



Unviersty of Anbar

Anbar Journal Of Engineering Science©

journal homepage: [http:// www.uoanbar.edu.iq/Evaluate/](http://www.uoanbar.edu.iq/Evaluate/)



A proposed plan for implementing the public transport policy in the city of Ramadi / Anbar University as a model

S. Thameel^{1*}, Th. Mahmood², A. Mustafa³, A. Mohson⁴

¹Development Center of Upper Euphrates Basin, Univercity of Anbar,Iraq;

² Director of Strategic studies Center, University of Anbar, Iraq;

³Civil Engineering Department, College of Engineering, University of Anbar, Iraq;

⁴ College of Engineering, Al- Mustansiriyah University, Baghdad, Iraq.

PAPER INFO

Paper history:

Received 17/11 /2020
Received in revised form
20/12/ 2020
Accepted 12/ 1/2020

Keywords:

Ramadi, private and public transport, Anbar University

ABSTRACT

The development of cities in the infrastructure and urbanization and the increase in the population make people increase in the purchase of the private car, which in turn causes the congestion , pollution , accident and noise especially after 2003, as Iraq's import of cars increased to 5,800,000 cars distributed between the provinces, as ³Anbar province ranked ninth in the development number of cars with 174,000 cars according to the Central Bureau of Statistics of the Ministry of Planning. The university is the largest governmental institution that has the largest traffic volume of vehicles. We have three directions for entering the Anbar university they are east, middle and west directions. Total traffic volume from east, middle and west direction is 2165 vehicles which lead to traffic congestion in Ramadi city and Anbar university. The total traffic volume in private transportation in east, middle and west direction is 727,515 and 923 vehicles respectively. No of students in private transportation in east, middle and west direction is 4617, 3185 and 3985 passengers respectively. As results of this research, there are three proposed parks one of them in the Sujaria at east direction, second park in Ramadi center at middle direction and third park in 5km area at west direction. In this paper, we make comparing between private and public transport in terms of fuel costs and time from the origin (the three proposed parks) to destination (Anbar University) assuming that private cars stopped in those three parks by using Park & Ride System and used buses with capacity of 40 passengers to transport students to the university. Depending on no. of passengers in private transportation from the three proposed parks to university we got the No. of buses from east park (Sujaria area), middle park (Ramadi center) and west park (7km area) to university which were 28, 20 and 25 bus respectively because each bus can transport four times.

© 2014 Published by Anbar University Press. All rights reserved.

1. Introduction

The mass transit suffers from tough problems in the developed countries of the world and the case different between countries and also from town to town [1] and it is depending on three factors: bus stations, sites and nodes. These factors are interrelated and can be developed to improve the public transport process [2] the studies of transportation demand are to Performance evaluation and assessment passenger demand and that is done by collecting and analyzing data obtained from current and future mass transportation [3].

Public Transport demand studies represent the initial section of transportation planned and the Advanced mass transit should be incessant and active to conform with demand of passenger.[4]

The concept of transportation in Iraq plays an important role in the trade and economy of the country, especially in Anbar province because the province of Anbar lies in western Iraq and is adjacent to the capital Baghdad from the east and Syria from the north-west and Jordan from the west and Saudi Arabia from the south-west Therefore,

it is considered the center of trade and passenger transport for three countries. The transport network is one of the factors influencing the economy, production and the development of the countries. It is a direct relationship. As the transportation network develops, the economy, production and progress increase [5] as cities develop in the construction of Infrastructure and institutions, the demand for the use of private vehicles has increased. Lewis Mimford likened in his book that the city is like human in his growth). Actually, the most popular means of transporting passengers in Iraq is the bus because the transport by bus is considered one of the oldest means of being convenient and less expensive where you move people from one city to another. Public transportation is a cultural phenomenon used in many countries such as America, Britain and other countries especially in the Arab countries, where mass transit companies in Saudi Arabia transported around 551,000 passengers in 1990 by convenient buses from Saudi Arabia to several countries including Qatar, UAE, Bahrain, Jordan, Turkey, Kuwait and Egypt , the problems of transportation such as , noisy air pollution, traffic congestion and accidents are more common of developed countries, Conversely in Europe and North America the Difficulties will be modest.

The aim from this research is to reduce the traffic flow of the Ramadi city as the largest traffic volume enters the university of Anbar therefore, we will study the characteristics of public transportation such as fuel cost, cost of transportation, delay time and compared it with private transportation [6].

