



# Combining Geospatial and Statistical Data for Analysis & Dissemination

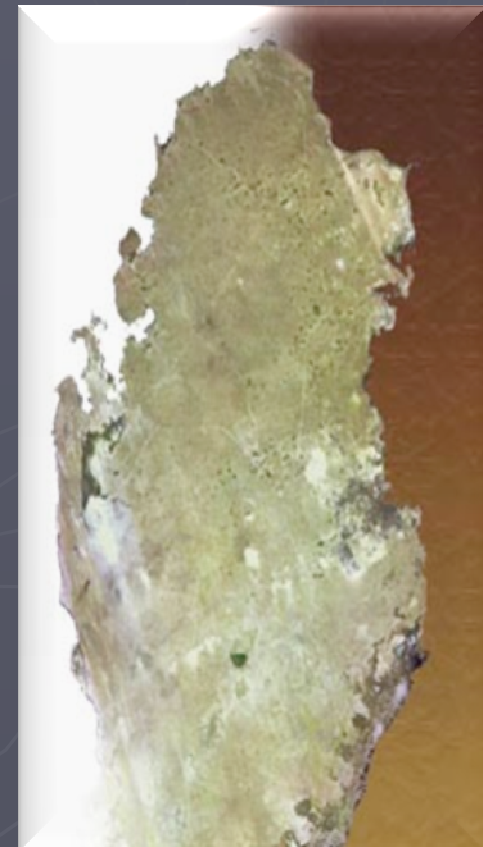
*(with Special Reference to Qatar Census 2010)*

Presentation by

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Integrating Statistical and Geospatial Information: Issues and Challenges  
UN-GGIM, Seoul. Thursday, 27 October 2011



# Combining Geospatial and Statistical Data for Analysis & Dissemination

## Overview

- Geospatial Data is Important to Statistical Information
- Integrating Geospatial and Statistical Data
- Qatar Statistics Integrated through Nationwide Geospatial Infrastructure
- Using Geospatial and Statistical Data for Analysis & Dissemination



# Geospatial Data is Important to Statistical Information



# Geospatial Data is Important to Statistical Information

- Spatial (Geographic) Data is the Key for:
  - Collection
  - Processing
  - Analysis & Dissemination
- Spatial (Geographic) Analysis of Statistics-
  - Transforms Data into Information, and
  - Presents results to the users in a concise and easy to understand manner





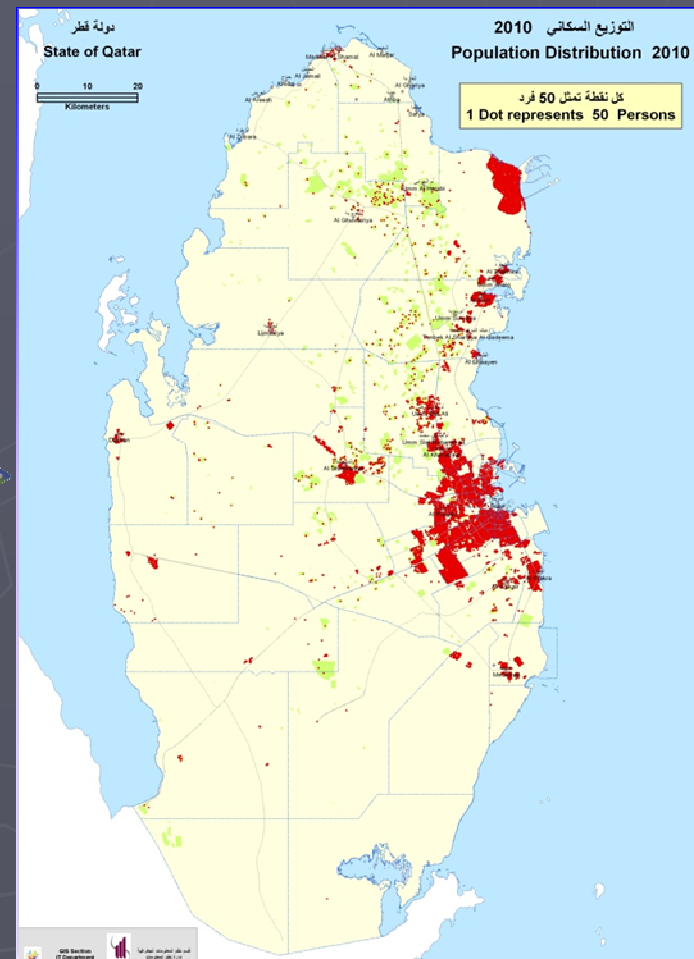
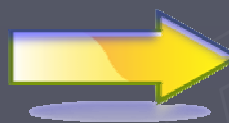
# Spatial (Geographic) Analysis of Statistics- Answering Where & How!

- Population Distribution (By Census Blocks)

Tables

Maps

OBJECTI	Zone	Block Id	Block Cod	TOTAL_MALE	TOTAL_FEMA	TOTAL_P
172	13	5	Z13B005	501	0	501
173	13	6	Z13B006	1	0	1
174	13	7	Z13B007	113	46	159
175	13	37	Z13B037	39	0	39
176	13	38	Z13B038	392	329	721
177	13	42	Z13B042	206	141	347
178	13	41	Z13B041	227	187	414
179	13	40	Z13B040	208	107	315
180	13	27	Z13B027	234	122	356
181	13	29	Z13B029	366	215	581
182	13	8	Z13B008	75	48	123
183	13	9	Z13B009	86	40	126
184	13	11	Z13B011	38	5	43
185	13	28	Z13B028	215	180	395
186	13	34	Z13B034	216	16	232
187	13	33	Z13B033	<Null>	<Null>	<Null>
188	13	15	Z13B015	201	45	246
189	13	23	Z13B023	147	58	205
190	13	21	Z13B021	334	193	527
191	14	42	Z14B042	597	98	695
192	14	34	Z14B034	212	107	319
193	14	47	Z14B047	19	4	23
194	14	40	Z14B040	155	26	181
195	14	41	Z14B041	265	192	457
196	14	39	Z14B039	265	21	286
197	14	35	Z14B035	185	39	224
198	14	38	Z14B038	278	26	304
199	14	43	Z14B043	329	43	372
200	14	36	Z14B036	134	17	151
201	14	37	Z14B037	397	36	433
202	14	44	Z14B044	380	80	460
203	14	29	Z14B029	145	14	159
204	14	33	Z14B033	79	6	85
205	14	20	Z14B020	359	2	361
206	14	10	Z14B010			





# Answering Where & How!

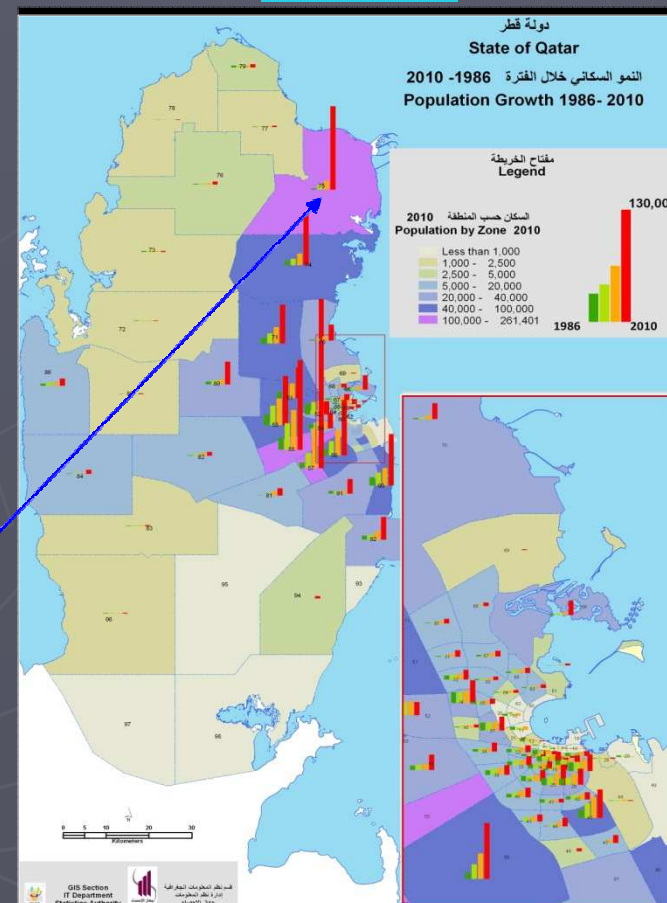
## ■ Population Growth 1986- 2010

### Tables

ZONENAME	ZONENO	AREA	POP 86	POP 97	POP04	TOTAL2010
Al Gharrafa/Bani Hajer/Al Zaghw	51	88.774	9647	16429	22727	46976
Al Luqta/Al Rayyan Al Qadeem	52	13.390	16302	19665	21452	20416
Al Rayyan Al Jadeed/Muaither No	53	98.567	16248	30289	41261	76291
Fareeq Al Amir/Muraykh/Al Souda	54	18.067	6669	8190	9319	23591
Al Soudan South/Al Aziziya/Al G	55	94.698	19208	41033	61712	138573
Al Khulaifat Al Jadeeda/Al Maam	56	65.941	10181	22393	39110	85906
<b>Industrial Area</b>	<b>57</b>	<b>29.954</b>	<b>8704</b>	<b>23454</b>	<b>62612</b>	<b>261401</b>
New District Of Doha 60	60	1.071	8	10	26	19
Diplomatic District	61	3.657	159	437	1282	2782
New District Of Doha 62	62	0.650	30	47	24	3
New District Of Doha 63	63	1.953	1145	2472	2817	5170
New District Of Doha 64	64	1.412	1309	2276	2814	4024
New District Of Doha 65	65	2.105	2001	4394	5316	7710
New District Of Doha 66	66	10.259	1736	3185	4471	22168
New District Of Doha 67	67	4.228	2463	2929	4873	8586
Qatar University	68	9.748	0	40	2398	5558
New District Of Doha 69	69	25.413	0	65	216	1213
Al Kheesa	70	160.677	1713	2457	6192	24722
Umm Slal/Al Kharaitiyat	71	309.687	9404	15935	25413	60509
Al Utouriya	72	702.044	761	915	939	1060
Al Jemaliya	73	626.243	1636	1303	1367	1706
Al Khor	74	455.298	7102	9930	18036	80220
<b>Al Thakhira</b>	<b>75</b>	<b>546.156</b>	<b>1891</b>	<b>7863</b>	<b>13511</b>	<b>128574</b>
Al Ghuwairiya	76	622.754	1629	1716	2159	4834
Fuwairit/Al Jassasiya	77	303.718	1005	982	1385	1970
Abu Dhalouf/Al Zubara	78	433.000	663	621	579	1009
Madinat Al Shamal/Al Ruwais	79	165.391	2712	2456	2951	4996
Al Shahniya	80	283.957	4654	6852	8380	35393
Abu Nakhl / Mukainess	81	199.788	427	1469	6287	11333
Rawdat Rashed	82	450.536	970	2640	4762	6046

PopulationConcentration1986\_201

### Maps





# Integrating Geospatial and Statistical Data



# Integrating Geospatial and Statistical Data Requires-

- Proper Geo-referencing and Coding of Census Data Units for Collection and Representation of Data.
- This is to be done at the time of Census Operations.
- A Census Geography Database is to be created, e.g., Qatar Census Geography.....





