



**A STUDY TO ESTABLISH TRAFFIC STATISTICAL RECORDS IN
GAZA CITY, PALESTINE**

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ABSTRACT

Most countries of the world are highly concerned in producing traffic statistics because of its great importance in the planning and design of various facilities of transport and communication services. In Gaza city, traffic statistics are currently very limited and are usually performed at locations where a problem exists and when funding is available. The currently used methods to collect traffic data in Gaza do not provide a good and valuable coverage of the required traffic information for decision making and planning. Therefore, the main objective of this research is to develop a system including a guide for the location of counting stations on selected roads and intersections in Gaza city and suggesting the best periods for traffic counting and data collection. It also indicates the beneficial methods of publication of data. In order to provide a working example on how to use the suggested system, it was applied on two case studies; analysis of traffic data of Al-Jalaa Street and Al-Saraya Road Intersection.

Keywords: Transportation statistics, traffic counts, count stations, traffic report, Gaza, Palestine.

1. Introduction

Gaza city is located in Gaza Strip; which is a coastal strip on the White Mediterranean Sea. Gaza Strip is bordered by Sinai desert in the South and the Mediterranean Sea in the West and Israeli settlements in the East and North. Gaza city is situated on a relatively flat coastal plane, the area constitutes about 45 square kilometres, and it has the largest Population Density in the Palestinian territory, according to a 2016 census by the Palestinian Central Bureau of Statistics about 645 thousand people lived in Gaza, representing 34.3% of the total population of Gaza Strip (P.C.B.S, 2016).

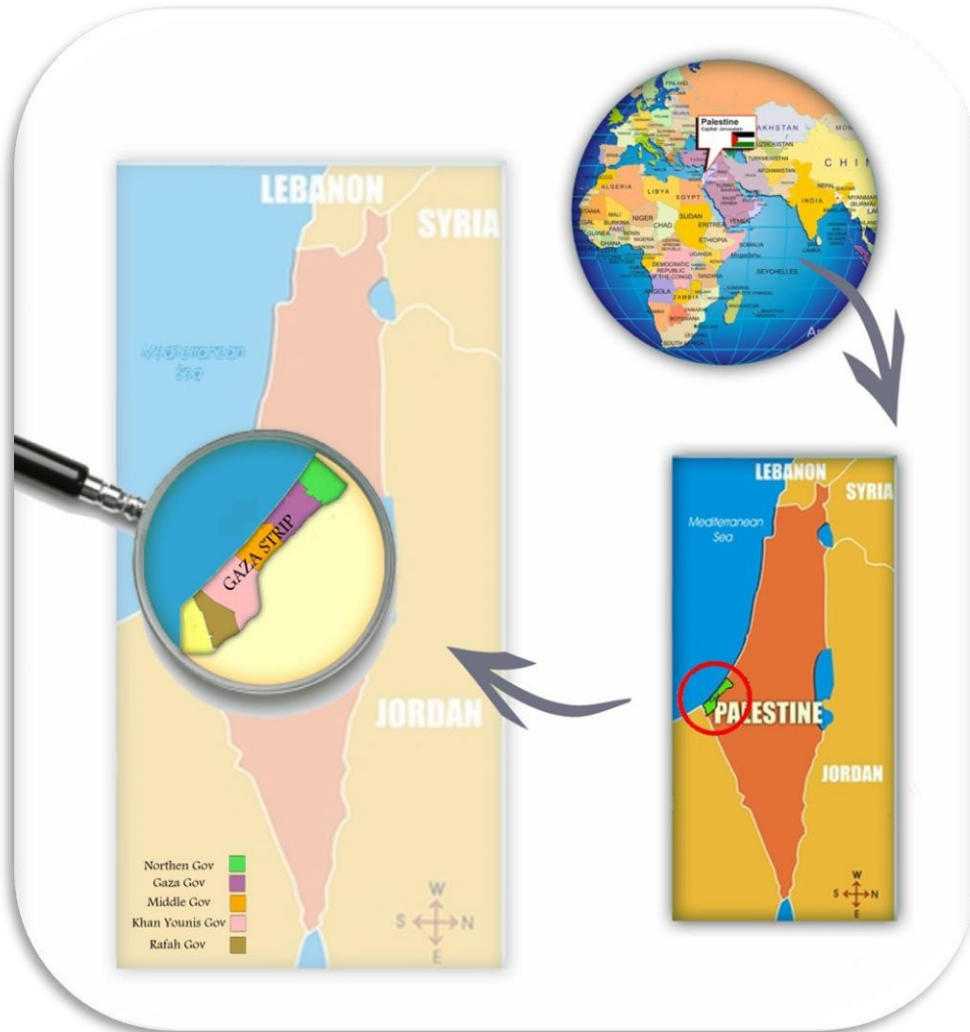


Figure 1 Location of Palestine and Gaza Strip (Source:("mapsworld.com," 2014))

In Gaza city, the transportation system relies on land transport. Roads are considered the only mode of transportation in the governorates of Gaza; where there is no rail lines, water or air transport facilities. Urban roads are classified by the Ministry of Transport (Ministry of Transport and Communication, 2013) in terms of their function and the relationship between

the roadway and the land use it serves; they are classified as arterial, collector and local streets.

