Land Use & Traffic Generation

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Land Use & Traffic Generation by using GIS

Using the GIS system to exam in the existing road network in certain region and testing wither it could accommodate the amount of traffic generated from the land use when this area been saturated and fully developed

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GIS Term Project

Abstract

The Objectives of this project is to utilize the GIS system to examine the existing road network in certain region and testing wither it could accommodate the amount of traffic generated from the land use when this area been saturated and fully developed in future,the outcomes of this project is stating the potential problem in the road network and suggesting solution to overcome the problem which may take place in future, in addition to evidence for decision maker about the technical validity in output results.

Chapter one

Introduction

Definition of Urban Planning

Urban planning is multi dispensary field of study that includes compromising criteria used to satisfy the sustainable development for social, economic and environment aspects. Urban planning also includes land use, road network, infrastructure, legislation, monitoring and control for implementation of main objectives and strategies adopted in the vision or master plan.

The process of planning is systematic and logical started by defining the goals and objectives, then stating the strategies that achieves these goals , later on designing the polices and measures which implement the adopted strategies , monitoring and control as well as evaluation for implementation progress usually done in order to make sure that everything is according to the plan .

Definition of Transport Planning

Transportation planning is the expression which concentrate on satisfying several combined objectives related to transportation issues, such as accessibility , mobility , equity , safety , integration between different mode of transport , improving environmental condition ..Etc

Each of these strategies could be adopted but each one of them has different measures that insure its implementation, designing the right package that avoids any clash or collision between these measures is very important.

Defining the threshold step or target to het within a period of time in order to easy the monitoring procedure is a critical issue because it means that standard must be adopted and policies should be implemented and controlled, and the most important part is the evaluation of current and future situation.

Definition of Urban Vas Transport Planning

Land use classification is the machine which generate traffic in any developing area , traffic leads to proper road network and environment control must be adopted, for example , traffic calming is a strategy which could be used to achieve an objective such as improving environment by using the one way route measure or narrow roads ,taxation , environment control cordon ..Etc

The relationship between transportation and urban planning is very significant, and correlated in many level which lead to careful consideration in adopting any strategy, as it was mentioned earlier a very good plan is the plan which integrate all the dispensaries and maintain an adequate compromise to insure best performance.

Goals and Objections of Project

The goals and objectives of this project are to find the relationship between the land use type and the traffic generation and it suggest a method of representing the outputs which clarify this issue.

Complexities expected

The complexities expected in this project is mainly technical aspects , these points related to how to correlate the line which are representing the road network to the polygon which represent the area and land use type which generate traffic .

Chapter Two

Literature Review

Background about the Problem

The area selected for this project is located in the northern governorate in Kingdom of Bahrain, it is Saar village area. It is an old village with high densities of residential land use area. This village due to certain objectives in the master plan of the northern governorate becomes an urban agglomeration of different type of land use which serve an educational investment and other commercial uses. The population of this area is 8769 person and the area is about 674 ha which indicate a falls density of 13 per/ha The number of dueling units exist in this village are1697 which lead to 3397 number of car generated out of this area by statistical data of 2006 from CIO in Bahrain .

This area has potential to be developed by the coming decades as it was mentioned earlier, this means a proper investigation about the existing road network should be done as one of the important studies that is required to insure proper planning progress.

Background about road network layout

Roads are the links which connect different blocks, sites, areas ….etc with each other. Accessibility, mobility and safety are the main objectives of road network planning,

one of the main issue is to understand the principles of designing different categories of road links, the transport planning engineering emphasis of the road type, junction type, capacity of the road, the traffic generated which is going to use the road link, the slope of the road, the environment issues related to transportation in terms of vehicle emission and noise..Etc.

What are the criteria used in this project.

The highest capacity of road is the motor way or some time they name it highways in some, standard, usually it has traffic capacity of 2000 car/h for each lane, the second level of road type is the arterial or some time it is named as express road, which link several distributor together. It could be dual carriageway or more, it has capacity of 1200 car/h par lane, the third level of road type is the distributor which link all the local road together, it has capacity of 400 car/h per lane, the forth level of road link is the local roads which links the different sites together, it has capacity of 120 car/h. The following diagram illustrates the relationship between different types of road links mentioned earlier.

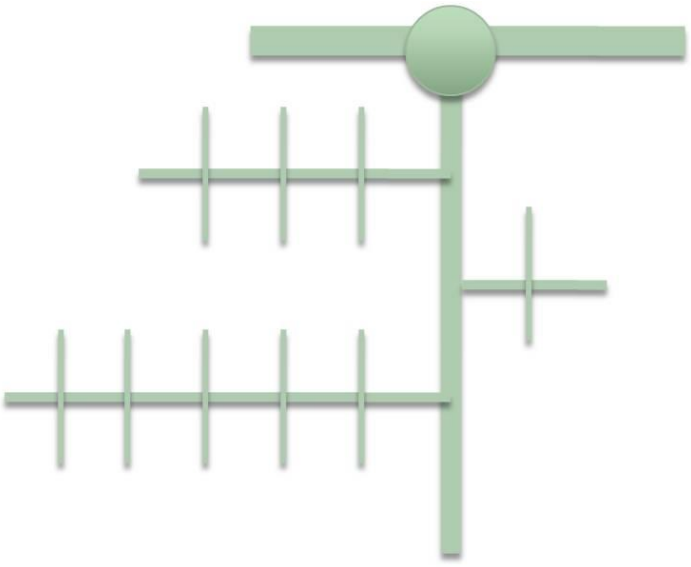

Figure 1 Road Classification Layout

The above diagramed illustrate the road layout criteria , the maximum width is for the motor way the narrower is the arterial and the narrowest is the local , in between the distributor is laying which link the local with the arterial . The junction type is one of the main aspects which have a great impact on traffic flow in the road network. I.e. it has to be design well to allow maximum capacity flow in the road layout.

