) of the respondents replied that there was shortage of car parking service from Monday to Friday in the study area followed by Afternoon time accounting 85 (22.7%). It is only 27 (7.2%) of the respondents faced challenge in getting parking service during evening. This indicates that most sampled drivers have got shortage of parking service in morning

time from Monday to Friday. This time might be mostly people move to the inner city for the purpose of work, market, education, health and many other personal affairs which will create shortage of parking lots.

The study clearly shows that, out of a total of 356 respondents who replied to this question most 222 (63.4%) of the sampled drivers have got shortage of parking service on Saturday in the afternoon and followed by Morning and evening accounting 66 (18.9%) and 62 (17.7%) respectively. This indicates that most of the respondents have got shortage of parking service on Saturday in the afternoon.

The study indicated that, out of the total of 230 respondents who replied to this question most 126 (54.8%) of sampled drivers have got shortage of parking service in the evening on Sunday and followed by afternoon accounting 81 (35.2%). This indicates that usually most of the respondents have faced shortage of parking service in the evening on Sunday in the study area. This might be due to most people entertain and refresh in different recreation centres on Sunday both in the afternoon and evening.

From Monday to Friday, majority 262 (70.1%) of the respondents face difficulties of finding parking spaces during morning times, 85 (22.5%) face difficulties during afternoon hours and 27 (7.2%) face difficulties during evening hours. On Saturdays, majority 222 (63.4%) of the respondents face difficulties of finding parking places during afternoon hours, 66 (18.9%) face difficulties during morning hours and 62 (17.7 %) face difficulties during evening hours. On Sundays, majority 126 (54.8%) of the respondents expressed difficulties of parking spaces during evening hours, 81 (35.2%) of the respondents face difficulties in the afternoon hours and 23 (10%) faced difficulties during morning hours. In view of this finding, most of the respondents face difficulties of finding parking places during weekdays in morning hours and on Saturdays in afternoon hours and on Sundays in the evening hours though parking spaces are available with little problems on Sunday. Therefore, parking spaces are mostly occupied during weekdays that are Monday to Friday.

The study shows that, most 140 (36.3%) of sampled drivers faced parking lot challenge mostly in market place and followed by others (both like market places, public transport service areas, recreation centres, schools, hospitals and hotels) accounting 91 (23.6%). Equal number of, 52 (13.5%) of respondents replied that they have got shortage of parking place when the y moved to places like public transport areas and recreation centres. This indicates that most of the respondents have faced challenge in getting car parking facility when they moved to market places in the study area.

Drivers were asked in survey question to evaluate the level of surface condition of surface car parking in study area. Thus, the study displayed that the largest proportion 227 (58.8%) of respondents said very unsatisfied while 30 (7.8%) were very unsatisfied. Hence, based on drivers' evaluation it is possible to argue that the level of surface condition of surface car parking facilities in the study area is remained to be either very unsatisfied or unsatisfied accounting 257 (66.6%). This might be due to the fact that the existing surface condition of the car parking sites is coved either by mud and red ash.

Regarding the availability of parking, majority 331 (85.7%) of the drivers reported either unsatisfied or very unsatisfied agreed with the statement 'there is enough car parking availability at destination' while 39 (10.1%) of the drivers either satisfied or very unsatisfied with the statement. This indicates that most sample drivers have shown their dissatisfaction towards the availability of enough cars parking availability at destination by criticizing the practice of Addis Ababa traffic management agency in providing appropriate car parking supply and its management practice.

Regarding the quality service like CCTV and Toilet facilities, majority 258 (66.9%) of the drivers reported either unsatisfied or very unsatisfied with the statement 'the quality service like CCTV and Toilet facilities in surface parking areas' while 77 (19.9%) of the drivers either satisfied or very satisfied with the statement. This indicates majority of the respondents have shown their dissatisfaction on the controlling camera and toilet service provided to the customers.

Drivers were also asked in survey question to evaluate the level of car washing service provision at surface parking in study area. Thus, the study displayed that the largest proportion 245 (63.4%) of respondents said either very unsatisfied or unsatisfied. Hence, based on drivers' evaluation it is possible to argue that the level of car washing

service provision in the study area is remained to be either very unsatisfied or unsatisfied. The interview data from chairperson of car wash association supports this idea; the interviewee said there is no support from AATMA in fulfilling the necessary equipment including water tankers and constructions in the site to provide quality service to our customers. The interview also said most of our customers' complain about the surface condition which is made of mud and ash which later made dirt their vehicle due to wind blowing to their car.

