

# Improving Traffic Management by Traffic Micro-simulations Model

Alireza salek and Maryam pournasir roudbane

**Abstract**—In this paper, Aimsun simulation software was used for micro-modeling and analysis of cross sections of two vital streets of portal city of Bandar Imam Khomeini named Taleghani and Imam Khamenei streets. Data from field studies including census of motor vehicles passing the square and each side of square were obtained in traffic climax hour. Additionally, selection percentage of cars passing the routes in the square was determined for specification of traffic situation. After collection of data and inputting those in Aimsun software, localization of software is performed so software output gets adjusted according to country of Iran and obtained results to become valid. For this purpose a main scenario was evaluated. In this scenario, forbiddance of vehicle park in margin of street, conversion of Saedi street to pedestrian route, elimination of connecting pathway of cross sections of 6 and 9, conversion of square 6 to equal surface cross section and transmission of U-turn from cross section of 9 to cross section of 6 before Fanous square were evaluated. Obtained results from simulation software show that in this scenario, travel time and vehicle stopping numbers show decreasing trend, and instead traffic speed rate and traffic outflow rate show increasing trend.

**Keywords**— Traffic Management, Simulation, AIMSUN Software.

## I. INTRODUCTION

### A. Urban management and traffic

With major development of cities and fast increment of city population, planning, management and investment in cities surprisingly have become complex and difficult. Since management and development of cities in developing countries are founded and engineered by central government, government authorities control development of the cities by related ministries. They do not trust to independent actions of local governments. Urban management is stated to act of all organizations, foundations, and people who impact the management process of city officially and unofficially. Hence, urban management are not only related to the municipality and city council, but any element that influence the urban management in any form is considered in this category. During the many years, urban management adopts different plans and solutions in different cities to control the traffic. Various plans such as: creating the traffic limit, creating the streets without traffic, pacifying residential areas, increasing parking price, and forbiddance of vehicle park in margins of the streets are applied to motivate and encourage citizen to utilize public

transportation. These plans have been successful in some cities of the world. It is possible with standardization of mentioned planes and localization of them in urban planning to find a solution for traffic control in cities.

### B. AIMSUN simulation software

Traffic simulation softwares are powerful tools for transportation and traffic experts to study current traffic conditions and evaluate and analyze the impact of any modification in transport structure virtually (Respati, 2015). Traffic modeling softwares in Mid-Vision and Macro-Vision levels are principally used for simulation of big traffic networks. For evaluation and analysis of smaller sections such as: a square, a cross section, a special route or vehicle, Micro-Vision level is more appropriate (Anya et al., 2014). Aimsun software is one of the traffic modeling softwares that allows users to model any related subject from one-way bus route up to all parts of a traffic region. This software has exceptional speed in simulation and has traffic modeling capability in Mid-Vision and Micro-Vision levels and hybrid mode. Also, this software can perform traffic calculations in any scale and complexity. In this paper, evaluation of present situation of current cross sections in portal city of Bandar Imam Khomeini and presentation of suitable solutions for improvement of traffic condition were considered. Improvement of traffic condition was done by reduction of total delay time, increment of outflow and speed of traffic in the mentioned square. Thus, a main scenario was evaluated. In this scenario, forbiddance of vehicle park in the margin of street, conversion of Saedi street to pedestrian route, elimination of connecting pathway of cross sections of 6 and 9, conversion of square 6 to equal level cross section and transmission of U-turn from cross section of 9 to cross section of 6 before Fanous square were evaluated. Then results were assessed by software.

## II. METHODS

In this section description of simulation model in Micro-Vision level of Aimsun software, study area and method of data gathering, inputting of field data related to the activity of motor vehicle are evaluated. Also, evaluation of parameters selection and their adjustment based of related behaviours of drivers in country of Iran are considered. A main scenario is studied in this project. In this scenario, evaluation and analysis of traffic conditions and a solution for improvement of traffic condition and assessment of obtained results after applying the solution are considered.

Alireza salek, MSc in Information Technology Management, lahijan Branch, Islamic Azad university, lahijan, Iran.

Maryam pournasir roudbane, Islamic Azad university, lahijan, Iran.

### A. Studied area

After field work visit from the city, it was determined that main problem of present cross sections along two vital streets of Bandar Imam Khomeini city, i.e. Taleghani and Imam Khomeini streets are following two problems; Presence of high level of vehicles involvement and engagement and inappropriate directing of U-turn which can be improved by geometrical correction and adjustment of U-turn. In other hand, presence of trucks and lorries in vital street of Taleghani is part of main problem. Therefore, to suggest a formal plan, proposing and determination of central network traffic of Bandar Imam Khomeini city with the aim of revaluation of traffic solution and suggested methods for comprehensive plan of this city and proposing the alternative scenarios with the aim of smoothing of traffic movement in the city centre were employed.