Background about land use and zoning classification

It is the technical expression of map which illustrates the building regulation and the land use approved by the government. Land use means the type of activities which is take place within a bounded area, the classification of land se is could zone classification. The building regulation which is usually created by the planning affairs within the government sector is to control the development in the area which has certain classification zone. This control will lead to limit the densities within the infrastructure available in any region.

The road type criteria of laying out the network usually based on segregating between different land uses or between different densities.

Type of land use

Residential, Commercial, Investment, Industrial, Agricultural, Public services, Recreational, Archeological, Special project

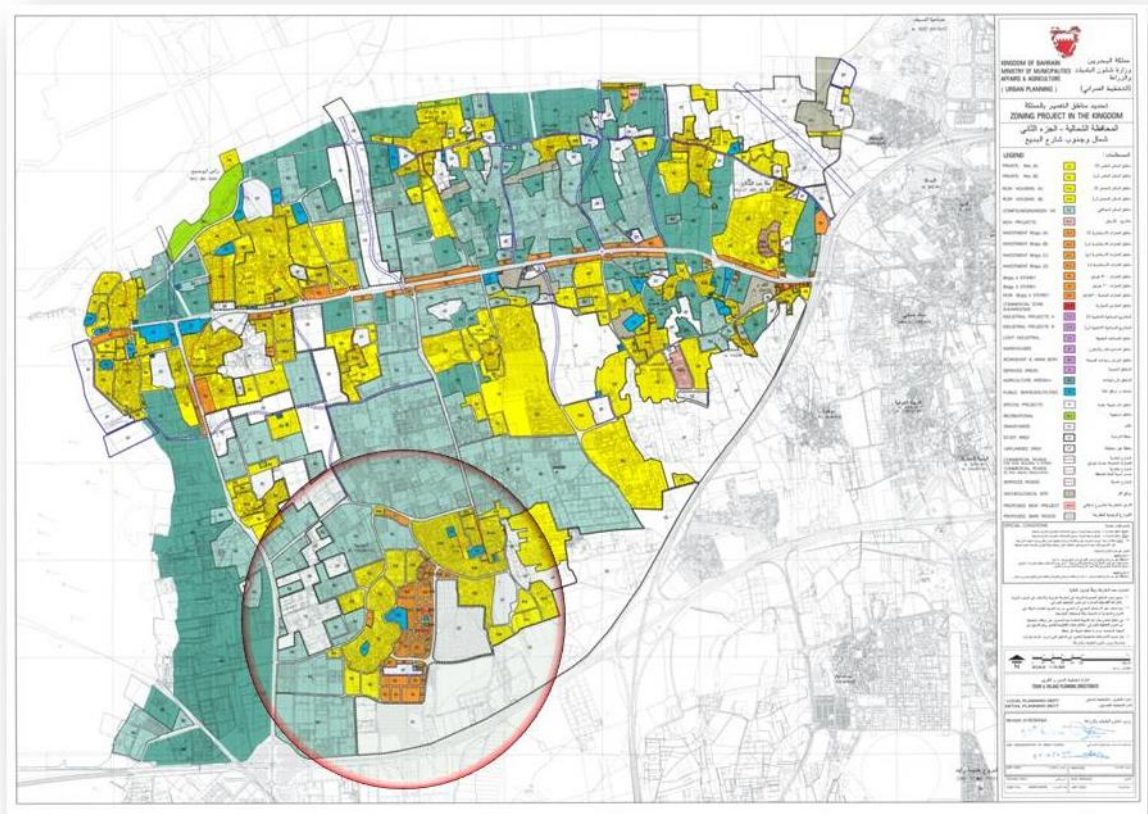

Figure 2 Northern Governorate Zoning MAP

The above map is one of the zoning maps for the northern governorate in kingdom of Bahrain, the area highlighted is Saar village which is the area selected for this project. This area includes different type of land use, which generates different traffic densities. The project is based on land use calculation for the car generated densities and not on the actual number of resident or population, i.e. the aim of this project is to test wither the existing road network can accommodate the amount of traffic generated from the land use when the area become saturated and fully developed or not, and if not what could be the proposed solution to overcome the potential problem within this area.

Also the traffic generated from the land use within this area is the only part used to calculate the traffic flow, this means it is not accurate enough because the traffic flow must be taken for the whole area not only partial region, i.e. if the is a problem appear in the study for one of the

links, this means that the problem could be worse than what this study suggest, i.e. an immediate action should be taken to solve this issue and avoid more complexities.

Building Regulation 20051 Table

التشتراطات التنظيمية للتعمير بمختلف مناطق المملكة (٢٠٠٥)

