



## **GEOLOGICAL AND PARCELS PECIES DEPENDED SUGESSTED ROUTE ROAD**

Wafa Khudier Leabi\*

Assist Lecturer, Highway and Transportation Engineering Department, Al-Mustansiriyah University, Baghdad, Iraq.

**Abstract:** Planning for road is one of the important application of highway engineering. The planning depends on several parameters (geological, topographical, agricultural, parcels pieces and urban development). planning utilizes the geological map for giving depiction of the soil of case study. GIS technology is used for utilizing the digital map, visualizing and analyzing data. The cadastral map is then converted from clark 1880 geographical system to clark 1880 projected. The project system is converted to WGS84 by adding many different of coordinate system factors. The analyzed data is served to specify parcels pieces of suggested routes.

**Keywords:** *geological map, satellite image, cadastral map, GIS*

### **مسار الطريق المقترح يعتمد على ملكية قطع الاراضي وجيولوجيا الارض**

**الخلاصة:** تعد مسألة تخطيط الطرق من أهم التطبيقات في هندسة الطرق. التخطيط يعتمد على عدة عوامل (الجيولوجية، الصناعية، طبوغرافية الأرض، ملكية الأراضي، التطور الحضاري). التخطيط يستخدم الخارطة الجيولوجية لوضع التصور الأساسي للتربة لمنطقة الدراسة. تقنية نظم المعلومات الجغرافية تستخدم للتعامل مع الخارطة الرقمية، وأيضا عرض المعلومات وتحليلها. الخارطة الكادسترالية تحول من النظام الجغرافي كلارك 1880 إلى المترى كلارك 1880. النظام المترى يتم تحويله إلى نظام WGS84 بإضافة عدة معاملات للنظام الاحداثي. من خلال تحليل المعلومات نقوم بتحديد قطع الأراضي التي يمر بها الطريق المقترح.

## **1. Introduction**

One of important application in highway geometric and is primarily steps before construction of road. Geological map is initial explanatory of covered area which include structure geology, hydrology and elements geology) for case under consideration . GIS is widely used for utilizing planning of highway and is very important for visualizing place before decision of implementing the road .

The cadastral map limits parcels pieces that road pass through. The planning have two types geometric and transportation [1].

\* [wleabi@gmail.com](mailto:wleabi@gmail.com)

### 1.2.General

Geometric design is important before implementing the road [2], the methodology of work is as shown in figure(1).

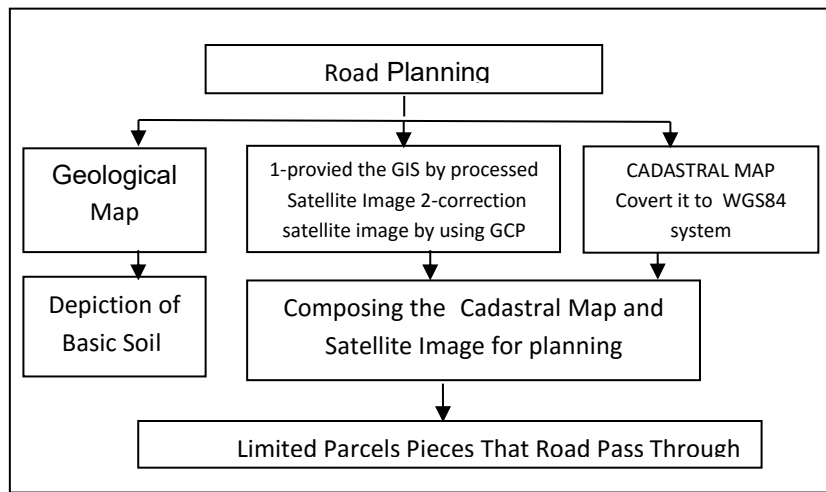


Figure (1): Methodology of Work

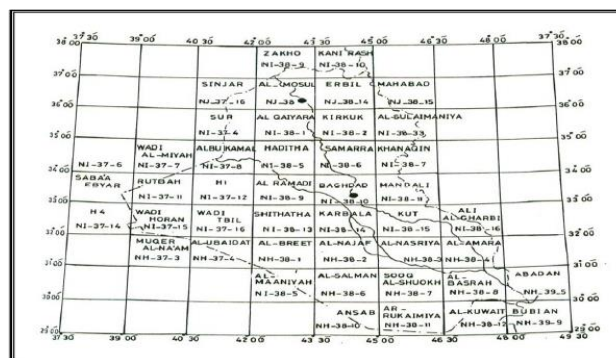
### Steps Of Geometric Design

1. The use of geological map is modern method for depicting soil maps before laboratory test of land.
2. The next step using GIS software for performing processed satellite image.
3. Processing the cadastral map by using many operation so as to convert WGS84 system.
4. Then using (satellite image and cadastral map) for planning route of road and specifying the parcels ownership.

