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Selection of Temporary Debris Collection Areas using the Geographic Information System (GIS) Program

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Abstract: ***Geographic Information System (GIS) is very helpful tool in area management.It was used to predict the best candidate locations for temporary debris collection area in Baghdad. From the map of Baghdad,the city of Kadhimiyah, which consists of four regions (Kadhimiyah, Utefiyah, Shu'laa, and Hurriah), was used as an example to demonstrate the process of utilizing the program to search for adequate empty spaces that will be used as temporary places for debris collection. Empty spaces and areas within the center of each district or neighboring districts were determined by the GIS program and some of these spaces were considered as highly recommendedareas for debris collectiontemporarily. This process is considered important from the economical point of view because the cost of collecting and transportingthe debris is greatly reduced by using two stages (from residential area to temporary collection place, and then to the final landfill place) instead of one stage (from residential area directly to the landfill site). The study revealed that a noticeable reduction in the cost can be gained through using temporary debris collection areas.***

Keywords: Debris collection, Empty spaces, GIS

1. Introduction

The necessity of additional housing units has been increased due to the Social development and population growth. Moreover, the economic situation has enforced the people to reconstruct many houses as well as the division of many of them. This in turn led to a huge increment in the amount of debris and construction waste that must be transferred to the designated areas. According to the Law of Regulating Areas for Rubble Collection No. (67), 1986,which confirms the existence of temporary areas to collect rubble. A fine may also be imposed and may exceed imprisonment if the rubble is not discharged within the period specified for it [2], because these ruins affect the cultural and aesthetic form of the regions. Therefore, temporary places should be set up to collect debris.

In this research, Areas have been proposed using GISto identify the areas of study and howtheir layers work.

Geographic Information System (GIS) is a system in which a database is combined with its visual representation as a map. The system includes software and hardware that allowscollected information to be examined and corrected(In terms of geometric proportions and content),[1], [5], statistical analysis by region, produce maps display [3],[6], for display used for planning[1], [4] decision-making purposes. That depends on each of the data collections of non-graphic as graphic data[1].

A GIS is a computer-based system for Cartography. It provides different functions and featuressuch as capture, query, store, display, analyze, and output [4],[5]. Also, it provides tools for designing information to support decisionsintelligent, get quick decisions, find and describe geographic patterns, improve network and resource customization, and automate workflows during a visional modeling environment[1], [5].

GIS is playing an increasingly significant role in civil engineering companies such as backing all stages of the infrastructure life. Built on a database instead of individual project files, GIS enables civil engineers easily to reuse, manage, share, save time and resources, and analyze data. GIS technology provides a central location to integrate other solutions, systems, and overlay data conduct spatial analysis [5], [7]

Modern improvement in the analysis of Environment Maps have been affected by and earnedbytaking practices for Geographical reference health data and developing new methods of connecting these data geographically. These methods will help to prospect exporter of environmental risks, the geo demographic characteristics of people, and the places of health resources[1][5]. The speed of this expansion is expected because the true necessarily of the public health community of the method spatial analyses to availability decision support.

2. Methodology

For the purpose of allocating fenced off sites to collect the debris temporarily to make it easier for citizens to throw the rubble. To move the rubble to the main landfill sites, which helps to clean the cities and to show them properly and reduce the causes of pollution of the environment.

To ease throw construction outdoor waste, considering that some companies are still determined to repeat these irregularities, and to reduce the cost to get rid of the rubble exploit times of the night and early morning to put up the rubble randomly and contrary to the roadside, or in the empty spaces between neighborhoods residential away from the control of what constitutes a clear attack on the streets and polluting the environment and a distortion of the general view, which is limited to the occupancy of the road operations or lack of waste disposal, especially after construction.

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This also influences other services like electrical wires or water pipes, or irregularities affecting the traffic or the environment or the scene of the streets. Because of illegal violence activities, there are many destroyed buildings that produce large amounts of debris that need to be transferred to places dedicated to maintaining the cleanliness of the environment and the general shape of the area.

Building violations are not limited to leaving them at the work site, but throwing them in unallocated places is a violation, which is where many contractors are located. Any negligence on this side can lead to the spread of rubble and more attacks on various roads.

There is a replacement and renovation of houses and the demolition and reconstruction of new buildings, all of which leave behind huge quantities of waste. Unfortunately, Waste is thrown away on both sides of roads and near residential areas, which pollutes the environment and distorts the public landscape.

The phenomenon of dumping debris and construction waste has been increasing in many areas in the governorates, especially in the presence of excavations resulting from infrastructure projects and construction works for buildings.

It is necessary to beware of the increasing phenomenon of rubble on the roads, despite the presence of warning signs to prevent it, because it causes accidents and distort the beautiful scenes in the province.