ROAD WIDTH	PLOT AREA		BUILDING HEIGHT FLOORS	PROJECTION			SETBACK			MAX. FLR. COVERAGE	MAX. BUILT-UP AREA	DEVELOPMENT ZONE	NO.	CD
	CORNER PLOT	STANDERED PLOT		SIDE	REAR	FRONT	SIDE	REAR	FRONT					
12.5	500	450	3	-	-	1.2	2	2	3	60	180	السكن خاص (أ)	2\1	RA
12.5	360	300	3	-	-	1.2	2	2	3	60	180	السكن خاص (ب)	2\2	RB
12.5	240	220	3	-	-	1.2		2	3	70	210	السكن متصل (أ)	2\3	RHA
6,8,10	120	120	3	-	-	-	-	-	-		300	السكن متصل (ب)	2\4	RHB
12.5	2000	1500	2	-	-	1.2	3	3	5		55	السكن الحدائقي	2\5	RG
25	2200	2000		0.6	0.6	1.2	6	6	-	60	1200	مناطق العمارات الاستثمارية (أ)	3\1	BA (INVST)
25	1800	1500		0.6	0.6	1.2	4.5	4.5	-	60	750	مناطق العمارات الاستثمارية (ب)	3\2	BB (INVST)
20	1400	1200	10	0.6	0.6	1.2	3.5	5	-	60	500	مناطق العمارات الاستثمارية (ج)	3\3	BC (INVST)
18	900	800	6	0.6	0.6	1.2	3	3	-	60	300	مناطق العمارات الاستثمارية (د)	3\4	BD (INVST)
15	700	600	4	-	-	3.2	2	2	5	60	240	مناطق العمارات ٤ طابق	3\5	B4
15	500	450	3	-	-	3.2	2	2	5	60	180	مناطق العمارات ٣ طابق	3\6	B3
18	600	600	5	-	-	-	-	-	-		500	مناطق العمارات المتصلة	3\7	BR
20	1200	1000	5	-	-	1.2	3	3	6	60	300	المعارض التجارية	4	COM
									-			المشاريع الصناعية الانتاجية (أ)	5\1	DA
			4	-	-	1.2	4	4	6	60	240	المشاريع الصناعية الانتاجية (ب)	5\2	DB
15	1200	1000	3	-	-	-	3	3	6	60	180	مناطق المستخدمات و المخازن	5\3	ST
15	1200	1000	4	-	-		4	4	6	60	240	مناطق الصناعات الخفيفة	5\4	LD
15	500	450	4	-	-	1.2	2	2	6	60	240	مناطق الورش و خدمات الصيانة	5\5	WMS
15	300	280	4	-	-	1.2	-	2	5	60	180	المناطق الخدمية	5\6	SA
12.5	6000	6000	2								15	المناطق الزراعية	4	AG

The above table illustrate the detailed types and regulation of each classification zone in the approved zoning map in Bahrain. There are five main categories which subdivided in to so many detailed classifications; the first one is the residential types of doweling units which is subdivided in to 5 types. The second category is the investment building, or in another word the mixed land use type of building. This is the highest density in compression with the other type of zoning classification. It is sup divided in to 7 classification type, and there is a revision for this category coming soon by adding few more classification with certain regulation for different region. The third category is the commercial classification which is also mixed lad use but with different regulation. Usually it is applied in linear rather than area wise zoning, ie there are road with commercial land use but there is no area of commercial zoning land use. The fourth category is the industrial type of classification which sup divided in to classification depending on type of industry and amount of capital investment. The last category is the agricultural zone which follows the agricultural regulation.

Calculation Table for Difernt Densities as per Classifiction2 Table

Criteria							IN PUT AREA in Meters Seq ?	Output			
Constant Information				Information Per Ha				Urban			Traffic
TYPE	%	PLOT AREA	Area of min DU	NO. of Plot/Ha	Average DU/ Ha	Pop/Ha	AREA	NO. of Plot	NO of DU	Population	NO of Car
RA	180	450	200	16	31	156	10000	16	31	156	62
RB	180	300	100	23	78	389	10000	23	78	389	156
RHA	210	220	80	32	64	318	10000	32	64	318	127
RHB	300	120	60	58	117	583	10000	58	117	583	233
RG	55	1500	150	5	30	152	10000	5	30	152	61
BA	1200	2000	-	4	560	2800	10000	4	560	2800	1120
BB	750	1500	-	5	350	1750	10000	5	350	1750	700
BC	500	1200	-	6	233	1167	10000	6	233	1167	467
BD	300	800	-	9	140	700	15000	13	210	1050	420
BH	300	1000	-	7	140	700	15000	11	210	1050	420
B4	240	600	-	12	112	560	10000	12	112	560	224
B3	180	450	80	16	158	788	10000	16	158	788	315
BR	500	600	60	12	583	2917	600	1	35	175	35
Total							130600	199	2187	10937	4340

The above table illustrate the method of calculating the different densities for each of the residential and investment mixed zone classification. The table have three main type of information , criteria in how the calculation been generated , the input area required to

calculate each and individual type of classification zone , and output data which show the results of the calculation as per the area used .the criteria is divided in to two type of information constant which is generated from the building regulation table such as built up ratio and size of plots and the other type of information is the densities per hectare for each classification . The output information's are depending of the input area size for each classification type within a region. The formula for each classification is different from the other types because it has different criteria and different regulation.