## 2. Geological Map

### 2.1. Location of Karbala City

The location of karbala city exist in sector NI-38-14 of Iraq, is as shown in Figure(2) with scale1:250000.



Figure(2): Location Karbala City of Iraq [3].

## **2.2. Structural Geology**

The structure geology indicate extension flat of nature bed rocks, lack of good continuous exposures and due to covered deposits. Regional depression direction to the NE, and ranging between  $0^{\circ}$ - $2^{\circ}$ , with average around half degree Departure and some of variation depression ( $5^{\circ}$ ) from the regional ocean [3].

## **2.3 Hydrogeology**

More than (80%)percentage of map area is covered by quaternary deposits and divided into two zones. The Desert Plain and the Mesopotamian Plain [4].

### **2.3.1 Desert Plain Zone**

The first part is performed 50% of the desert plain is Dibdibba Plain The Plain is vast, slightly wavy, limited from east by Mesopotamian Plain and from south by Tar Al-Najaf (about 50 m. high), from west by Tar Al-Sayid (about 20 metres high) and the eastern bank of Al-Razzaza Lake.

### **2.3.2 Mesopotamian Plain Zone**

The plain is covered by deposits quaternary, it consists of rotatory layers of clay, silt and sand with less gravel.

## **2.4. Geology Elements**

The economics of map area, are essentially materials of constructional and building interest, such as limestone, sands, gravels and gypcrete [5].

### **2.4.1 Limestones**

They are distributed as a part of Euphrates and Lower Member of Fatha Formations. The limestones are well bedded, dolomite, chalky, fossiliferous, marly, recrystallized, clayey, sandy.

all Thickness of carbonates reach 30m. They are suitable as building stones and in cement industry [5].

### **2.4.2 Sandstones**

The Sandstone widely extension in the Desert Plain between Najaf and Karbala, Sandstones are light brown, poorly sorted, friable. They are covered by thick mantle of sandy gravelly (0.3-2.0 m). Sandstones are used widely for construction and building purposes.

### 2.4.3 Gravels

Gravels are mixed with sands, thickness reaches 6m. Gravels are variable in color, size and composition, and used locally for constructions. All these explaining is Illustrate in figure (3).

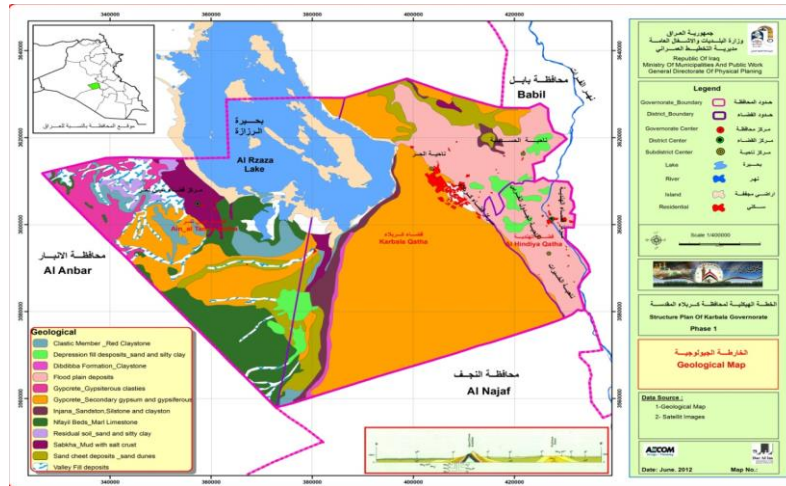


Figure (3): Geological Map of Karbala [4]

### 3. Geographical Information System(GIS)

GIS Is the technology software for geographical extensive information, spatial data usual in analyzing transfer it is Use in many fields (agricultural , industrial, environmental, highway) and enable the capture, store, manipulate, visualizing, analysis [6].

