# Achieving the Efficient Distribution of Police Stations and Rescue Police Points in Duhok City/ Iraq by Using (GIS)

Dr. Maha J. Malaika1*,   Hussein Hamid2,   AbdulWahid Sulaiman3

1.   School of Engineering, Duhok University, Avro City, Duhok, Iraq

2.   School of Spatial Planning, Duhok University, Dabeen City, Duhok, Iraq

3.   School of Spatial Planning, Police General Directorate,, Duhok, Iraq

* E-mail of the corresponding author: maha.jameel@uod.ac

## Abstract

Duhok city in Kurdistan of Iraq have witnessed a great urban expansion and population growth since 2003. Many areas are built up and population has increased because of the migration from other parts outside the governorate to Duhok city.

This research intends the investigation and evaluation of existing situations and distribution of rescue police points and police stations in Duhok city. The study tries to find out whether the existing rescue police points are fairly distributed or not, and to which extent they can control the city and reach at crime position efficiently.

The research investigates the rescue police and police stations and compares the police stations services with local and regional criteria regarding population and quarter's area.

In spite of the hardships and difficulties faced by the researchers in collecting necessary data, the researchers have obtained data about RP and PSs by field surveys and interviews. Data about RP staff, equipment and cars have been collected. The study has used new techniques such as; Global Position System (GPS) for determining the points, locations, and Geographic Information System (GIS) for producing maps and other needed issues.

The research followed local and regional planning criteria such as; crime rate, population density, roads, main roads, roads intersections, and important public utilities, with field study. The research has reached some recommendations and suggestions regarding the efficient distribution of rescue police and police stations, in the whole Duhok city. The recommendations also include methods and solutions for the problems that are facing the RP and PSs in order to strengthen and better operate their duties in reducing crime rates.

**Keywords:** Police Stations (PS), Rescue Police Points (RPP), Geographic Information System (GIS).

## 1. Introduction

Police is considered as the most important institution for enforcing the implementation of the law in the city. The main purpose of its duties is the preservation of the public system and the protection of security of society. Due to the Duhok city rapid urban expansion and population growth, police and rescue police have to increase its abilities regarding the increasing of police stations and rescue points in the city, enforcing and strengthening their physical abilities, their equipment like cars, protection methods and related issues. Some regional and international standards are set to determine the efficient distribution of Police Stations and Rescue Police Points. Some of the major factors affecting the planning criteria for security-police services and their efficiency are population densities, crime rates, and economic activities (Saudi Arabia Planning Criteria, 2005). No local studies are available regarding criteria or standards of distribution of police stations. This paper aims the study, investigating and setting these criteria for efficient Police services distribution.

## 2. Research questions:

The paper will try to answer the following questions:

-What are the rational methods for the distribution of the PSs and the RPPs?

-How to decrease the time required reaching the event location in minimum rate and better controlling the whole city?

## 3. Methodology:

The research used scientific method for studying distribution of Police Stations and Rescue Police Points by acquiring the spatial data of Duhok city from related directories. Using interviews with specialized police officers and using geographic information system (GIS) for:

a) Pre-processing and processing the spatial data and fill questioners in order to know importance of each criterion and combining them in final digital map in raster format.

b) Comparing the existing PSs and RPPs and its distribution with the final digital map and improve their locations in order to better service.

## 4. Theoretical Part:

*4.1 Definitions:*

*4.1.1. Police*: Is the management of state to provide security, maintain order and execute laws that are enacted for public interest. Police in modern terminology has a duty of enforcing law and ensuring security. Policemen are employees, their duties are almost the same across the world and can be summarized as follows ( Waadolla, 2013).:

Maintaining order, Deterring and controlling crimes, Criminals' correction and rehabilitation, Executing laws.

*4.1.2 Local police station (LPS):* is a security centre that provides security services for neighbourhoods or villages; it's linked to the main police directorate.

*4.1.3. Main police directorate (MPD):* The security centre  provides security services for the whole city and the adjacent residential areas .

*4.1.4. Rescue Police:* is the first line of defence against illegal behaviour; it has a comprehensive humanitarian preventive duty. Rescue police is the first division that comes into the scene in accidents, enforces laws and rules and turns cases to specialized departments without getting into any details .

## 5. Planning Criteria for police stations distribution:

*5.1 Regional / Saudi Arabia planning criteria:*

Table (1) shows regional ( Saudi Arabia Kingdom), and local( Iraq) planning criteria for police stations distribution within cities.

*5.2 Local Iraqi Criteria:*

The main local Planning Criteria for distribution of Rescue Police points according to Ministry of housing and construction 2010 are:

- Crime rates.
- Population density.
- Main roads
- Important public utilities.
- Streets and crosses.

