

# **Lesson 1: Introduction to Geographic Information Systems for Urban Planning**

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# What will you learn from this lesson?

- Introducing Urban Planning
  - Motivation of urban planning
  - Urban planning practice
  - Urban planning in Singapore
- Geographic Information Systems (GIS) Fundamentals
  - Basic concepts of GIS
  - Major components of a GIS
  - GIS toolkits

# What is Urban Planning?

- A **technical** and **political process** concerned with the development and design of land use and the environment and the infrastructure passing into and out of urban areas.
- The primary concern is the **public welfare**, which includes considerations of efficiency, sanitation, protection and use of the environment, as well as effects on social and economic activities.
- Urban planning is considered an **interdisciplinary** field that includes social engineering and design sciences.

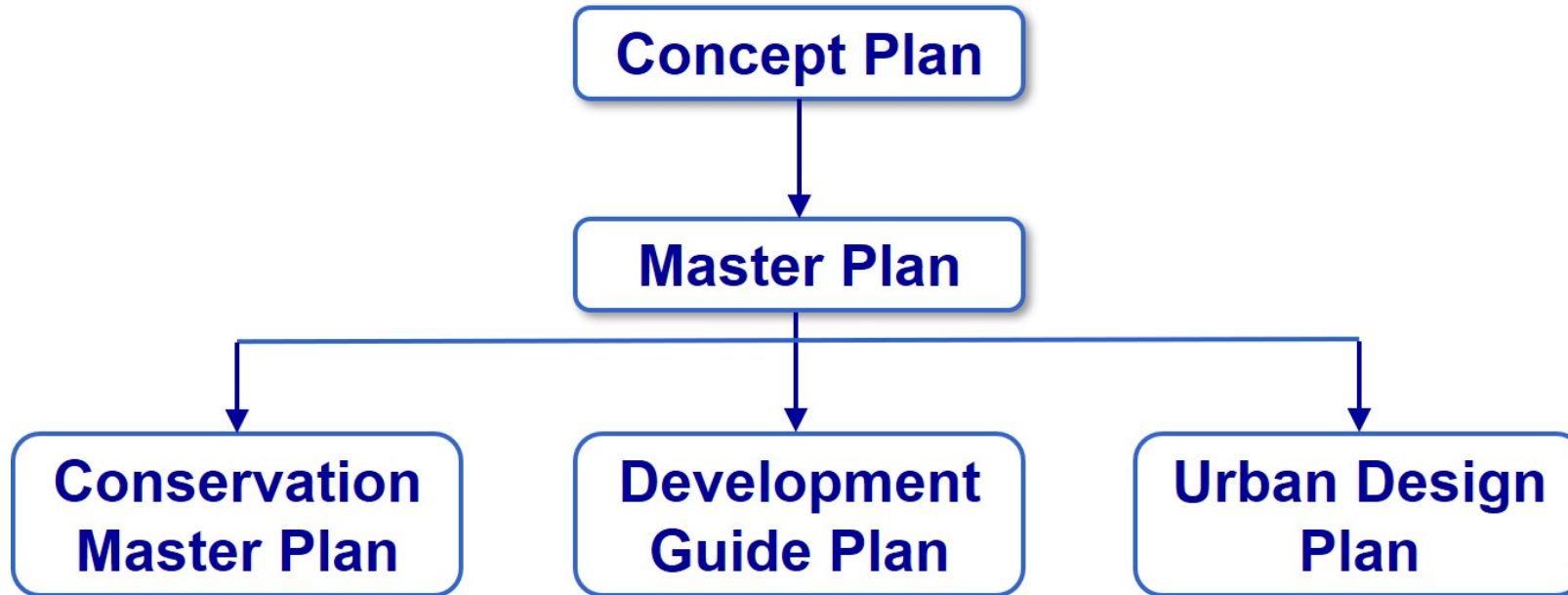
# Urban Planning in Practice

Practitioners of urban planning are concerned with research and analysis, strategic thinking, architecture, urban design, public consultation, policy recommendations, implementation and management.

Enforcement methodologies include governmental zoning, planning permissions, and building codes, as well as private easements and restrictive covenants.

# Urban Planning in Singapore

## Functions of Singapore's national planning authority



Source: Singapore, [Urban Redevelopment Authority](#)

# Why Geographic Information Matters?

About 80% of all data maintained by organizations around the world has a location component.

(Source: BusinessWeek Research Services, 2006)

# GI in Smart Nation

Thursday, Jan 8, 2015

**THE STRAITS TIMES** / Singapore

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## Singapore needs to be 'smart city' to stay ahead: PM

PUBLISHED ON NOV 24, 2014 11:13 AM

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The need for Singapore to be a "smart nation", using the latest technology to benefit the country, goes beyond just making life better for the people, said Prime Minister Lee Hsien Loong at the launch of the Smart Nation initiative on Monday. -- PHOTO: ST FILE

One major initiative will be to let people access maps and build up geospatial databases by contributing information such as animal sightings, traffic incidents or the best mee pok eateries.