Regarding the availability of parking signs and marks in the car parking sites, the study shows that, majority 293 (76%) of the drivers reported either unsatisfied or very unsatisfied with the statement 'the availability of parking signs and marks in parking areas' while 66 (17.8%) of the drivers either satisfied or very satisfied with the statement. This indicates most of the respondents have shown their dissatisfaction on the availability of parking signs and traffic marks both on street and surface parking sites to provide necessary information to the customers/drivers. This might be due to the fact that most of the signs were crashed and not replaced in their appropriate places on time as well as since surface condition is made of ash and mud there is no important marks on the ground which could provide information particularly in the surface parking sites.

Drivers were also asked in survey question to evaluate parking price in study area. Thus, the study displayed that the largest proportion 246 (63.7%) of respondents said either very unsatisfied or unsatisfied. Hence, this indicates most of the drivers have shown their opinion either by saying very unsatisfied or unsatisfied and criticizing the parking fee is not reasonable. The parking price set by the AATMA is 7/8 birr per hour which will also increase as service time increases.

Regarding safety and security in the parking sites, most 176 (45.6%) of the respondents said unsatisfied regarding safety and security in the parking sites while 127 (32.9%) replied their response satisfied. This indicates that most of the respondents said either unsatisfied or vey unsatisfied in safety and security in the parking sites. This might be due to the presence of some kind of crashes and theft parts of vehicles like mirrors, tyres, decors and lab tops and mini bags from vehicles in the parking sites. The interview data from the parking warden also clearly indicates that, there is no fixed camera in the parking sites to improve safety and security of customers.

Regarding the existence of Notice board, the largest proportion 230 (59.6%) of the respondents said that either unsatisfied or very unsatisfied in their evaluation of the existence of notice board in the parking sites. This indicates that most of the drivers criticized the absence of notice board which can indicates the time restriction, available parking space and reserved space to special needs both at surface parking and on-street parking sites.

Regarding the availability of technical equipment and tools used during mechanical failure in the parking sites, majority 338 (87.6%) of the respondents said either unsatisfied or vey unsatisfied in their evaluation of the availability of technical equipment and tools used during mechanical failures in the parking sites. This indicates most of the respondents have shown their dissatisfaction on availability of technical equipment and tools in the parking sites in the study area.

The study shows that, majority 356 (92.3%) of the respondents said either unsatisfied or very unsatisfied in their evaluation of the of well-organization information system to get parking service. This indicates most of the respondents have shown their dissatisfaction in the parking management practice particularly in organization of necessary parking information in the study area. This implies that there is no application of modern technology in accessing parking service like using satellite and mobile based application to get well organized parking information anywhere and at any time.

Regarding the aesthetic quality of the existing parking facilities, majority 280 (72.6%) of the respondents said either unsatisfied or very unsatisfied in their evaluation of the aesthetic quality of the existing parking facilities. This indicates that most of the respondents have shown their dissatisfaction about the aesthetic quality of the existing parking facilities in the study area. This might be due to poor fencing, no green areas and also surface condition is muddy during rainy seasons and dusty during dry season particularly in the surface parking sites.

Factors influencing the provision of parking facilities

The type of parking facility and its location are influenced by numerous factors. Some of the influential factors are described as land use type, vehicle ownership and vehicle population, availability of land space, availability of funds and average travel distance. Moreover, the challenges of parking in Addis Ababa City were identified as lack of adequate space for parking, congestion, pedestrian safety and comfort, rapid urbanization, lack of proper policy direction, increased vehicle population, enforcement issues and institutional challenges particularly weak institutional arrangement of parking management

Conclusion

Yeka and *Bole* sub city, then the parking the data collector were trained and then conducted inventory of the existing parking facilities with manual count of vehicle type, number, time of stay in an hourly interval on three days of the week for 12 consecutive hours. The accumulation study provides information on parking duration, turnover or parking violation

The survey data collected and analysed in the study sites have shown some problems. These are higher demand for parking more than the capacity of the streets. As a result, the vehicles are exiting so fast with short duration of time stayed; at some period of the survey period, a number of drivers searching park lot affected traffic flow by reducing the speed of vehicles due to narrow carriageway width, which later led to queuing large number of vehicles in study area.

The other problem is the capacity of the on-street parking, in some case the number of vehicles arrived in the area is more than the actual capacity. This is condition led to a spill over effect of vehicles and drivers forced to illegal parking most commonly double parking is occurred. These problems have impact on environment in the form of noise pollution and carbon emission; economically, increasing petroleum consumption in searching parking lot as well as due to traffic jam what is called "*chifche*"; and also illegal parking leads to road safety problem/road traffic accidents.