Table (1) shows regional ( Saudi Arabia Kingdom)  and local( Iraq) planning criteria for police stations distribution within cities.

| Criteria that determine needs for local police station according to Saudi Arabian Kingdom criteria. | | | |
|---|---|---|---|
| Item | From | To | Notes |
| Number of people served | 20000 | 30000 | In a neighborhood or residential section |
| Computerized service area in km² | 3 | 5 | |

| Criteria that determine needs for local police departments according to local (Iraqi) criteria. | | | |
|---|---|---|---|
| Item | From | To | Notes |
| Number of people served | 9600 | 14400 | In a neighborhood or residential section |
| Computerized service area in km² | - | 0.64 | |

Source1 and 2:Saudi Arabian Kingdom, planning standards for services 2005.& Ministry of Construction and Housing 2010-Iraq.

## 6. Practical part:

*6.1: Study Area:*

The case study is Duhok city in Kurdistan region of Iraq which represents the centre of Duhok governorate. It is located between latitudes 36° 48' 00" - 36° 57' 00" N and longitudes 42° 51' 30"- 43° 06'40"E. The total area of the study area is about 46 km2, with population about 293398, distributed into 44 quarters. (Statistic Directorate of Duhok (2010). Duhok city is surrounded by three mountains from north, south and east. In the western direction; the city is opened to Sumeal agricultural plain. Figure (1) shows the study area. Duhok Quarters city Map.

Fig. 1 Duhok Quarters city Map



Figure (1.1) Duhok city map.

There is unfair distribution of people on quarter areas of Duhok. Some quarters with large areas have low population density, while other quarters with small areas include large density. Such as; Etit quarter's area is about 4.974578 km2 with population density of 1151.45 /km2. While Naoore and Zozan quarters area are about 0.185845 km2 with high population density of 48546.53/ km2. See table (2) Duhok quarters population

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(Directorate of Guide and Information of Duhok (2010).

Table 2: Duhok Quarters Population and Areas

| | Quarter | population | Area of each quarter | | Population density(km$^2$) |
|---|---|---|---|---|---|
| | | | M$^2$ | Km$^2$ | |
| 1 | Ashti | 4826 | 604892 | 0.60489 | 7978.31 |
| 2 | Azadi | 4021 | 276020 | 0.27602 | 14567.78 |
| 3 | Bahdinan | 3696 | 1173688 | 1.17368 | 3149.06 |
| 4 | Southern Baroshke | 3411 | 121927 | 0.12192 | 27977.36 |
| 5 | Baroshke | 23060 | 958908 | 0.9589 | 24048.38 |
| 6 | Bazar | 634 | 79080 | 0.07908 | 8017.2 |
| 7 | Bin Tika | 3875 | 499737 | 0.49973 | 7754.18 |
| 8 | Botan | 4679 | 1014995 | 1.014995 | 4609.87 |
| 9 | Brayati | 940 | 98315 | 0.09831 | 9561.59 |
| 10 | Dasinya | 516 | 379279 | 0.3792 | 1360.75 |
| 11 | Diyari | 10667 | 464126 | 0.464126 | 22982.98 |
| 12 | Efit | 5728 | 4974577 | 4.97457 | 1151.45 |
| 13 | Gali | 8959 | 393321 | 0.393321 | 22777.8 |
| 14 | Gavarke | 2529 | 288400 | 0.2884 | 8769.07 |
| 15 | Gre Base | 4782 | 230047 | 0.23004 | 20787.68 |
| 16 | Kani Kheshmana | 1754 | 202120 | 0.20212 | 8678.01 |
| 17 | Kani Mahmadke | 9149 | 533599 | 0.5336 | 17145.8 |
| 18 | Khabat | 7292 | 302068 | 0.302068 | 24140.25 |
| 19 | Down_Malta | 10688 | 1577222 | 1.577222 | 6776.47 |
| 20 | Up_Malta | 19351 | 3286763 | 3.286763 | 5887.55 |
| 21 | Western_Masik | 11588 | 2859475 | 2.85947 | 4052.49 |
| 22 | Masike | 7587 | 2647762 | 2.647762 | 2865.43 |
| 23 | Mazi | 4230 | 1540710 | 1.54071 | 2745.48 |
| 24 | Midya | 5205 | 872312 | 0.87231 | 5966.91 |
| 25 | Muhabad | 6355 | 422527 | 0.422527 | 15040.45 |
| 26 | Naoore and Zozan | 9027 | 185945 | 0.185945 | 48546.61 |
| 27 | Nawroz | 1383 | 227135 | 0.22713 | 6089.02 |
| 28 | Nohadra | 1974 | 266452 | 0.266452 | 7408.46 |
| 29 | Nzarke | 5340 | 2771487 | 2.771487 | 1926.76 |
| 30 | Peshangaha | 310 | 1254166 | 1.25416 | 247.17 |
| 31 | Peshasazi | 299 | 227420 | 0.22742 | 1314.74 |
| 32 | Raza | 11967 | 1665091 | 1.665091 | 7186.99 |
| 33 | Ronahi | 7598 | 932491 | 0.932491 | 8148.06 |
| 34 | Sarbasti | 2062 | 676901 | 0.6769 | 3046.24 |
| 35 | Sarheldan | 33115 | 1930806 | 1.9308 | 17150.92 |
| 36 | Se Gerka | 5160 | 368999 | 0.369 | 13983.73 |
| 37 | Shahidan | 3509 | 224914 | 0.224914 | 15601.51 |
| 38 | Shakhke | 10652 | 1277886 | 1.277886 | 8335.64 |
| 39 | Shele | 9843 | 257064 | 0.257064 | 38290.07 |
| 40 | Northern Shindokha | 8246 | 1764002 | 1.764 | 4674.60 |
| 41 | Old Shindokha | 4449 | 574472 | 0.57447 | 7744.52 |
| 42 | Shorash | 6024 | 489201 | 0.4892 | 12313.98 |
| 43 | Zanko | 1521 | 3111440 | 3.11144 | 488.84 |
| 44 | Zrka | 5397 | 2043794 | 2.04379 | 2640.68 |
| | total | 293398 | 46051536 | 46.051 | |

