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The project

Analysis of Traffic Accidents in Al Seeb in 2013

Case study: Al Qaser Roundabout, Al Mabeela Bridge and
Bait Al Baraka Roundabout

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Abstract

The aim of this study to analyze traffic accidents in a small-scale area in Willayat Al Seeb within Al Qaser Roundabout, Al Mabeelah Bridge and Bait Al Baraka Roundabout.

Geographic Information System technique is widely used to locate and estimate traffic accidents sites in the study area. These sites then linked to useful attribute data for each traffic crashes using ArcMap GIS software. After that, the black spots were detected for these traffic crashes.

Al Seeb's traffic accidents data for year 2013 were collected from Statistical Department in Directorate General of Traffic and also from Police reports at Al Seeb and Al Khoud Police Stations.

The main challenge in this study is identify the traffic accidents sites as the original data are lack of X & Y coordination. These data are not available in digital maps. so the coordinates are not available and is also not easy to derive from practical surveying. This paper provides a Geographical Information Systems (GIS) -based approach for the production of digital accidents site's maps and shows the black spots based on sketches for accidents in study area from police reports and geospatial methods in a GIS.

1. Introduction

Increasing number of vehicles in cities is one of the consequences of urbanization. Positive relationship appeared between number of vehicles and traffic accidents. Traffic crashes are a global issue, the World Health Organization reported that the total number of road traffic deaths remains unacceptably high at 1.24 million in 2010 (WHO: 2013). WHO (2011) reported that road traffic injuries are among the three leading causes of death for people between 5 and 44 years of age. Unless immediate and effective action is taken, road traffic injuries are predicted to become the fifth leading cause of death in the world, in addition, its Socio-economic side effects. Road safety is of great concern to the Sultanate of Oman government. His Majesty Sultan Qaboos Bin Said presented a speech about traffic accidents in 2009, he stressed the seriousness of the situation on the roads and loss of life due to excessive speed and violation of traffic laws. His Majesty directed to put this issue in a huge attention and cooperation from all segments of society (Oman TV: 2009).

Even though the percentage of traffic accidents in Oman between 2012 and 2013 decrease to -5% but the number still high. Total road accidents all over Oman during 2013 were 7829 accidents (ROP: 2014). Muscat Governorate recorded the highest number of accidents, 2582 in 2013 and inside Muscat Governorate number of accident peaked in Willayat Al Seeb at 1369 in the same year. It is about 53% of total accident in Muscat and 17% of the whole country. A serious situation is obvious from these statistical.

To study any issue we should tracking its dimensions and aspects to facilitate ways of possible solutions. Geographic information system is an important and prominent technology that solving many issues around the world. This study shows the importance of the use of GIS to reduce the

traffic accidents, through the identification of black spots and to figure out potential solutions for each site.

2. Literature review

There have been a lot studies about Geographical Information Systems-based accidents and the ability to use its applications on traffic safety worldwide. A study in south Australia done by Affum and Taylor (1997) described the development of a Safety Evaluation Method for Local Area Traffic Management (SELATM), his study was about a GIS-based program for analyzing accident patterns over time and evaluation of safety benefits of local area traffic management schemes. Erdogan and others (2008) developed a system transforming text into table form and then to georeferenced onto the highway by determined hotspots in highways in Afyonkarahisar in Turkey. Anderson (2009) presented a methodology using Geographical Information Systems (GIS) to study the spatial patterns on injury related road accidents in London then, create a classification of road accidents hotspots. Yao Ye and others (2014) provided in their study a geographical Information Systems-based approach for the creation of digital black spots maps in Nottingham in UK, using historical accidents dataset and geospatial methods in a GIS. Studies in the same field appeared in Arab countries like the research by D. Al Samani and others (2011). The research focused on problem of transport accidents and traffic jam in Central Khartoum. In addition, from GCC Al Rihily (2008) presented a study about spatial analysis of traffic accidents locations in Al-Madina city using GIS. The study focused on detected some of characteristic of distributional patterns of traffic accidents. Al-Anbouri (2013) submitted a research about analysis of traffic crashes in Oman. She used Geographic Information Systems techniques to identify the high severity traffic crashes areas or black spot locations in Governorate of Muscat.