Parking problem and demands in Addis Ababa city requires an immediate response from the government, its organs and other concerned institutions. The reports of Federal transport clearly indicated that, the number of vehicle is increasing day to days. There is no sufficient parking space in the city; most vehicles are observed parked along the selected route in Yeka and Bole sub city. The routes were selected based on the impact on traffic flow on vehicles and pedestrian movement. Based on the findings, the following conclusions could be drawn.

The current availed on-street and off-street parking facilities in the study areas were inadequate with parking places largely occupied during weekdays and on Saturday in the morning and afternoon hours respectively and drivers are forced to park their cars on illegal parking places including double parking narrowing the carriageways of the roads resulting road congestions. The results also showed that most of the drivers use on street parking in their final destination. Moreover, On-Street parking places are not enough to accommodate the existing cars. The designated parking spaces at the basements of buildings are utilized for other purposes exacerbating the parking problems. As a result drivers are forced to use streets near to final destination for parking their vehicles. The researcher observed illegal parking including double parking which narrows road carriageways resulting in road congestion as well as created discomfort to pedestrians' mobility.

In addition, the current method of collecting parking fees is manual by issuing receipt which is out-dated. Parking meter technologies are not adopted and also detail study regarding price differentiation, depending on different zones of the city have not been carried out yet. Generally, there is Poor Street parking management systems and pricing strategies in the city.

It can be summarized that the major problems of the current parking facilities in Addis Ababa are: lack of sufficient parking spaces, loss of resources such as time and fuel during looking for parking place; lack of sufficient off-street parking near to commercial or business centres; blocking of personal or individual business centres by parking in front of their shops and offices; risk of insecurity and theft of vehicle parts while parking, as well as double parking on prohibited spaces due to lack of proper parking places results in road congestions, accidents during manoeuvres of car. In conclusion, the existing parking places in the study area are not adequate to accommodate the existing demand leading to resource wastage and traffic congestion.

Reference

Adam J. Pel Et Al. (2016). Stochastic User Equilibrium Traffic Assignment With Equilibrated Parking Search Routes.

Adams, C.A., Boahen, R.O. & Zambang, M.A.M., (2014). Parking Management in Metropolitan Cities in West Africa Case Study of the Kumasi Paid Parking Scheme, Ghana. , 3(6), pp.1–8

Adams, A. Obiri – Yeboah, and J. Amo –Gottfred (2008), Impact of Adum paid parking scheme in Kumasi, Ghana, Proc. of the International Conf. on Best Practices to Relieve Congestion on Mixed Traffic Urban Streets in Developing Countries, IIT Madras Chennai, India, 421-430.

Ashenafi S. (2014). Challenges and Opportunities of car parking in Addis Ababa City, St. Mary's University, Unpublished Thesis, Addis Ababa Ethiopia.

Babatunde (2012). Appraisal of Parking Problems and Traffic Management Measures in Central Business District in Lagos, Nigeria.

Chen, C. (2015). The sensitivity of on-street parking demand in response to price changes : A case study in Seattle , WA.

Cuddy MR, (2007). A practical method for developing Content-Sensitive Residential Parking Standards, Dissertation, Rutges University at http//:transportationnorthwestern.edu/ news/2007/cuddy dissertation final cr.pdf.

Giuffrè, T., Siniscalchi, S.M. & Tesoriere, G., (2012). A Novel Architecture of Parking Management for Smart Cities. Procedia - Social and Behavioral Sciences, 53, pp.16–28. Available at: http://linkinghub.elsevier.com/retriev e/pii/S187704281 2043182.

Guo, H., (2012). Modeling Travel Time under the Influence of On-Street Parking. Journal of Transportation Engineering, 138(2), pp.229–235.

Guo, Z. & Ren, S. (2012). From Minimum to Maximum: Impact of the London Parking Reform on Residential Parking Supply from 2004 to 2010? Urban Studies, 50(May 2013), pp.1183–1200.

He Yulong, X Sun, L Du, R. Jinmei, S Das., (2015). Level of Service for Parking Facilities. , 3, pp.35–41. (May 2015)

Inturri, G. & Ignaccolo, M. (2011). Modelling the impact of alternative pricing policies on an urban multimodal traffic corridor. Transport Policy, 18(6), pp.777–785. Available at: http://linkinghub.elsevier.com/retriev e/pii/S0967070X11000497.

Litman, T. (2015). Parking Management-Strategies, Evaluation and Planning. http://www.vtpi.org/park_man.pdf: Victoria Transport Policy Institute.

Litman T. (2013). Parking management: strategies, evaluation and planning, Victoria Transport Policy Institute, Victoria, Canada.