2. The Theoretical Part

2.1. The problem of research

Al-Anbar University suffers from traffic jams because it is located west of the city of Ramadi and to the presence of other institutions close to the university such as factories and the General Traffic office in addition to the residential areas therefore all the traffic volumes of the University and the city of Ramadi uses one road, it is 60m street , Which linking the area of Sujaria in the area of the 5 km through Anbar University, which in turn is very crowded along a queue length from 500 meters to 600 meters for two sides in the morning time and the end of work as shown in Figure 1. where the entry of traffic

volumes belonging to the university of Anbar from three directions, the eastern direction and include the area of Sujari , Habbaniyah, Al-Khalidiya and Saqlawiyah, as well as the middle direction, including the areas of Sufia, the center of Ramadi, jazera of Ramadi and Ta'mim, as well as the western direction, including the area of 5 km and the area of Hit , Haditha, Baghdadadi and Kubisa,[5][6].



Figure 1. Traffic congestion on the Entrance of University of Anbar(E.O.U)

The university is a government institution that hosts the largest volume of traffic compared to other institutions and Anbar university, which contains a high traffic volume of private vehicles, resulting in:

1-Congestion and air pollution: because of the traffic congestion in the United States, there was asthma disease reach about two million emergency status and five thousand deaths per year. the costs of asthma were calculated about 14 billion dollars" Washington: U.S. Environmental Protection Agency, 2006. the public transportation is reducing from gases emission which effect on air pollution and health such as Nitrogen oxides (NOx) and Volatile organic compounds (VOCs) [7].

2- Delay in time: The delay time at year 2003 in united states was about 27 percent. The Texas transportation institute in united states calculated that public transportation saved passengers 1.1 billion hours Texas Transportation Institute, 2005[8].

3-Cost of fuel: Saving energy is a sacred national duty. As President Bush said the United States is “addicted to oil” and Hard work must be done to reduce oil imports) Bush, George Walker. January 31, 2006 it does mean the public transportation can be saving the energy), the reducing of Volatile organic compounds (VOCs) larger than 70,000 tons and 27.000 tons for Nitrogen oxides (NOx) will save about 130,000,000 USD to 200,000,000 USD Per year [9].

4- Accidents: Actually, many countries in the world use mass transport depending on their cities, some of them are used buses and others are used railways during transportation, for example in India, refer Brihanmumbai; Indian Railways 2002), That most of the Indian cities depend on public transpiration and those cities do not have railways. where the buses transport more than 90% of the total transport compared to the city of Mumbai, it uses railway during the transport of people where transport more than five million passengers per day, only 42% by buses and 58% of total mass transit and the total number of passengers is 80%. Only 20% use buses. But in America, mass transport offers a great potential for transporting people who do not own cars. actually, more than 90% of poor people prefer public transportation because it offers good services such as comfort and safety. as well Consolidation of social relations between people It also provides job opportunities for unemployed people therefore developed countries are studying the cost of mass transportation compared to private transportation so that the public transportation should be less cost, comfortable, secure and systematic geometrically. (American Association of State Highway and Transportation, AASHTO) Urban Public Transport in India: [7][10]. The effectiveness of private and public transport has been discussed for a long time in the context of sustainability. Previous studies^{1,2} have shown that private car dependence is generally recognized as the largest factor of atmospheric pollutant emissions from the transport sector and use of public transport brings to a reduction in emissions. However, financial sustainability of public transport totally depends on population density [11].

3. The Practical Part

3.1. case study

The province of Anbar is one of the largest governorates of Iraq and the center of Anbar province is the city of Ramadi, where the city of Ramadi is experiencing great congestion as a result of the increasing population and the

development of urban buildings, which increased the number of users of private vehicles and the province of Anbar near of Jordan, where the import and purchase of cars from Jordan was easy from 2003 up to 2017 Where the province of Anbar ranked ninth with the import of cars compared with the other provinces of Iraq at a rate of 174,000 cars according to the central bureau of statistics of the ministry of planning. through my modest studies I found that the largest traffic volume is coming to Anbar university [7].