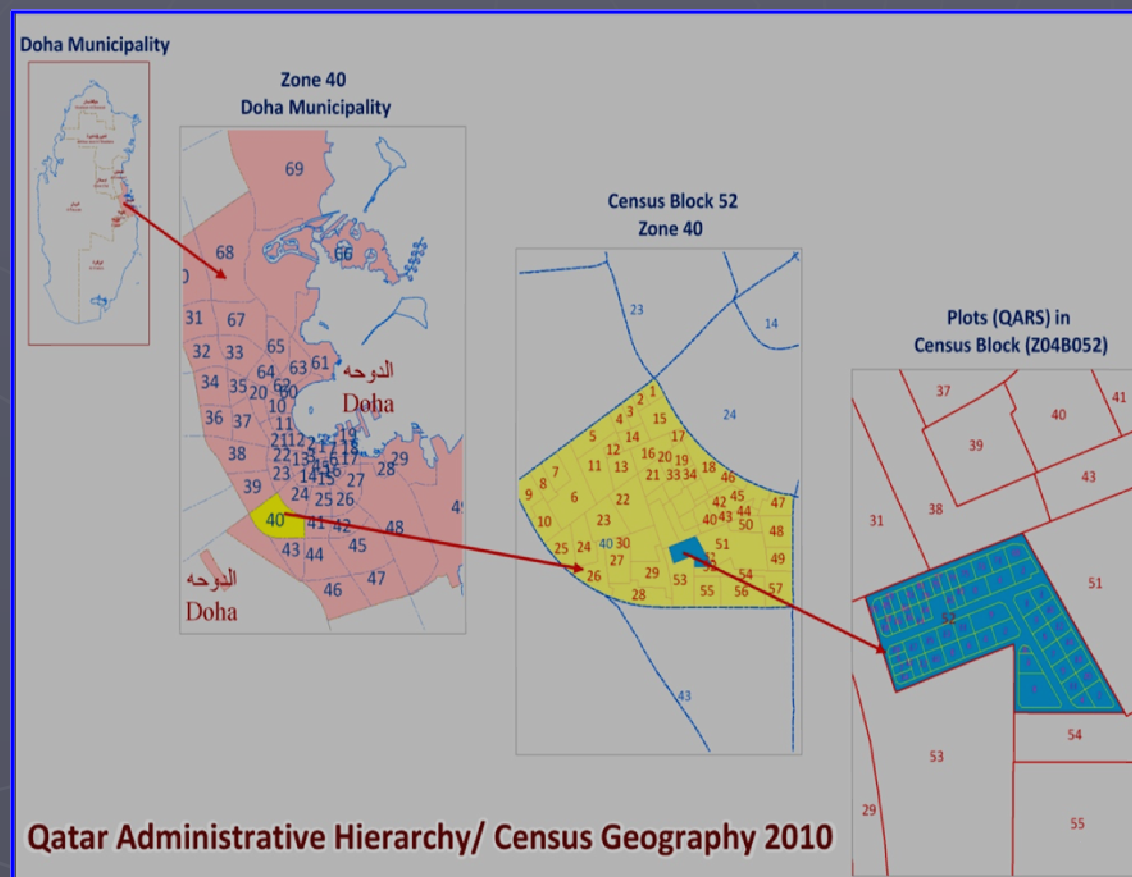
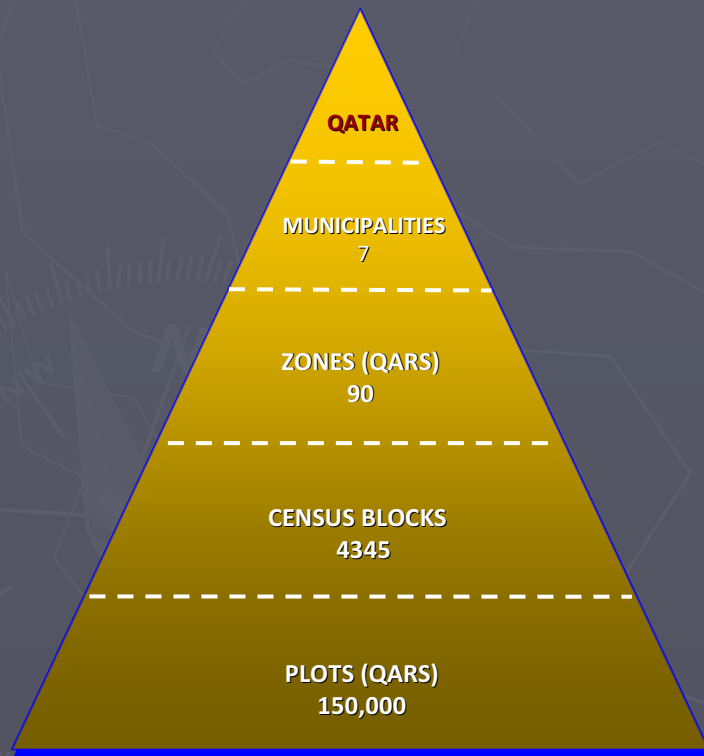
## ■ Qatar Three Tier Administrative/ Census Data Unit Hierarchy 2010





# Qatar Census Geography contd...

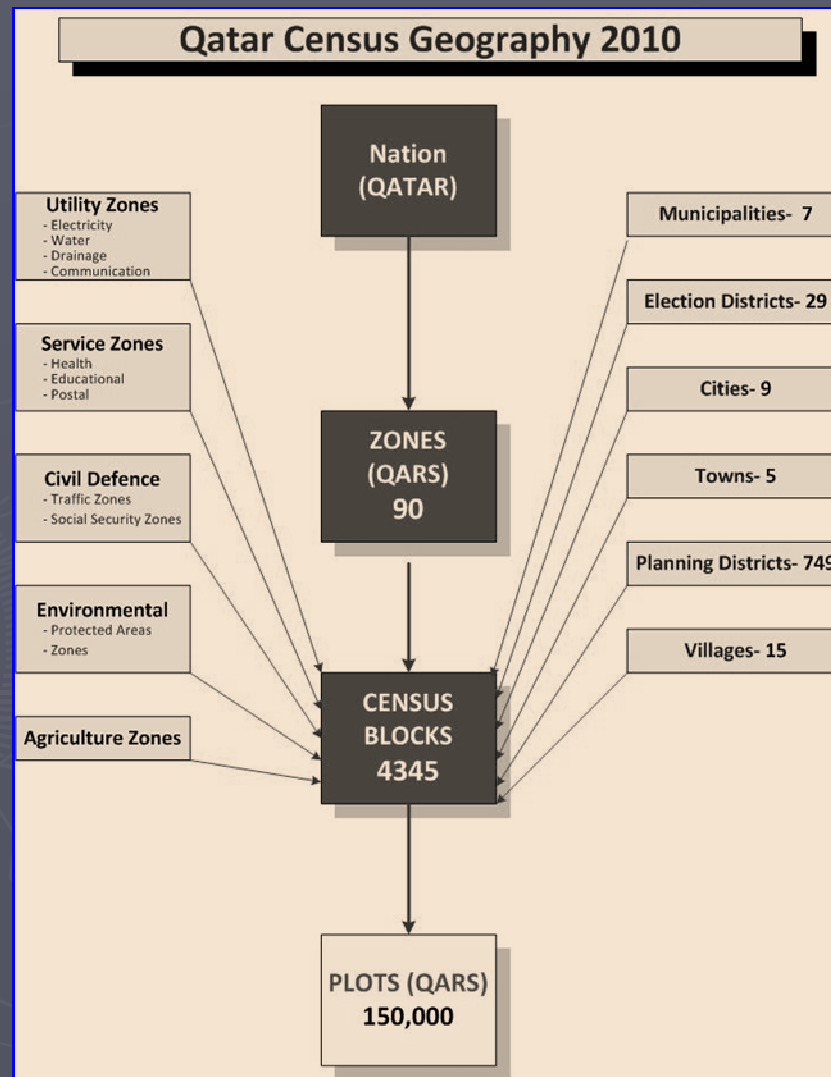
## ■ Qatar Census Geography- Data Unit Hierarchy 2010





# Qatar Census Geography-

## Census Data Aggregation & Dissemination Units



- **Census Data Aggregated to Agency Specific Spatial Data Units**

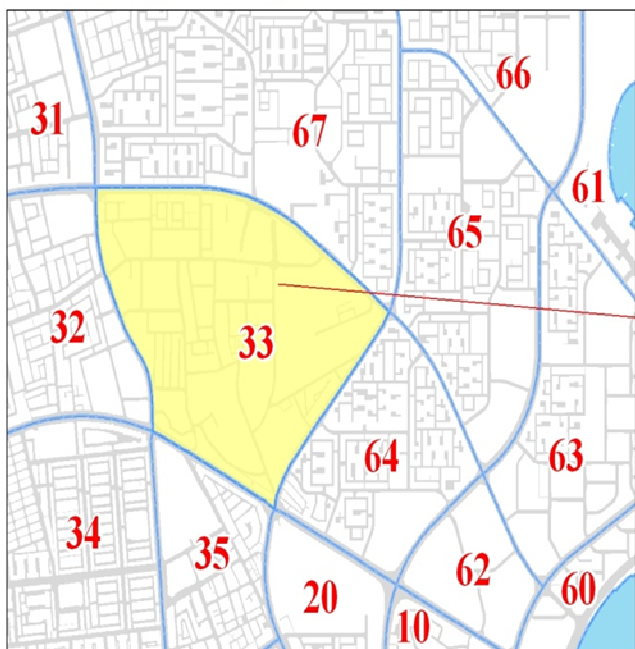




# Coding of Geospatial & Statistical Data

## ■ Zone Level- Census GIS Database

### Zones (QARS) 2010



### Geographic Features Table- Zones

OBJECT	ZONE_NO	SHAPE_Le	SHAPE_Are
11664	35	4537.2	1118086.0
11667	63	6033.8	1953118.4
11668	65	6244.9	2104705.3
11671	67	9023.9	4228395.7
11674	33	6668.6	2743700.2
11712	64	4772.3	1411789.0

### Attribute Table - Zones

ZONE_NO	MALES	FEMALES	TOTAL2010
35	4632	3070	7702
63	3161	2009	5170
65	3686	4024	7710
67	4078	4508	8586
33	2909	2288	5197
64	2100	1924	4024

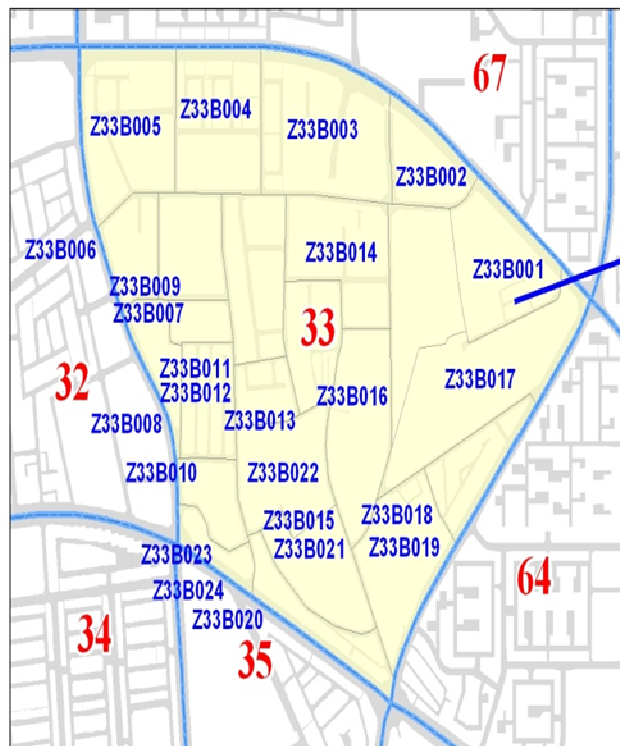




# Coding of Geospatial & Statistical Data

## ■ Census Block Level- Census GIS Database

### Census Blocks 2010



### Geographic Features Table- Census Blocks

OBJECTID	ZONENO	BLOCKNO	BLOCKCODE	Shape_L	Shape_Area
1074	33	1	Z33B001	1566.3	149061.4
1075	33	2	Z33B002	1234.5	85880.4
1077	33	3	Z33B003	1957.7	232501.5
1085	33	4	Z33B004	1635.0	166593.0
1076	33	5	Z33B005	1798.5	193601.3
1086	33	6	Z33B006	1071.4	70943.5
1073	33	7	Z33B007	1229.2	91938.2

### Attribute Table- Census Blocks

BLOCKCODE	MALES2010	FEM2010	TOTAL2010
Z33B001	103	90	193
Z33B002	16	0	16
Z33B003	3	0	3
Z33B004	168	178	346
Z33B005	100	80	180
Z33B006	200	62	262
Z33B007	0	0	0



# Qatar Statistics Integrated through Nationwide Geospatial Infrastructure





# Qatar Statistics is part of- The Qatar Nationwide GIS

- 1992:
  - National GIS Steering Committee
  - Centre for (CGIS)
- Standards
- systematic fashion.
- Today > 60 Govt. & S-Govt Agencies linked to GIS Net.





# The Qatar Nationwide GIS

- GISnet : High speed fibre optic network.







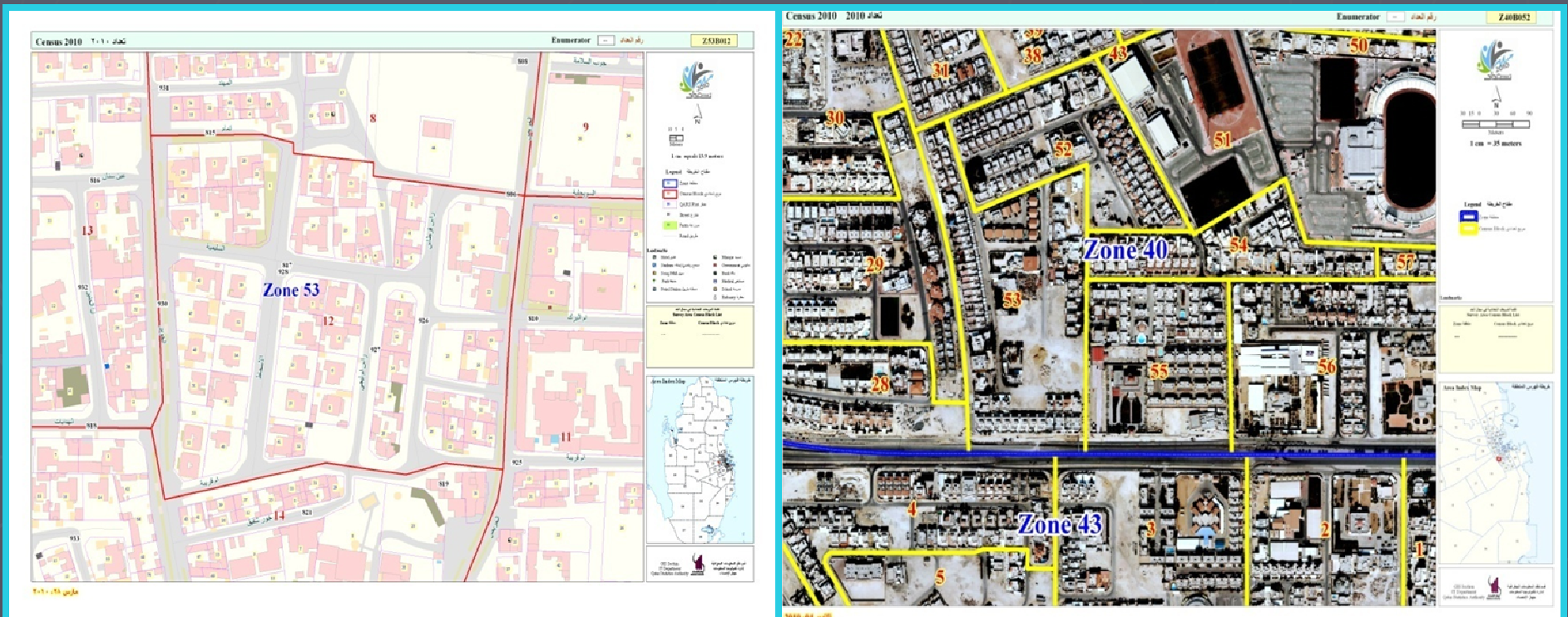
# Geospatial Data in Qatar is Integrated through Qatar Nationwide GIS