Source: [Singapore needs to be 'smart city' to stay ahead: PM](#)

# The explosion in the availability of Government GI



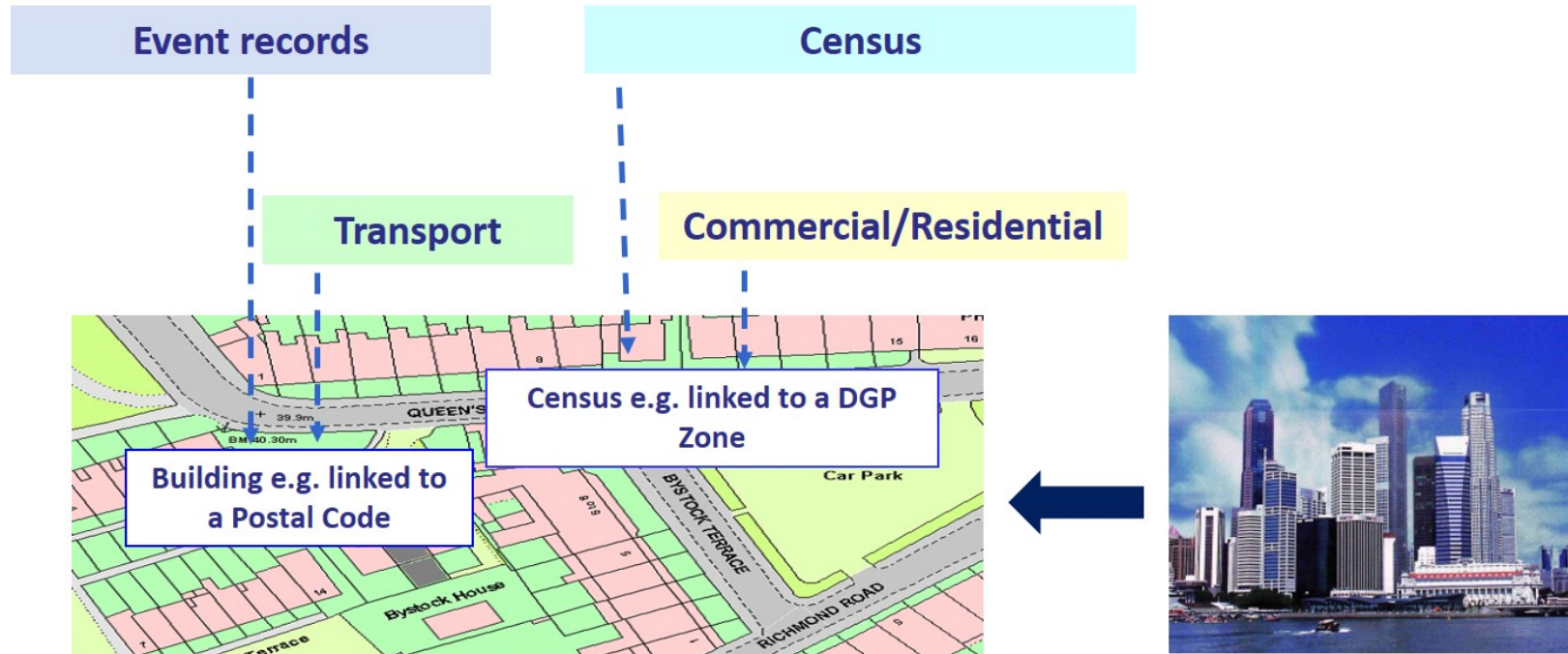


# GIS Fundamentals

- Introduction to GIS
- Major component of a GIS
- GIS functions
- GIS toolkits

# GIS as a toolkit

A Geographic Information System (GIS) is a toolkit for creating, managing, analyzing, visualising, and sharing data of any kind according to where it's located.



# Components of a GIS

GIS extends the study of information systems by including geospatial data management, geoprocessing and geographically mediated knowledge.