3.2. Data Collection

3.2.1. Traffic volume of Anbar university

The total traffic volume of Anbar university was calculated by installing affixed camera at the entrance of Anbar university from 7.30 am to 8.30 am for 4 weeks in November - 2019 as shown in Figure 2 .the traffic volume coming from three directions which they are east direction, middle direction and west direction, and Through the questionnaire, the traffic volumes and no. of passenger of each area were determined. Total traffic from east, middle and west direction were 2165 vehicle.

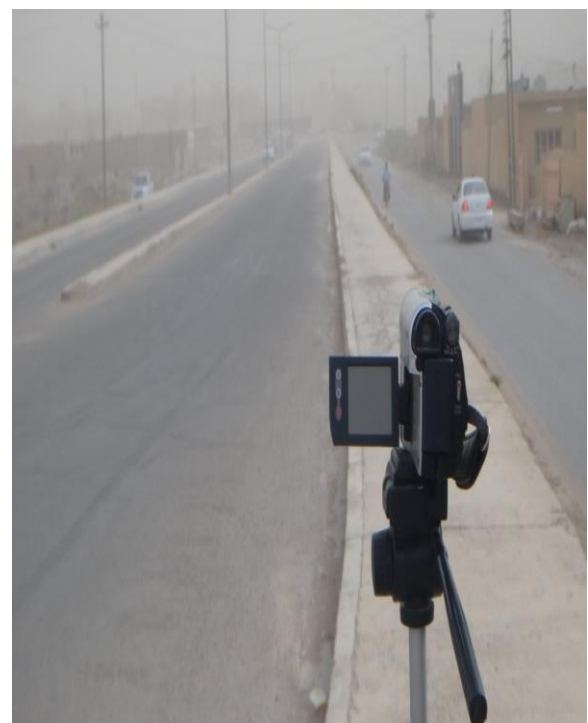


Figure 2. Affixed camera at the entrance of Anbar University to calculate the traffic volume

And table 1. Shows the number of each type of vehicles entered the university such as private cars, minibus and coaster. From the table we can see that the maximum traffic volume of private

car was 1556 V in second week at Monday and min bus was 567 V at third week on Sunday. but the number of coaster and buses was approximately constant during the month.

Table 1. The traffic volume for one month

First week 4-11-2019	Private cars	Mini bus	Coaster	Bus
Sunday	1450	478	42	12
Monday	1410	529	42	12
Tuesday	1457	531	42	12
Wednesday	1363	428	42	12
Thursday	1267	457	41	12
Second week 11-11-2019	Private cars	Min bus	Coaster	Bus
Sunday	1544	488	42	12
Monday	1556	511	42	12
Tuesday	1522	437	41	12
Wednesday	1418	413	40	12
Thursday	1392	389	41	12
Third week 18-11-2019	Private cars	Mini bus	coaster	Bus
Sunday	1523	567	42	12
Monday	1512	534	42	12
Tuesday	1421	521	42	12
Wednesday	1453	492	41	12
Thursday	1416	478	40	12
Fourth week 25-11-2019	Private cars	Mini bus	Coaster	Bus
Sunday	1478	502	42	12
Monday	1498	526	42	12
Tuesday	1533	533	42	12
Wednesday	1443	488	42	12
Thursday	1468	467	42	12

And the figure 3 shows the percentages of traffic volume which entered the university of Anbar. it is clear from figure that the percentage of private cars gave high percentage with 71.5% as comparing with mini bus 26.10%, costar 1.90% and buses 0.5% only.