3. Study area

Al Seeb is one of the vital Willayats in Governorate of Muscat, Capital city of Sultanate of Oman. Located between 58° 02' E to 58° 20' E longitudes and 23° 28' N to 23° 42' N latitudes (Figure1). It is bordered to the West by Willayat Barka (Al Batinah South Governorate), from East Willayat Boshar, from North Sea of Oman and to the south by the Willayat Bidbid (Al Dakhiliah Governorate). It has a population of 310 673 inhabitants in 2012 (Statistical Yearbook: 2013). The importance of Wilayat Al Seeb is being it the entrance for people who come from the Governorates of Al Dakhiliah and South Al Batinah to the capital. In addition to Al Seeb's dwellers, many people move daily from Al Dakhiliah and South Al Batinah governorates across Al Seeb roads to their places of work, hospital or governmental departments in the governorate of Muscat using cars or buses. This cause a huge traffic jam and most of the time lead to traffic accidents. According to 2013 statistical data a high percentage (53%) of accidents in Muscat happened in Al Seeb. The study shed light on small areas of Al Seeb, these areas include Al Qaser Roundabout, Al Mabeelah Bridge and Bait Al Baraka Roundabout (Figure 2)

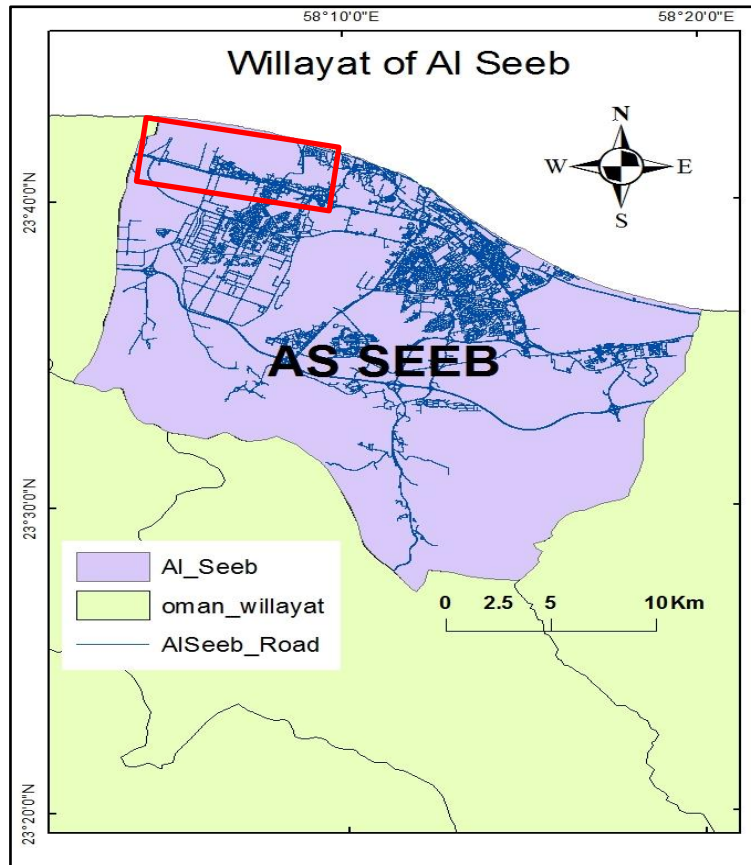


Figure 1: Willayat of Al Seeb map

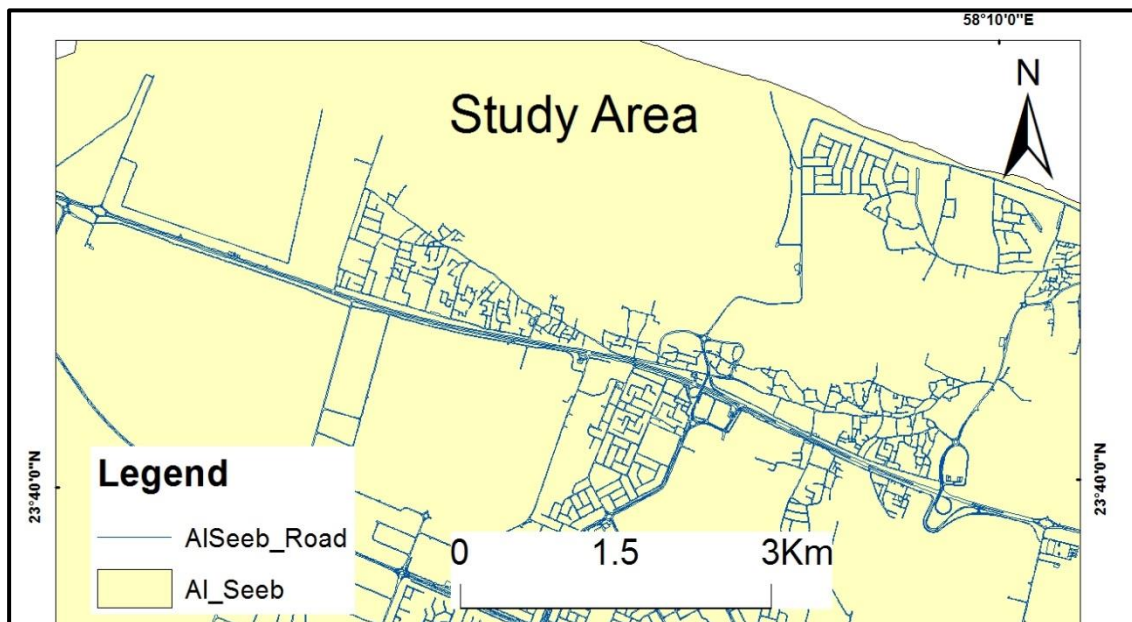


Figure 2: Study area map

4. Methodology

In order to determine the black spots in the study area various procedures and data were used. Two types of GIS data used in this study, spatial data like Al Seeb map in shapefile format which exported from Oman willayat map that got it from Geography department in Sultan Qaboos University. Al Seeb road map is from Supreme Council of Planning (Census 2010 project). Accidents sketches (schemes) collected from ROP. In Addition, primary data for accidents points and black spots were created using a point vector data model in ArcMap in ArcGIS. Other type of data is attribute data, it contain some details like name of the police station, number of fatalities and injuries, location, date and causes of traffic accidents (Figure 4) . Statistical data for year 2013 which belong to study area collected from Statistical Department in Directorate General of Traffic. In addition, some tools in ArcMap and Arc Catalog are used to reach to the aim of this study, as shown in Figure 3.