- Factors that make Integration of Geospatial Data special in Qatar Statistics is that-
  - **Requirements for statistical operations:**
    - Maps
    - GPS Coordinates
    - Ortho and Satellite Images
  - **Economical in resource.**
  - **Time saving .**
  - **High quality output**
  - **Statistics integrated with other agencies data**
  - **On-line dissemination on Qatar GISnet.**



# Base Map Information

- Geo-Info. Available on-line to QSA

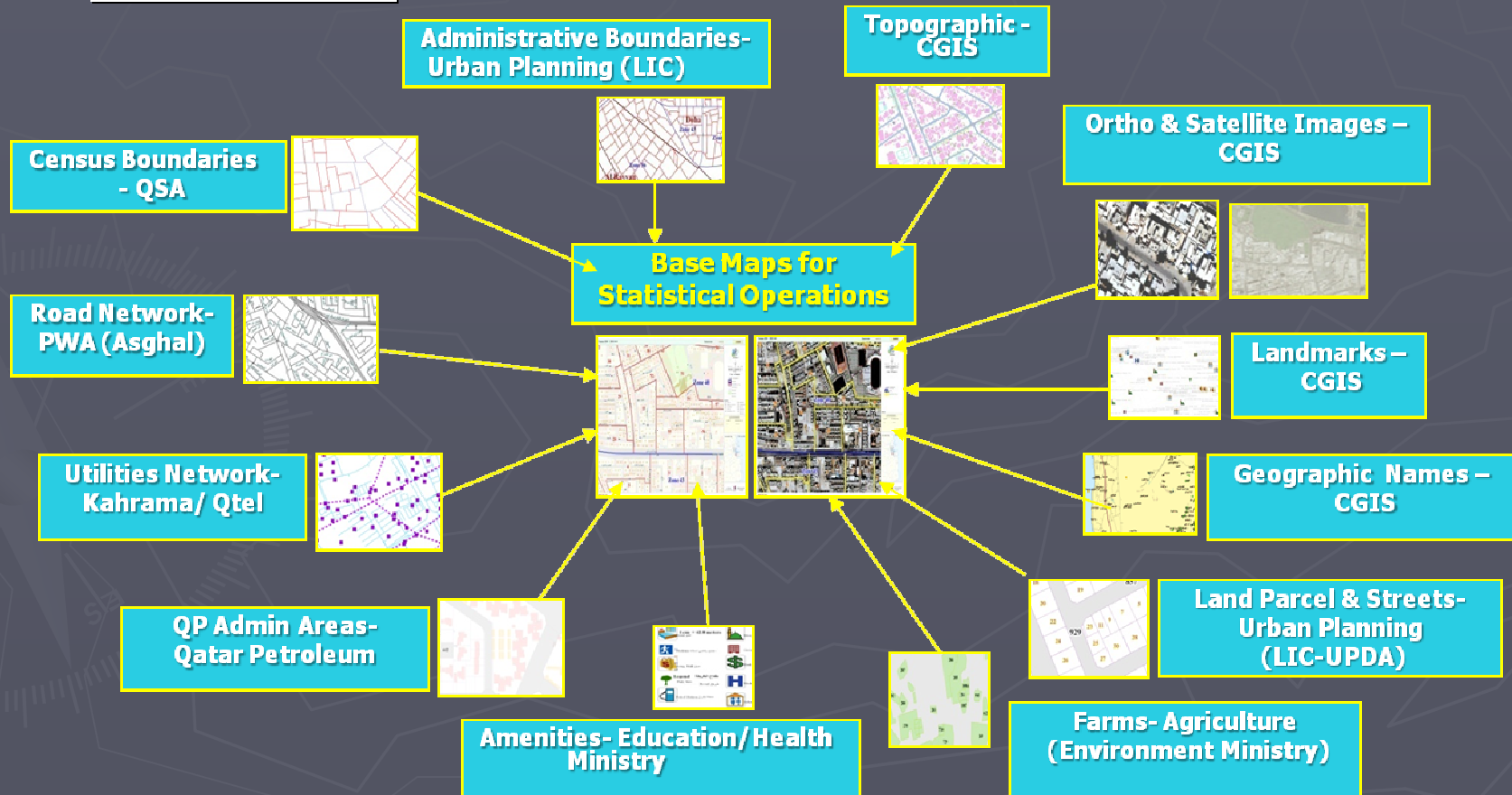


*(QSA maintains only GIS data for the Census Data Units and Census Charge Area Boundaries)*



# Up-to-date Geospatial & Statistical Information Shared on-line

- Combining Layers of Information for Analysis & on-line Data Dissemination







# Using Geospatial and Statistical Data for Analysis & Dissemination





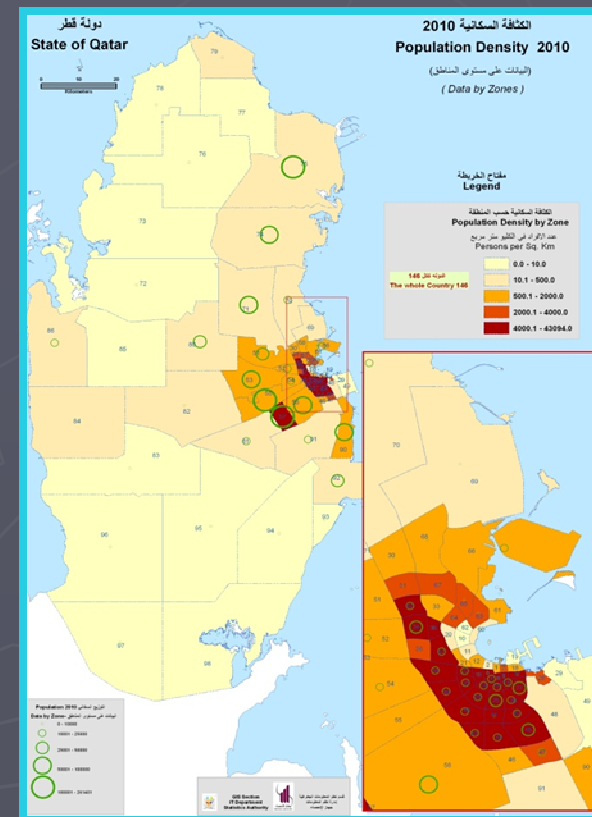
# Combining Geospatial and Statistical Data- Some Prevalent Forms

## Thematic Mapping- Choropleths/ Colour Maps

Table

ZONE_NO	POP_86	POP_97	POP04	POP2010
1	1291	1047	827	240
2	1168	515	294	35
3	6689	5415	7273	4886
4	7333	7914	9655	14063
5	3496	3546	3175	4138
6	3144	3120	3917	3462
7	1484	1353	1901	679
10	3262	3206	3921	8
11	5170	3724	5236	63
12	4436	3558	1379	1067
13	3254	3217	4615	8648
14	6612	7565	9385	10808
15	7698	8129	9459	13059
16	7255	7099	9330	14230
17	4450	4306	6130	7125
18	683	656	777	741
19	279	260	176	6
20	143	71	31	539
21	696	595	576	1532
22	4681	5175	6669	10590
23	5833	7429	8003	13582
24	8035	8649	10391	17219
25	10658	14074	19024	31573
26	9141	10826	16697	24763
27	13226	14022	19345	26069
28	1267	1554	1479	1868
29	2338	1969	770	1
30	596	1866	4093	7059
31	927	1493	4486	9871
32	5958	7780	8246	14725
33	1419	2179	2952	5197
34	16667	16669	19621	35125
35	2776	4323	5311	7702
36	1460	2549	2982	4716
37	11873	12502	13189	21066
38	3962	5447	5323	14113
39	7365	9889	10983	15184
40	5418	7573	10818	15114
41	4706	2260	4596	6604

Map





## ■ Spatial & Temporal Analysis & Mapping

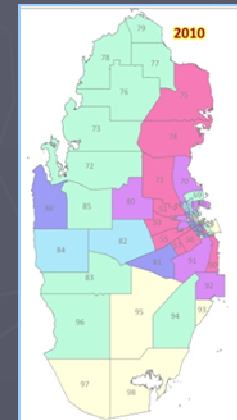
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20	143	71	31	539
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31	927	1493	4486	9871
32	5858	7760	8246	14725
33	1419	2179	2952	5197
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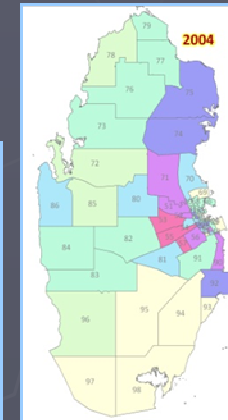
Maps for Census Years



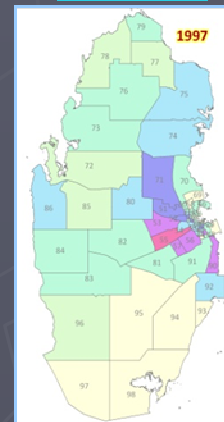
2010



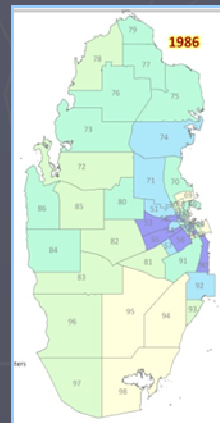
2004



1997

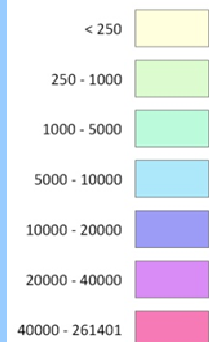


1986



■ Darker Shades represent Higher Concentration of Population

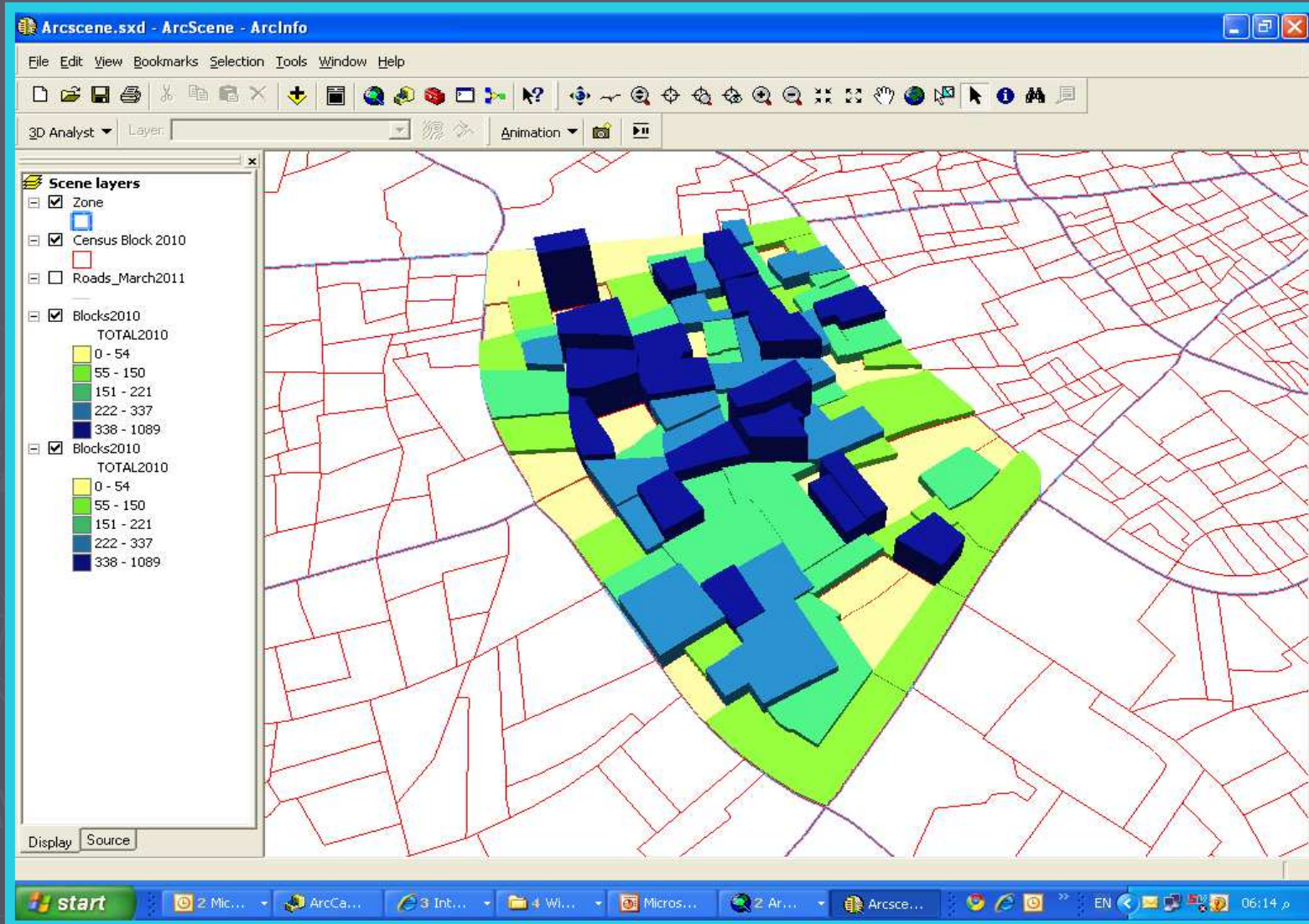
السكان حسب المنطقة  
Population by Zone







## ■ 2D & 3D Representation of Census 2010 Population Data



3D

Zone 22  
 & 23-  
 (Data by  
 Census  
 Blocks 2010)