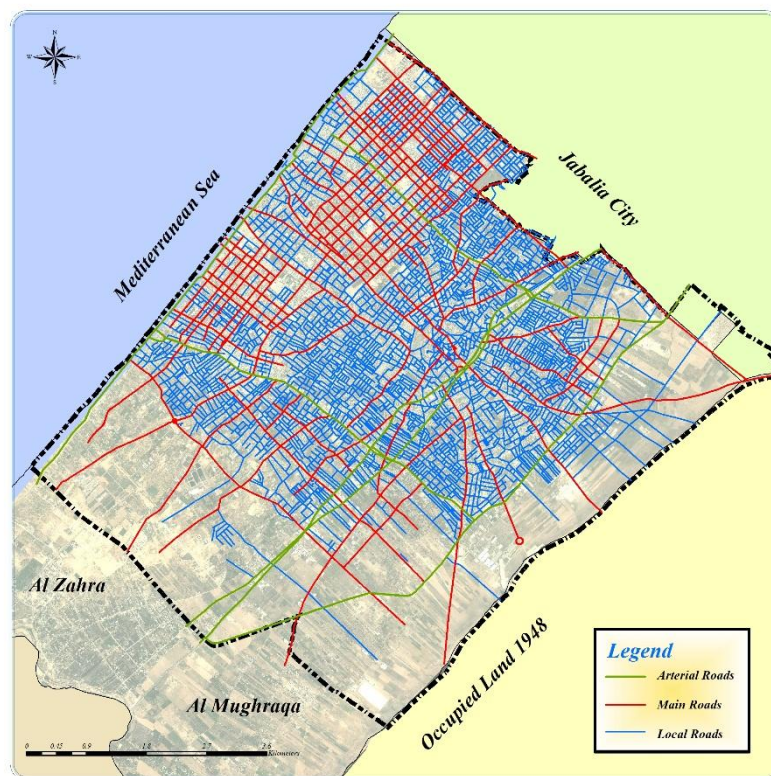


Figure 2 Road Network in Gaza City (Source: The land Authority of Gaza)

Gaza city road network combines between the Radial network system in the old part of the city and the Grid system in the newer parts of the city. The Ministry of Public Works and Housing as cited by the Palestinian Central Bureau of Statistics explained that the total Gaza city paved road network length in 2014 was 62 Km(PCBS, 2015). Total length of Roads in Gaza city is 709.443 km consisting of Arterial roads with a length of 46.756 km, Main roads with a length of 165.255 km and Local Roads with a length of 497.432 km, as obtained from ArcGIS. Figure 3 shows the percentage of road types in Gaza city.

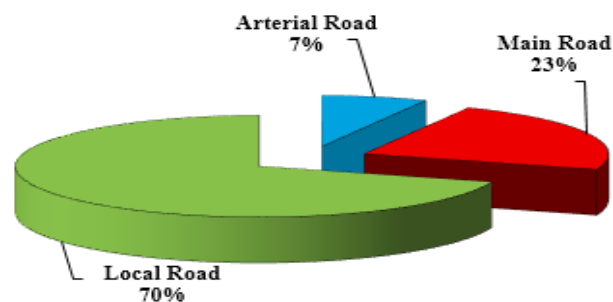


Figure 3 Percentages of Road Types in Gaza City

The available traffic statistics in Gaza city are chaotic and without good management. They are also limited to statistics conducted for solving a particular problem or for developing some roads. On the other hand, traffic statistics might be available from reports produced by students of the College of Engineering at the Islamic University of Gaza. This was confirmed by the Deputy Director of the Roads Department in the Municipality of Gaza, he said that "the existing traffic statistics are limited to traffic junctions that have problems, these statistics are used to make modifications to the timing of traffic signals based on trial and error and the observations of the traffic police."

Traffic statistics are currently conducted using the manual counting method, however, this method is tiring and do not cover all local road network. Traffic flow data are collected and classified by vehicle type, and then they are analyzed using Excel program. Traffic statistics are not published officially or periodically; they might be found in university students' graduation projects, master thesis and some local road studies. The Director of the General Administration of Urban Planning in the Ministry of Local Government said that "traffic statistics, which should be under the responsibility of the Ministry of Transport, are not performed as required". This may be because of the lack of potential, lack of experience and lack of will. However, to facilitate the understanding and usage of traffic data, it should be published in an easy and simplified format. Therefore, it is necessary to collect and analyze the data and then publish it at regular basis. But The Director of the General Administration of Urban Planning expressed his lack of confidence in government institutions and suggested that this should be conducted by consultancy offices through government-funded projects. Alternatively, the Director Manager of the Gaza Office of Municipal Development and Lending Fund (MDLF) confirmed that the Ministry of Transport should be responsible for traffic statistics.