Source/ Directorate of Guide and Information of Duhok (2010)

*6.2 Police Directorate and Police stations in Duhok city:*

According to (Saudi Arabian Kingdom.2005) standards for distributing the main police station in urban area which state that each PD should cover area about 30 km2 and serves about 80000 to 250000 inhabitants. In Duhok city area 46.05 km2 and population about 293.398 inhabitant, there is only one Police Directorates PD and it is divided into two Sections, one in east and other in west, and six local police stations distributed in Duhok city. See figure (2)

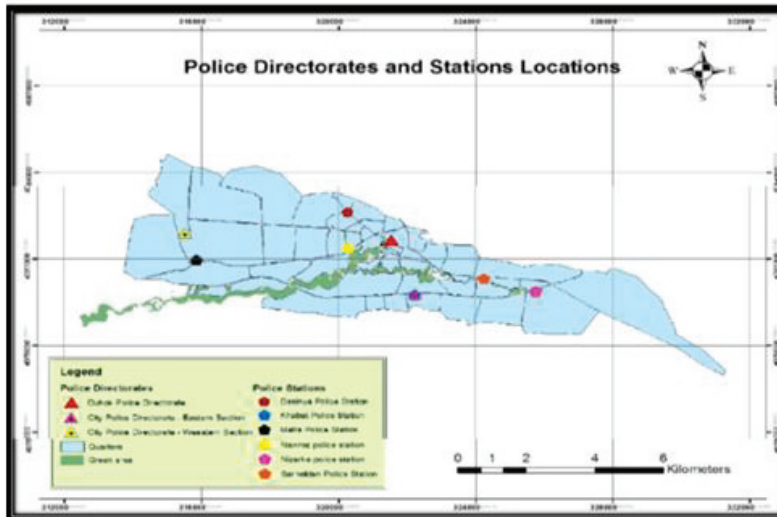Fig 2: Duhok Police Directorates and Stations Locations

Figure (3.1): Directorate police station, City police directorate and six local police station.

Source/ Done by the researcher

*6.3 The Rescue Police Points:*

According to the data of RPD in Duhok city there is one department of rescue police and 25 points distributed over 44 quarters. The figure (3) shows the distribution of all RPPs over 44 quarters and each section under the control of mentioned RPP code.

Fig. 3: Duhok Rescue Police Points Sections
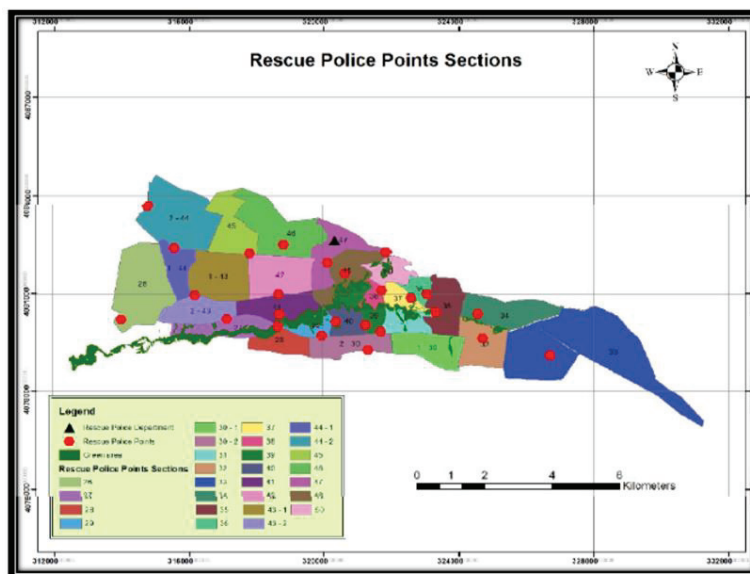


*6.3.1 A study of rescue police conditions and the system adopted:*

Until 2013, no unified system is available in distributing points or patrolling cars inside the Kurdish cities. It all depends on the prior knowledge of the police general commander aided by a number of senior officers including patrol police commander (Interview with: RP commander; lieutenant colonies: Rasheed M Rasheed.)