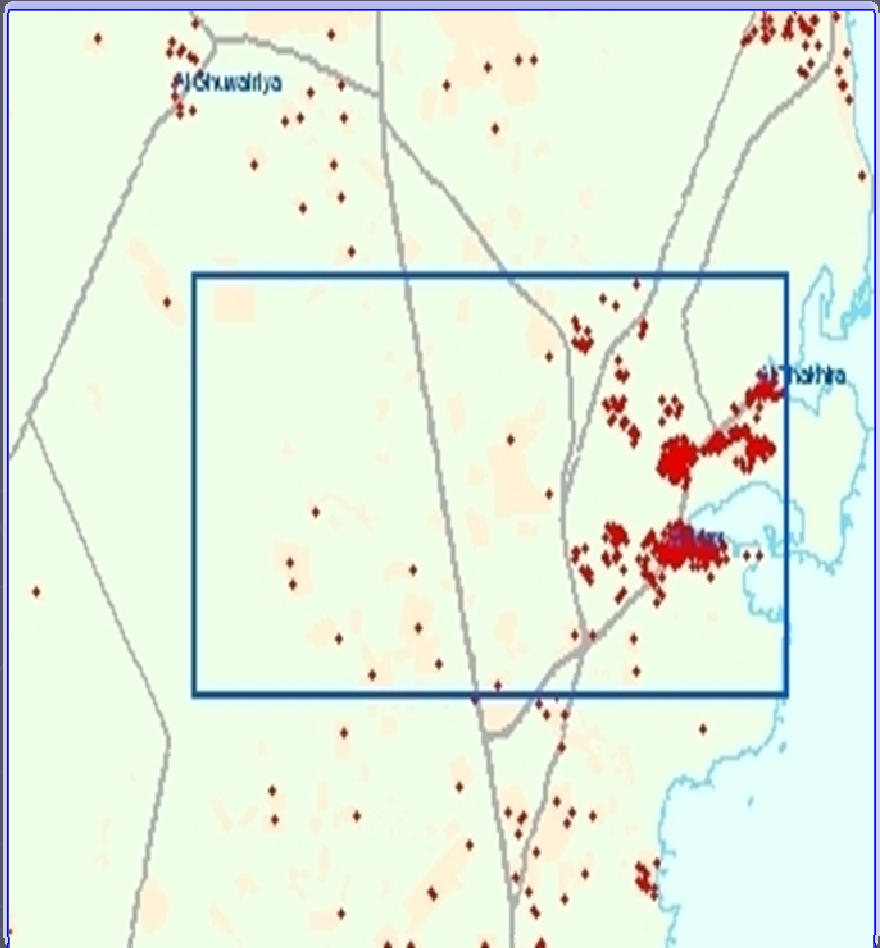
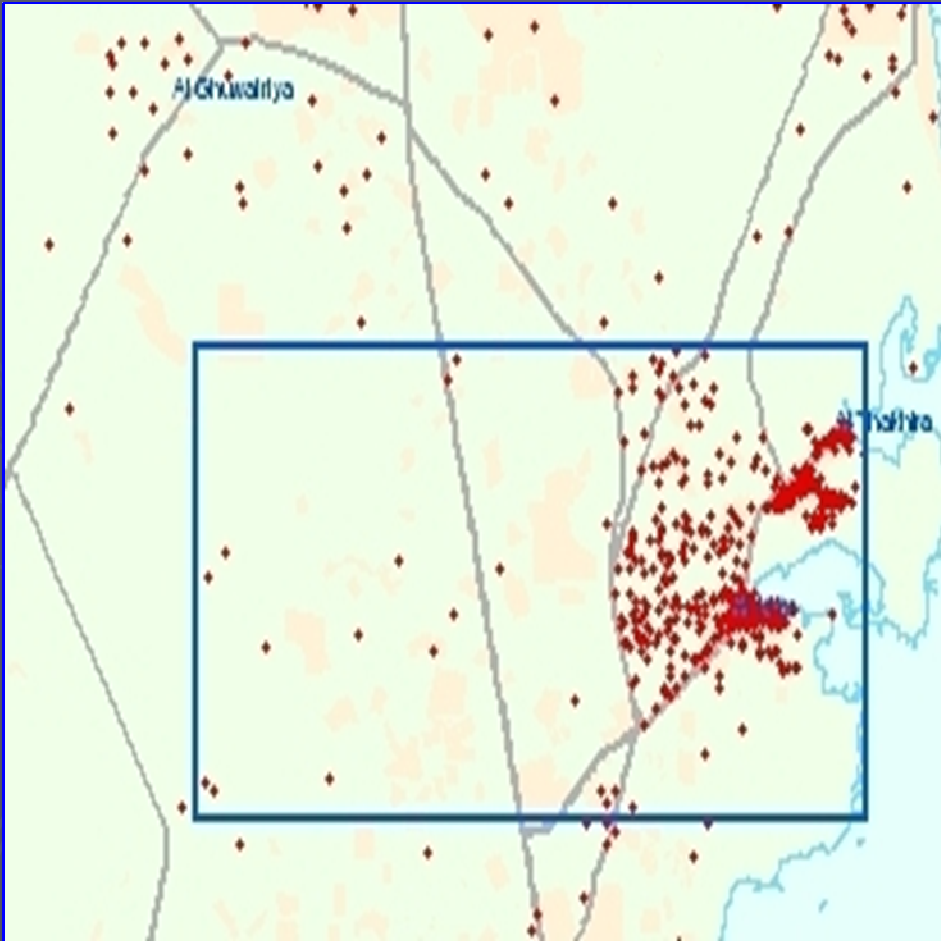




- Dasymetric Mapping-
  - using Ancillary Information (e.g., Land use)

Before

After





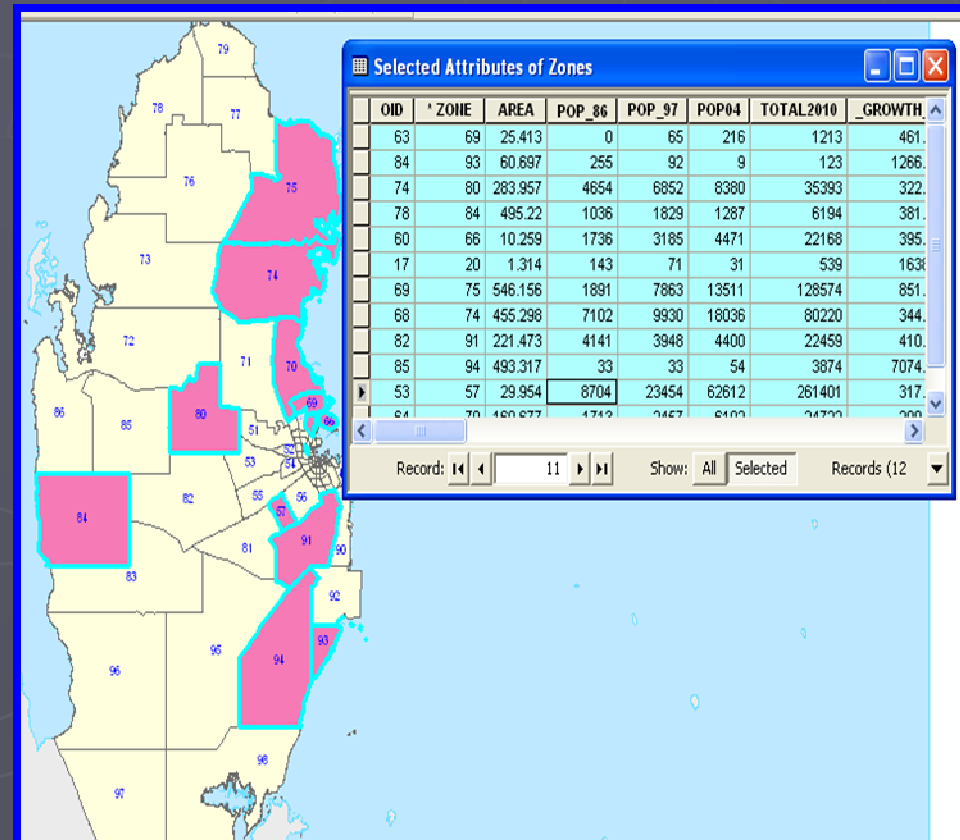
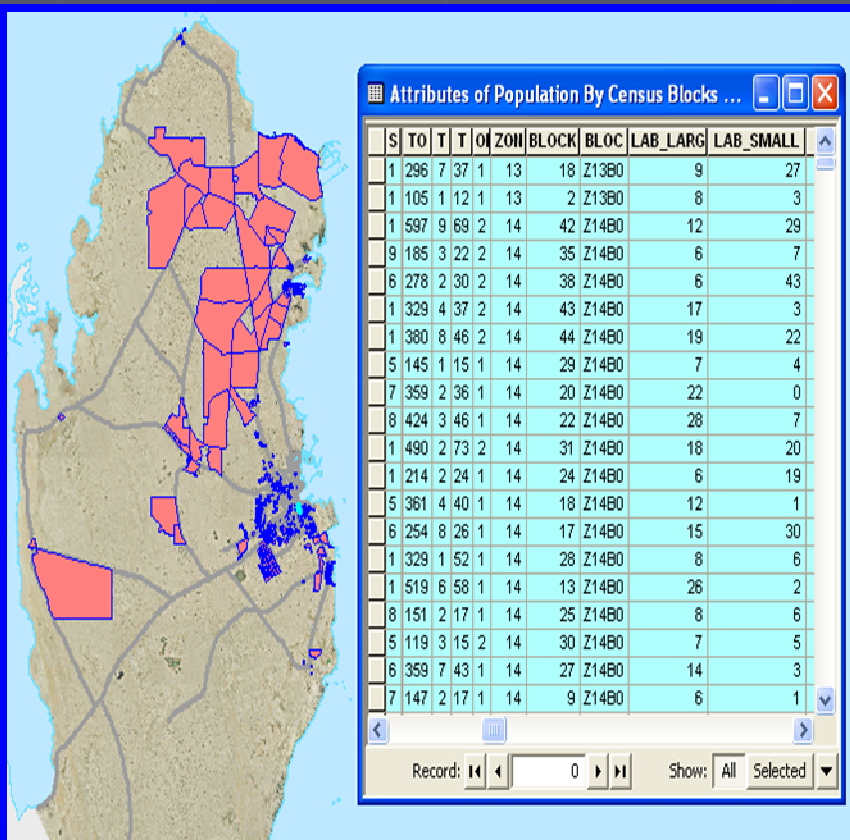