The Head of the Technical and Engineering Affairs Sector in the Ministry of Transport emphasized the importance of traffic statistics and the need to make regular traffic reports. This led to the convening of a workshop in December 2016, one of its most important recommendations was the need for coordination between the Ministry of Transport and the Palestinian Central Bureau of Statistics in updating statistical data in the transport sector, and to form a traffic statistics center in coordination with relevant institutions and benefiting from the research conducted by students of the Islamic University in the transport sector.

2. Objectives

The aim of this study is to prepare a system that can be used to make continuous collection and update of traffic and transportation data in Gaza City. The system will include a guideline for the location of traffic counting stations and the timing of traffic counts. It is also required to identify data publication mechanisms and to suggest the agencies responsible for monitoring, collection, and analysis and reporting of data.

3. Methodology

In order to achieve the objectives of this study a review was conducted on the literature of traffic data collection, analysis and publication in some developed as well as developing countries. The existing roads and road intersections in Gaza city were then classified and the available traffic statistics were collected from the relevant institutions and available sources. The second phase involved the collection of new traffic counts for selected main roads and intersections in Gaza city. This was important to fill some gaps in the traffic counts and statistics at important locations. The researcher also conducted interviews with policy makers, traffic engineers and municipal engineers to discuss the current situation of traffic statistic in Gaza City and to explore their opinions about how to develop traffic statistic in Gaza. This was followed by the analysis of collected information in order to determine the locations of counting stations on selected roads and intersections, preferred counting periods, alternatives of traffic counting methods and possible methods of publication. This paved the way to prepare a system that can be used to make continuous updates of traffic and transportation data in Gaza city. Finally, the proposed system was applied on local case studies producing a traffic statistics report. Two case studies were selected; Al-Jalaa Street and Al-Saraya Road Intersection.

4. Literature Review

Local studies on traffic statistics are limited to studies that discuss particular problems on some roads, which require traffic statistics on these roads. In the developed countries there is a great interest in traffic statistics by governmental and non-governmental bodies. The publication of traffic statistics, in many cases, is made by means of websites and periodic reports. On the other hand, in developing countries, traffic statistics are in short supply and they are not given adequate concern.

Gaza city suffers from the lack of regular traffic statistics and the limited interest of official institutions. The Ministry of Planning paid some interest to traffic statistics; it carried out few studies; the first one was in 1995 about traffic and accidents in the Gaza Strip (The Ministry of Planning, July 1995). The most recent publication was issued in 2010 on the sectorial planning of roads and transportation (The Ministry of Planning, 2010) which necessitated the collection of traffic statistics on Salah al-Din and Al Rasheed Streets for 9 hours from 7:00 am to 4:00 pm. However, in the field of traffic related statistics the Palestinian Central Bureau of Statistics (PCBS) publishes statistics limited to the number of licensed vehicles and the length of the road network in the Gaza Strip classified by governorate, region and type of road. The latest data was published in Ramallah in 2011. These data has not been updated and were published again in 2015. In 2003, a report was published giving traffic statistics on the main road intersection in Gaza city (Sarraj, 2003). A serious effort was exerted in 2007 where a collection of several traffic related data was analysed and published giving important information on several main roads and intersections in Gaza Strip between 1994 and 2006 (Sarraj, Feb 2007). Therefore, it was concluded that in order to advance and keep abreast of global development in Gaza city, and in order to meet the urgent need for statistics on traffic and transportation, it is necessary to create a system to regulate traffic statistics.

5. Results and Analysis

This section presents the main results obtained by this research. It includes the suggested data collection methods, traffic counting locations, the timing of traffic counts, the methods of publication and finally the proposed contents of a traffic report.

5.1 Methods of Data Collection

Traffic counting methods fall in two main categories, namely; manual counts and automatic counts. The selection of the appropriate method of traffic counting is a function of the level of traffic flow and the required data quality. In Gaza city, due to the lack of potential and lack of funding, traffic counting is currently based on limited manual traffic counts. Manual Traffic counting methods are tiring, and cannot include the entire road network. Therefore, it is suggested that surveillance cameras can be exploited, to analyze video camera recordings utilizing some computer programs such as Smart Traffic Analyzer (STA) for vehicle counting and road traffic analysis (PICOMIXER, 2017).

5.2 Traffic Counting Locations

A very important step is to determine where and when to conduct traffic counts. Considering several guidelines and regulations, the locations of counting stations on roads and intersections in Gaza city were selected based on the following criteria (Ministry of Communication, 2001):

- 1) Traffic flow is typical of the average flow on the road.
- 2) The existence of previous traffic data at the same station.
- 3) The lighting is good and vehicles can be easily seen.
- 4) The enumerators can take shelter in case of inclement weather and still observe the traffic, for Manual traffic counts.
- 5) Enumerators have good vision of traffic approaching from both directions. There are no bends, trees or buildings obscuring vision, for Manual traffic counts.
- 6) The road section should have an uninterrupted traffic flow.
- 7) Section meets safety requirements.