Steps of processing satellite image and cadastral map

- 1- The digital satellite image of (karbala) that is obtained from Quick Bird satellite is geometric correction from office with highly resolution 0.6m in 2013, as shown in figure (4).

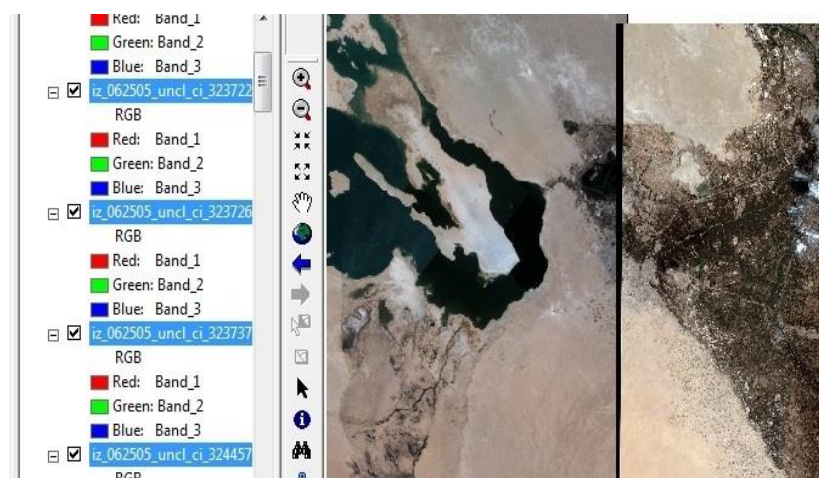


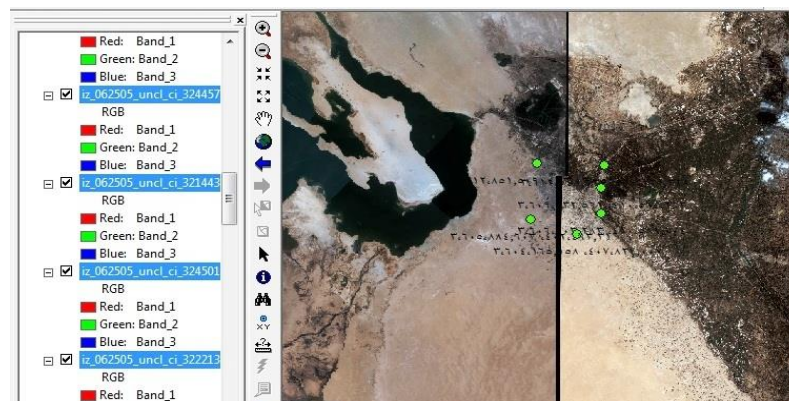
Figure (4): Satellites Image of Karbala obtained from Quick Bird

### 3.1 Correction of satellite image by using GCP

Correction of satellite image is processed by taking GCP (obtained from total station instrument trimble 5700 in 2006) that tabulated in table (1) then projects these points on the satellite image, then obtain the correction as shown in figure (5). From GIS software georeference tools, make several geometric correction until correlation is achieved between satellite image and GCP.

Table (1) Ground Control Points

POINT	X	Y
1	403137.511	3612851.506
2	402463.310	3605884.603
3	407827.007	3604165.158
4	410969.328	3612548.637
5	410514.263	3609832.561
6	410581.004	3606703.283



Figure(5): Correction of Satellite Image by Using GCP

## 4. Performing Digital Cadastral Map

It is land ownership for all land districts of government and Boundaries of all parcels, identifying parcel dimensions and areas for parcels, subdivision boundaries names of political and names of geographic boundaries sections, townships, government) locations and names of streets, highways, alleys, railroads, rivers, lakes, and other geographic features [7].

The obtained cadastral map is in scales (1/10000,1/2.5,1/100000). These maps are in system (clark 1880) to be converted to WGS84. It must be performed by many processes.

### 4.1 Steps of processing cadastral map

1- For digital cadastral maps convert geographical coordinate to projected coordinate system in clark 1880 by using geotrance software version (4.2) as shown in figure (6).