*6.3.2 Role and tasks of rescue police within the police force:*

RP is one of the most active departments in the police directorate. It's the primary unit that deals with incidents, crimes, natural disasters; it's the first unit which executes the law. Their job includes arresting wanted people, gamblers, swaggerers in casinos and coffee shops. Most of the times police stations, aided by RP, arrest the suspects wanted by courts within their domain areas. RP also chases wanted cars and the accused driving away from justice. When crimes or any other problem occur police patrol arrives instantly at the scene, then the case is turned to the department concerned (criminal investigation department, police stations, violence against women directorate, traffic police, etc.), (Interview with: RP Commander; lieutenant colonies: Rasheed M. Rasheed)

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*6.3.3 Criteria currently used in distributing police patrol zones:*

RPPs have been distributed in Duhok city regarding some standards and important terms such as:

1. Population density

2. Troubles, fights, and murders.

3. Number of public stores.

4. Governmental institutions and banks.

5. Prevailing customs and traditions.

6. Places with recurring incidents.

7. High crime rates in particular areas.

8. VIPs neighbourhoods.

9. Girls' secondary or mixed schools. See Table (3)

Table (3) The Current Quarters of Police Directories and Sections in Duhok

| No. | Name of police sections and stations | Quarter |
|---|---|---|
| 1. | City police directorate-eastern section | Bintika |
| 2. | City police directorate-western section | Zrka |
| 3. | Malta police station | Up_Malta |
| 4. | Dasinya police station | Ashti |
| 5. | Nawroz police station | Mazi |
| 6. | Khabat police station | Bintika |
| 7. | Sarheldan police station | Sarheldan |
| 8. | Nizarke police station | Nizarke |

Source/ Directorate of Police in Duhok city

**7. Setting Criteria Importance:**

After evaluation of existing RPPs and assessment of all criteria that RPPs were selected upon, the researcher used Interviews with specialized police officers to determine the main criteria for Rescue Police Points distribution according to theoretical studies. Six main criteria had been considered for analysing the current situation of Rescue Police Points in Duhok city. The priority of listing the criteria are done by a questioner for 20 officers in Rescue Police Department. The results show that the criteria' importance for distributing RPPs were as: Table (4) Distribution Criteria percentage of importance/ Questioner

Table (4) Distribution Criteria percentage of importance/ Questioner Results

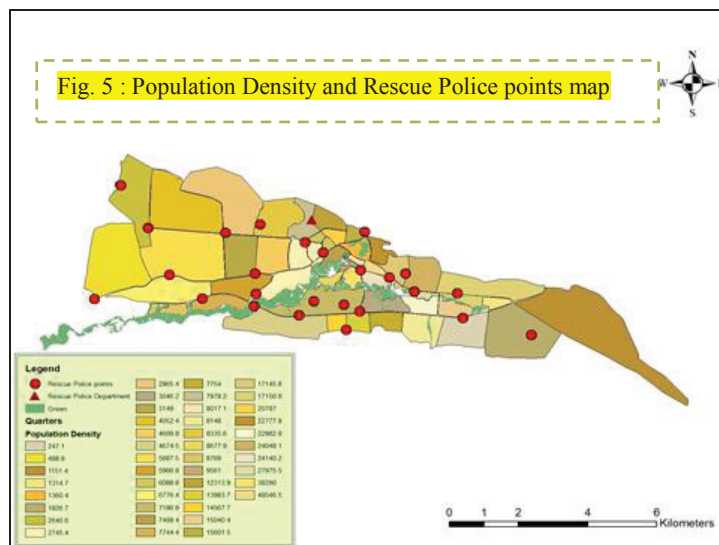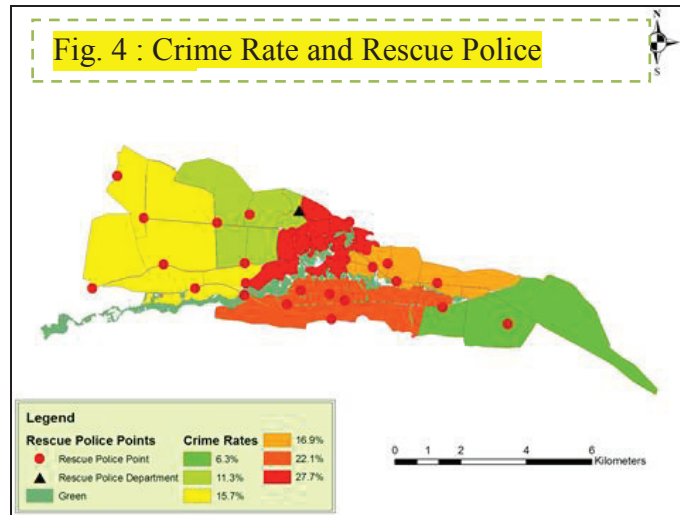| Criteria | Main Road | Crime Rate | Population Density | Streets | Important Public Utility | Road Cross |
|---|---|---|---|---|---|---|
| Importance | 17.5% | 31.25% | 21.25% | 5% | 10% | 15% |

*7.1 Application of Criteria on GIS Mapping:*

The research used Global Position System(GPS) for determining the rescue police points and police stations locations and Geographic Information System (GIS) for:

a) Pre-processing and processing the spatial data and the questioner's data to engage them in good clear maps.

b) Designing Maps declaring the spatial distributing of PS and combining the spatial layers.