Figure 4 exhibits the location of 22 counting stations on the roads of Gaza city. The location of 26 counting stations at selected road intersections is also exhibited in Figure 5. These counting stations represent the minimum number required for traffic counting in the city of Gaza in order to provide beneficial information about traffic movement in the city. However, other locations might also be added in case of any justified need. It is also possible to select some of these suggested locations because of reasonable reasons such as limited time or limited available budget.

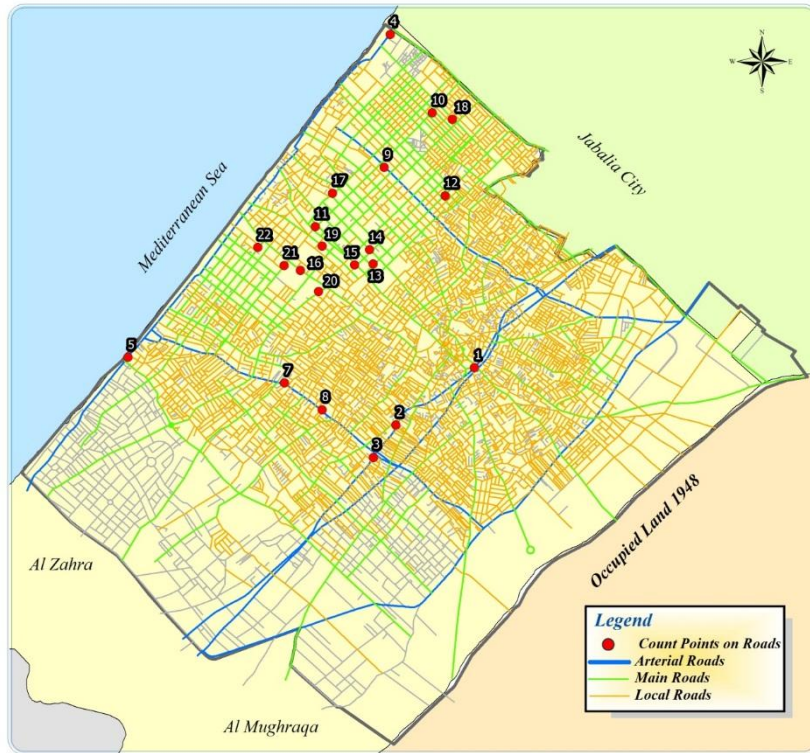


Figure 4 Locations of Counting Stations on the Roads of Gaza City

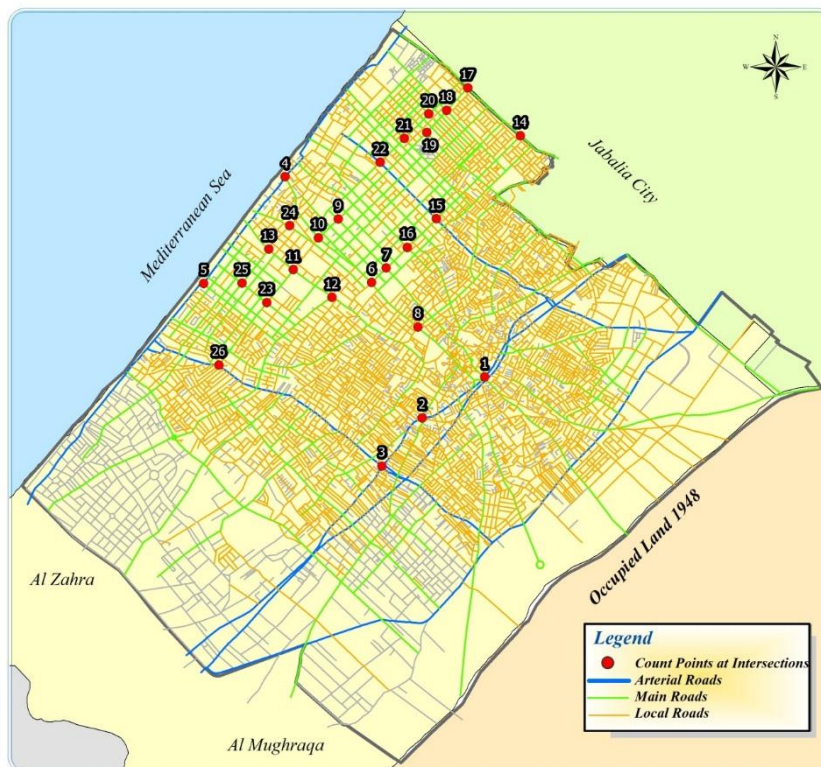


Figure 5 Locations of Counting Stations at Road Intersections in Gaza City

5.3 Timing of Traffic Counts

The best practice is to conduct traffic counting for 24 hours for a week. Alternatively, traffic counts for 16 hours from 6:00 am to 10:00 pm may be adequate. However if this is not possible, counts should be conducted during the following periods 6:00 - 9:00 am, 12:00 - 3:00 pm and 5:00 - 8:00 pm. For the benefit of identifying the peak hour period and the peak hour volume; Counting should be conducted on 15 minute intervals. This procedure helps in determining the peak hour as well as the Peak Hour Factor (PHF).