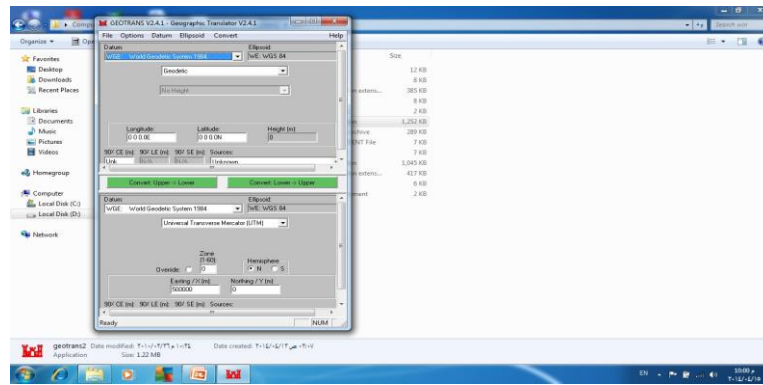


Figure (6): Geotrace Software Version (4.2)

- a- Convert the projected clark 1880 from triple coordinate system to couple coordinate system by adding karbala parameter (x=-147,y=+69).
- b- Convert from projected coordinate couple to projected coordinate WGS84 by adding karbala parameter (x=+86,y=+481).
- c- This conversion is achieved for the fourth corners of the cadastral map. The result is map of system, the WGS84, and correction is achieved by using georeference tools. Figure (7) depicts a sample of this processing for a map of the 18 maps considered. All the 18 maps are corrected using the same processing .

2- Geometrical correction for the digital cadastral map on satellite image. Which mean geometric object such as (highway, railroad, edge parcels piece, river) are correlated by using GIS software georeference tool. Geometric correction while increased when small RMS is performed. The correction on the cadastral map is as shown in figure (8).

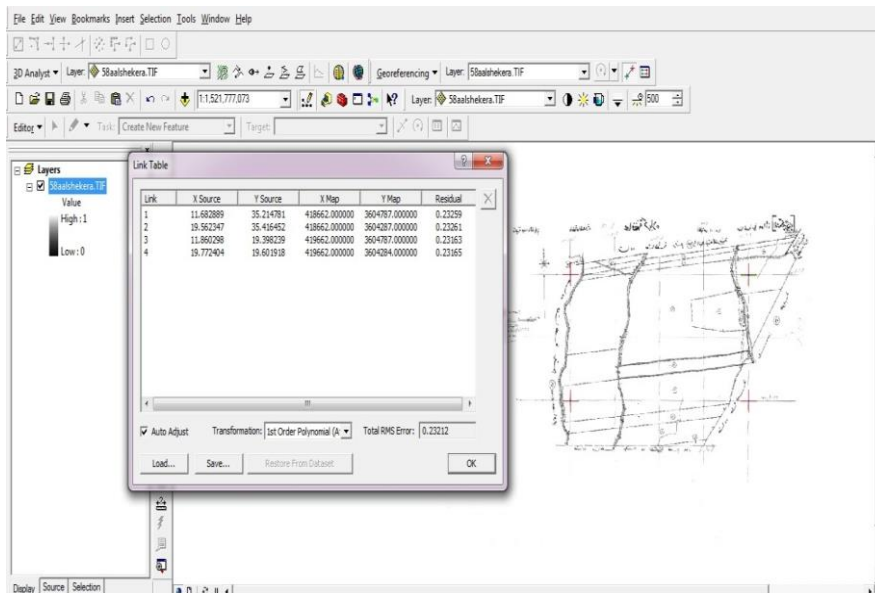


Figure (7): Correction by Using Georeference Tools



Figure (8): Cadastral Map on The Satellite Image

### 5. RMS Error Per Ground Control Points

Root mean square is the distance between GCP in source location digital map for the GCP same in image. The RMS error of each point evaluate the GCPs. This is calculated with a distance formula:

$$R_i = \sqrt{XR_i^2 + YR_i^2} \tag{1}$$

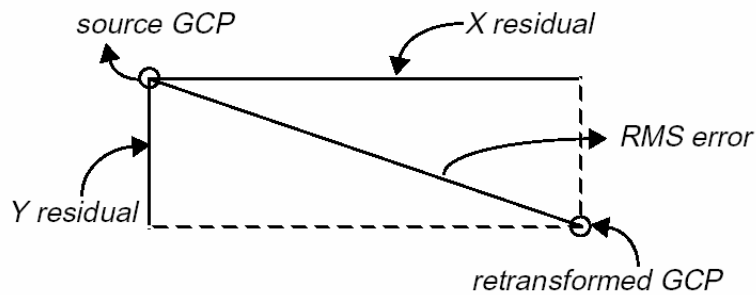
where:

R<sub>i</sub>=the RMS error for GCP<sub>i</sub>

X<sub>Ri</sub>= the X residual for GCP<sub>i</sub>

Y<sub>Ri</sub>= the Y residual for GCP<sub>i</sub>

Figure (9) illustrates the relationship between the residuals and the RMS error per point.



Figure( 9): Error Per Point [8]

#### 5.1.Total RMS Error

From the residuals, the following calculations are made to determine the total RMS error, the X RMS and the Y RMS errors:

$$R_x = \sqrt{\frac{1}{n} \sum_{i=1}^n XR_i^2} \tag{2}$$

$$R_y = \sqrt{\frac{1}{n} \sum_{i=1}^n YR_i^2} \quad (3)$$

$$T = \sqrt{R_x^2 + R_y^2} \quad (4)$$

Choosing eight GCPs is covering the case study and the operation geometric corrections as illustrate in equation [8].

where:

$R_x$  = X RMS error

$R_y$  = Y RMS error

T= total RMS error

n= the number of GCPs

i= GCP number

$XR_i$  = the X residual for GCP<sub>i</sub>

$YR_i$  = the Y residual for GCP<sub>i</sub>

## 6. Suggested Location of Route Road

After performing geometric corrections the cadastral map is united with the satellite image by using coordinate system WGS84, the draw suggested route of road by using editor tool and buffering tool in 20m of road width for analyzing data. Limit parcel pieces that pass through the route road.

The suggested routes of road with cadastral map on satellite image, as shown in figure (10), the numbers of parcel pieces of cadastral map (that road pass through), length route road, area of route are illustrate in table (2).



Figure (10):Planning Route Road



Table(2): Number of Parcels Pieces Of Cadastral Map

No.	length(m)	Area (m <sup>2</sup> ) Length*width	Name of cadastral map	No. segment parcels pieces that road pass through from cadastral maps
1	15072.94	301458.8	15aaltheab 32balabase at	1,2,5,6,8,9,10,15,16,17 1,2,3,20,32,21,27,28
2	16433.09	328661.8	15baltheab 18balkuan ea 49btanoba 51aalshake 58aalshake	2 43,47,48 11,12,13,20,28,29,49,62 65,67,68 86,87,91,93,95,109,115 118,119,135 54
3	17781.04	355620.8	17aalduka- nea 33aalkakae a 49atanoba 51aalshake r 58balshake r	9,12,16,17,23,27,36, 37,40,49,61,66,70,87,110 9,10,12,23,26 42,48,50,51,53,67,68,71 8,23,24,55,56,64,72,73 77,79,81 10,13,17
4	18993.52	379870.4	15aaltheab 22aalnabha ne 33aalkakae a 58balshake r	11,13,14,15,16 70,78,79,81,83 3,4,20,21 37,53
5	21045.09	420901.8	16aalduka nea	33,34,35,37,99,11,122,125,126

## 7. Evaluation

From the table comparing among the planning road and parcels pieces, the best suggestion for road is the fifth route because it is smallest parcels pieces of the ownership although is tallest.

## 8. Conclusions

- Geological map is useful for Visualizing basic soil map (structure geology, hydrology, element geology) for construction of road and is needed for many laboratory analysis.
- Geological map of karbala depicted there is no oil discovery or geohazard map for area Under consideration.

- Cadastral map is the ownership of all parcels before implementing road and this map is geographical coordinated by many processes for converting WGS datum with high accuracy.
- GIS is good software is used for many resource, such as highway, road planning and is very important before implementing road.
- specifying the parcels pieces before construction of road for restitution land ownership.