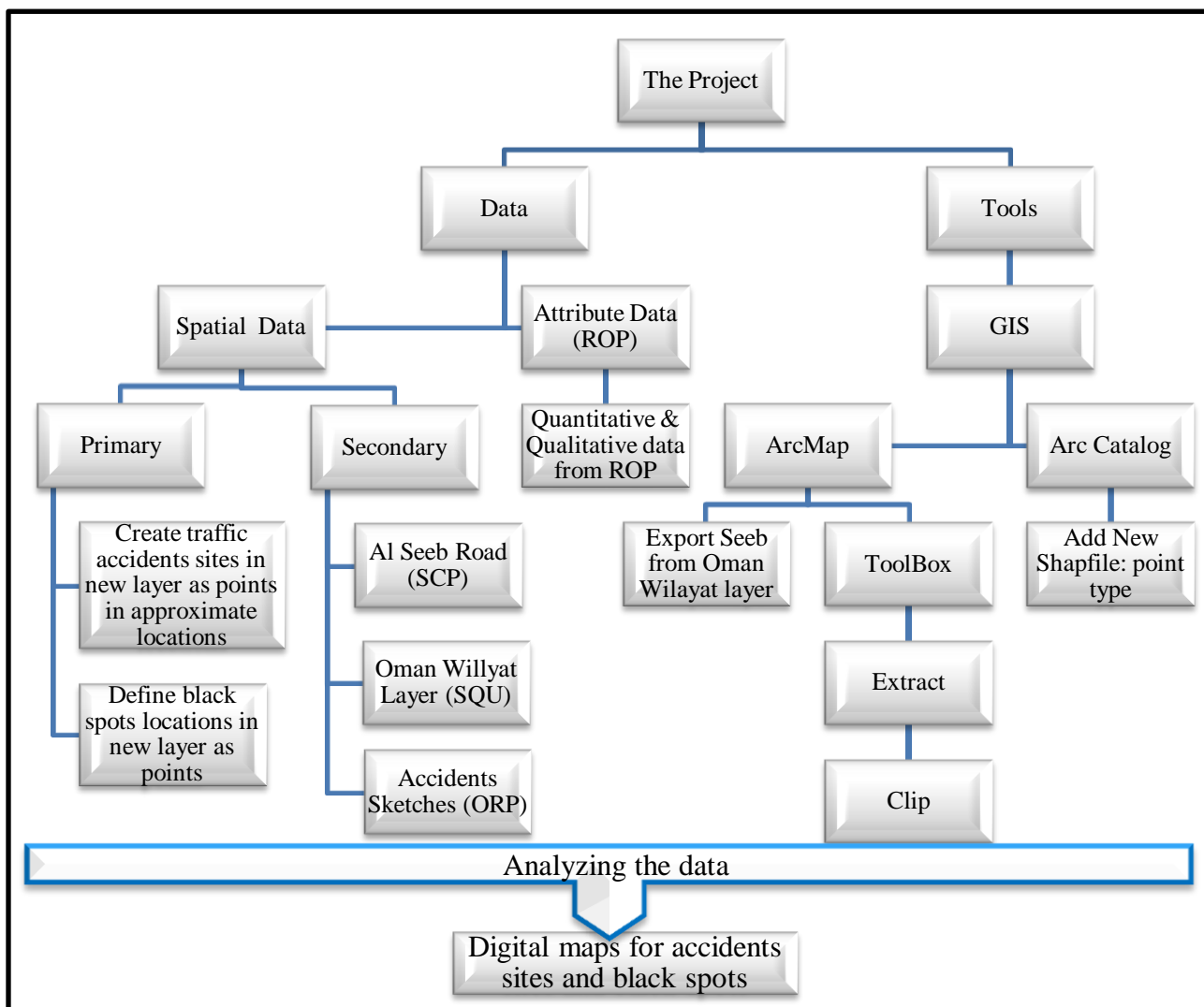


Figure 3: Methodology Structure

5. Analysis and Results

To take into account the credibility of this paper it should clarify at the outset that, despite the fact that the researcher was aspired to identify all traffic accidents in the study area in 2013, it was hard to get all the schemes and reports. Thus it has relied on a sample of about 80.5 % of traffic accidents in study area. Add to that, the global position system was not used to identify these traffic accidents, so the coordinates are not available. Hence, this study relied on approximate positions as shown in the schemes and reports of traffic accidents.