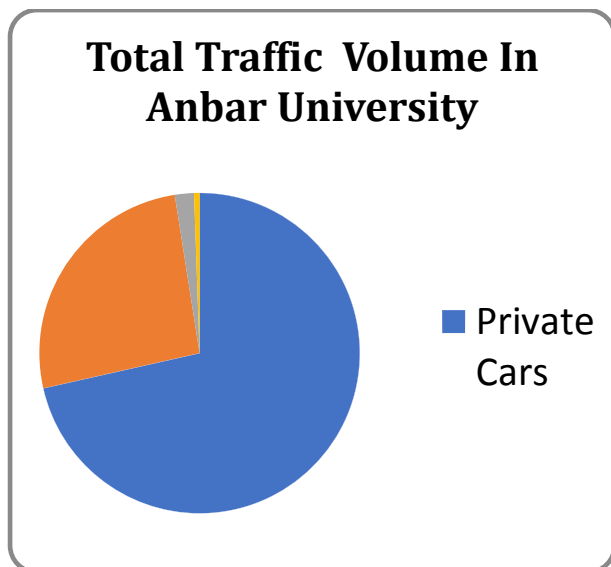


Figure 3. Total traffic volume in Anbar university

3.2.2. Distribution of traffic volume of Anbar university

In this research, we studied the traffic volumes which coming from the east, middle and west directions and assuming that the starting points of the vehicles will be from the three proposed parks to university which they are east park, middle park and west park to calculate the delay time, cost of transportation and cost of fuel consumption. The second hypothesis is that private transportation includes private cars, mini bus and coaster. therefore, from the above figure we can see that private transportation show 99.5% as comparing with public buses only 0.5 %.

The distance between the proposed east park (E.p) and Anbar university is 12.5 km, the distance between the proposed west park (W.P) and Anbar university is 10 km. and distance between the proposed middle park (M.P) to Anbar university about 6km. as shown in figure 1. All the traffic volumes coming from the three routes and meet at the entrance of university (E.O.U). which causes great traffic congestion at the entrance of university (E.O.U). Through the movements of vehicles there are different check points (Ch.p) along the routes which marked with yellow route and cause the delay .

And table (2) show the traffic volume and no. of passenger for each direction depending on the average passengers for private car, mini bus

and coaster. The no. of passengers from East, Middle and West direction was 4617, 3185 and

3985 respectively.it does mean the total no. of passengers is 11787.

Table 2. The traffic volume of private transportation and No. of passengers from East, Middle and West Park to university

East direction		Middle direction		West direction		Total
Distance from East park to university	12.5km	Distance from Middle park to university	8 km	Distance from west park to university	10.5 km	
Private car	450	Private car	310	Private car	796	1556
Average passenger in private car	3	Average passenger in private car	3	Average passenger in private car	3	-
Total passenger in private car	1350	Total passenger in private car	930	Total passenger in private car	2388	4668
Mini bus	255	Mini bus	205	Mini bus	107	567
Average passenger in mini bus	11	Average passenger in mini bus	11	Average passenger in mini bus	11	-
Total pass. In mini bus	2805	Total pass. In mini bus	2255	Total pass. In mini bus	1177	6237
Coaster	22	Coaster	----	Coaster	20	42
Average passenger in coaster	21	Average passenger in coaster	----	Average passenger in coaster	21	-
Total passenger in coaster	462	Total passenger in coaster	----	Total passenger in coaster	420	882
Total passenger in East park	4617	Total passenger In Middle park	3185	Total passenger in West park	3985	11787
Total traffic from East park	727	Total traffic from East park	515	Total traffic from East park	923	2165

From the above table we can see that traffic volume for private cars and mini bus is varying as comparing with bus and coaster which was constant. The expected traffic volume at 2025.

There are three delay time along the road one on the Al-huz bridge (ch. p1), second delay on the intersection of (Al-hukm Al-mahali) And third delay is entrance of university (E.O.U) and the distance from middle park to university is 6km.

4. The Proposed Model

4.3. The Proposed West Park to University

4.1. The Proposed East Park to University (E.P.)

The proposed west park located in the west of Ramadi exactly in 7km area. and the distance from park to university is 10.5km. There are three delay time along the road one on the first check point (ch. p1), second delay on the second check (ch. p2) And third delay is entrance of university (E.O.U). and the figure bellow show the all the details of the road from East park (EP) to university with blue color, from Middle Park (MP) to university with red color and from West Park (WP) to university with green color by using Vissim software to drawing the road and show the delays on the check points. Vissim program is used by pty university in Germany, which helps in

The proposed park located in sujaria area with distance of 12.5 km from park to university. There are three delay time along the road one on the first check point (ch. p1) in the 60street, second delay on the Kassim bridge (ch.p 2) . in AL-Kssim bridge the delay time for each vehicle is (10) min approximately and third delay is entrance of university (E.O.U).

4.2. The Proposed Middle Park to University

the proposed change to the transport network and simulates the movement of vehicles and pedestrians to intersections and roads through the introduction of real data for the program such as the number and type of vehicles as well as the speed of vehicles and the width of the lanes as well as used in the simulation of railways and sea lines and air.

The vissim software display the simulate of actual movement of vehicles by adding the number of vehicles and their type such as private car, minibus and coaster [12].