### Abbreviations

GIS	Geographic information system
RMS	Root mean square
GCPs	Ground control points
R <sub>i</sub>	The RMS error for GCP <sub>i</sub>
XR <sub>i</sub>	X Residual for GCP <sub>i</sub>
YR <sub>i</sub>	Y Residual for GCP <sub>i</sub>
R <sub>x</sub>	X RMS error
R <sub>y</sub>	Y RMS error
T	Total RMS error
N	Number of GCPs
I	GCP number
XR <sub>i</sub>	X Residual for GCP <sub>i</sub>
YR <sub>i</sub>	Y Residual for GCP <sub>i</sub>

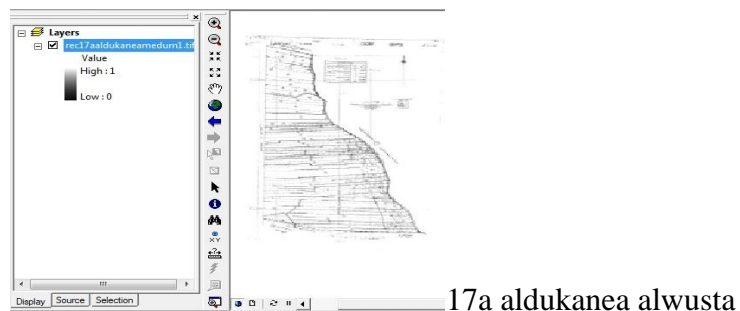
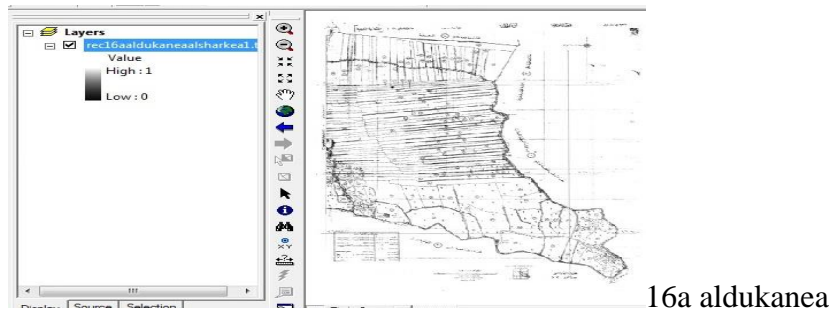
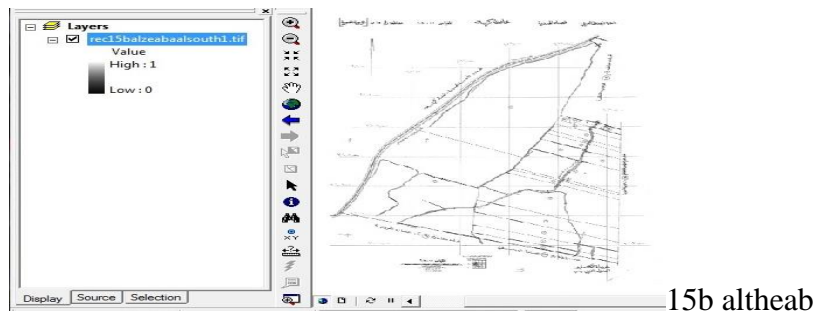
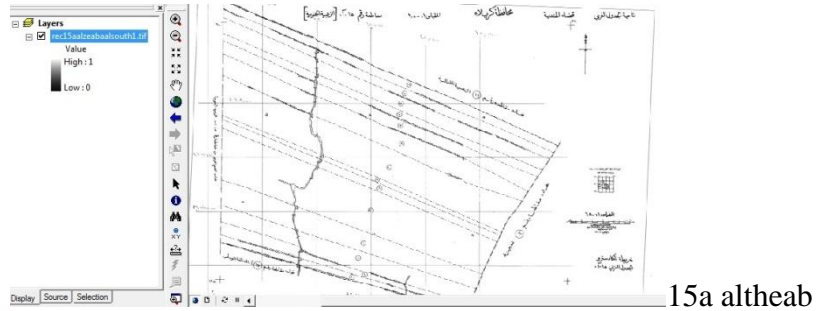
### 9. References