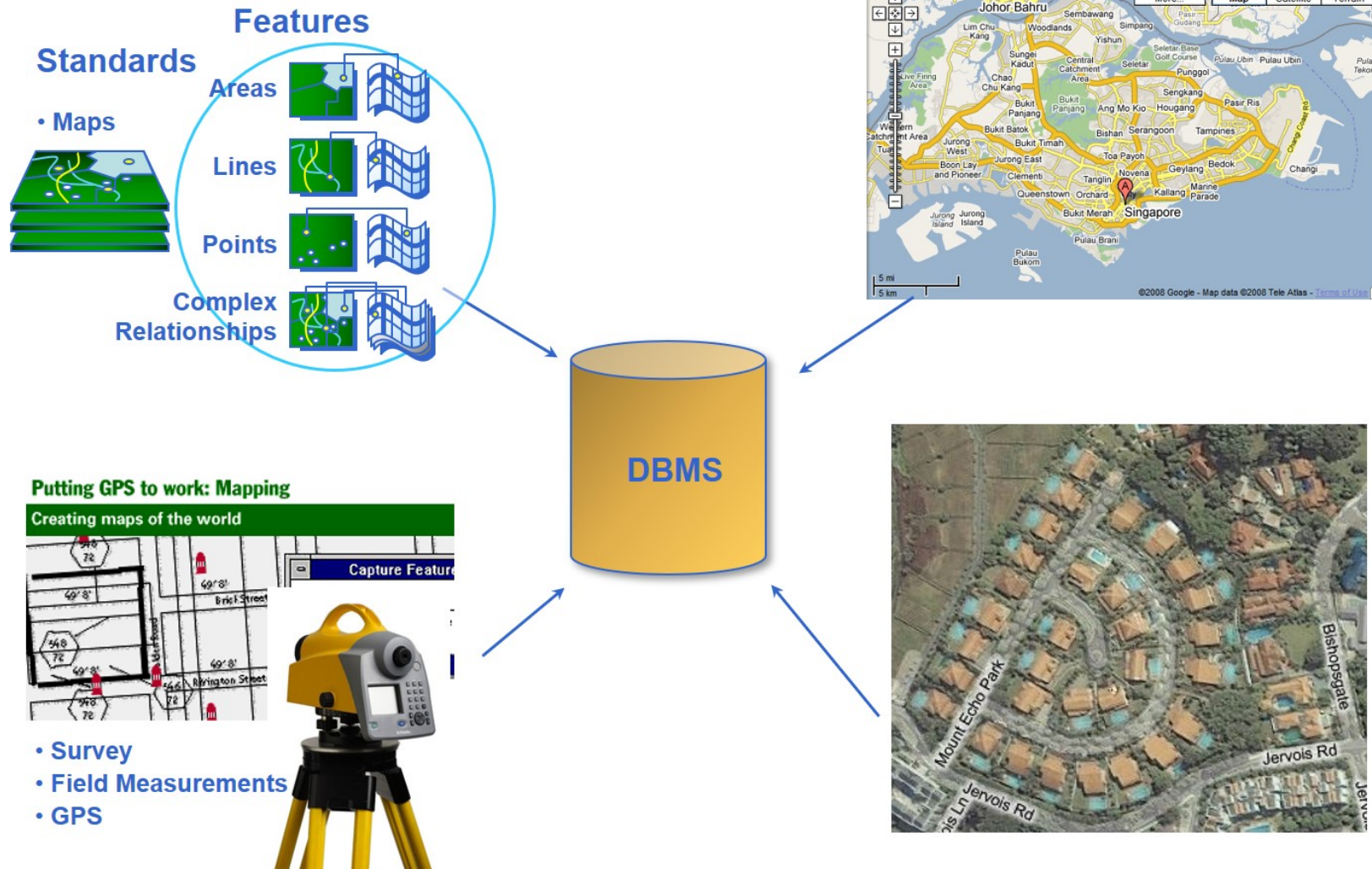
# Getting to Know GIS Functions

Geospatial Data Management

GIS Mapping and Geovisualisation

GIS Analysis

# Geospatial Data Management: Data Capture





# Geospatial Data Management: Data Integration

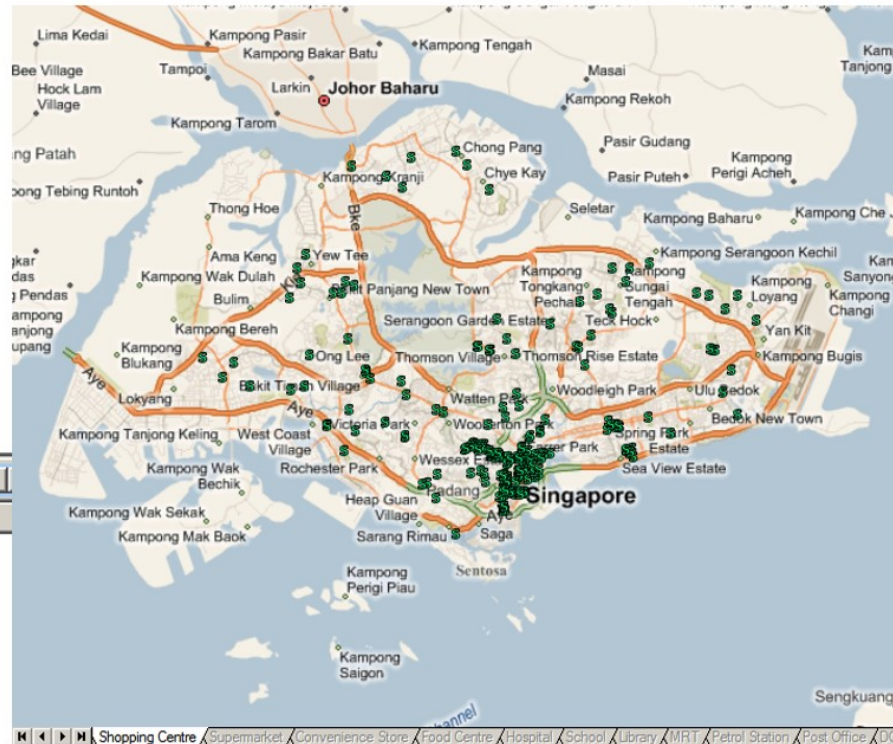
- Spatial Information + Attribute Information
- Spatial data model: vector vs raster

## Spatial Information

| HDB Transaction Table * |            |            |            |            |
|-------------------------|------------|------------|------------|------------|
| ID                      | X (I)      | Y (I)      | Longitu... | Latitud... |
| 1274081                 | 31498.3... | 31758.1... | 103.8665   | 1.3035     |
| 1274082                 | 22454.2... | 31650.8... | 103.7852   | 1.3026     |
| 1274083                 | 22454.2... | 31650.8... | 103.7852   | 1.3026     |
| 1274084                 | 22454.2... | 31650.8... | 103.7852   | 1.3026     |
| 1274085                 | 22831.5... | 32793.2... | 103.7886   | 1.3129     |
| 1274086                 | 34658.4... | 38466.7... | 103.8949   | 1.3642     |
| 1274087                 | 34658.4... | 38466.7... | 103.8949   | 1.3642     |

## Attribute Information

| HDB Transaction Table * |                 |           |          |        |
|-------------------------|-----------------|-----------|----------|--------|
| ID                      | ADDRESS         | POSTAL... | CATEGORY | PRICE  |
| 1274081                 | 1 Beach Rd      | 190001    | HDB3RM   | 250000 |
| 1274082                 | 1 Dover Road    | 130001    | HDB3RM   | 236000 |
| 1274083                 | 1 Dover Road    | 130001    | HDB3RM   | 215000 |
| 1274084                 | 1 Dover Road    | 130001    | HDB3RM   | 220000 |
| 1274085                 | 1 Ghim Moh Road | 270001    | HDB3RM   | 275000 |
| 1274086                 | 1 Hougang Ave 3 | 530001    | HDB3RM   | 141000 |
| 1274087                 | 1 Hougang Ave 3 | 530001    | HDB3RM   | 155000 |
| 1274088                 | 1 Kg Kayu Rd    | 432001    | HDB3RM   | 180000 |