Generally, the best months for traffic counting are from February to April or from September to November, avoiding high temperatures in summer and heavy rains in winter; excluding May and June because they contain exams for school and university students. During the selected months of traffic counts, attention should be paid for days in which traffic counts are not suitable, such as the following:

- Public Vacations, such as Labor Day, Independence Day, New Year's Day, Al Israa and AL Meraaj Day and the Prophet's birthday, etc.
- Religious feast days for Muslims such as Eid al-Fitr and Eid al-Adha
- School holidays
- Fridays
- Any day when traffic flow is expected to be abnormal.

5.4 Methods of Publication

Currently, in Gaza city, information on traffic data is not available or easily accessible. It is recommended that traffic data should be made easily available and accessible in an understandable format. Tables, simple maps and graphs should be produced for presentation of summary information. The use of infographics could also be of great advantage. The proper presentation of data will assist staff, stakeholders and decision makers who are not familiar with traffic data.

Traffic statistics can be published utilizing several means, such as:

- ❖ Periodic reports and publications
- ❖ Websites, the most important of which is the website of the Ministry of Transport in Gaza www.mot.ps/site/, www.mot.gov.ps as well as the website of Palestine Transport; www.paltrans.org, which was established in 2008. A portal on the internet might also be beneficial in order to interact with specialists and users.

- ❖ Social media and applications on smart phones.
- ❖ Regular specialised workshops.

For the above system to be achieved, it is of great importance to assign responsible bodies for taking care of such duties. The assigned body should be able and willing to cooperate and coordinate with several other public and private institutions including academic institutions. The recommended bodies are the Ministry of Transport, the PBCS and the Municipality of Gaza.

5.5 Traffic Report Contents

To facilitate the understanding and usage of traffic data, it should be published in easy and simplified reports. These reports have to be supported by tables, figures and infographics.

The report should include an introduction, summary description, summary traffic statistics, analysis, conclusions, and recommendations. Information about the location, the day, the date and the time of data collection must be included in any traffic statistics report. This will give useful and comprehensive information of the traffic flow data on roads and intersections. Reports should be published at regular periods of 6 months or on annual basis.

6. Conclusions

Traffic statistics is a crucial task that road agencies have to perform in order to improve operational and planning activities, as well as to supply policy makers with reliable data to be used when attaining strategic decisions.

Automatic counting methods might be a better alternative. This is especially true if surveillance cameras that are already installed on many locations in Gaza city are utilized to analyze video camera recordings making use of some computer programs for vehicle counting and road traffic analysis.

Collected Traffic data should be analyzed to get important parameters such as, traffic flow during the peak hour (PHV) (veh/hr), peak hour, minimum traffic flow during the counting period (veh/hr), time of minimum traffic flow, Peak Hour Factor (PHF), Design Hour Volume (DHV) and Traffic Composition.

The current methods used to collect traffic data in Gaza do not provide a good and valuable coverage of the required traffic information for decision making and planning of both development and maintenance of the road network. In order to be able to use traffic statistics in planning for the development and maintenance of road network and intersections in Gaza

city, it is crucial to produce a system for the development of traffic statistics. Such a system includes a guide for the location of counting stations on the roads and intersections of Gaza city. It also suggests the best time periods for traffic counts and data collection. Finally, it discusses the methods and means of publication in order to exhibit results in the simplest way using charts and images.

Traffic Statistics Samples:

In order to provide a working example of the analysis and presentation of traffic flow data, it was applied on local case studies. Two case studies were selected; analysis of traffic data of Al-Jalaa Street and Al-Saraya Road Intersection.

Figure 6 exhibits the hourly distribution of traffic flow data on Al Jalaa Street in both directions of travel between 2002 and 2015. It exhibits traffic counts from 6:00 to 21:00.

Traffic counts for Al Jalaa Street are available for the years 2002, 2005 and 2006 for 16 hours; unfortunately, no data is available about the locations of counting stations. In 2015 traffic counts were made for 16 hours at a location north of Dabeet Intersection. In 2010 the traffic counts were conducted in two different areas for 14 hours, the first counting station was near Al Zafer Tower, the second counting station was near Jawwal Company. However, traffic counts in 2016 were for a whole week from Saturday to Friday for 24 hours near Hanoun Restaurant.

*Means that the traffic count was on the same day but at a different station.