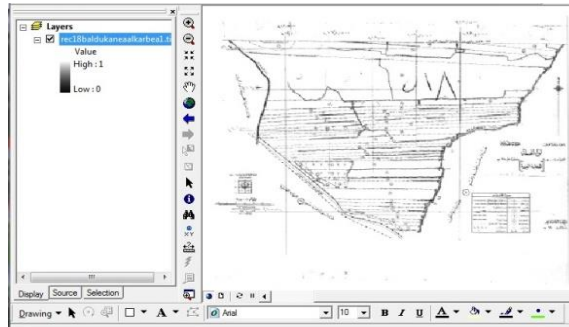
1. Mukti Advani, B.Srirama and S.K.Pathan. (2005)" Improvement in Transit Service using GIS – Case study of Bhavnagar State Transport Depot" India.
2. Uwe Deichmann, DECRG, March 30, (2007)" Use of GIS IN road sector analysis".
3. Al-Mubarak, M.A., and Amin R.M. (1983). Report on the regional geological mapping of the eastern part of the western desert and western part of the southern desert, GEOSURV, Baghdad, Iraq.
4. Murad, N.T. (1976). Report on the geology of the Razzaza-Habbaniya area, GEOSURV, Baghdad Iraq.
5. Lateef, A.S.A., and Barwary, A.M. (1984). Report on the regional geological mapping of Bahr Al-Najaf area, GEOSURV, Baghdad, Iraq.
6. Al-hayani a.a.(2000). "Remote Sensing Techniques for Route planning of Highway Engineering Mangement".

7. Wonjun CHO, Minsuk LEE and Woosub SIM. (2000)" Cadastral Maps – How To Make Digital From Graphical", Korea, Korea Cadastral Survey Corp,Unhak, Yongin.
8. Erdas Field Guide. (1999). fifth edition Erdas, Inc .Atlanta, Georgia.

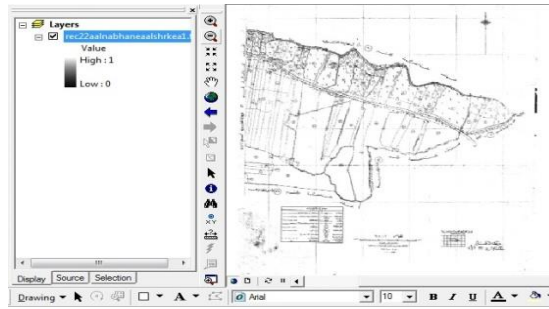
## Appendix

Digital cadastral coordinate system of WGS84

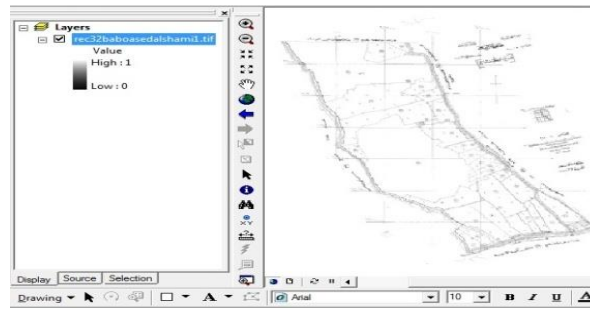




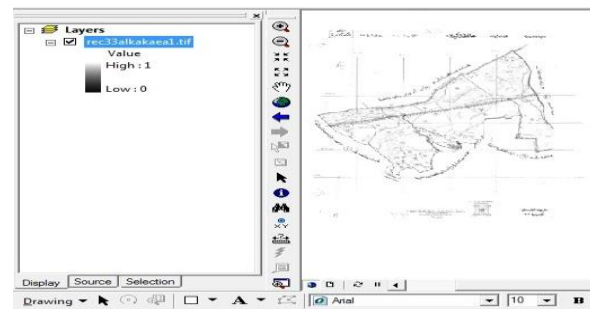
18b al dukanea



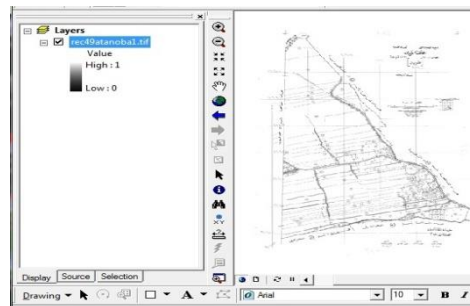
22a alnahanea



32b alabaseat



33a alkakaea



49a tanoba