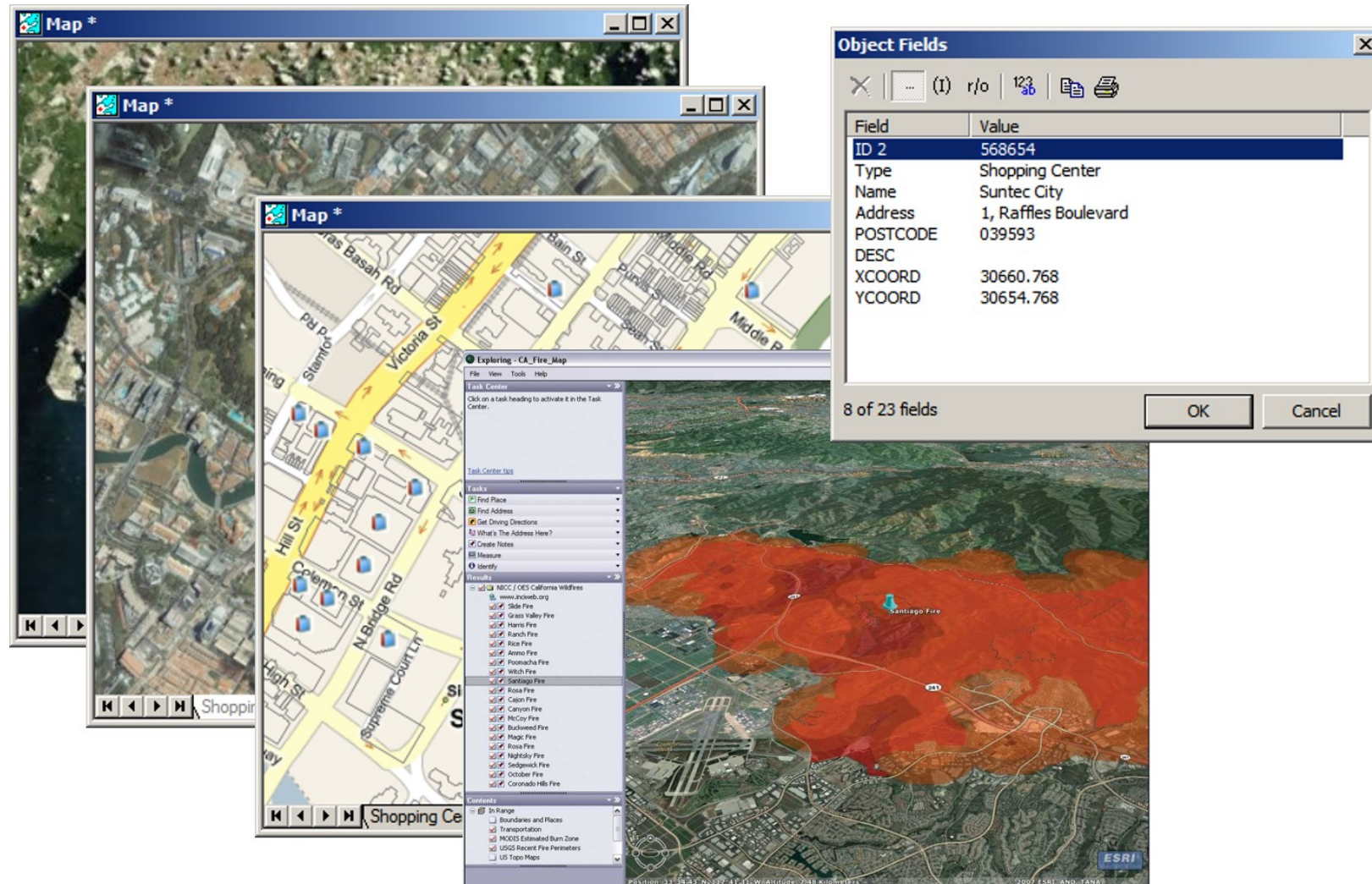
# Geospatial Data Management: Georeferencing