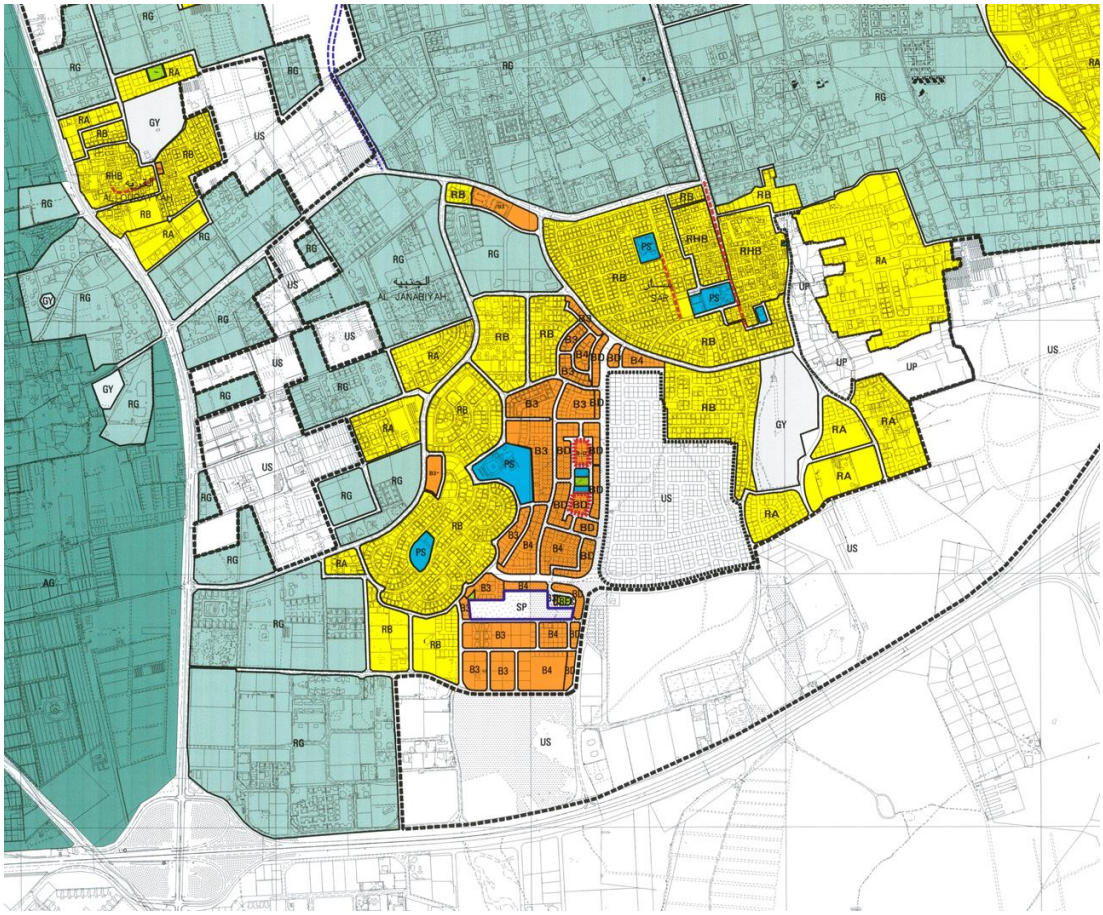

Figure 3 Zoning for the Selected Study Area

The above map illustrates the zoning classification captured from the approved zoning map. The following table summarise what is included in the study area.

Summery Table for Atrbute in Study Area by GIS3 Table

* OBJECTID	NZP_CODE	Cnt_NZP_CODE	First_NZP_DESC_E	First_NZP_DESC_A	Sum_SHAPE_AREA
1	AG	2	Agricultural Area	المناطق الزراعية	2365927.99
2	B-D	14	Investment Buildings -D	مناطق المعارات الإستثمارية د	89417.71
3	B3	13	Storey Buildings ٣	مناطق المعارات - ٣ طوابق	195538.43
4	*B3	2	* Storey Buildings ٣	مناطق المعارات - ٣ طوابق*	9505.94
5	B4	7	Storey Buildings ٤	مناطق المعارات - ٤ طوابق	103826.355
6	GY	3	Graveyards	مقابر	169091.145
7	PS	6	Public services/Utilities	مرافق عامة - مناطق خدمية	67665.67
8	RA	11	Private Residential -A	مناطق السكن الخاص أ	648535.54
9	RB	12	Private residential -B	مناطق السكن الخاص ب	1042310.905
10	REC	3	Recreational	مناطق ترفيهيه	6060.045
11	*REC	1	*Recreational	مناطق ترفيهية *	1764.04
12	RG	21	Compounds Garden Housing	مناطق السكن الحدائقي	4886351.885
13	RHB	3	Row Housing -B	مناطق السكن المتصل ب	185961.21
14	SP	1	Special Projects	مناطق ذات طبيعة خاصة	33971.705
15	STUDY	5	Under Study	منطقة الدراسة	4437501.695
16	UNPLANNED	2	Unplanned Area	منطقة غير مخططة	3484719.365

The above table illustrate the summery information about the zoning area and code in the selected study region for the project. From the above table the number of residential units and car generated been calculated. To make life easier the assumption of for each rendition unit one car is adopted.

Layout for the imput data and maps used in the GIS software for the project.