Litman. T. (2012). "Parking Management: Strategies, Evaluation and Planning", Victoria Transport Policy Institute.

Litman T. (2011). Parking Management, Strategies: Evaluation and Planning. Victoria Transport Policy Institute

Litman. T, (2009). Recommendations for Improving LEED Transportation and Parking Credits, VTPI; (available at www.vtpi.og/leedrec.pdf).

Soup, D. (1999). The trouble with minimum Parking Requirements, Transportation Research Part A, 549 - 574.

Mackowski, D., Bai, Y. & Ouyang, Y.(2015). Parking Space Management via Dynamic Performance based Pricing. Transportation Research Procedia, 7(August), pp.170–191. Available at: http://linkinghub.elsevier.com/retriev e/pii/S23521465 15000782.

Martens, K., Benenson, I. & Levy, N. (2010). The Dilemma of On-street Parking Policy : Exploring Cruising for Parking Using an Agent- based Model. In B.Jiang, X.Yao (eds), Geo Spatial Analysis and Modelling of Urban Structure and Dynamics, Geo Journal Library 99 Springer Science Business Media B.V., pp.121–138.

Mengistu A. (2018). Analysing and Optimization of Car Parking Space in Addis Ababa: The Case of Addis

Ketema Sub-City, AAU, Unpublished Thesis, Addis Ababa, Ethiopia.

Osoba B.S (2012).Appraisal of Parking Problems and Traffic Management Measures in Central Business District in Lagos, Nigeria. Journal of Sustainable Development; Vol. 5, No. 8

Rye, T. (2010). Parking Management : A Contribution Towards Liveable Cities, German Technical Cooperation (GTZ), Module 2c , Sustainable Transport, A source book for policy makers in Developing Countries.

Rye T. (2011). Parking management, a contribution towards liveable cities, German Technical Cooperation (GTZ), Module 2c, Sustainable Transport, A source book for policy makers in developing countries.

Rye T. (2011). Gestión de estacionamientos: una contribución hacia ciudades más amables. In GIZ (Ed.). Bonn. s.a. (s.a.). Road charging scheme: Asia-Singapore.

Rye, T. and Koglin, T, (2014). Parking Management, in Parking: Issues and Policies, ed Ison, S and Mulley, C, Bingley: UK, Emerald (forthcoming).

Rye, T., Cowan, T. & Ison, S. (2006). Expansion of a Controlled Parking Zone (CPZ) and its Influence on Modal Split: The Case of Edinburgh. Transportation Planning and Technology, 29(1), pp.75–89.

Saltzman, R.M., (2015). An Animated Simulation Model for Analyzing On-Street Parking Issues. pp.79–90.

Shoup, DC, 1999. The trouble with minimum parking requirements. Transportation Research PartVol. (33) pp. 549-574

Shoup (2005) and Litman, T. (2006). Parking management best practices. Chicago: American Planning Association.

Shoup, D. (2005). The High Cost of Free Parking, American Planning Association, Chicago, Illinois Shoup, D. C. (2005).Parking Cash Out, American Planning Association, Planning Advisory Service Report Number 532.

Shoup, D. (2013). On-Street Parking Management v. Off-Street Parking Requirements. Access, 42, pp.38–40. Available at: http://www.uctc.net/access/42/access 42_ almanac.pdf.

Sofiya M. (2019). Problems Associated with On-Street Parking Lots in Addis Ababa: The Case Nifassilk Sub city, Wereda 1, AAU, Unpublished Thesis, Addis Ababa, Ethiopia.

The Institution of Highways and Transportation (2005). Parking Strategies and Management

Transport Policy of Addis Ababa Five Years Strategic Plan, August 2011

Victoria Transport Policy Institute (2005). Transport Demand Management online Encyclopedia. (www.vtpi.org)

Victoria Transportation Planning Institute (VTPI) (2008). Evaluating Accessibility for Transport Planning, VTPI, Victoria, Van Couver, Canada.

Willson RW, Shoup D. (1999). Parking Subsidies and Travel Choices: Assessing the Evidence. Transportation, 17(2):141–157.

Willson, R. (2005). Parking Policy for Transit-Oriented Development: Lessons for Cities, Transit Agencies, and Developers. Journal of Public Transportation, 8(5), pp.79–94. Available at: http://scholarcommons.usf.edu/jpt/vol 8/iss5/5/.

Willson, R. (1995). Suburban Parking Requirements: A Tacit Policy for Automobile Use and Sprawl. Journal of the American Planning Association, 61(1), pp.29–42. Available at: http://www.tandfonline.com/doi/abs/1 0.1080/01944369508975617\nhttp://d x.doi.org/10.1080/019443695089 75617