## Integrating layers of GIS data into an unified view





# Geovisualisation: interactive maps



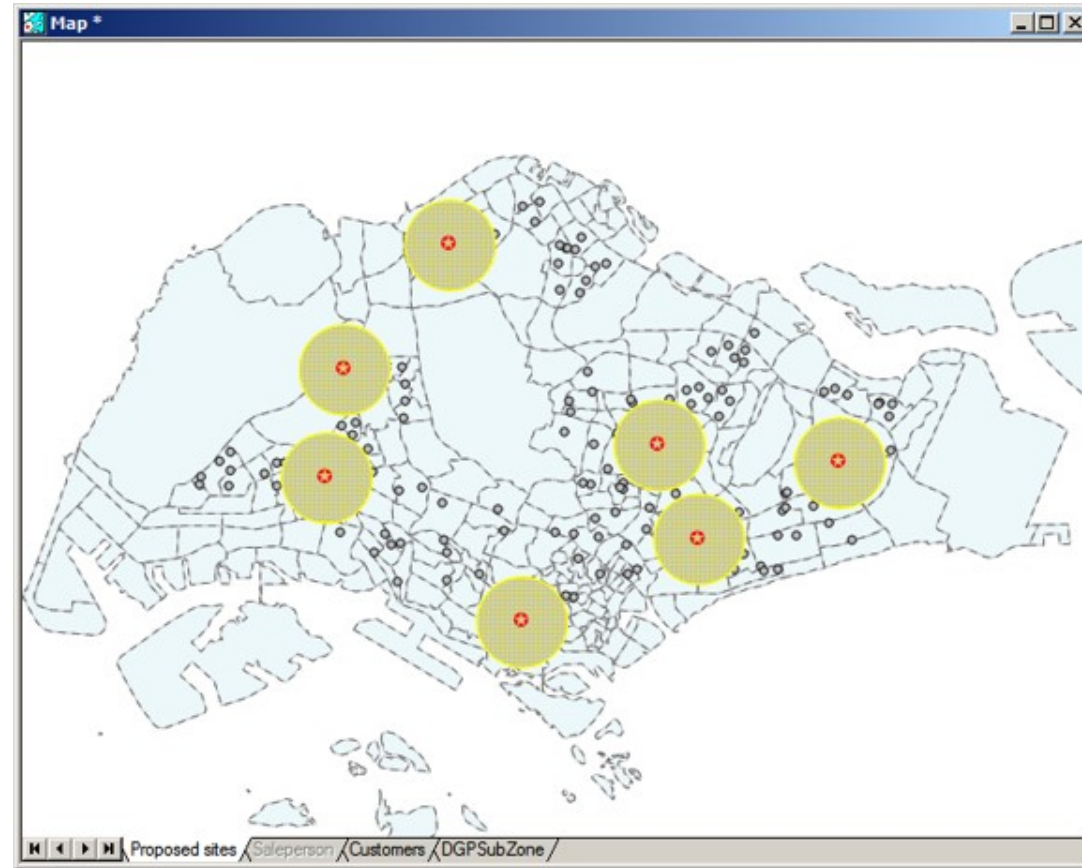


# GISs generates information

- Locations What is at.....?
- Conditions Which environment.....?
- Trends What has changed....?
- Patterns What data are related.....?
- Models What if .....?

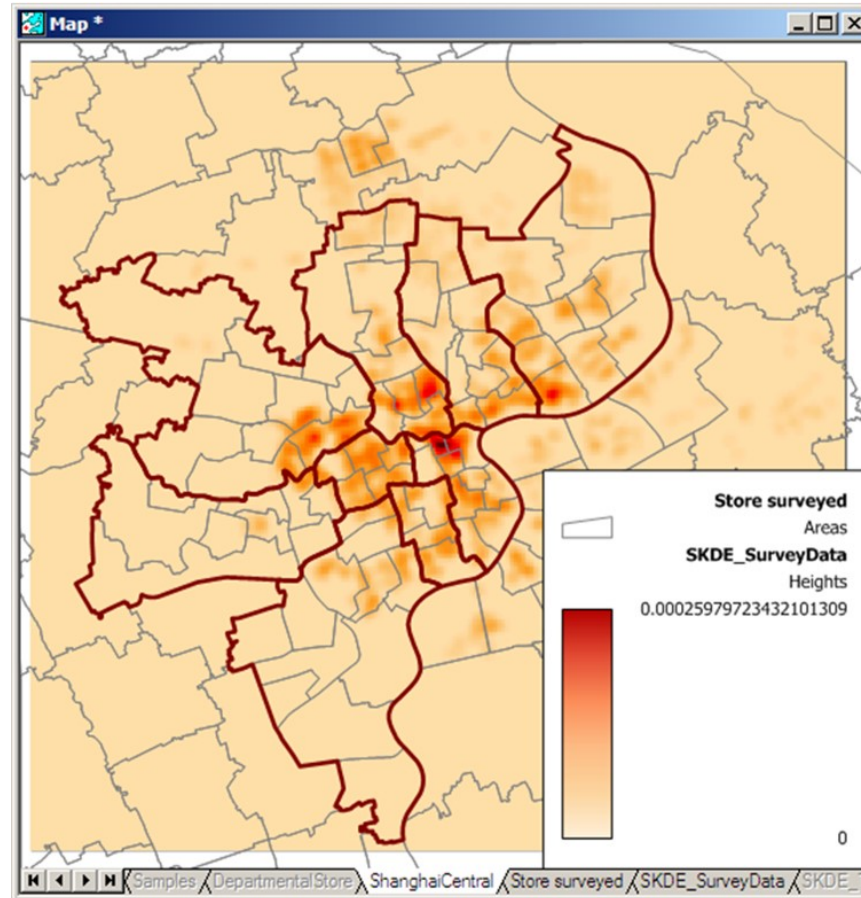
# GIS analysis – vector-based

- Geoprocessing techniques: buffering, overlaying etc



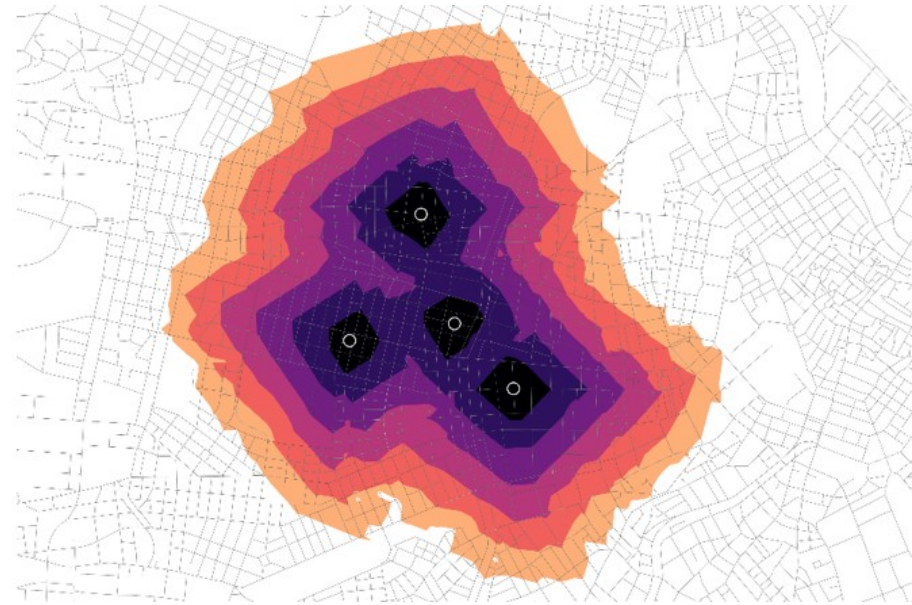
# GIS analysis – raster-based

Map algebra, surface analysis, cartographic modelling.