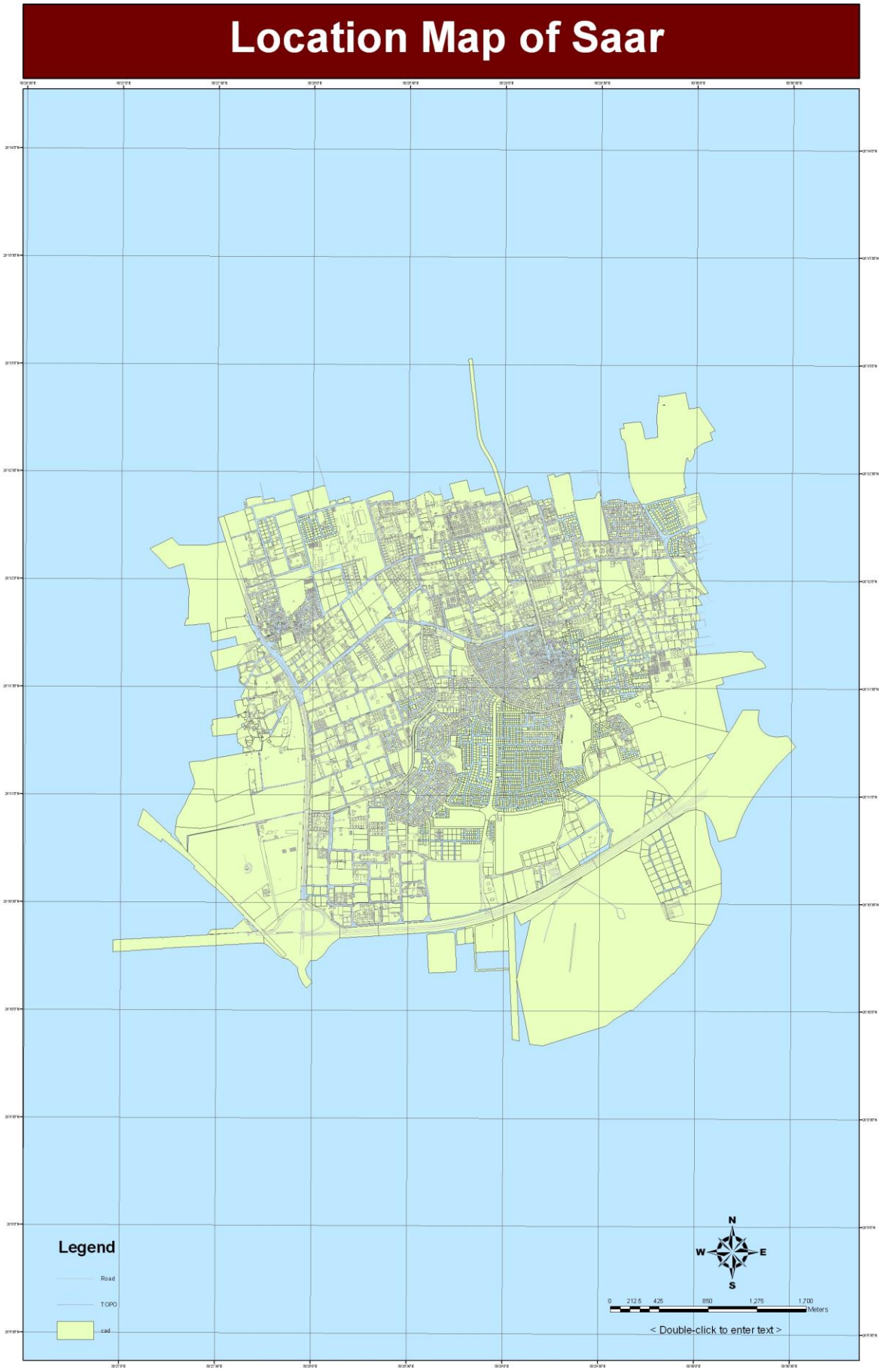

Figure 4 Output MAP from GIS Saar Location Map

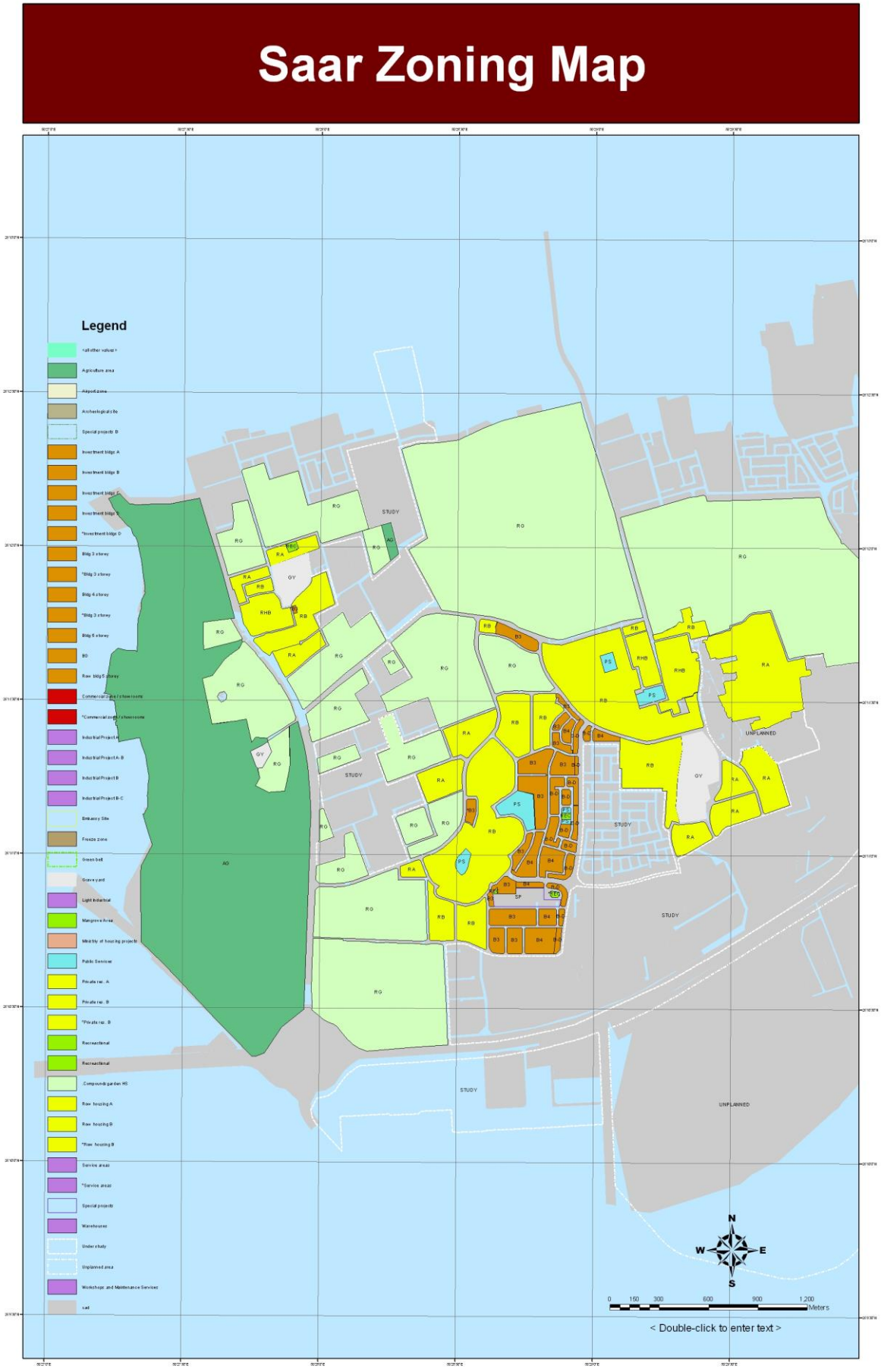

Figure 5 Output from GIS Saar Zoning Map

Chapter Three

Methodology

- Using Collected Data from Planning Affairs
- Generating an output form GIS by using the input data
- Finding the results of Processing
- Analyzing the outcomes representation
- Stating the general conclusion
- Recommendations

Developing criteria for such project is the corner stone in this project.

1. The accessibility
2. The amount of traffic using the layout network
3. The fulfillment of Road network Standard
4. The easiness of implementation

The Data required for such project are

1. The Map for the area subject of study
    a. Cadastral and Topography
    b. The existing road network
    c. The land use map
    d. the calculation table for population density ,number of residential units ,car generated ,
2. The traffic generated from land use which may use the road network.

The following process have been done to generate the output information from the GIS

- Adding Fields in the Attribute Table
- Calculating Fields with reference to existing fields in the same attribute table.
- Calculating number of dulling unites per classification zoning
- Calculating Car density generated from the land use
- Representing the car density in map
- Generating summery table
- Drawing Road Layout
- Linking Road (Lines) with Zoning area (Polygon)
- Representing Road layout Car generated densities