Table below shows the number of traffic accidents have identified via ArcMap GIS program.

Traffic accidents identified	Location
16	Bait Al Baraka Roundabout
6	Al Mabeelah Bridge
36	Al Qaser Roundabout

Table 1

5.1 Accidents causes

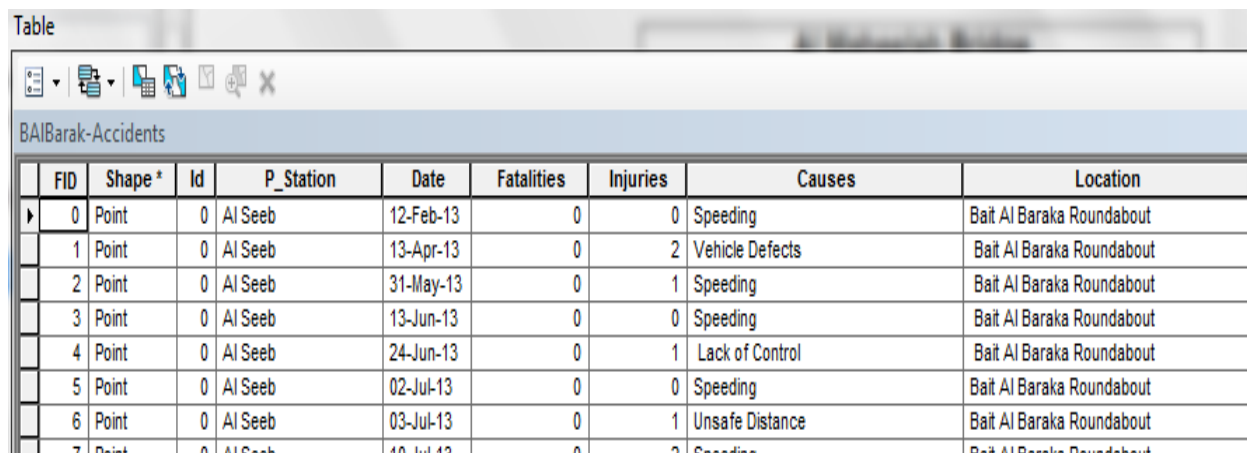
There are various causes for traffic accidents in study area, it turns out that 53% of these accidents were caused by speeding along with other causes, which are: Negligence, Fatigue, Drink driving, overtaking, weather condition, sudden stop, unsafe distance, lack of control, vehicle defects and road defect.