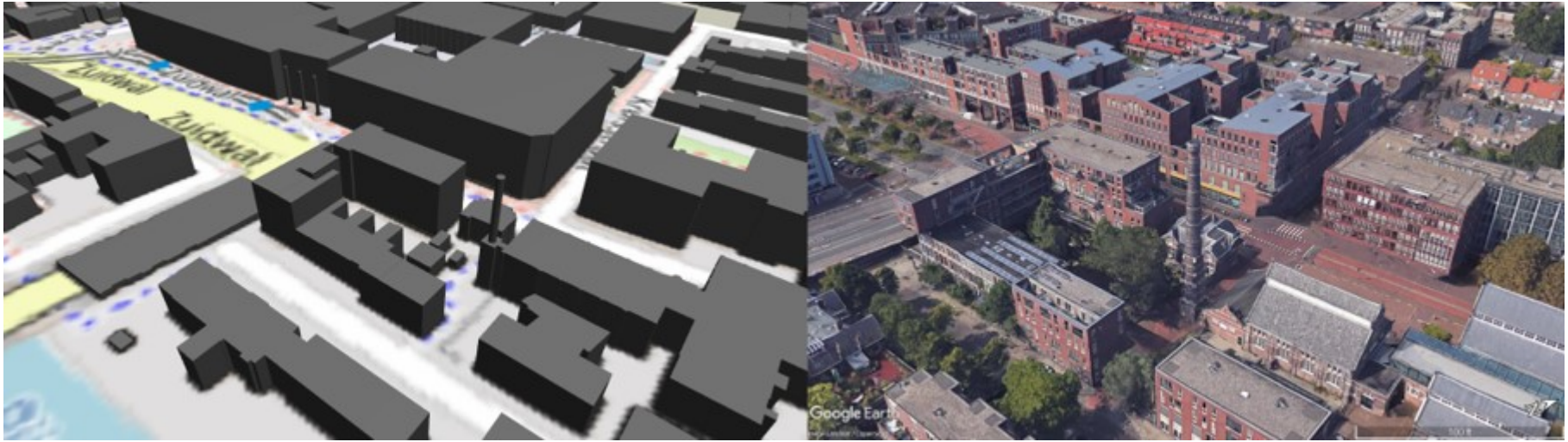


# GIS Analysis – network-based

Shortest path analysis, travelling salesman modelling, network service area



# GIS Analysis: 3d Urban Models

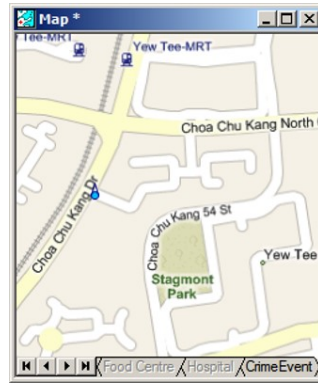


[Link](#) to an 3d Urban Model

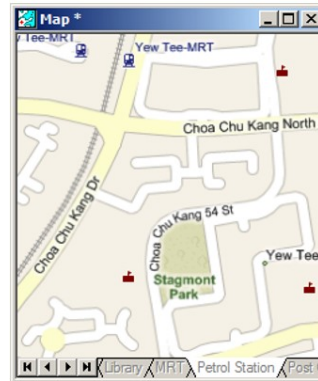


# GIS as a Melting-Pot

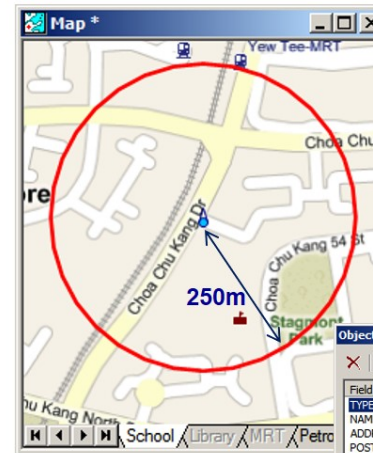
## Planning Support Systems for city



Petrol station



School



Emergency Risk

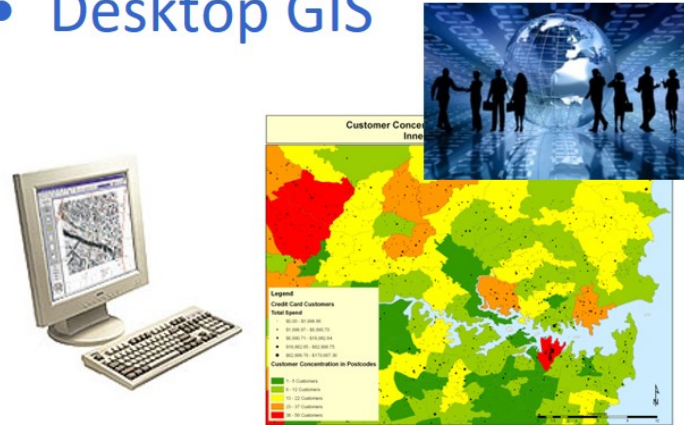
| Field      | Value                              |
|------------|------------------------------------|
| TYPE       | Primary                            |
| NAME       | Krang Primary                      |
| ADDRESS    | 11 Choa Chu Kang Street 54 S689189 |
| POSTALCODE | 689189                             |
| WEBSITE    |                                    |
| XCOORD     | 18494.074                          |
| YCOORD     | 41799.577                          |