The piles of rubble are on the way to the danger they pose as a result of their drifting to the road when the rain falls, and the visibility of drivers is blocked, especially on sharp turns.

The people throws debris without the slightest commitment to warning signs that prevent the removal of debris at the site, pointing to the seriousness of public safety, especially as it prevents vehicles from forced stopping on the sides of the roads.

The piles of rubble dumped indiscriminately on the sides of the roads, harm the beauty of nature and its environment, especially as the dust from rubble, as well as the erosion of dust and stones to the middle of the roads in case of heavy rain, causing traffic and damage to vehicles,which constitute environmental and visual pollution.

Therefore, one or several sites in the governorate must be designated for use for the purpose of removing debris and construction waste resulting from buildings or land reclamation, Because of the construction movement, which is building debris, a great deal needed of time and effort to move it to the rubble.

Also, large vehicles are needed to transport them to these places. So, suggested the existence of areas to collect the debris temporarily outside the residential areas and close to them, which have an economic return instead of moving directly to the designated places are transferred debris resulting from the reconstruction and demolition of one housing unit enough car with a few loads and collect debris from several works of several units and then transferred with large cars to the final assembly points and thus will save time, effort, cost and fuel

3. Present Work

Kadhimiyah was chosen as a case study and GIS computer program was used to download the image of Baghdad to the accuracy of distinguishing a 60 cm of the satellite Quikbirdby using a height of 450 km from the ground level.Four regions were identified in the municipality of Kadhimiyah(Kadhimiyah, Utefiyah, Shu'laa, and Hurriah) and their boundaries were marked. Also,the center of each region is defined as a green circle as shown in Figure (1).

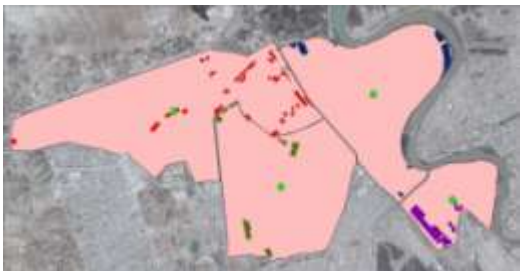

Figure 1: Center of each region

Then, for each one of these regions, the empty areas were identified, as shown in Figure (2,3,4, and 5). Figure (2) represents the Kadhimiyah area and the empty areas were shown misled blue. Figure(3) represents the area of the Utefiyahwith the empty areas colored in violet. Figure (4) represents the Shu'laa region and the empty areas were shown in red. Figure (5) represents the Hurriah region with the empty areas colored in green. Then, the calculations of the empty areas were conducted by the program**.**

4. Results

In Figure (2), the empty areas in the Kadhimiyah area were near the boundary of the region.Areas (1) and (3) were suggested to be collection areas. For the region of Utefiyah, it is possible to choose area No. (3). It is also possible to select (1) as shown in Figure (3).

Figure 2: Kadhimiyah city center and empty region

Figure 3: Utefiyah city center and empty region

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Figure 4: Shu'laa city center and empty region

Figure 5: Hurriah city center and empty region

For the region of the Shu'laa that appears in the Figure (4), the selected area is No. (2) andit is possible to select the areas No. (4 and 11). Finally, for the region of Hurriah shown in Figure (5),area No(1) was selected.

It should be noted that the amount of debris produced within the Kadhimiyah area per year is about 43206 $m^3$and about 5535 m^3 for the area of Al-Utefiyah according to the data from the municipality of Kadhimiyah. Furthermore, about 5600 m^3 of the debris were generated from the area of the Shu'laawhich has 6 places to collect the rubblewhich needs 390 Lorry cars to transport them where the estimated cost is 487,700,000 dinars.It is worth mentioning that the debris was not removed except from one location in the locality 460 which is in front of the mosque of Aljawadin. This location had been cleaned and a school had been built instead of the debris collected, 1000 m^3. The area of the Hurriah which is shown in Figure (5) produces an amount of rubble equal to 1596035 $m^3$from 12 places ofdebris collection,which needs 352 Lorry cars to transport them where the estimated cost is 44 million dinars, with the presence of four places have not been calculated cost or the number of cars to transfer them because they need a great effort according to the information provided by the municipality of the Shu'laa.

These quantities require temporary areas to collect the rubble safely and preserve the beauty of the environment.