Output MAP and Tables from GIS

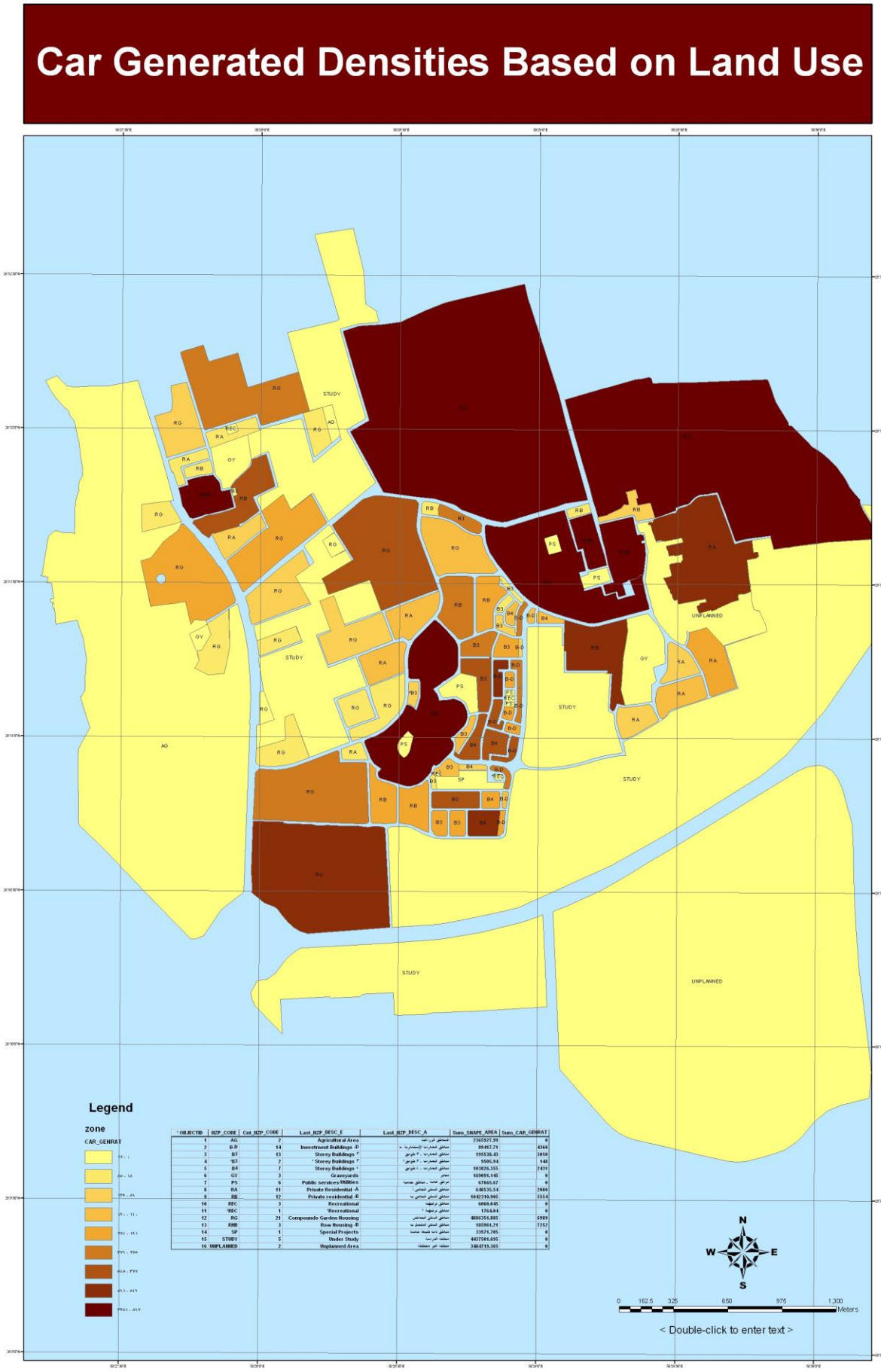

Figure 6 OutPut From GIS Car Generated Densities

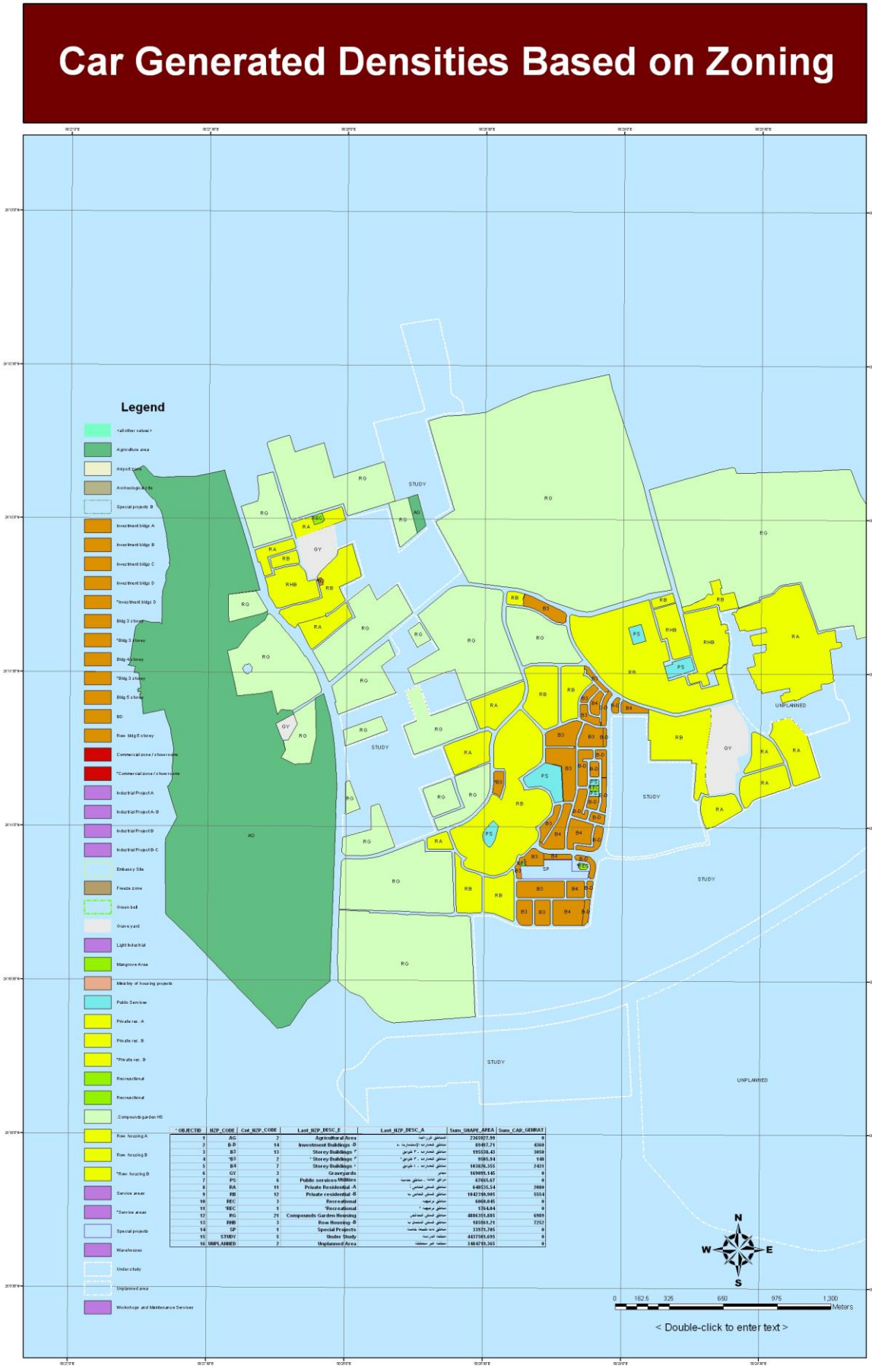

Figure 7 Output From GIS Car Generated Densities

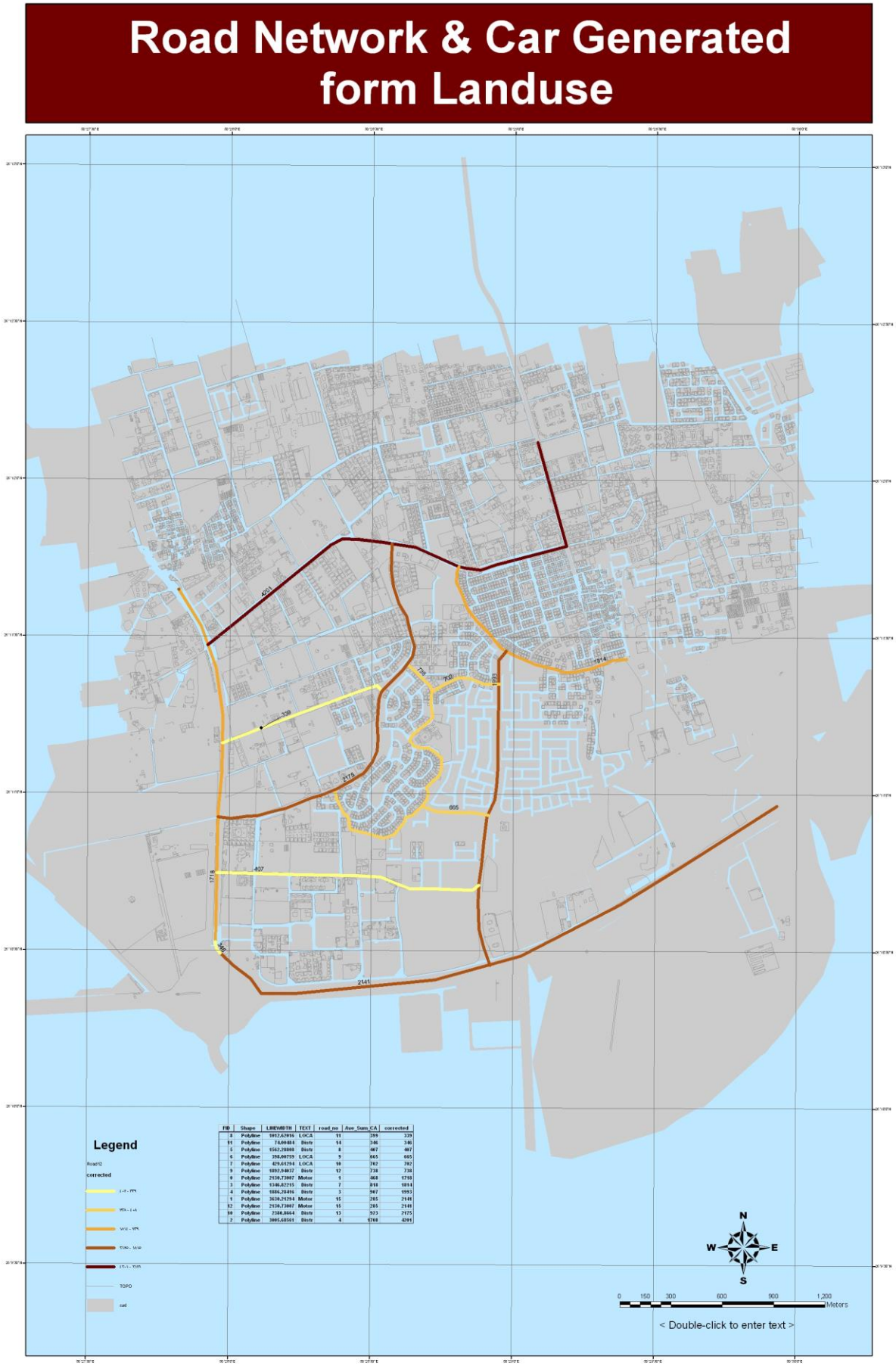

Figure 8 Output From GIS Road Network

Conditions & Explanations

Road Network Densities were calculated based on average number of cars generated from different land use located next to road layout by 50m , i.e. 50m buffer zone is the area or block of zones that are expected to generate traffic which is going to be transmitted towered the adjacent link.

Summery Table for the Road Network4 Table

FID	Shape	LINEWIDTH	TEXT	road_no	Ave_Sum_CA	corrected
8	Polyline	1012.62016	LOCAL	11	399	339
11	Polyline	74.00484	Distr	14	346	346
5	Polyline	1562.28808	Distr	8	407	407
6	Polyline	398.00759	LOCAL	9	665	665
7	Polyline	429.61294	LOCAL	10	702	702
9	Polyline	1892.94037	Distr	12	738	738
0	Polyline	2130.73007	Motor	1	468	1718
3	Polyline	1346.82215	Distr	7	818	1814
4	Polyline	1886.28416	Distr	3	907	1993
1	Polyline	3630.21294	Motor	15	285	2141
12	Polyline	2130.73007	Motor	15	285	2141