7 of 22 fields

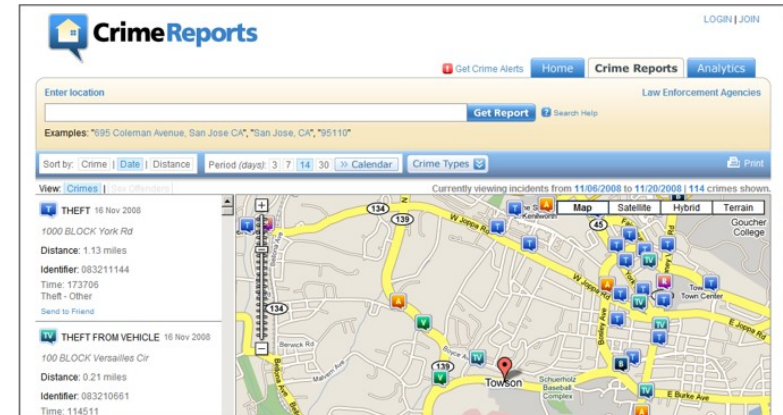
OK Cancel

# GIS platforms

- Desktop GIS



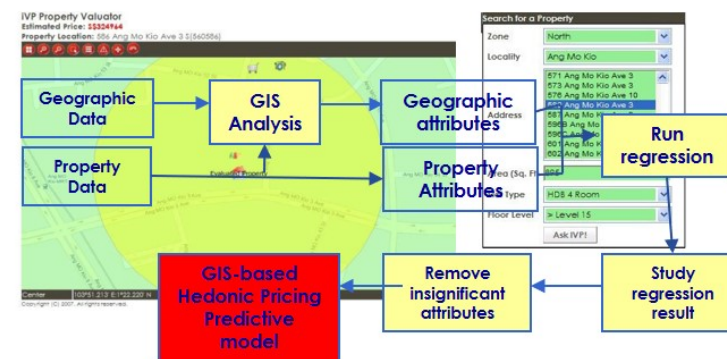
- Internet Map Service



- Mobile GIS



- Server GIS



# GIS Desktop Software

## Proprietary vs Open Source



GRASS



UDIG



JUMP



QGIS



gvSIG



# QGIS: An Open Source Desktop GIS

Visit this [link](#) to learn more about QGIS.



The screenshot shows the QGIS website homepage. At the top, there is a dark navigation bar with the QGIS logo on the left, which includes the version number '3.20.1' and '3.16.9 LTR'. To the right of the logo are links: 'DISCOVER QGIS', 'FOR USERS', 'GET INVOLVED', and 'DOCUMENTATION'. Further right is a search bar and a language dropdown menu set to 'English'. Below the navigation bar, the word 'QGIS' is prominently displayed in a large, bold, white font. Underneath it, the tagline 'A Free and Open Source Geographic Information System' is written in a smaller white font. The main visual element is a large banner with a historical map background. Overlaid on the map is the text 'QGIS 3.20 Odense has been released!' in a large, white, sans-serif font. Below this text, there is a smaller line of text: 'New release: 3.20! Get the [installer](#) or [packages](#) for your Operating System and read the [changelog](#).' At the bottom of the page, there are two lines of text: 'Create, edit, visualise, analyse and publish geospatial information on Windows, Mac, Linux, BSD and mobile devices' and 'For your desktop, server, in your web browser and as developer libraries'. On the right side of the banner, there are three lines of small text indicating release schedules: 'Time until freeze 2021-09-10 12:00:00 UTC 31d 20h 11m', 'Time until packaging 2021-10-22 12:00:00 UTC 73d 20h 11m', and 'Time until next pointrelease 2021-08-13 12:00:00 UTC 3d 20h 11m'.

3.20.1  
3.16.9 LTR

DISCOVER QGIS FOR USERS GET INVOLVED DOCUMENTATION

English ▼

Time until freeze 2021-09-10 12:00:00 UTC 31d 20h 11m  
Time until packaging 2021-10-22 12:00:00 UTC 73d 20h 11m  
Time until next pointrelease 2021-08-13 12:00:00 UTC 3d 20h 11m

## QGIS

A Free and Open Source Geographic Information System

**QGIS 3.20 Odense**  
has been released!

New release: 3.20!  
Get the [installer](#) or [packages](#) for your Operating System and read the [changelog](#).

Create, edit, visualise, analyse and publish geospatial information on Windows, Mac, Linux, BSD and mobile devices