5. Discussion

The empty areas in the Kadhimiyah region were near the periphery of the region and areas (1 and 3) wereselected for being large enough. This can be shown in Table (1) which arrange the areas according to the size of the area.The first and third largest area were selected to collect a largest volume of debris which in turnwould reduce the process of moving these debris to the main or permanent landfill area.This will save the time required to transport the debris and help to reduce the number of the rented cars and that will lead to a reduction in fuel consumption and the cost of the labor.Moreover,these two areas are near the borders of the river, so using them will reduce the impact of environmental pollution on the landscape and maintain the beauty of the region because the Kadhimiyah area is considered one of the most important religious tourist areas in Iraq. Figure (6) shows the selected areas and the ease of access by cars due to the paved and smooth roads.

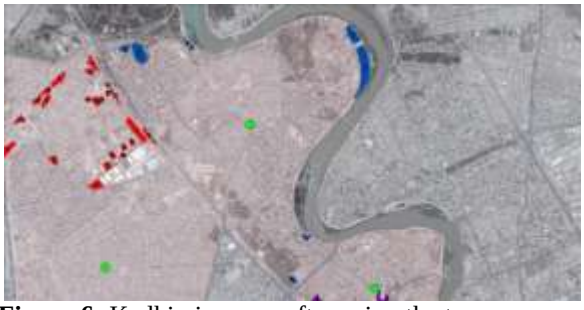

Figure 6: Kadhimiya area after using the transparency property

Table 1: Represents the empty region areas in the Kadhimiyah

No.	Shape	Area	FID
1	polygon	93931.6	5
2	polygon	48310.6	0
3	polygon	34476.8	4
4	polygon	12447.6	1
5	polygon	9718.6	7
6	polygon	7135.2	6
7	polygon	4064.1	2
8	polygon	3799.5	3

For the Utefiyah region, area No (3) was selected due to its location near the city center. Also, area No(1) can be selected for being the largest area according to Table (2). Also, area No (1) is located near the borders of the region and away from the houses which will reduce the impact of environmental pollution on the landscape and maintain the beauty of the area.

Figure 7: Utefiyah area after using the transparency property.

Table 2: Represents the empty region areas in the Utefiyah.

No.	Shape	Area	FID
1	polygon	193011	3
2	polygon	51875.9	2
3	polygon	23065.1	0
4	polygon	21718.6	1

Regarding to the region of the Shu'laa,area No (2) was selected because its location at the city center which in turn facilitates the arrival of all areas of the city and its large area according to Table (3). Also, the areas (4 and 11) can be selected for their location near the center and their relatively large area compared to other areas. However, in the

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Shu'laaregion, one can select more than one area to collect the debris due to facilitate access to all areas, which collects the largest volume of the debris, reducing the process of moving these rubble to the main assembly or permanent and time to move the debris, which helps to reduce time and cost, This can lead to a reduction in the fuel used and a reduction in the consumption of cars, thus saving the cost, in addition to reducing the effort exerted on the labor. For example, the areas (6 and 1) can be chosen for the their relatively large area and their distance from residential areas, shown in Figure (8).

Figure 8: Shu'laa area after using the transparency property.

Finally, for the region of Hurriah shown in Figure (9) and Figure (5), The area No (1) was chosen because it is the largest area in the region which can be shown in Table (4).

Figure 9: Hurriah area after using the transparency property.

Table 3: Represents the empty region areas in the Shu'laa.

No.	Shape	Area	FID
1	polygon	37370.3	0
2	polygon	29854.8	27
3	polygon	26636.6	24
4	polygon	26283.9	28
5	polygon	21395.7	16
6	polygon	19984.2	1
7	polygon	17032.2	15
8	polygon	15364.4	29
9	polygon	14396.1	18
10	polygon	12168.8	8
11	polygon	11740.4	26
12	polygon	11376.4	25
13	polygon	11302.6	20
14	polygon	11118.4	21
15	polygon	10909.3	17
16	polygon	10697.5	19
17	polygon	10424.0	2
18	polygon	9479.2	7
19	polygon	8925.2	14
20	polygon	8753.7	12
21	polygon	8168.5	3
22	polygon	8108.3	22
23	polygon	6860.2	5
24	polygon	5901.5	6
25	polygon	5851.0	23
26	polygon	5803.3	4
27	polygon	5737.6	11
28	polygon	5281.1	10
29	polygon	4839.0	9
30	polygon	2386.6	13

Table 4: Represents the empty region areas in the Hurriah.

No.	Shape	Area	FID
1	polygon	53809.5	3
2	polygon	44179.8	0
3	polygon	22251.7	2
4	polygon	19996.3	6
5	polygon	15241.6	1
6	polygon	11935.3	4
7	polygon	8033.7	5

6. Conclusion

When there are areas to collect the debris of the temporary work, a coordination between the Secretariat of the provinces and individuals must be made in order to obtain a clean environment free of debris, reduce the cost, and consumption of cars.A fine should be imposed on individuals who do not commit to removing rubble in time.

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