5.2 Determine traffic accidents locations

Step 1: Traffic accidents Schemes and reports were studied carefully, then, their locations were primarily identified on a paper map which has been taken from Google Earth.

Step 2: Added all necessary layers like Al_Seeb.shp, AlSeeb_Road.shp and CenterLine.shp.

Step 3: Added new Shapefile in Point type from Arc Catalog, then identified traffic accidents sites in study area. After that, added the attribute data for each accident as shown in Figure 4



FID	Shape *	Id	P_Station	Date	Fatalities	Injuries	Causes	Location
0	Point	0	Al Seeb	12-Feb-13	0	0	Speeding	Bait Al Baraka Roundabout
1	Point	0	Al Seeb	13-Apr-13	0	2	Vehicle Defects	Bait Al Baraka Roundabout
2	Point	0	Al Seeb	31-May-13	0	1	Speeding	Bait Al Baraka Roundabout
3	Point	0	Al Seeb	13-Jun-13	0	0	Speeding	Bait Al Baraka Roundabout
4	Point	0	Al Seeb	24-Jun-13	0	1	Lack of Control	Bait Al Baraka Roundabout
5	Point	0	Al Seeb	02-Jul-13	0	0	Speeding	Bait Al Baraka Roundabout
6	Point	0	Al Seeb	03-Jul-13	0	1	Unsafe Distance	Bait Al Baraka Roundabout
7	Point	0	Al Seeb	10-Jul-13	0	2	Speeding	Bait Al Baraka Roundabout

Figure 4: Attribute table for Bait Al Baraka Roundabout

5.3 Identification of Black Spots

Identification of black spots differs from one country to another, also it depends on the period of studying the area. One of the identification belong to Apparao & D.P (2013) “A location whether link or node that experiences abnormal crash frequencies”. According to ROP, black spots are the places with high severity traffic crashes areas (Al Anbouri: 2013). According to Directorate General of Traffic (ROP: 2014) Black Spots in one year defined if one of the following conditions is appear:

- Three traffic accidents with injuries
- Two traffic accidents with fatalities

5.4 Results

5.4.1 Bait Al Baraka Roundabout

The statistical data shows that about 20 traffic accidents happened in Bait Al Baraka Roundabout area in 2013. Figure 4 illustrated 16 traffic accidents locations in Bait Al Baraka area. As it is obvious from data and ROP conditions of black spots, it is unlikely to find black spot in Bait Al Baraka Roundabout.