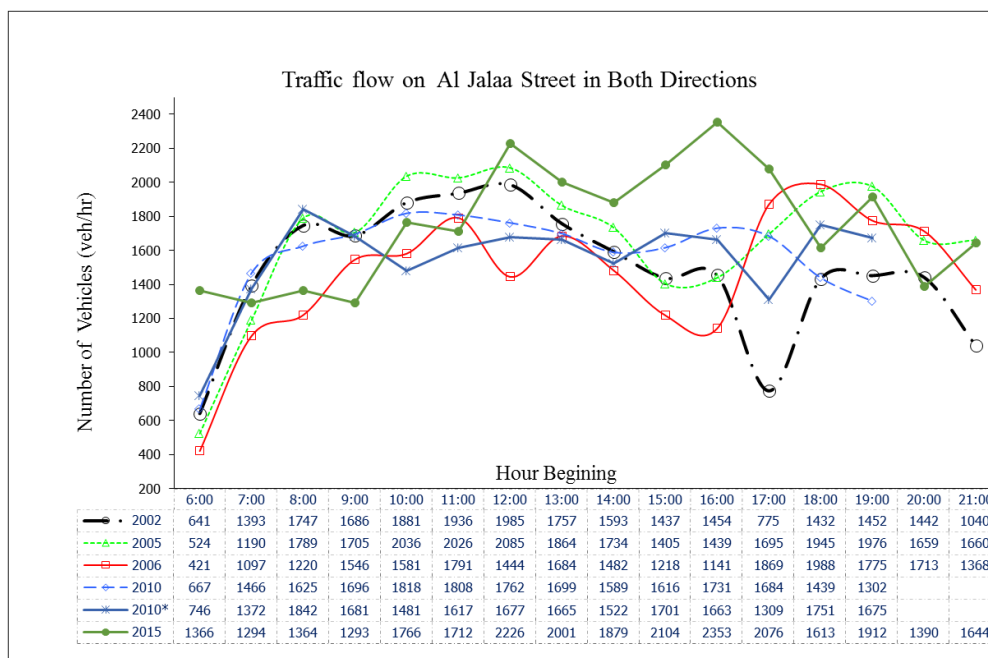


Figure 6 Traffic Flow on Al Jalaa Street in Both Directions from 2002 to 2015

Figure 7 and Figure 8 present the hourly distribution of traffic flow on Al Jalaa Street for the southbound and the eastbound traffic for 24 hours in a whole week in February 2016.