10	Polyline	2380.8664	Distr	13	923	2175
2	Polyline	3005.68561	Distr	4	1708	4201

Correction Summation calculated in the corrected filed in the Attribute illustrated based on road type and cost analysis this means the following, 50% of car generated that are transmitted from the area around the link shall use one direction to reach the next level of road category depending on the standard until it reach the motor way which shall be the maximum capacity holding expected. For example if this is a link which carry 1000 car , 500 of them will go in one direction and the rest will go towered the other direction.

The correction filed is the collection of all the traffic generated from the adjacent zones based on the hierarchy system of road layout, i.e. the local catchment traffic well goes through the distributor and then the summation of the traffic in this level of links will be transmitted towered the arterial and finally towered motor way. Based on this concept the motor way should carry the maximum traffic generated. The problem appeared when there is a link carrying capacity more than its limit standard.

It is clear from the output that link 4 which is distributor having problem in the amount of traffic it carry , that means the carrying capacity of this link will not cop with the amount of traffic expected when this area being developed 100% .

Chapter four

Conclusion

Problem Found

- The capacity of roads and links should cop with land use.
- Road number 4 is Main Distributor link which carry high density of car generated from land use. It should be design in a way that cop with rate of growth of traffic generation.

Recommendation

Dual carriageway with proper junction linked with motorway and reducing the land use density could be the recommendation to overcome the potential problem in this link for the road network in Saar Village

References

a. *Micro station DGN format files for the zoning maps in different regions in Bahrain.* Planning Affairs – Ministry of Municipalities and Agriculture
b. *Excel Sheets Programs calculating the densities and other related information according to the zoning classification used in Bahrain* Planning Affairs – Ministry of Municipalities and Agriculture
c. *Statistical Information* CIO –Central Information Organization Bureau