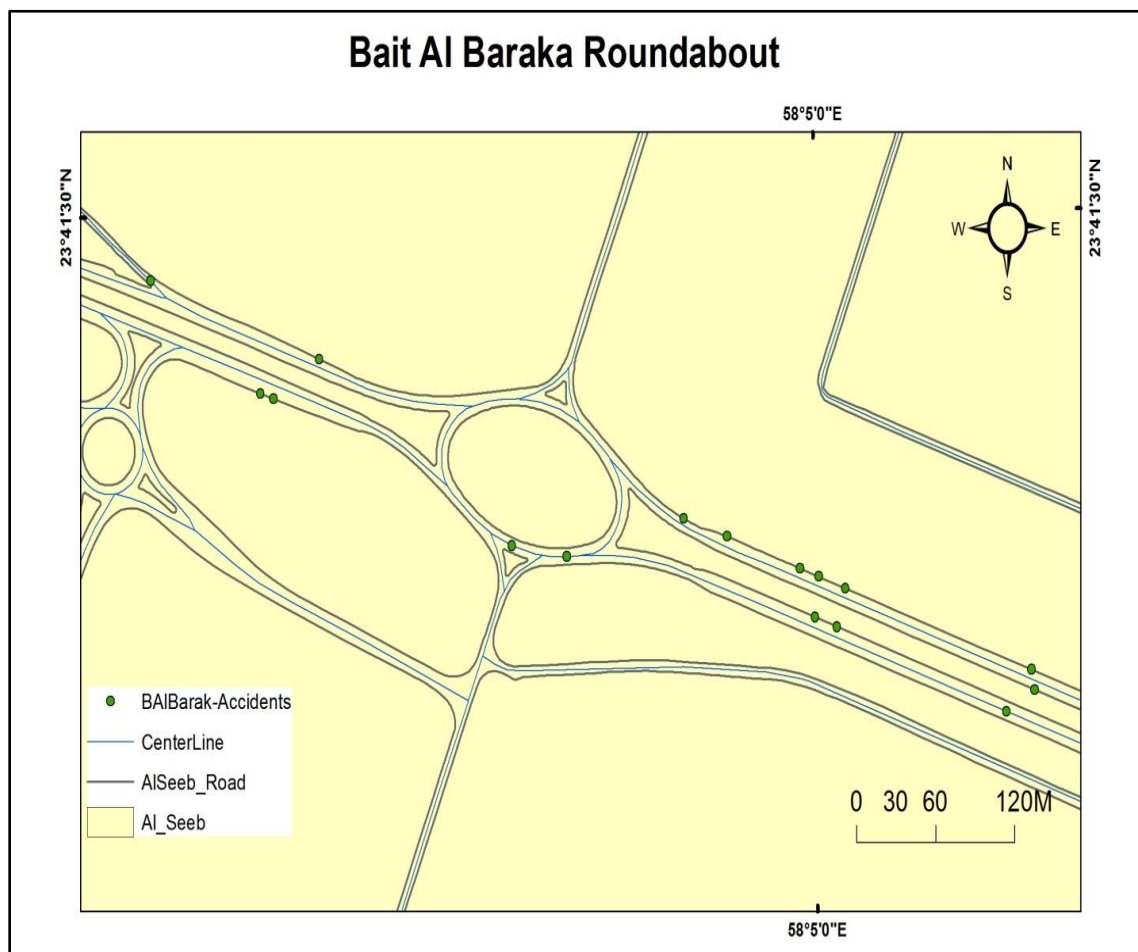


Figure 5: Map shows traffic accidents in Bait Al Baraka

5.4.2 Al Mabeelah Bridge

Even though a few numbers of accidents occurred in Al Mabeelah Bridge, there is a black spot as ROP mentioned (three traffic accidents with injuries) on the bridge Figure 7.