# Combining Geospatial and Statistical Data for

## ■ Query & Display

Census Blocks with Large Labor Gatherings

Zones Recording more than 200 % Growth in Population during 2004- 2010

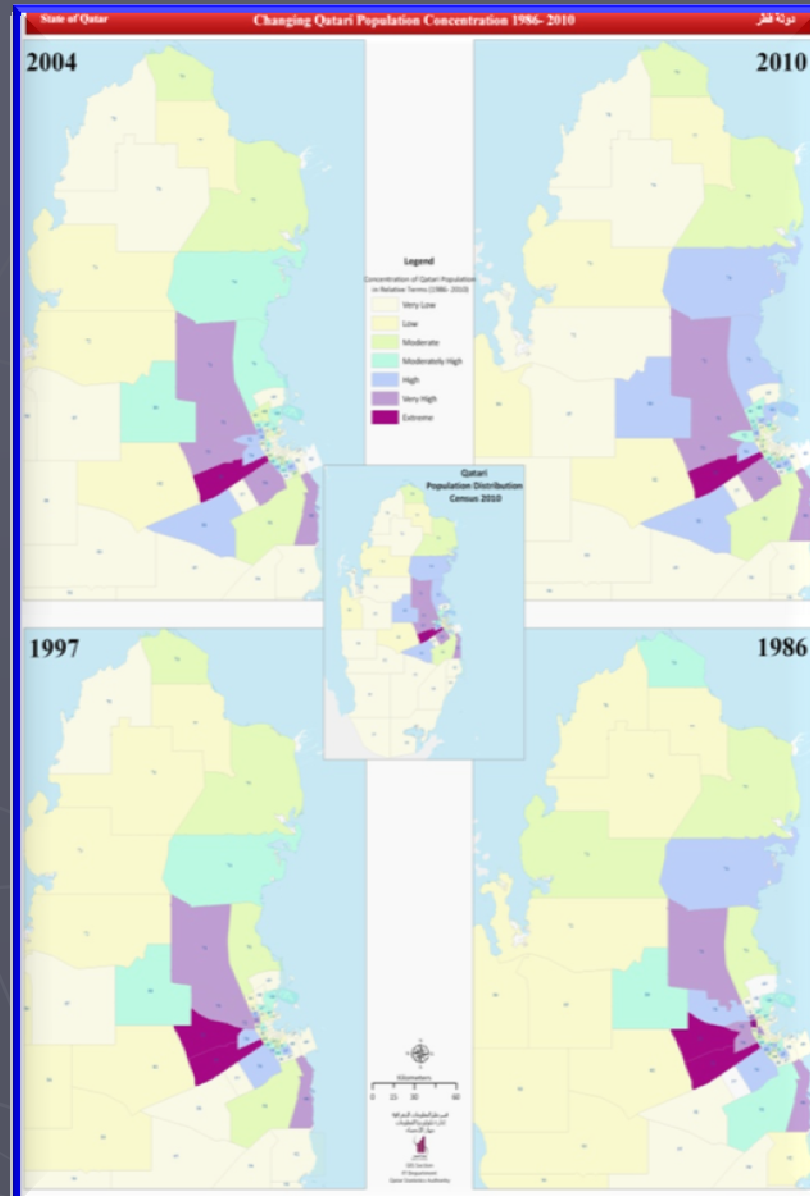






## - Trends & Patterns

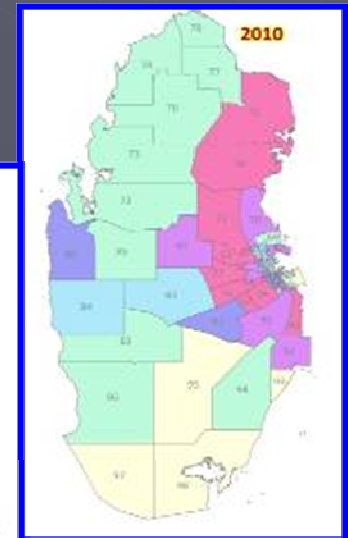
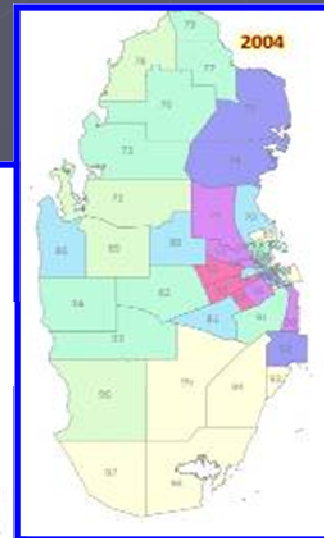
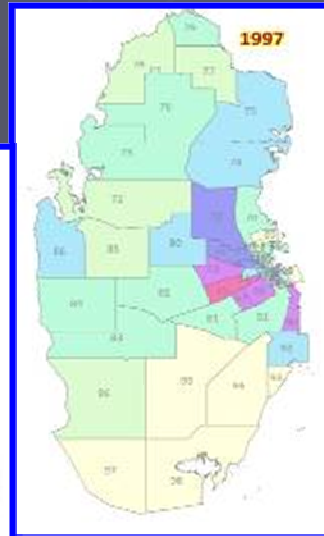
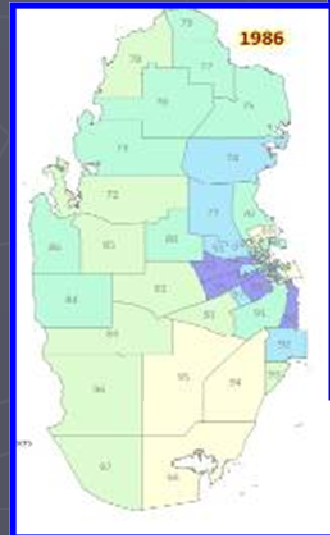
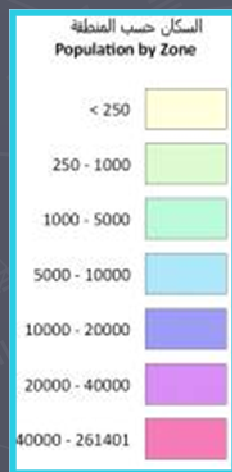
### Changing Concentration of Qatari Population in 25 Years





## ■ Changing Trends & Patterns

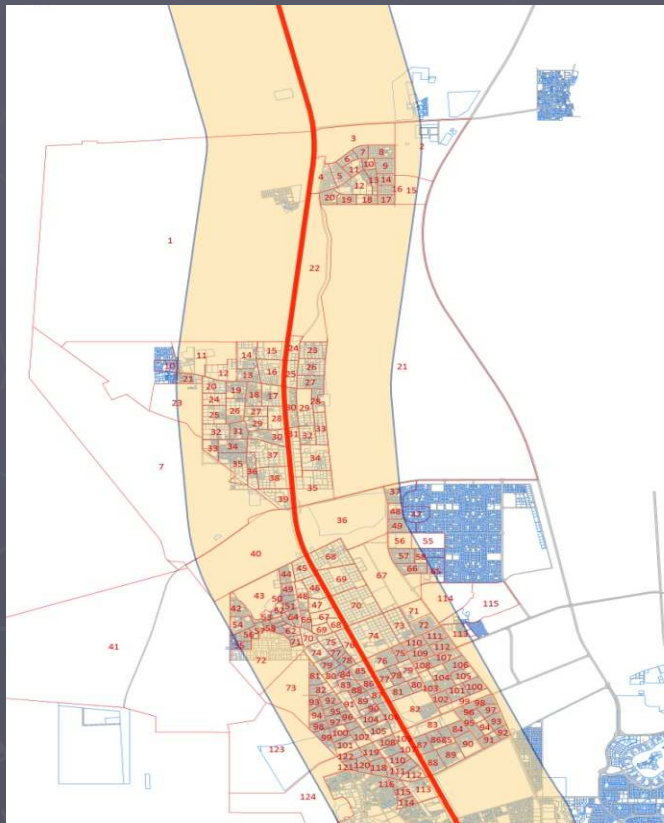
### Changing Population Concentration (1986- 2010)





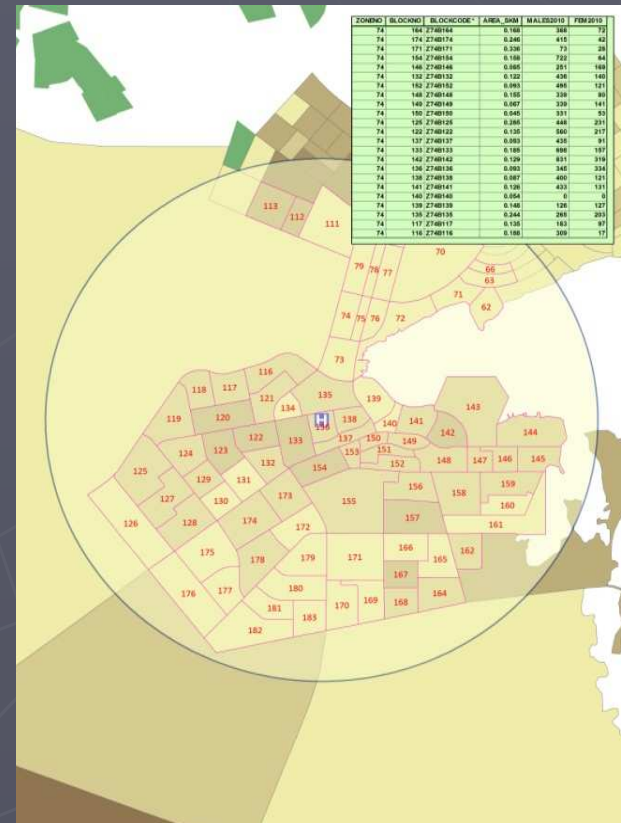
## ■ Transformation- Buffering

### Population Characteristics in 3 Km distance



#### Line Buffer-

along the Al Shamal Road



#### Point Buffer-

surrounding Al khore Health Centre

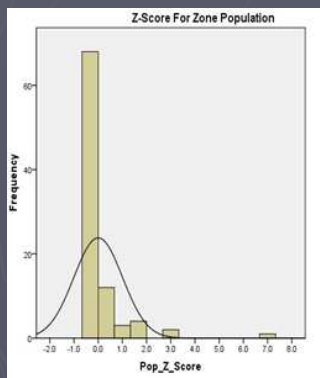




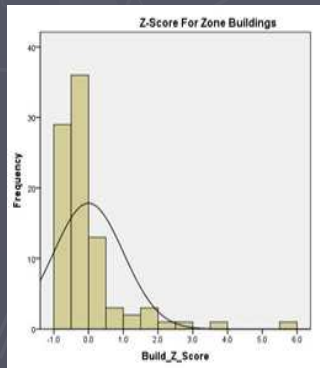
## ■ Spatial Interpolation

Method designed to fill in values that lie between observations (Samples)

### Z Scores



75.6% of the zones have Population below National Average

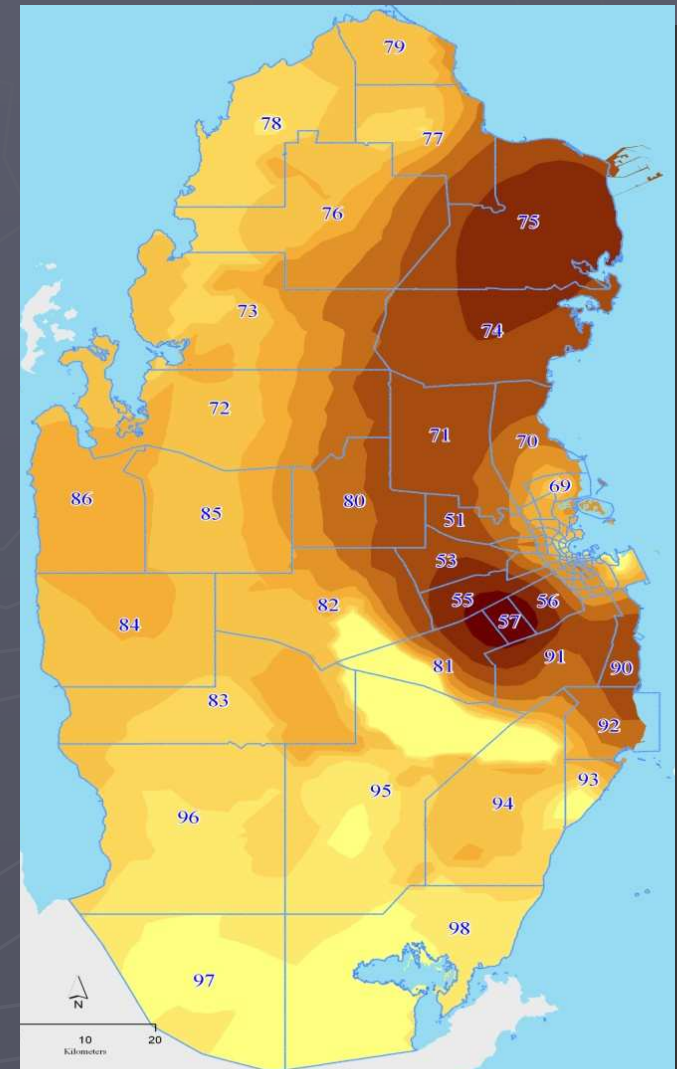


72.2% of the Zones have Buildings below National Averages.

### Kriging Interpolation Technique

Legend  
Ordinary Kriging- Prediction Map  
Values Zone Population 2010  
Z Scores

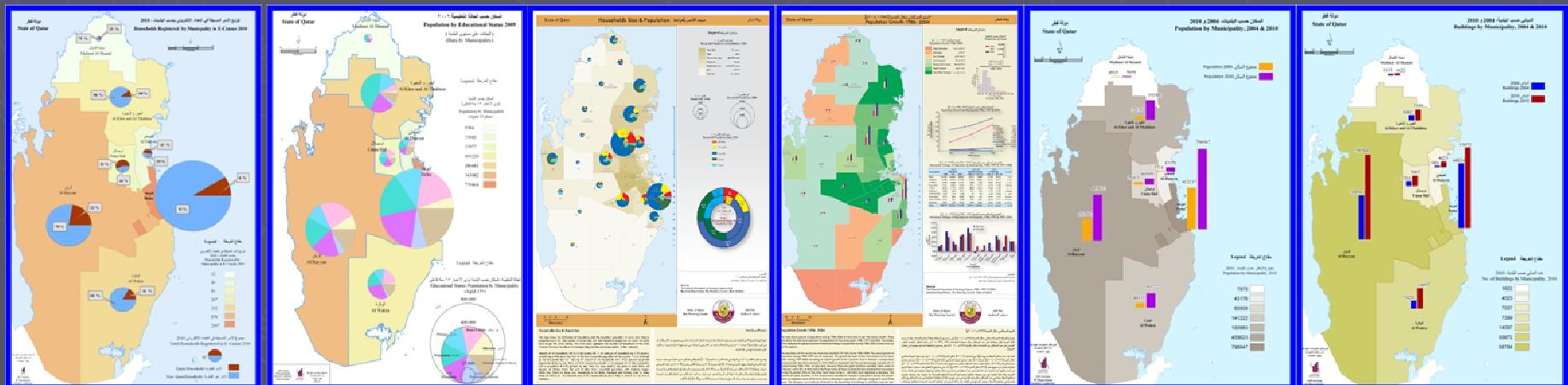
-0.507 - -0.520	
-0.484 - -0.507	
-0.440 - -0.484	
-0.359 - -0.440	
-0.209 - -0.359	
0.070 - -0.209	
0.589 - 0.070	
1.554 - 0.589	
3.347 - 1.554	
6.679 - 3.347	





# Qatar Statistics Output using Geospatial & Statistical Data

- Data User Requests
- QSA Publications & Reports





How GIS is been utilized to  
disseminate/visualize Qatar Census 2010  
Results for the Stakeholders?