The results were in the maps below.

After determining six criteria, all these criteria were converted to raster format with same cell size (Figures 4, 5, 6, 7). Some layers like population density was converted to raster layer directly, and some others like road map after obtaining distance map, were entered as raster layer. Then in order to be in same range, all layers were reclassified in same range which was 1 to 10. After that, importance of each layer, was multiplied with value (importance) of each pixel. Finally by combining all layers (summation), final digital map was obtained (Figure 9). The higher value in pixel will be more suitable place for RPPs. At the end, for improving place of existing RPPs, we moved the existing RPPs to its new place with higher value in pixel. Figure 8 shows the steps and layers used for calculating in GIS and application of GIS for producing the final digital map.



Fig. 4 : Crime Rate and Rescue Police



Fig. 5 : Population Density and Rescue Police points map

Fig. 6: Roads and Rescue Police Points



Fig. 7 : Important Public Utilities and Rescue police points Map
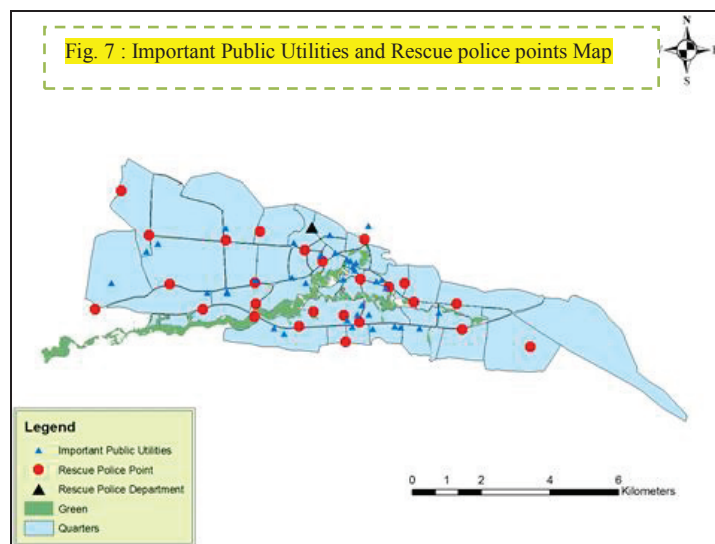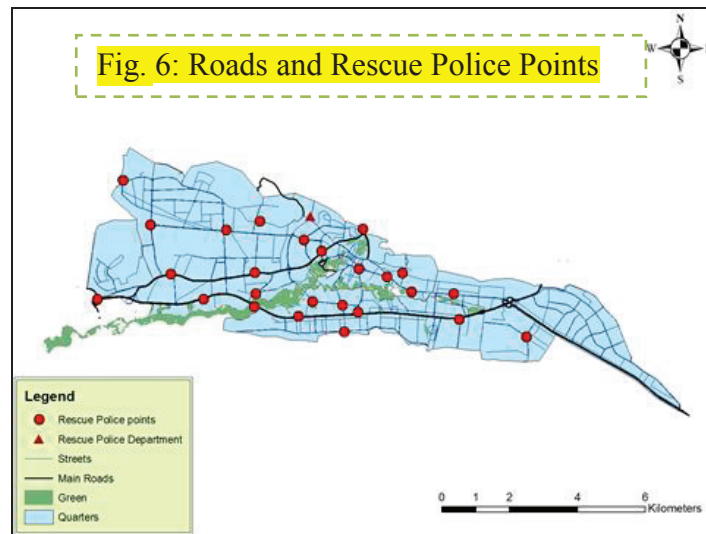
Fig. 8 the GIS process of apply importance percentage of each Criteria and combine them in order creating final digital map.
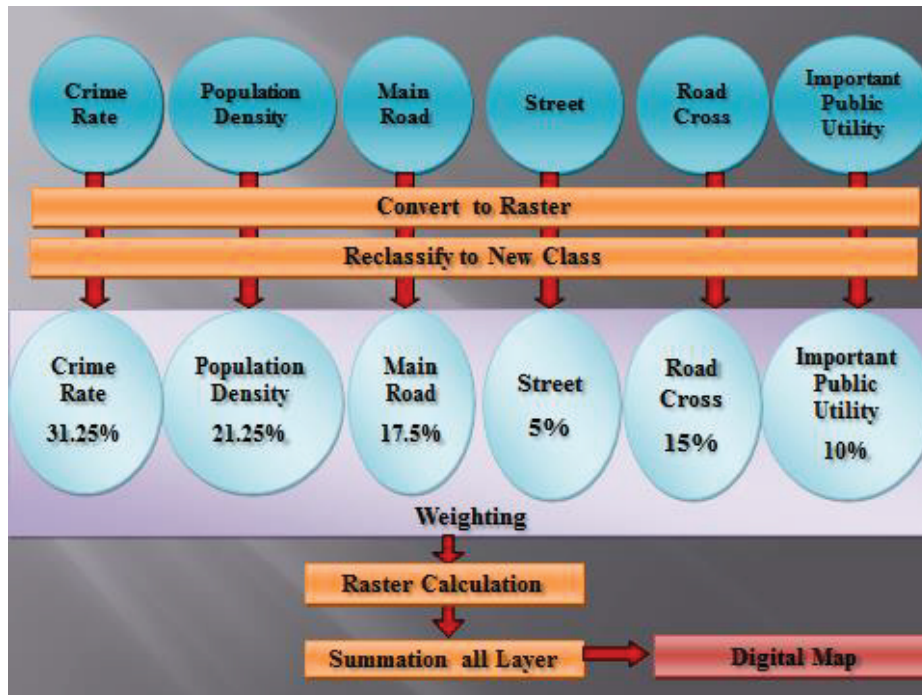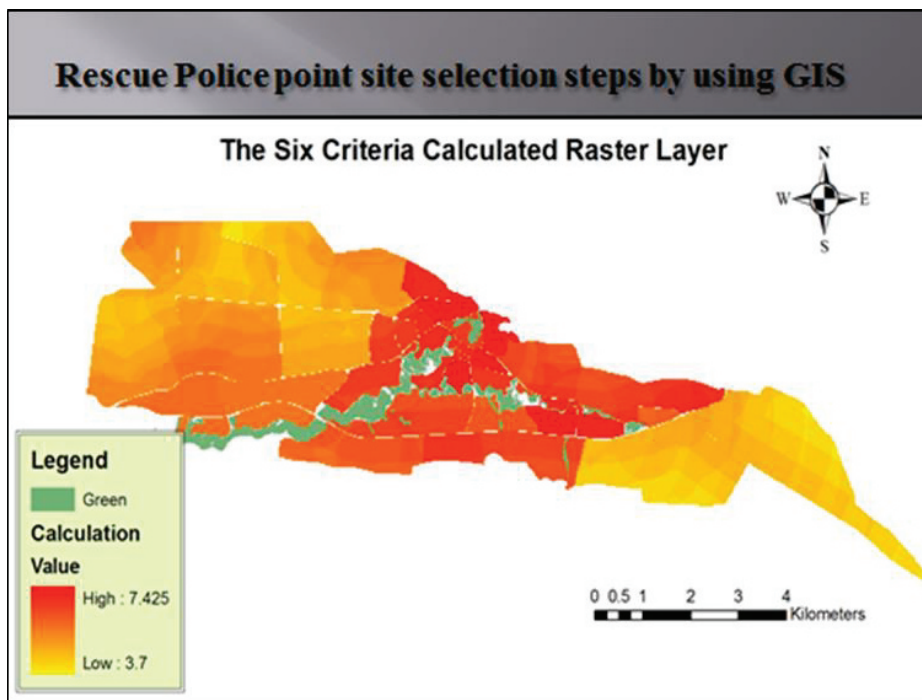
Fig. 9 The Calculated six Criteria Raster Layer Map