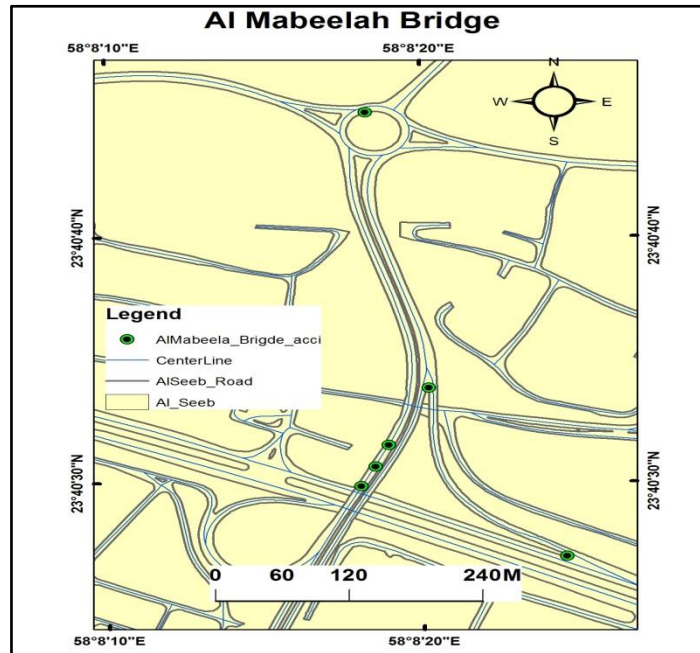


Figure 6: Map shows traffic accidents in Al Mabeela Bridge

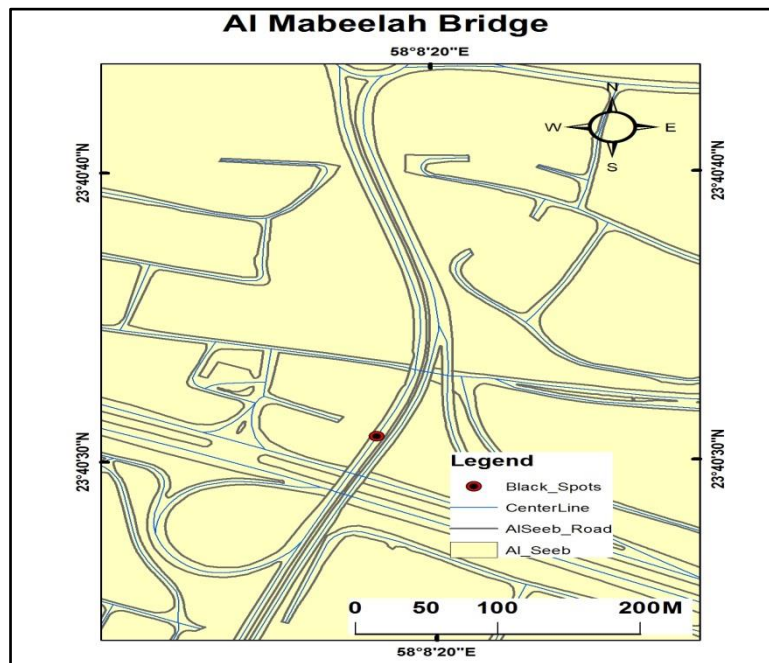


Figure 7: Map of black spot in Al Mabeelah Bridge

5.4.3 Al Qaser Roundabout

Al Qaser Roundabout recorded the largest percentage of traffic accidents within the study area, 59.72 % (Figure 8)

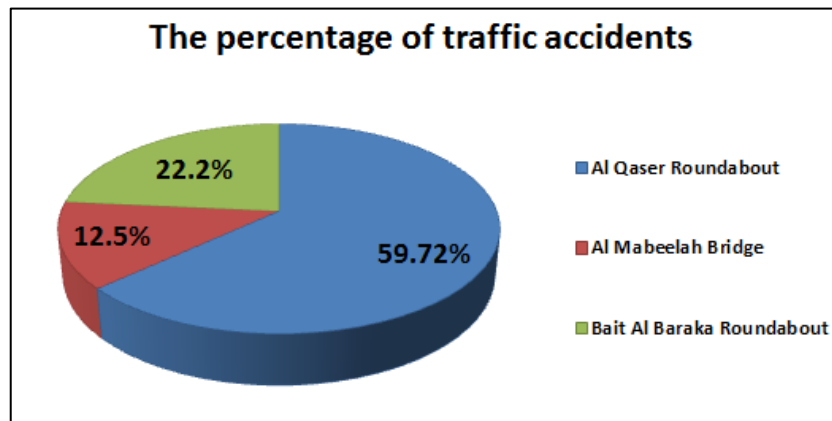


Figure 8: Percentage of Traffic accidents in study area

Figure 8 demonstrates the distribution of 36 traffic accidents in Al Qaser Roundabout.