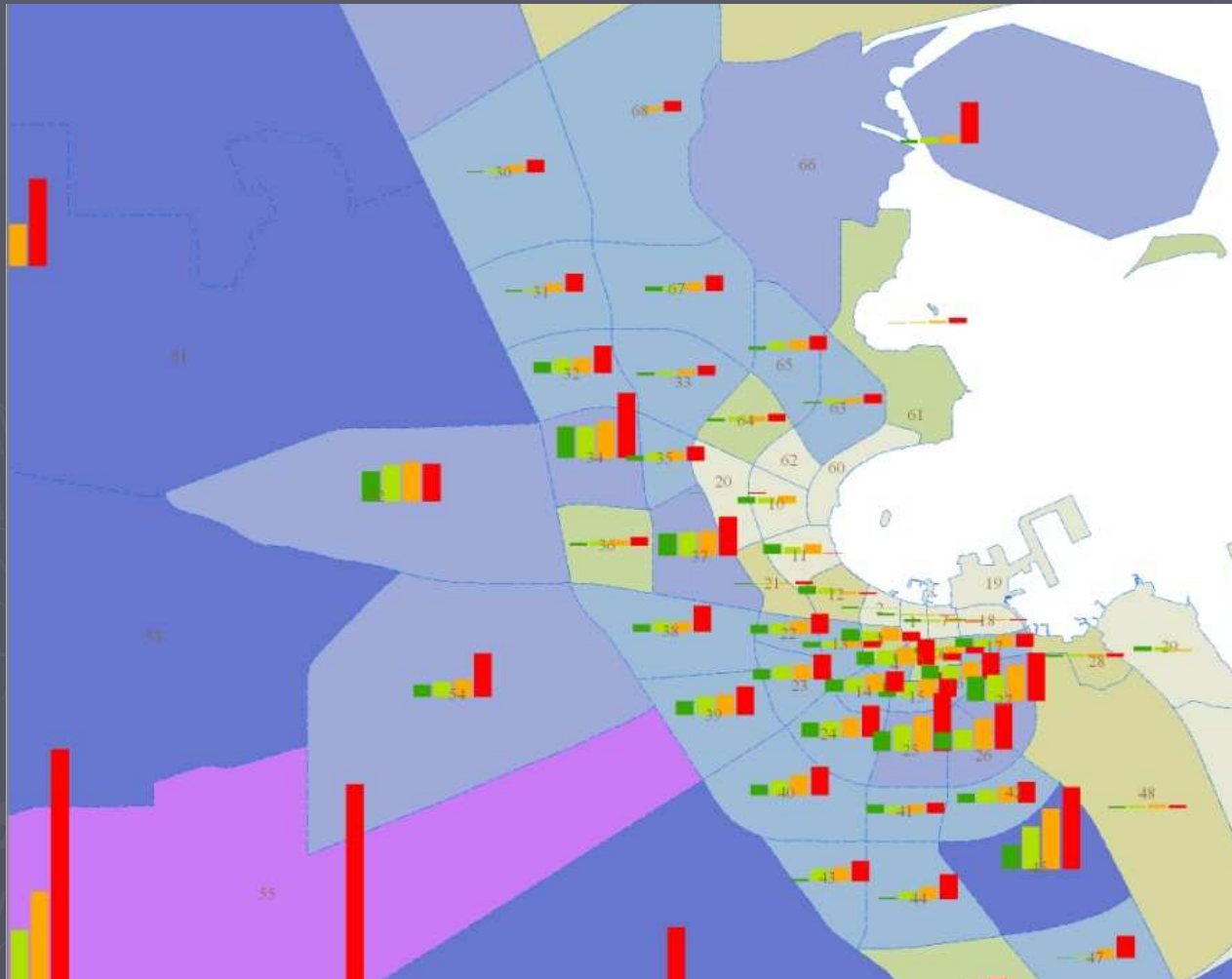


# How GIS is been utilized to disseminate Qatar Census 2010 Results for the Stakeholders?

- Tailored results = specialization of agencies
  - Importance of statistics in decision making.
  - Supporting the needs:
    - National Strategy for the Development of the Statistics (NSDS).
    - National Development Strategy (NDS).
      - 14 Task teams (Social – Economic)
  - Areas for improvements.



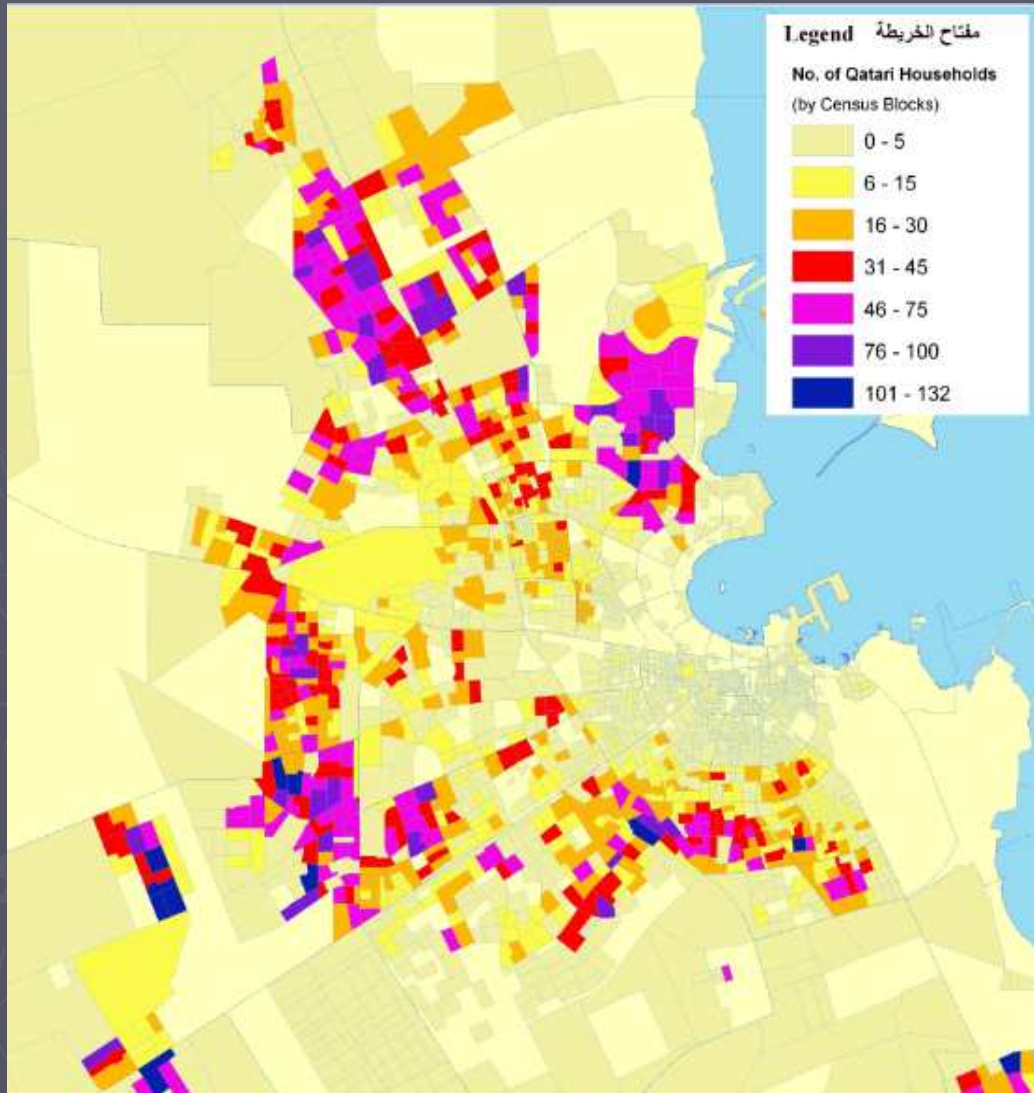
## Utilizing the Results: Identify the Population distribution for the developed areas