## 8. Results and Conclusions:

The research concluded that There is unfair distribution of PSs in Duhok city regarding population densities and areas. There are no clear scientific standards and criteria which the RPPs and PSs can follow for the purpose of control on distribution. There are one RPD in Duhok city including 25 RPPs. The city needs 4 other RPPs in order to control the security of the whole city and some RPPs must be replaced according to the six criteria analysis which are; population density, crime rates, important public utilities, main road, streets and crosses.

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**9. Recommendations**:

- According to studies of regional and local criteria, four new police stations must be established regarding population numbers, and two other PSs regarding city expansion and increasing population number, so total number of police stations will reach 12 PSs.

- 2. Dasinya PS must cover 5.19 km2 with 29089 inhabitants and the quarters included are Shorash, Ashti, Shacked and Masike quarters. The changes will be adding Shorash quarter under its control and excluding Botan and Bahdinan quarters. Nawroz PS will control 18029 inhabitants and cover 4.1 km2 containing Mazi, Botan, Bahdinan, Midya and Shindokha village quarters.

- Establishing a new PS to control Azadi, Shindokha Bakor, Se Gerka and Raza quarters which contains 29394 inhabitants and cover 4.074 km2..

- Establishing a new PS that controls Zrka and Masike Western which were under the control of Malta PS and this station will control 16985 inhabitants and 4.9 km2.

- Sarheldan PS must control Peshasazi and Sarheldan quarters with 2.15 km2 and 33414 inhabitants.

- Establishing three PSs which will control 15 quarters.

- Establishing a new PS to control Etit quarter and adjacent villages which have witnessed a rapid growth and expansion in built up area and population. This PS will cover 4.97 km2. See fig.10.