Figure 4. Paths of three proposed parks to Anbar University

Actually, the big problem of these delay times is the entrance of university (E.O. U) because all the traffic volumes which coming from the three directions will meet at the entrance of university (E.O. U) as show bellow. the queue length from 500 meters to 600 meters for two sides in the morning time and the end of work as shown below.



Figure 5 The traffic jam at the Entrance of University (E.O.U)

meters to 600 meters for two sides in the morning time and the end of work as shown below.

4.4. The Measure Fuel Consumption and Travel Time for Each Type of Vehicle

The fuel consumption depending on size of vehicle engine and no. of cylinder. we calculated the fuel consumption for each vehicle by the questionnaire on vehicle drivers also by fill up the fuel tank and fixed the quantity of fuel then traveling from east park (origin) to university (destination) with recording the journey time and delay at check points and entrance of university then from university to east park after that fill up the fuel tank again and check the quantity of fuel from pump station , the amount of fuel added is the consumption of fuel for the vehicle during recording the time of the trip from the eastern park to Anbar University, including stops during checkpoints , delay time at the entrance and exit of the university and return to the East park . The same calculations were made on the mini bus, coaster and bus during the movement from middle and the West park to university and find the amount of fuel per vehicle during the times of delay. The table 3,4 and 5 shows the fuel consumption and total cost in private transportation from east, middle and west park to

university. The private transportation includes private cars, mini bus and coaster. The price of fuel is 0.416 USD.

Type of vehicle	No. of vehicles	Consumption of fuel /car for Departure and return	Consumption of fuel per day	Cost of fuel per liter (USD)	Total cost of fuel (USD)	Delay (min)	Travel time for two ways (min)	Travel time for one way without delay (min)
Private car	450	(5)	2250	0.416	937.5	52	75	11.5
Mini bus	255	(6)	1530	0.416	637.5	52	77	12.5
Coaster	22	(7)	154	0.416	64.16	52	79	13.5
Total	727	-	3934		1,639.16			

Table 3. The fuel consumption and the cost of private transportation from east park to university

Type of vehicle	No. of vehicles	Consumption of fuel / car for Departure and return	Consumption of fuel per day (liter)	Cost of fuel /liter	Total cost of fuel (USD)	Delay (min)	Travel time for two ways (min)	Travel time for one way without delay (min)
Private car	310	(4)	1,240	0.416	516.66	55	69	7
Mini bus	205	(5)	1,025	0.416	427.08	55	71	8
Coaster	-	-	-	-	-	-	-	-
Total	515	-	2,265		943.75			

Table 4. The fuel consumption and the cost of private transportation from middle park to university

Table 5. The fuel consumption and the cost of private transportation from west park to university

Type of vehicle	No. of vehicles	Consumption of fuel / car for Departure and return	Consumption of fuel per day (Liter)	Cost of fuel /liter	Total cost of fuel (USD)	Delay (min)	Travel time for two ways (min)	Travel time for one way without delay (min)
Private car	796	(5)	3,980	0.416	1,658.33	40	60	10
Mini bus	107	(6)	642	0.416	267.5	40	62	11
Coaster	20	(7)	140	0.416	58.33	40	64	12
Total	515		4,762		1,984.16			

4.5. The number of buses needed for each direction

From the above table we can see that the consumption of fuel in private transportation is

very high from the three proposed parks to university which was 10,961 liters per day. And The total cost of fuel consumption in private transportation is 4,567 per day. From table 2 by depending on the no of passengers from the three directions which was 11787 passengers can be find the no. of buses for each park. the capacity of each bus is 40 passengers. it does mean we need 73 bus for all passengers because each bus can transport four times. the starting time for each bus is 7:30AM to 9:00AM from the three proposed parks.

Same procedure we calculated the fuel consumption for one bus from the three proposed

parks to university and the delay time of buses is very low because the road will be free and speed of bus will be increasing as comparing with private transportation and table 6. Shows the fuel consumption and the cost of public transportation from east, middle and west park to university.