## Utilizing the Results: Identify Population Characteristics (Qatari, Non- Qatari).



**Villa**



**Multi-Story Building**



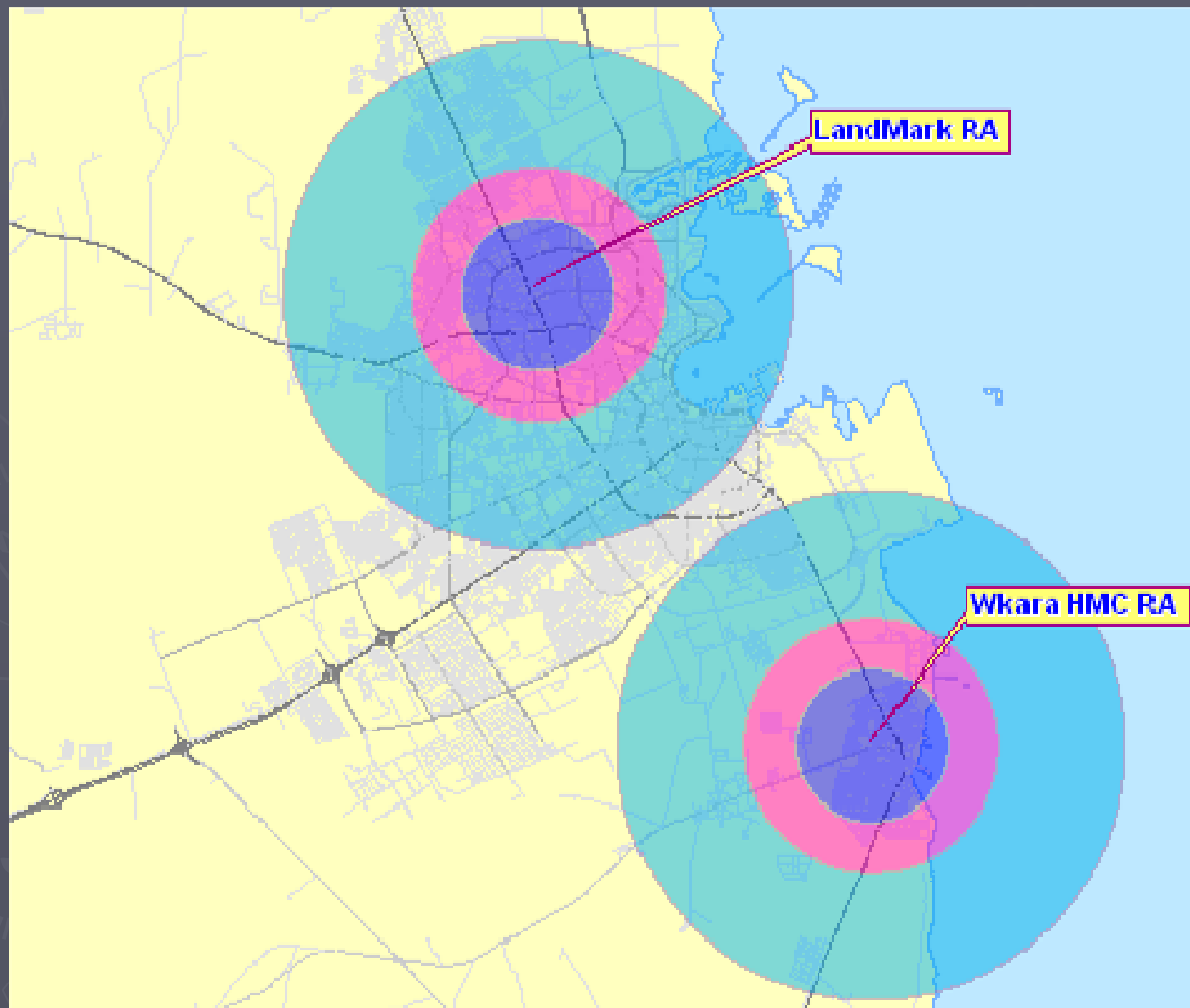




## Selecting the Elderly Clubs' Location

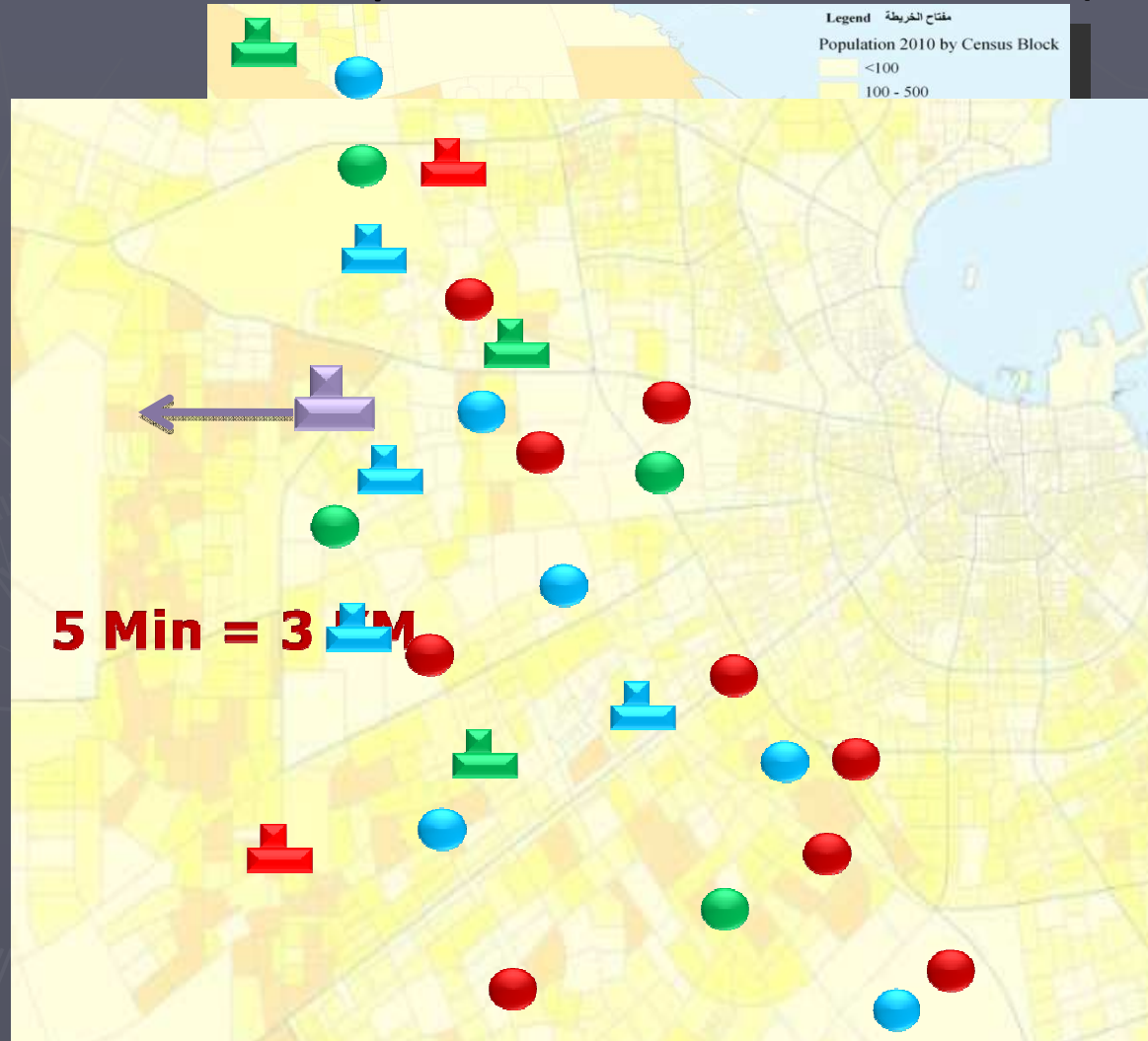


## Utilizing the Results: Select the public Services Location








## Utilizing the Results: Select the public Services Location (schools)



**Identify the current status:**

**Population by Age Groups:**  
 (0-13 Years)  
 (12-17 Years)  
 (15-20 Years)

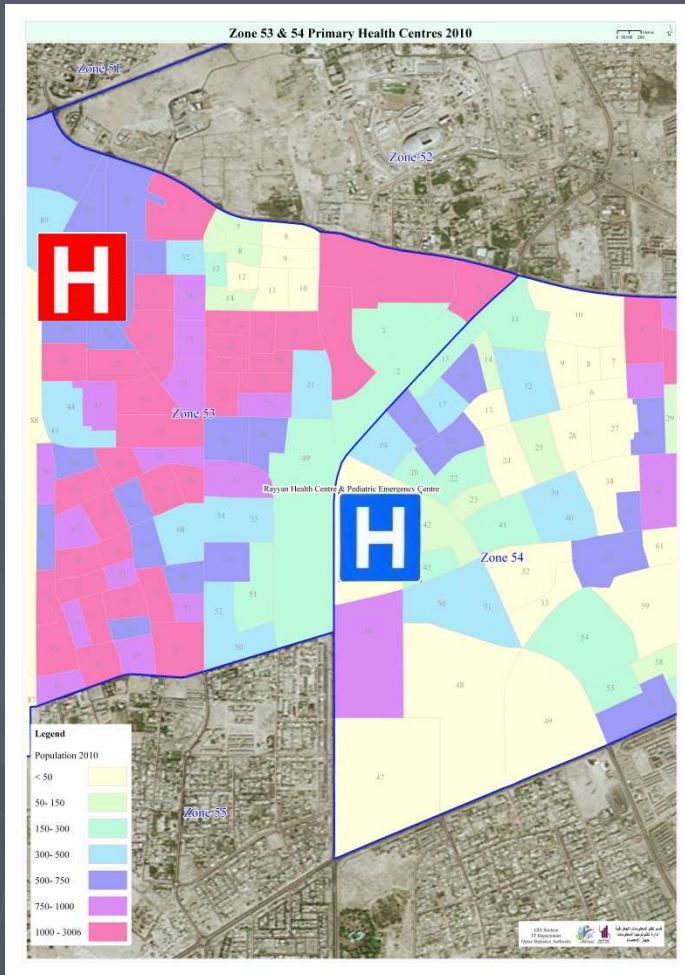
Class room Capacity is 25 Students

Prim.  **School Range**  
 Elem.   
 Sec.   
**Calculate Arriving Time**  
**Distance in KM**





## Utilizing the Results: Select the public Services Location

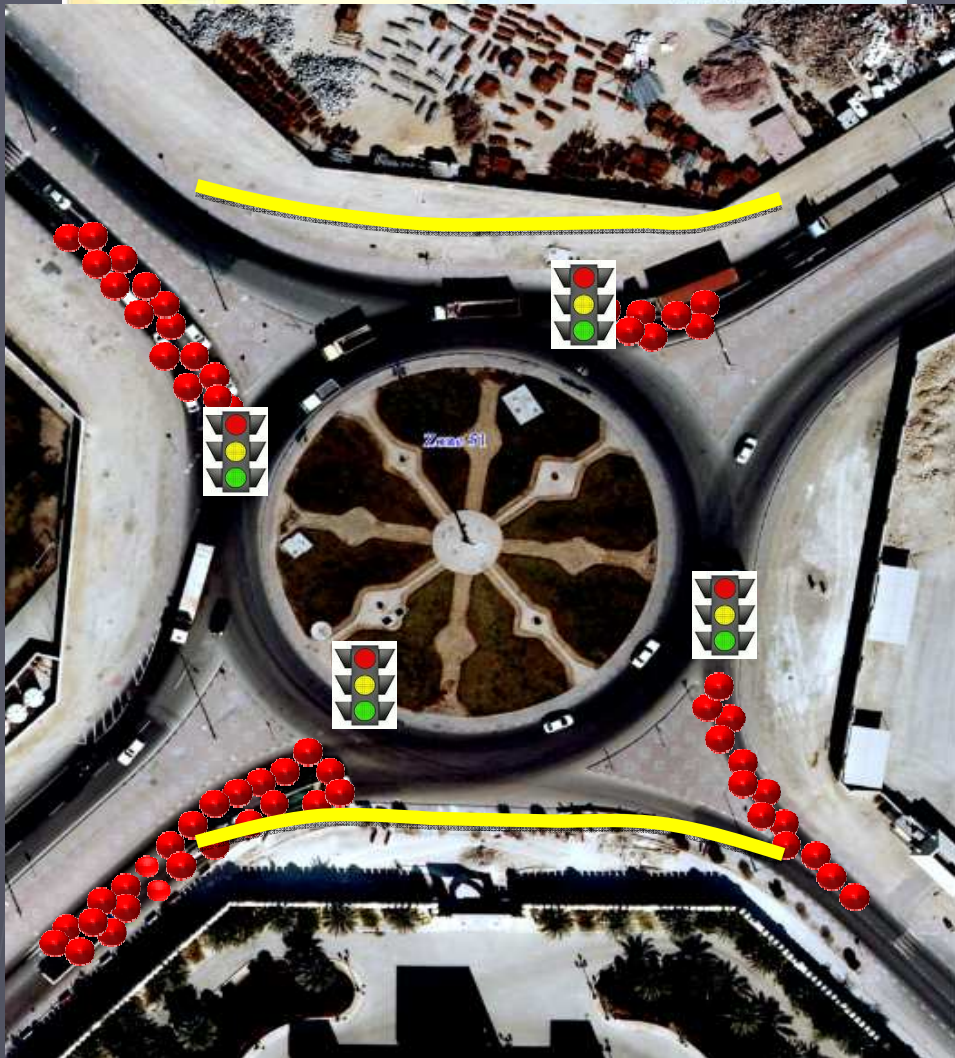


## Health Centers Location - Population concentration





## Utilizing the Results: Enhance Transportation



### Traffic Jams

Measuring the rout from  
the place of residence  
to work place :

- Place of Residence
- Place of Work

Identify the Traffic Jams  
places

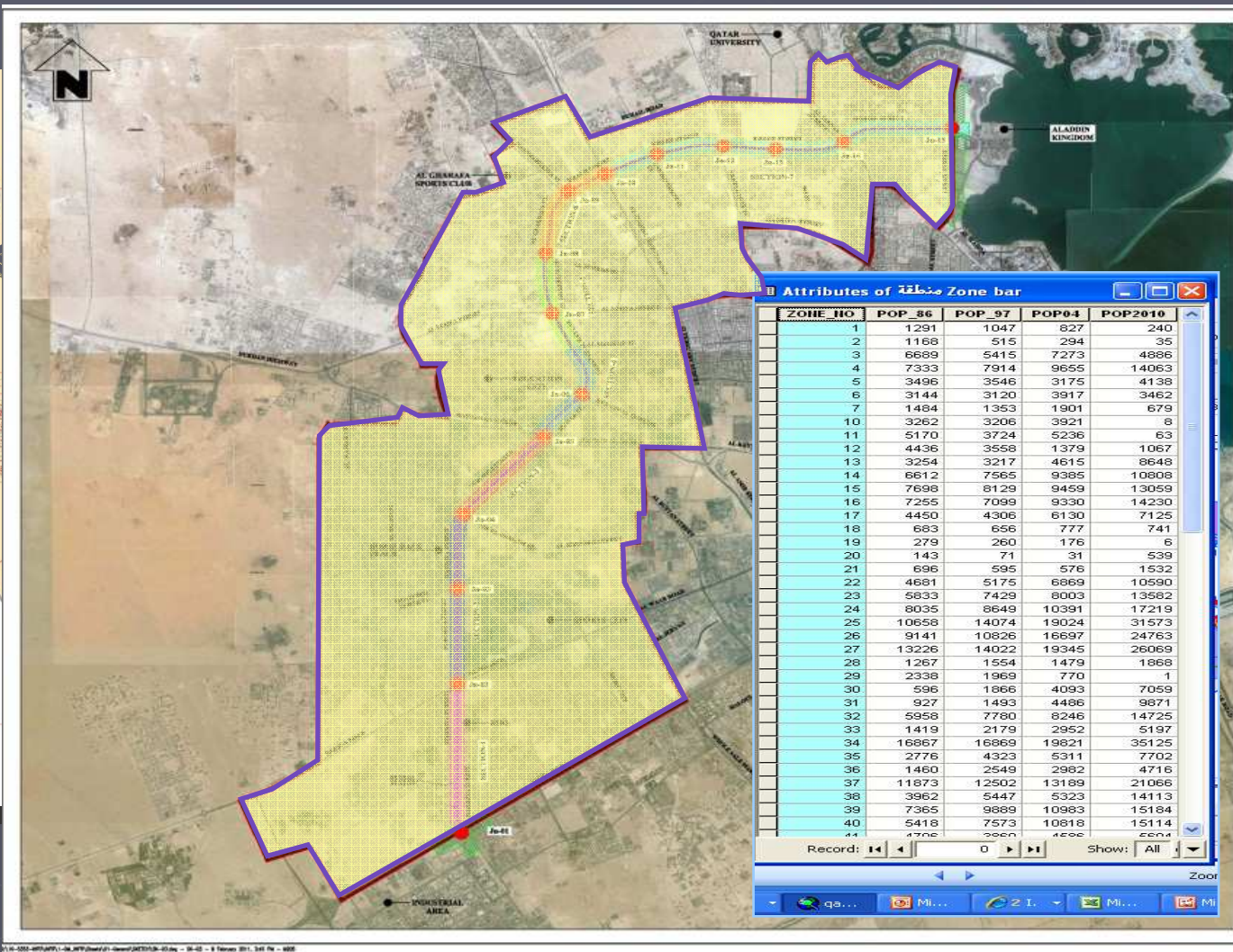
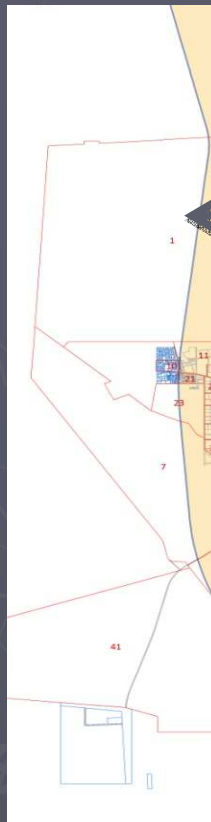
Peak Time: 6:30 – 7:45 AM