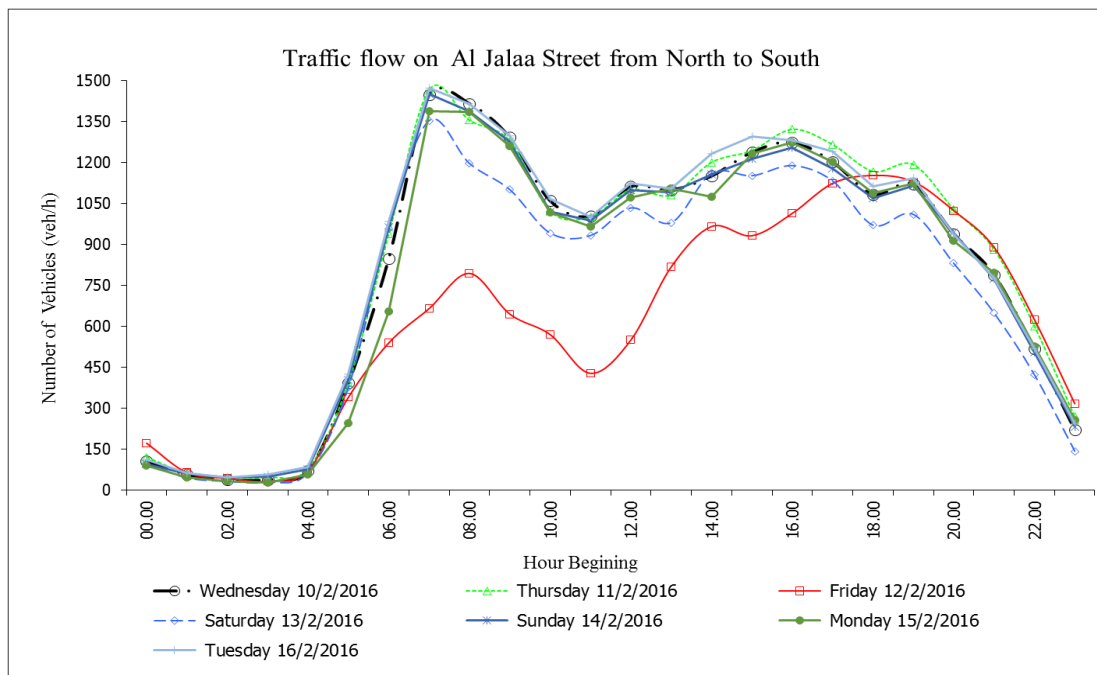


Figure 7 Traffic Flow on Al Jalaa Street from North to South in 2016

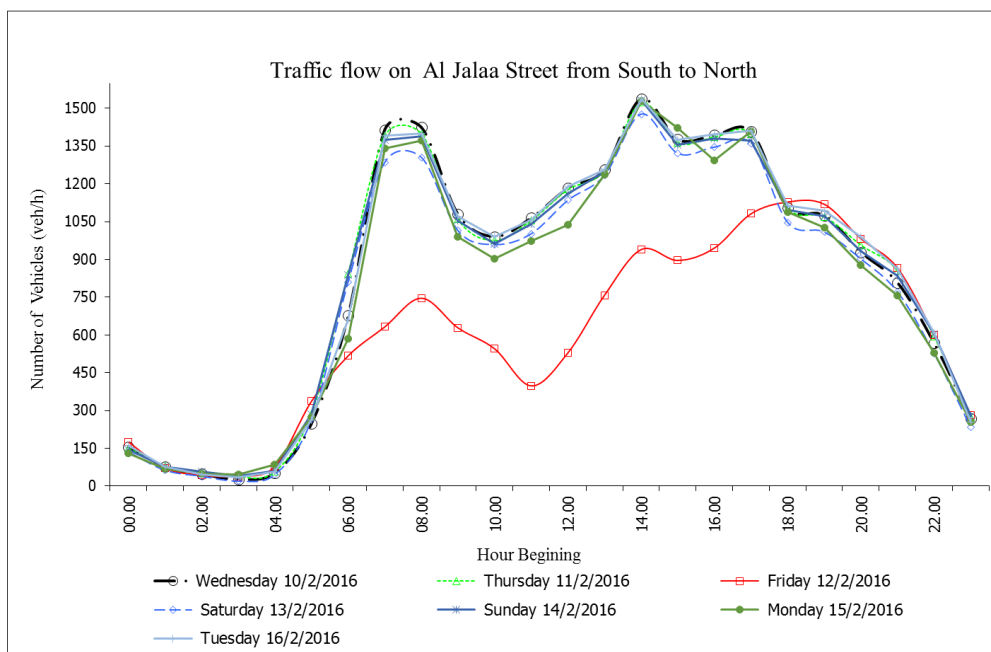


Figure 8 Traffic Flow on Al Jalaa Street from South to North in 2016

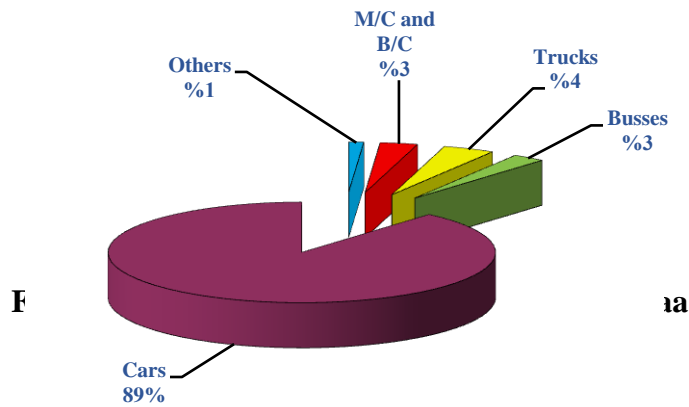


Figure 9 presents the average traffic composition on Al Jalaa Street in both directions from 2002 to 2015. However, Figure 10 exhibits traffic composition on Al Jalaa Street in both directions on every day for a whole week in February 2016.

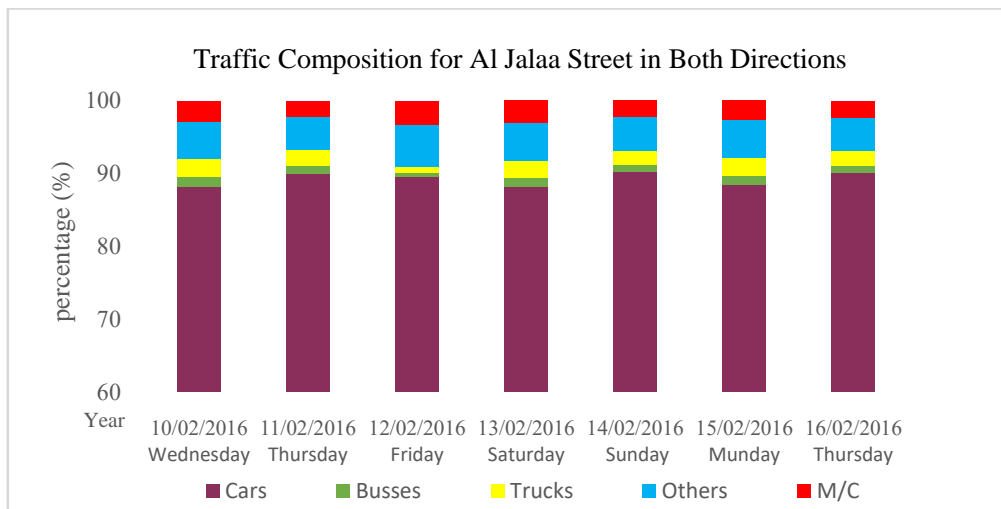


Figure 10 Traffic Compositions for Al Jalaa in Both Directions in 2016

The average traffic composition in 2016 on Al Jalaa Street in both directions of travel is exhibited in Figure 11 using info graphs. The 15-minute traffic flow distribution during the morning and evening peak periods in February in 2016 is presented in a bar-chart form in Figure 12.