Fig. 1. Suggested cross sections for modeling in Aimsun software

### B. Field work data

One of the characteristics of Aimsun software is capability of receiving the online maps of OpenStreetMap. After inputting the studied region map, reading of entering motor vehicle volumes to square and available cross sections in the studied network and reading of pedestrian volumes in the studied pathways were performed. For this purpose, traffic data was read after visiting Bandar Imam Khomeini city. Motor vehicles with the aim of better modeling of traffic composition in the current situation at the traffic simulation software and application of equal ratios of corresponding vehicle were classified into four groups of car, truck and bus, lorry, motor bike and bicycle. Also, during field work visits readings were performed in the city cross sections which are controlled with traffic light. Following figure shows three cross section of the studied city which are controlled with traffic light. These three cross sections are including:

- Cross section of Imam Khomeini Street and Shahid Rajaei Street
- Cross section of Imam Khomeini Street and Shahid Mofatteh Street
- Cross section of Imam Khomeini Street and Valiasr Street

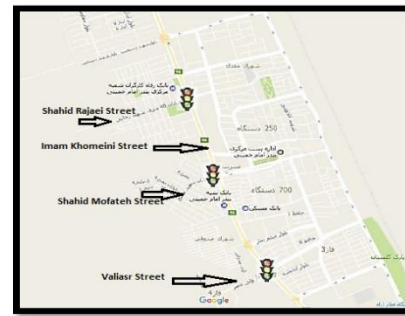


Fig. 2. Cross sections of Bandar Imam Khomeini city which are controlled with traffic light

Also, reading of traffic boards in the city and census of number of passengers getting a ride in route destination and number of passenger getting a ride throughout the route have substantial importance. In this method, considering this point that actuary is not present in taxi, no information can be collected related to passengers throughout the route. Hence, in designing this part of the form, questioning from taxi drivers has been considered. One of important indexes for the evaluation of performance of the public transportation terminal of a city, is waiting time of passengers (time difference between two public transport vehicles in row to get filled) in stations and stops. It is in a way that any amount that waiting time gets shorter, interest of passengers toward utilization of public transportation become more and together cause more encouragement and persuasion of passengers to use this system. However, it should be noticed that creating a shorter waiting time requires a suitable scheduling time, and also, devotion of more vehicle fleet to the routes which are not always applicable. Therefore, in this study, one important sections of the evaluation of performance of public transportation in the city is calculation of time interval of fleet in routes in different hours of a day in an appropriate way to passengers' demand, which will impact the waiting time. Also, it is possible to understand average circulation time of the fleet for a studied route, actually, with recording of exit hour of a public transport vehicle (with vehicle number) and recording of entering hour of same public transport vehicle in a location that the actuary is present.

### C. Execution of the simulated model

After inputting step of data and localization, execution of the simulated model is performed to receive the results before and after application of traffic solution. For this purpose, dynamic scenario option was used. Meanwhile, because only one field has been considered, therefore, Micro-Vision simulation test option was used for simulation. The number of simulation frequency was considered equal to 30 cycles so their average result become closer to the reality. Movement direction of available pathways in the studied network in this scenario has been presented in the following figure. Also, modeling of this scenario in the simulation software can be seen in the following figure. It should be noted that in the following figure, pathways which lack any movement remain unchanged relative to the current situation.

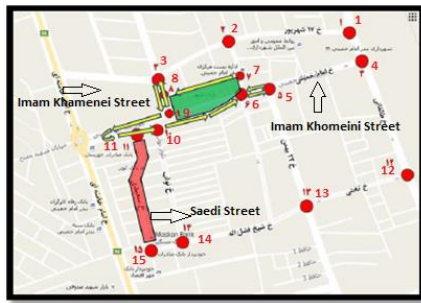


Fig. 3. Movement direction of available pathways in the studied network in the scenario

This scenario related to smoothing of traffic network in the city centre of Bandar Imam Khomeini city in the horizon plan of year 2026 includes following issues:

**a) Forbiddance of marginal park of vehicles**

Marginal park of vehicles as a problem in big and small cities, especially for central parts of city or important centres of activities in a city is not appropriate due to following reasons:

- Marginal park turns part of road to stopping location of cars, which can be used for passage of motor vehicles.
- Due to high demand of parking spots in these locations, cars which are looking for parking spot add to traffic volume and also interfere with passing traffic
- Because of close to full occupying status of marginal parking, usually motor vehicles in right lane do not find a location for passengers getting on and off and they have to stop in second lane.
- Due to many short time stops, the friction values, which are imposed to passing traffic by parking and getting out of the parking by cars, are high and this issue causes reduction in efficiency and performance of street traffic.

Therefore, one of the solutions for smoothing of traffic in central core of the city (cross sections of 5 and 6) is forbiddance of marginal park in 50 to 70 meters distances remaining to the mentioned cross sections.