## Utilizing the Results: Public Service Area Selection:

## Roads' Expansion Buffers - Population in the Buffer



مشروع

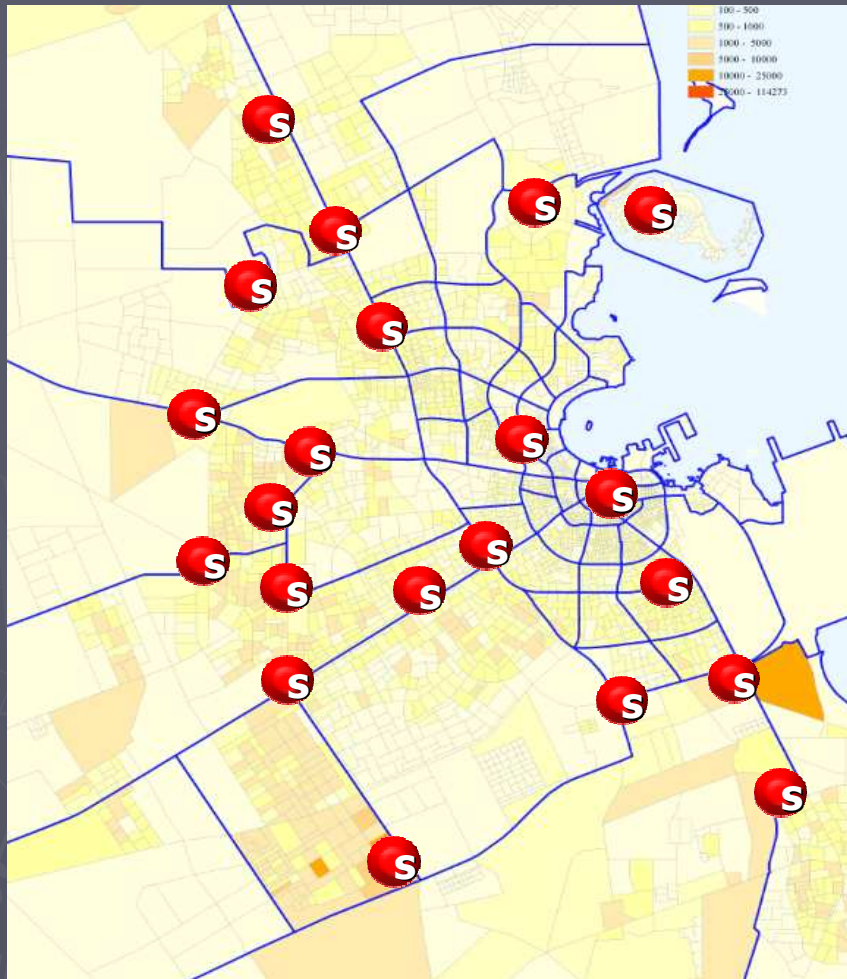




# Future Projects



## Utilizing the Results: Public Service Area Selection:

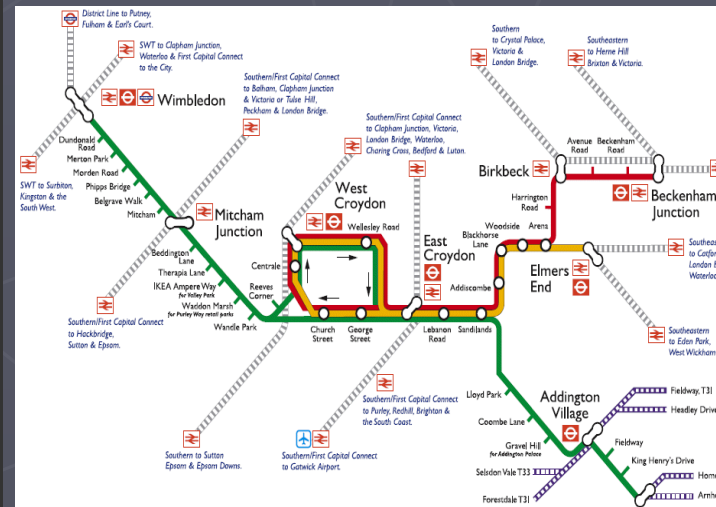


## Metro Project (Rail)

### Select the stop Stations Locations



**Geo. Location**







# Qatar FIFA 2022

- Smooth Traffic.
- Ease families movement
- teams Fast arrivals.
- Stadiums Accessing
- Select a nearer Resident for the teams







# Qatar Statistics Output using Geospatial & Statistical Data

- Thematic Maps & Reports being prepared for
  - Data User Requests
  - QSA Publications & Reports



# Qatar Statistics Output using Geospatial & Statistical Data

- Atlases – Digital (Interactive) and Printed

Qatar Census 1997



Qatar Census 2004



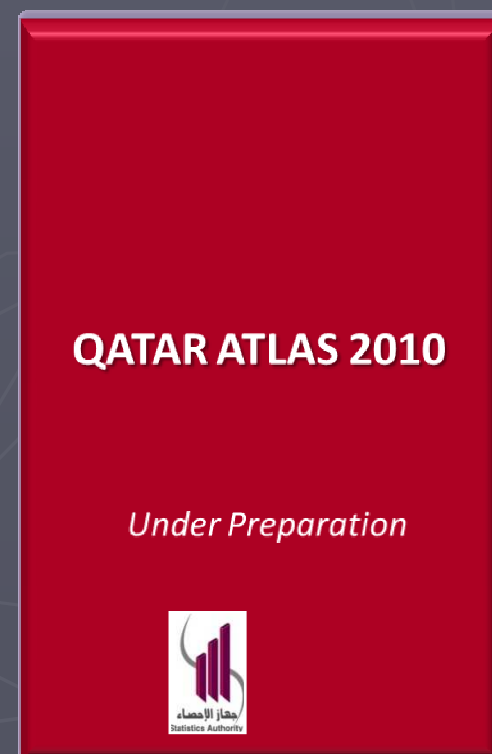


# Qatar Statistics Output using Geospatial & Statistical Data

- Qatar Atlas 2010- Digital (Interactive) and Printed

## About Qatar Atlas 2010

- A2 size portrait Atlas (200 Map Plates) in printed format and an interactive DVD of the same is under preparation
- The Atlas is primarily based on Qatar Census 2010 Results
- Geographic Layers of Administrative and Physiographic and Infrastructure etc. are added for better references and analysis and the interpretation of Census Data.







## ■ Qatar Atlas 2010 -The Scope

Phase I- Printing of an A2 size publication named Qatar Atlas 2010

Includes:

- Theme Selection- Research and Organization
- Data Collection, Storing, Processing and Analysis
- Programming and Mapping Applications
- Cartographic Design and Map Templates
- Thematic map Preparations & Tables, Charts and Images for Themes
- Explanatory Notes for Themes in English and then translation in Arabic
- Adding Ancillary Notes and Text, Cover etc..
- Preparing Manuscript for Press, Proof Reading & Printing Process
- Final publication of the **Qatar Atlas 2010**



## ■ Qatar Atlas 2010 -The Scope

### Phase II- Digital version of the Atlas (DVD) & GIS Web Application

Includes:

- converting manuscript into digital format :
  - an interactive DVD - multi-media techniques
- Internet application (on-line Atlas)



## ■ Qatar Atlas 2010 -The Methods

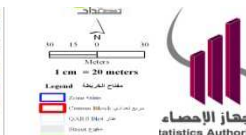
- Derive main themes and their sub-themes based on available information and past studies and a review of literature,
- Compile up-to-date geographic and statistical information available for the country at the lowest geographic unit level (Census Block),
- Compile the past two to three decades statistical data and the geographic data available in the form of aerial and orth-photographs, satellite images and records in digital and printed formats
- Store all data digitally and process for thematic mapping using the latest techniques of GIS
- Develop programmes and customized applications for cartography and mapping and Perform statistical analysis





## ■ Qatar Atlas 2010 -The Methods contd..

- Draft brief notes including introduction, the methodology followed and description for each Theme and Translate to Arabic
- Prepare manuscript ready to press, & Printing Process and final publication of Qatar Atlas 2010 in A2 size
- Creating interactive DVDs of the **Atlas** for easy access and handling of the users, and
- A web based internet application to provide easy-to-use tools to display, manipulate, and query statistical data so that customers can access and produce their own relevant information through interpretations.



## ■ Qatar Atlas 2010- Contents

Section	Section Name	Total Themes	Total Map Plates
1	THE ADMINISTRATIVE SETUP	7	14
2	THE HISTORY & CHANGING LANDSCAPE	8	16
3	THE PHYSIOGRAPHIC	7	16
4	THE ENVIRONMENT	5	10
5	THE SETTLEMENTS	17	34
6	THE SERVICES & FACILITIES	9	18
7	THE HOUSING & HOUSEHOLDS	19	38
8	THE POPULATION	50	100
9	THE AGRICULTURE, INDUSTRY, TRADE & COMMERCE	8	16
	Total Themes	130	260



# Qatar Statistics Output using Geospatial & Statistical Data

## ■ Interactive GIS Web Applications

- Many Applications prepared targeting Statistical Operations and Data Users.

The main applications are-

- The Landmark Locator
- Data Dissemination and Mapping System (DDMS)
- Geo-Statistical Application (GSA)



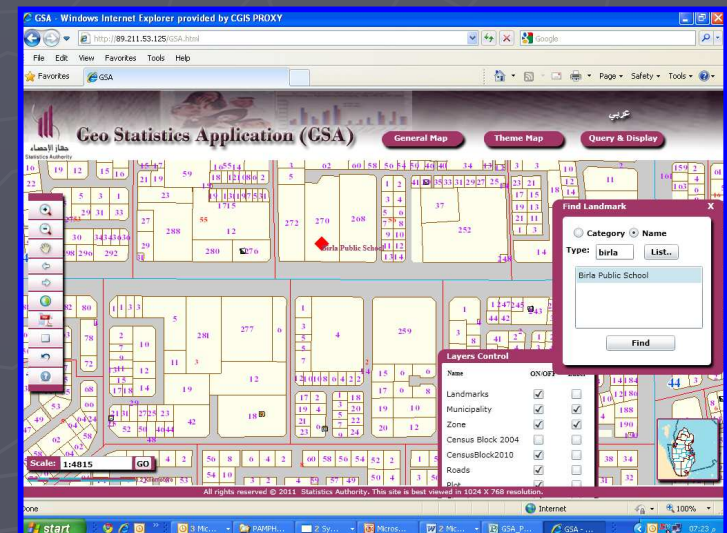
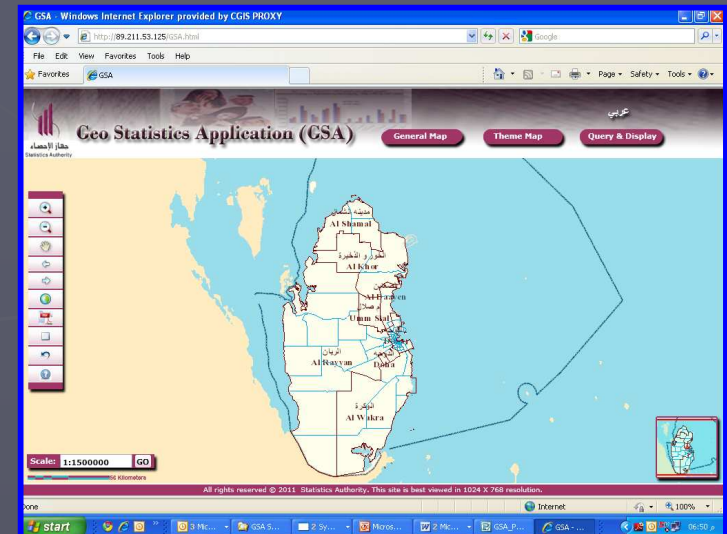




## ■ Geo-Statistics Application (GSA)

### The GSA (English/Arabic):

- GSA is Web based Application of:
  - Socio-Economic & Demographic Data
- Facilitate the field Operations:
  - Census 2010
  - Other Socio-economic surveys





# ■ Geo-Statistics Application (GSA)

## Features

### General-

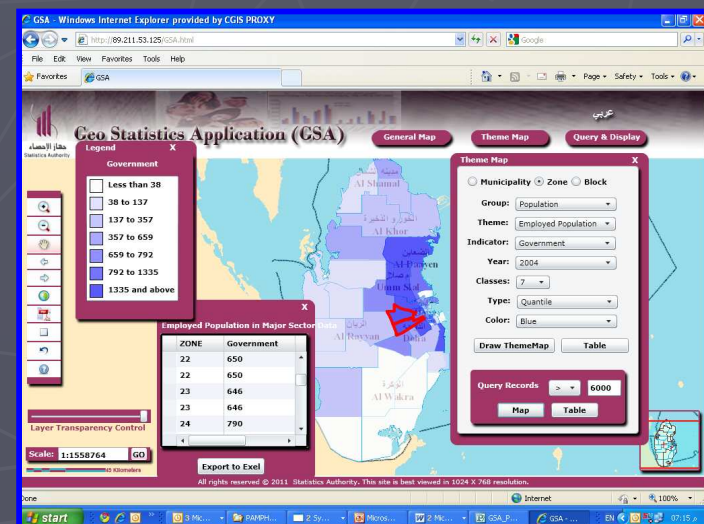
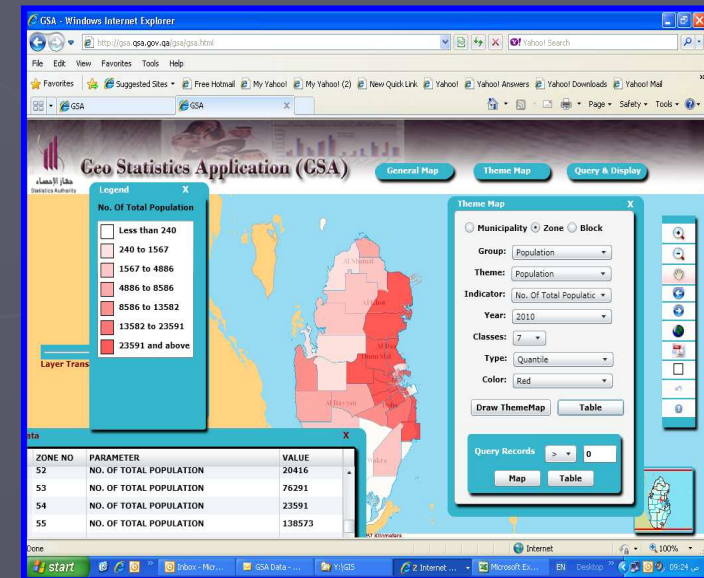
Includes base geographic information- Topographic features, Administrative areas, Road and Street network, Addresses, Place names and Landmarks.

### Thematic-

Socio-economic and Demographic Themes representation at selected geographic level using choropleth (color map) mapping techniques; Diagrammatic representation through pie and bars on map; Displaying theme table and exporting

### Query & Display–

To locate an address with Plot, Street and Zone names. Query about Census Enumeration Units and Landmarks and overlay necessary geographic information required to carry out the survey.





# Challenges:

- 1- Dissemination is on aggregated data level.
- 2- Map size -> Data/diagram overlapping.





# Conclusions:

1- Availability of a unified and standardized Geospatial information is the key for assured integration:

- Long term Investment (Time – Budget).
- Quality – Accuracy.
- Dissemination of the results.
- Support Decision Making.



# Thank You!

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