Fig.10 New recommended Police Sections in Duhok city/
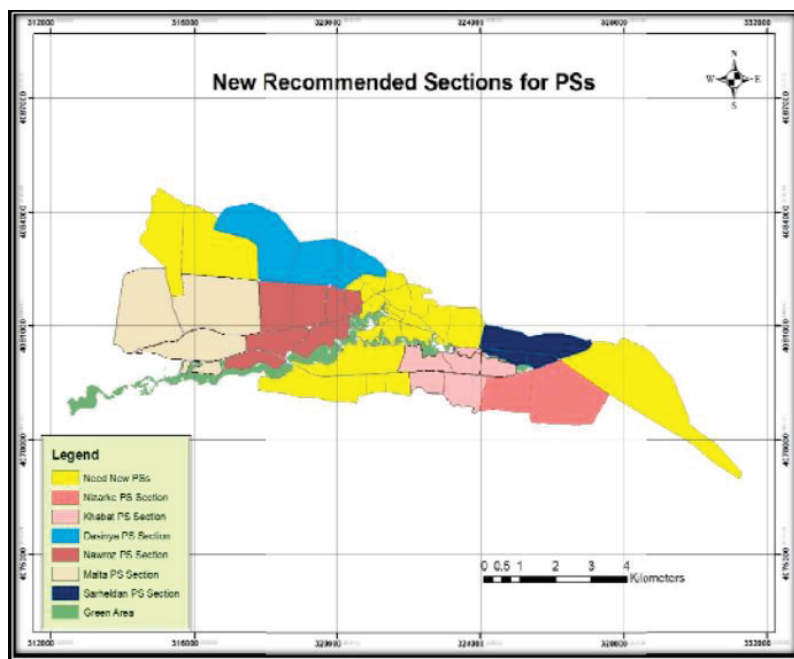


- The number of existing Rescue Police Points are 25 points distributed in the whole city, the research recommend establishing four other points and replacing the positions of six other existing points.

- Finding scientific standards and criteria appropriate to Duhok City applied for distribution of RPPs in the best way to control the security of the city.

- Increasing another police patrol staff by RPD to control the whole city easily. Fig. 11 show The New suggested 4 Rescue Police point in Duhok city and figures 12.13.14, 15 show the detailed locations of the four suggested RPPs.

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Fig. 11 New suggested 4 Rescue Police point in Duhok city
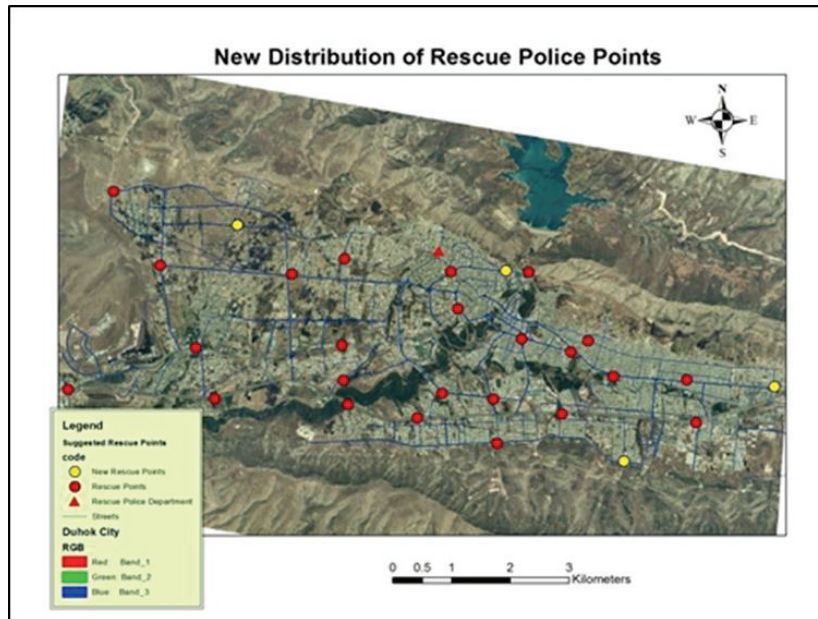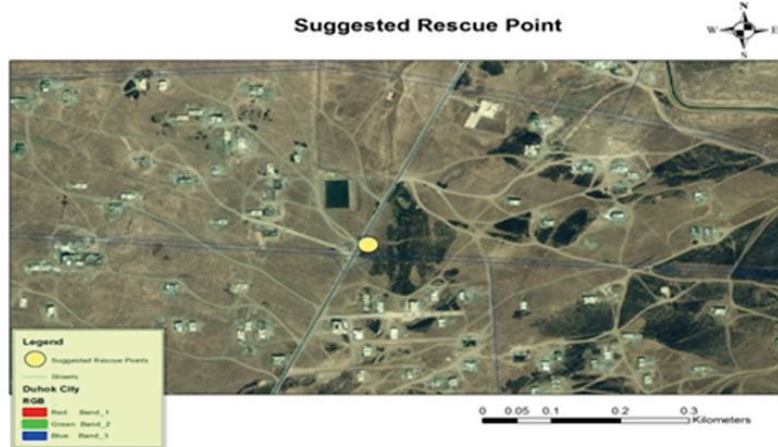