Park	Type of vehicle	NO. of vehicles	Consumption of fuel per bus for arrival and Departure	Consumption of fuel* 4 times per day (liters)	Cost of fuel /litter In USD	Total cost of fuel (USD)	Delay (min)	Travel time for two ways (min)	Travel time for one way without delay (min)
East park to university	Bus	28	10	280	0.416	116.66	6	36	15
Middle park to university	Bus	20	9	180	0.416	75	4	28	12
West park to university	Bus	25	10.5	262.5	0.416	109.37	5	31	13
	Total	73		722.5	0.416	301			

Table 4. The fuel consumption and the cost of public transportation from East, Middle and West park to university

From the above tables the no of buses from east, middle and west park to university is 28,20 and 25 buses respectively. the consumption of fuel multiplying with 4 because each bus will transport four times. Also the total fuel consumption in public buses is 722.5 liters as comparing with the private transportation which was 10,961 liters and the total cost of fuel consumption in public buses is 301 USD per day .actually The cost of transportation by private car from Fallujah to the University of Anbar is 116.66 USD per month but after the questionnaire with

the drivers of private vehicles, it was found that the cost of transporting students from Fallujah to the east park 75 USD only and then transporting them to the university by public buses. by using Park and Ride System. There is reduction in the cost of transportation about 41.66 USD per month. also, there are two reductions in the cost of transportation they are from middle area to the middle park about 25 USD and from west area to the west park about 25 USD. and the fig 6 and 7. Shows the consumption and costs of fuel between private and public transportation.