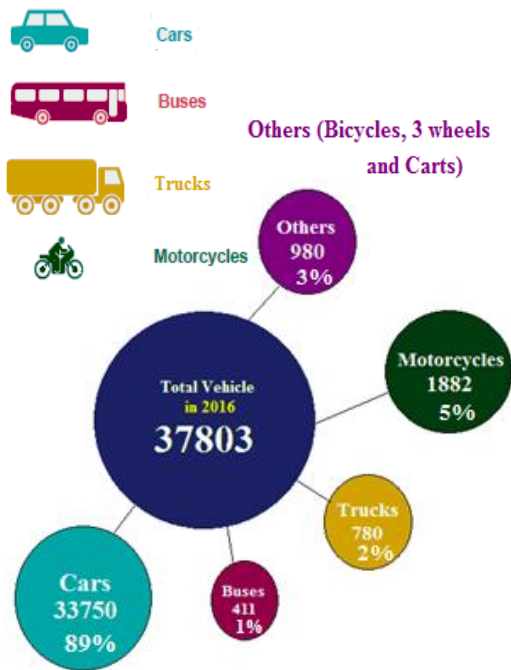


Figure 11 Average Traffic Composition for Al Jalaa Street in Both Directions in 2016

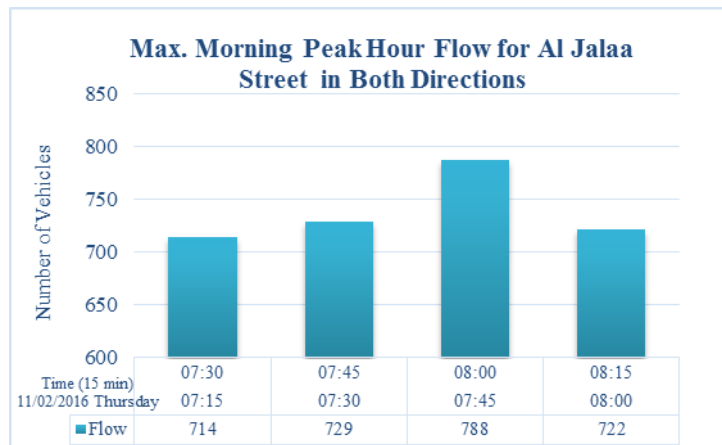
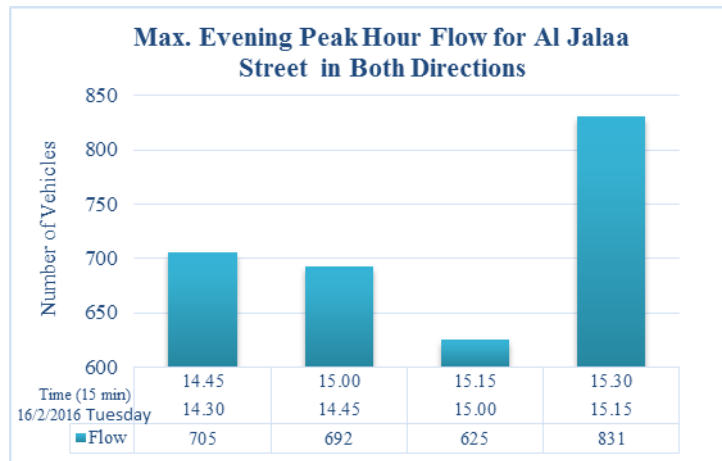


Figure 12 Max. 15 min. Flow during Morning and Evening Peak Hour Flow for Al Jalaa Street in Both Directions in 2016

Recommendations

The following recommendations are provided in order to help making traffic statistics in Gaza city well organized and to encourage cooperation between relevant institutions in this regard:

- 1) Cooperation between governmental and non-governmental organizations in the collection of traffic data.
- 2) Cooperation of governmental institutions concerned with the field of transportation and communication in order to facilitate the process of obtaining information and to help overcoming obstacles.
- 3) Creating an effective role for the private sector and investors to participate in the creation of reliable traffic database.

- 4) It is recommended to exploit the surveillance cameras installed on the roads of Gaza and to analyze video camera recordings utilizing some computer programs for vehicle counting and road traffic analysis.
- 5) Training courses on traffic counting and methods of statistical analysis.
- 6) It is recommended to create a portal on the internet that is specialized in collecting, sorting and publishing all related information about traffic and transportation in Gaza. It is also recommended to make use and develop the website of the Ministry of Transport as well as the Palestine Transportation Website www.paltrans.org, which was established in 2008 for the same purpose.

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