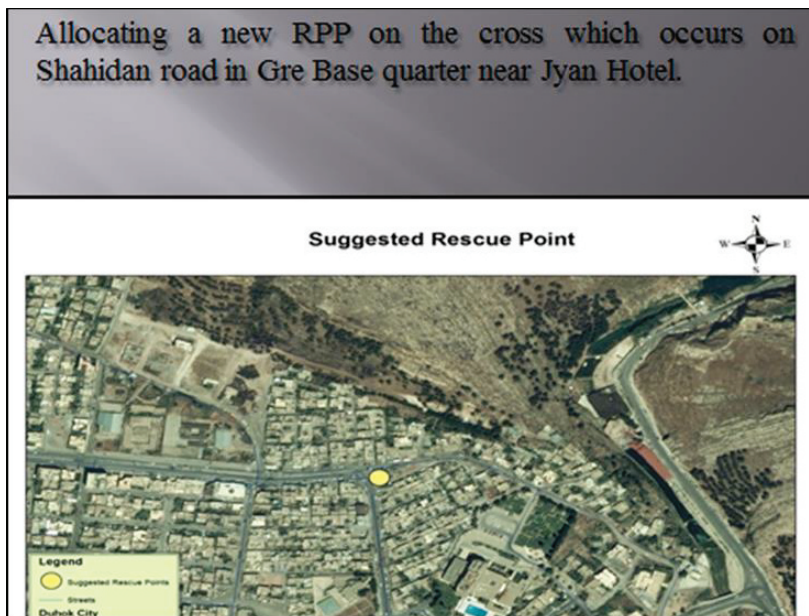Fig. 12 First new suggested RPP

Fig. 13 Second new suggested RPP
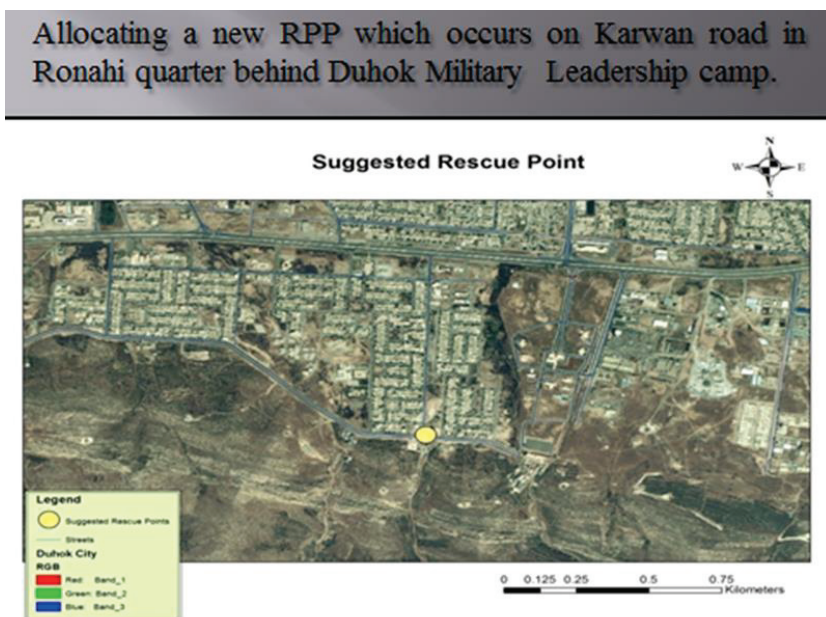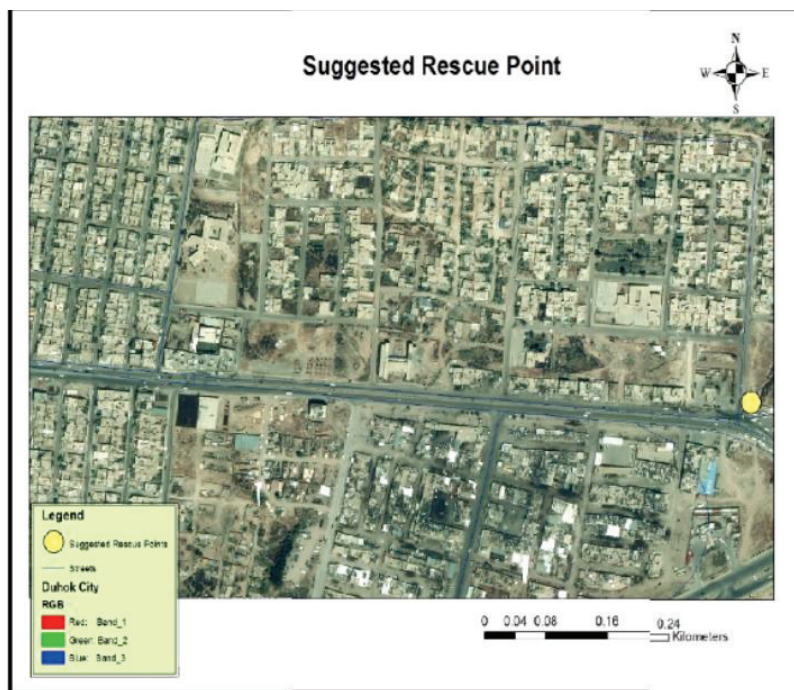


Fig. 14 Third new suggested RPP /Source: Researcher

Fig. 15 Fourth new suggested RPP/ Source: Researcher



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