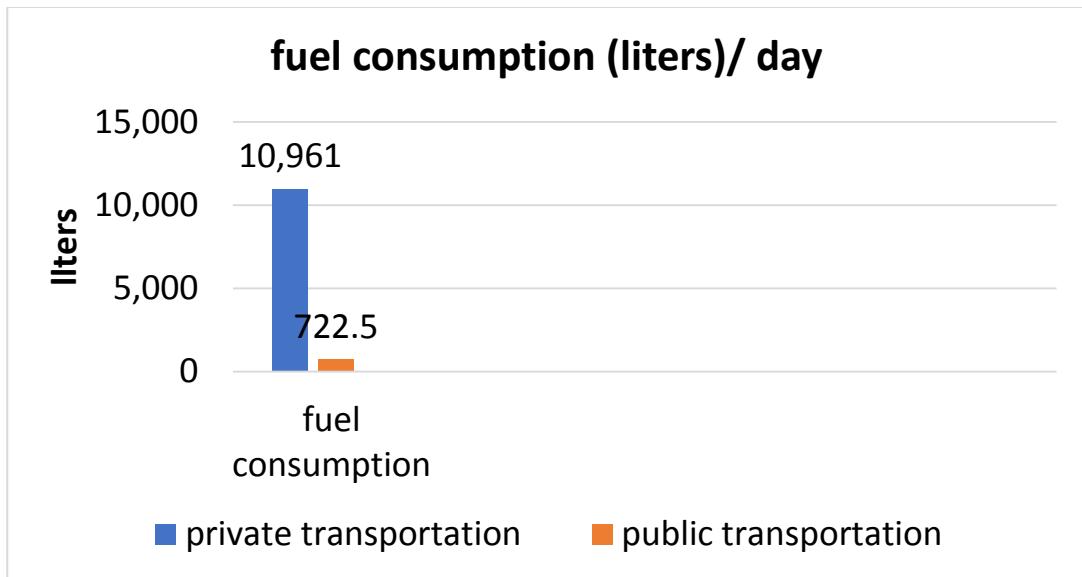


Figure 6. Fuel Consumption between private and public transportation

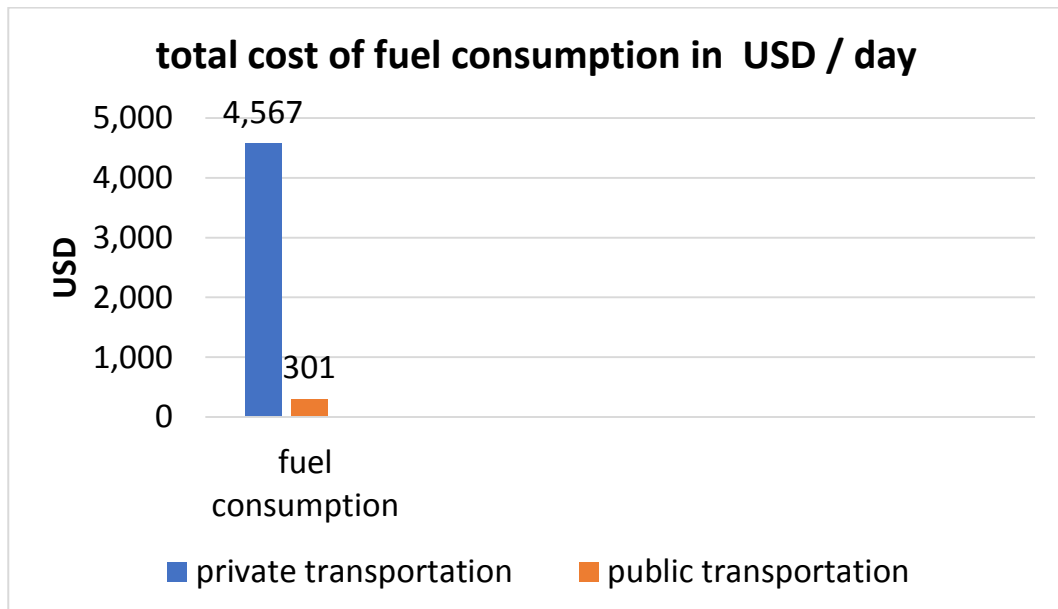


Figure 7. Cost of Fuel Consumption between private and public transportation

5.1. Conclusion

Results analysis and interpretation lead to the conclusion:

1. Reducing traffic volume and thus reduce travel time.
2. Reducing the cost of economic transportation in terms of fuel consumption and the cost of extinction for vehicles such as tires and the engines
3. Decreasing of thermal emissions which caused by the consumption of larger

quantities of fuel in private transportation.

4. Through the research is expected to be a low incidence of accidents
5. The economic benefits of the university in terms of the possibility of investing three parks (east park, middle park and west park) and the establishment of public services such as booths for quick foods and other services
6. Provide the security in Ramadi city and university of Anbar.

5.2. Recommendations and suggestions

1. We recommend the presidency of Anbar University to address the relevant parties to allocate suitable plots of land in three proposed parks (east, middle and west) to accommodate 3000 vehicles for expected traffic volume.
2. issuing a letter from the Presidency of the University not to allow the entry of private vehicles (Coaster, private car, mini bus) and limited only buses with a capacity of 40 passengers and carrying the university logo
3. we recommend to transport the student from their regions
4. Also open the behind gate for traffic volume of west direction
5. The optimal transport of the students is by tram.

Acknowledgements

Thanks, and appreciation to everyone who contributed to the completion of this work

References

- [1] Vasconcellos, E. 2001. Urban transport, environment and equity: The case for developing countries. London, UK: Earthscan Press.
- [2] Tony, T. (2006). Application of the hub concept to urban public transport in Hong Kong: A case study of north point. *Journal of HKU Scholars Hub*, 1, 1-148. Retrieved from.
- [3] Ceder A. 2007, "Public Transit Planning and Operation (Theory, modeling and practice)" Elsevier Ltd.
- [4] Aldukali Salem I. Amselati, Riza Atiq O.K Rahmat, and Othman Jaafar. (2011). An overview of urban public transport in Malaysia. *Journal of Social Sciences*, 6, 24-33.)
- [5] T. S. Mahmood ,2020, Land use of Al-Ramadi City and its Impact on Sustainable Transport Strategies Using AHP, *IOP Conf. Series: 737 (012139)*, p12
- [6] T. S. Mahmood ,2020, Change in land-uses of Ramadi city and its influence on public transportation sustainability, *IOP Conf. Series: 881 (012175)*, p8
- [7] Newman, P. and Kenworthy J. *Sustainability and cities*, Island press, Covelo, California. (1998).
- [8] Hayashi, Y. and Roy, J. (Eds.) *Transport, Land-use and the environment*. Kluwer Academic Publishers Inc. Dordrecht, Netherlands. (1996).
- [9] Shapiro, Robert J., Kevin A. Hassett, and Frank Arnold.,2002, *Conserving Energy and Preserving the Environment: The Role of Public Transportation*. Washington: American Public Transportation Association.
- [10] Newman, P. and Kenworthy J. Sustainable urban form: the big picture. In K. Williams, E. Burton, M. Jenks (Eds.) *Achieving sustainable urban form*. E&FN Spon. New York. 109-120. (2000).
- [11] Bush, George Walker. "State of the Union Address by the President." United States Capitol, Washington, DC, January 31, 2006.
- [12] Vissim program issued by PTV University in Germany,) www.ptvgroup.com).