For your desktop, server, in your web browser and as developer libraries

# ArcGIS vs QGIS

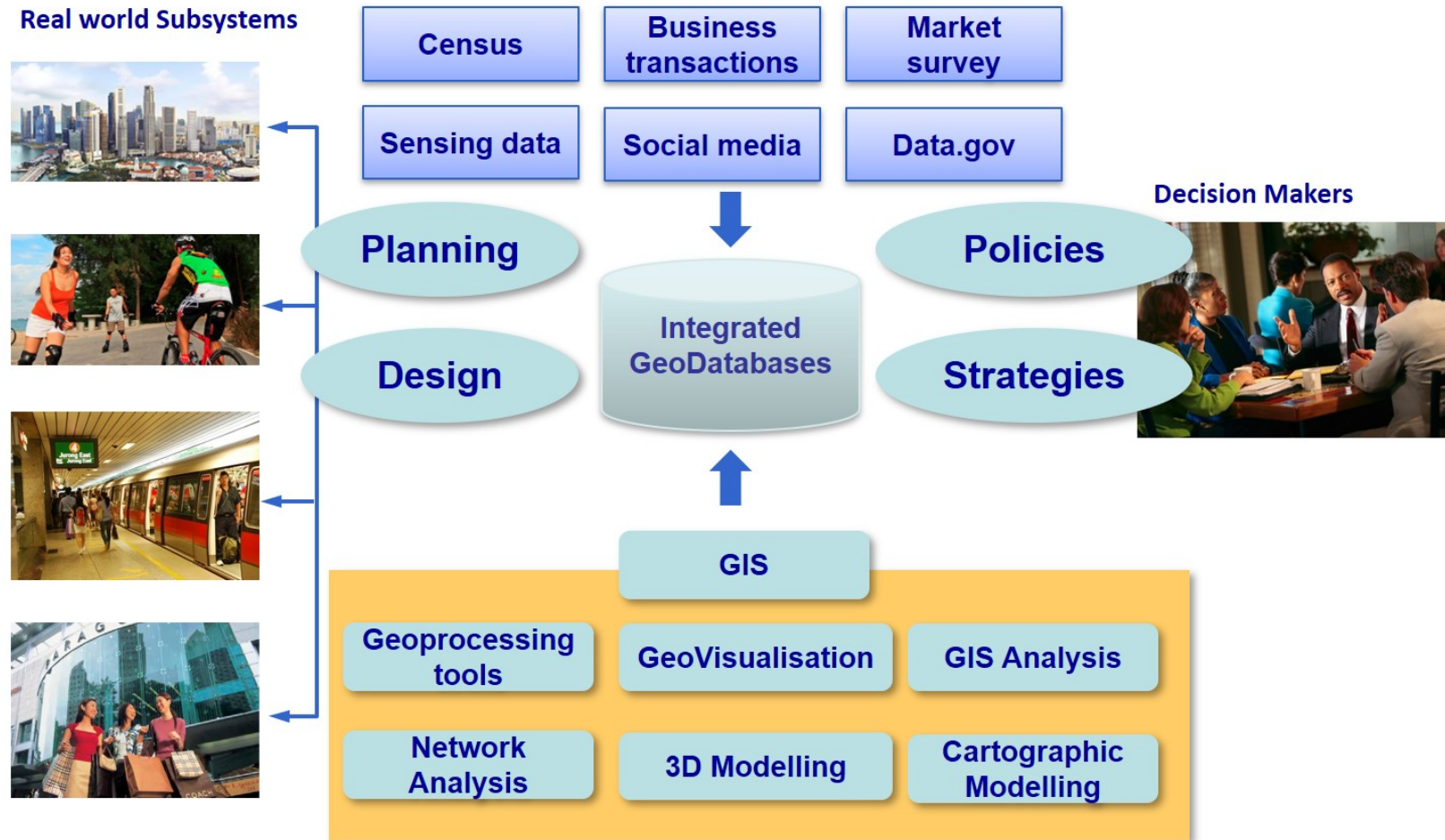


Reference: [27 Differences Between ArcGIS and QGIS – The Most Epic GIS Software Battle in GIS History](#)

# GIS Users in Singapore



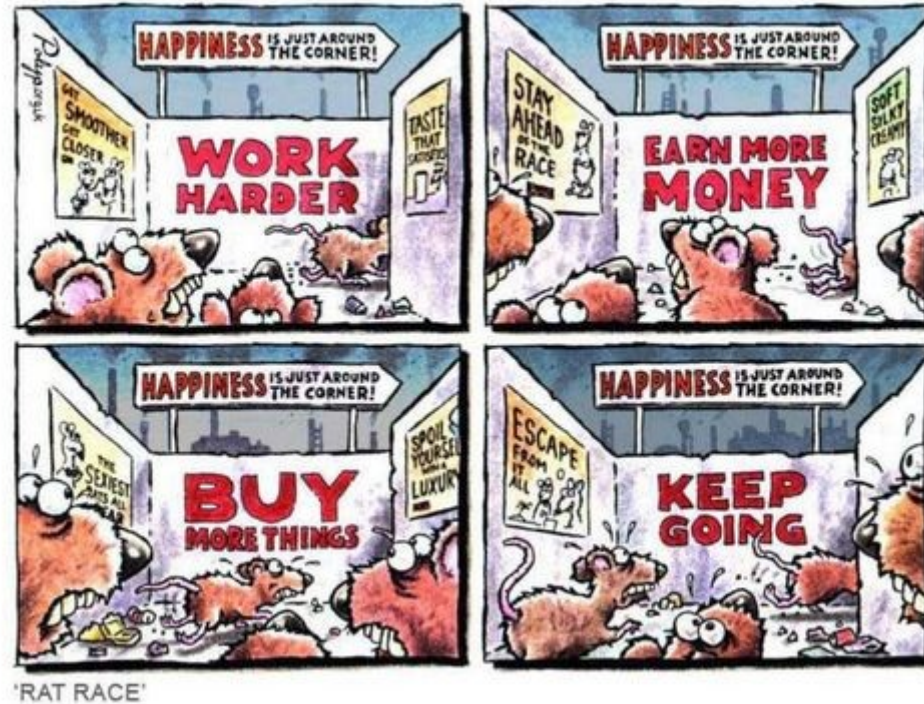
# GIS Supported Urban Planning Framework





# Social Consciousness

Using GIS to create a better world



## In conclusion, GIS support

Better informed decision making

Better communication with management

Better communication between departments

Better problem solving

More efficient use of resources

**GIS = Get Intelligent Solutions**