**b) Conversion of Saedi street to pedestrian route**

One of the upper-hand suggestions related to the traffic network of Bandar Imam Khomeini city was conversion of Saedi street to a pedestrian route and eradicating the traffic role (either by transferring or access) of this street. From traffic point of view, 60 meters distance between cross sections of 10 and 11, create disordered distribution of traffic flow. Therefore, Saedi street conversion to pedestrian route and elimination of one cross section, improve traffic interference resulted from adjacent cross sections of 10 and 11. Actually, Management of marginal park of cars along the Imam Khomeini street is complementary to elimination of cross sections along this street.

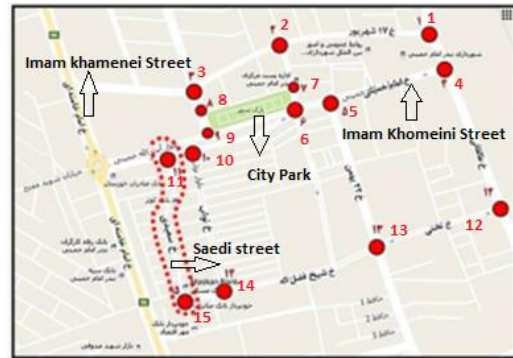


Fig. 4. Conversion of Saedi Street to pedestrian route in the scenario

**c) Elimination of connecting pathway of cross sections of 6 and 9 and conversion of square 6 to equal level cross section**

In this scenario, connecting link between cross sections of 6 and 9 are eliminated to decrease traffic involvement level in the central square of the city. Also, in the suggested scenario, cross section of 6 which is a square currently has been proposed as an equal level cross section. This is done to increase its performance level in high volumes traffic without need to a traffic light. Additionally, movement direction between cross sections of 7 and 8 has been proposed from east to west with a pathway between the cross sections of 6 and 9 with the aim of formation of a movement loop.

**d) Transferring of U-turn from cross section of 9 to cross section of 6 before Fanous square**

In this scenario, U-turn close to the cross sections of 6 and 9 is closed and the U-turn is transferred to a close distance from Fanous square. This decision is made with the logical engineering assumption that with elimination of cross section, U-turning is transferred to a better distance. This action results in better and more effective distribution of traffic flow.

**III. DISCUSSION OF OBTAINED RESULTS**

After execution of scenarios and completion of cycles and repetitions, Aimsun program provided an output report of general number for traffic condition of the governing scenario. In this output report, main parameters of the traffic including travel time, fuel consumption, delay time, traffic flow rate, pollution, motor vehicles density, and predicted speed rate are presented. In the following figure, improvement percentage of desirable and optimized traffic in central network of Bandar Imam Khomeini city has been compared with proposed scenario for elimination of traffic blockade in this city in horizon plan for year 2026. As can be seen from following figure, improvement levels in the parameters of delay time, pollution, and fuel consumption were higher than other parameters. Therefore this scenario can improve smoothing movement in the central traffic network of Bandar Imam Khomeini city until horizon plan of year 2026.

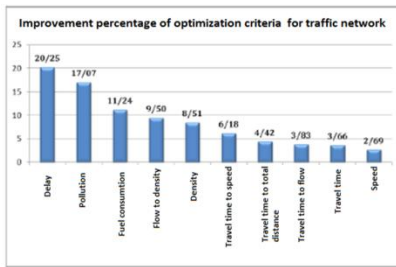


Fig. 5. Improvement percentage of traffic optimization criteria in the current network compared to the scenario proposed for elimination of blockade in horizon plan of year 2026.

#### IV. CONCLUSION

By refereeing to obtained results from the simulation, designing and execution of U-turns have decreased travel time and stopping numbers, and increased speed rate and traffic flow rate. Also, in addition to the mentioned benefits, performed design has decreased fuel consumption and environmental pollution. It is because the amount of consumed fuel originated from the congestion in the square or slow movement of motor vehicles shows decreasing trend with decrement of delay time and stopping numbers, and increment of traffic flow rate. These are important factors in reduction of pollution resulted from burning fossil fuels and production of greenhouse gases. Additionally, delay time has been decreased and as a result, time which is the most important factor in the life and is unreturnable is managed in a good way; and, is saved appropriately which will be resulted in more efficiency of the society and its people.

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Alireza Salek was born in Rasht, Iran, in 1992. He received the BSc degree in Industrial Management from the University of Guilan, Iran, and the MSc. in Management information technology from Islamic Azad University. His thesis title was Providing a solution to improve urban management by predicting traffic in smart cities and he has written some papers related to himself thesis. His research interests are Traffic and Transportation.



Maryam Pournasir was born in Lahijan, Iran, in 1979. She received the B.E. degree in Electrical engineering from the University of Guilan, Iran, and the Ms. in Industrial management. and Ph.D. degrees in Information Technology from the Multi Media University (mmu) Cyberjaya, Malaysia in 2008 and 2013, respectively. In 2015, she joined the Department of Information Technology Management, Islamic Azad University of Lahijan, as a Assistant Professor until now.