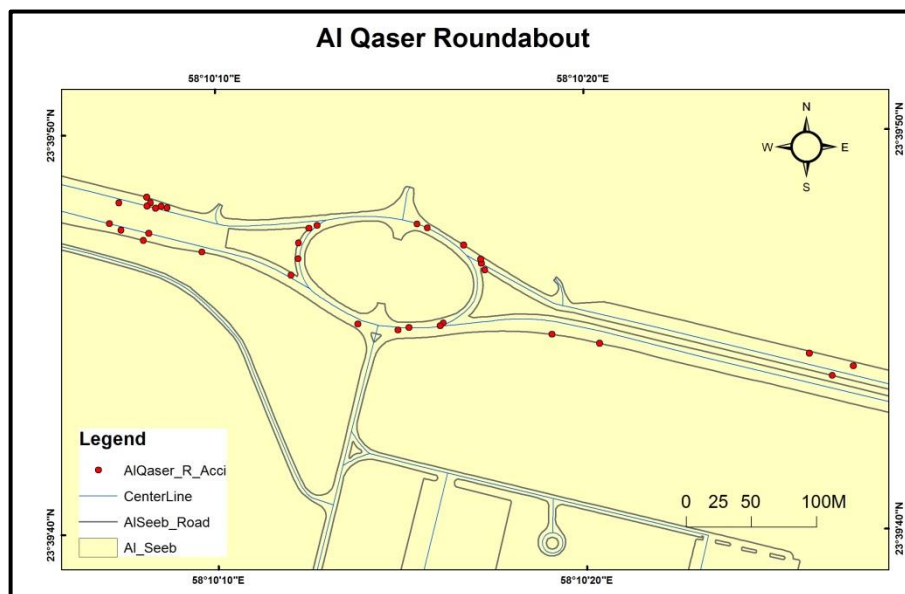


Figure 9: Map of traffic accidents in Al Qaser Roundabout

Unlike the rest of the sites in the study area, Al Qaser Roundabout has more black spots. Figure10 illustrated 4 black spots it this roundabout.

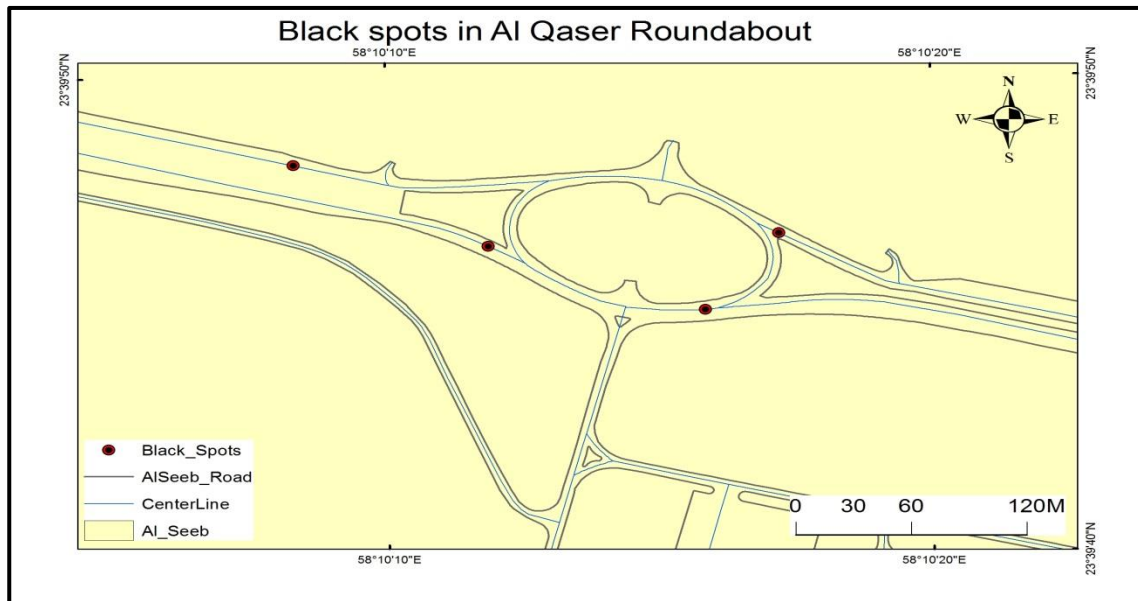


Figure10: Map of black spots in Al Qaser Roundabout

6. Recommendation and Conclusions

6.1 Conclusions

This study is introduced a GIS-based traffic accident by converted traditional methods to record traffic accidents in papers schemes to digital maps. The results show that Al Qaser Roundabout got the highest number of traffic accidents and black spots in 2013. Therefore, some important action must be taken in this area to reduce the number of traffic accident.

6.2 Recommendation

- 1- More studies should be done in roads, human behaviors and other subjects those related to traffic accidents and could help to decrease these accidents.
- 2- The traditional method that used in planning traffic accident should be changed, for example using a GPS will be useful and helpful in this aspect.
- 3- Plans that are put in place to reduce the number of traffic accidents must take into account the cooperation between all specialists in various sciences in society.
- 4- In the area of Al Qaser RA, traffic lights can be considered.

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