Data Space and Web

Information Location and Connection

A Geospatial Journey

Geographical Information Systems (GIS)

(*definitions*)

Geographic information system, a system for storing and manipulating geographical information on computer (Merriam-Webster)

A geographic information system (GIS), or geographical information system, is any system that captures, stores, analyzes, manages, and presents data that are linked to location. (Wikipedia)

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. (www.gis.com)

GIS is a computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth's surface. (Stanford University)

A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location. (USGS – US Geological Survey)

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Geographical Information Systems (GIS)

(*a brief history*)

•1854 - John Snow depicted a cholera outbreak in London using points to represent the locations of some individual cases, possibly the earliest use of the geographic method. His study of the distribution of cholera led to the source of the disease, a contaminated water pump (the Broad Street Pump, whose handle he had disconnected, thus terminating the outbreak) within the heart of the cholera outbreak. The idea was unique and was the first to analyze clusters of geographically-dependent phenomena.

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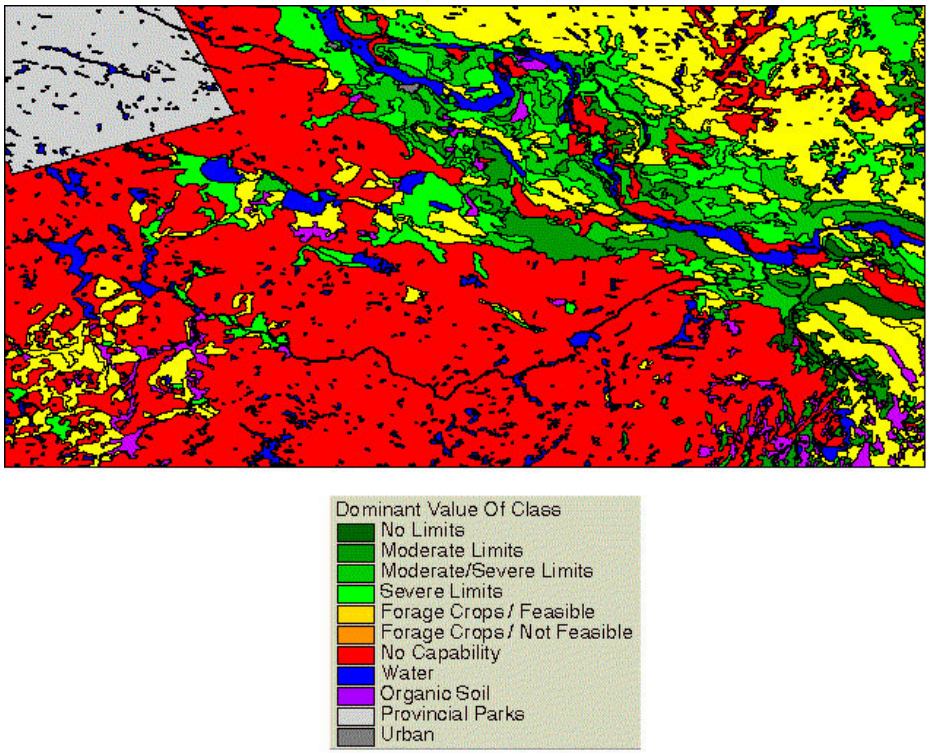

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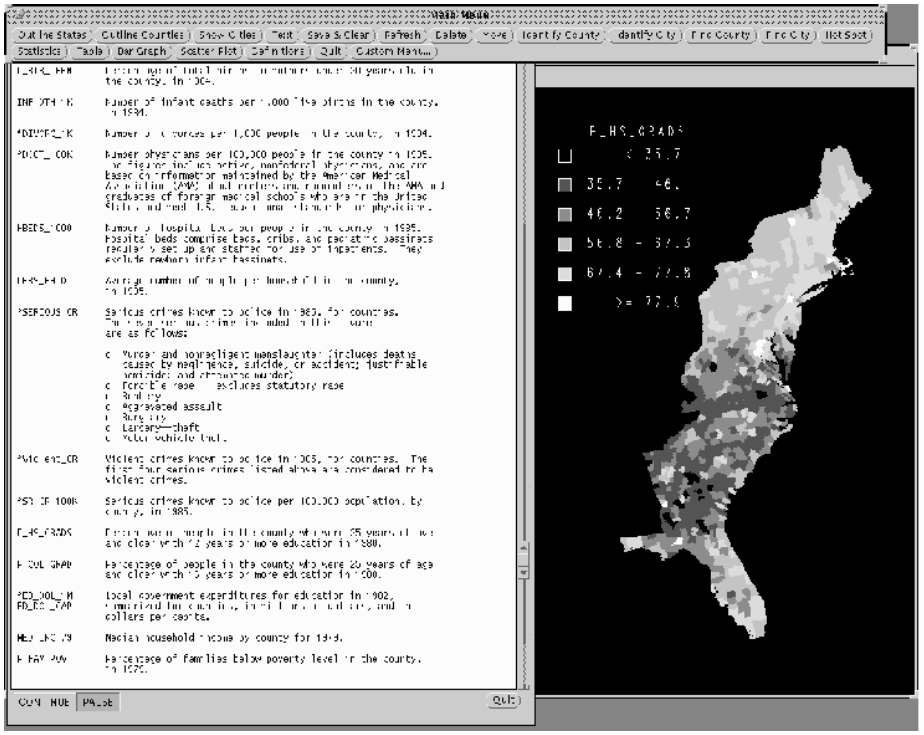

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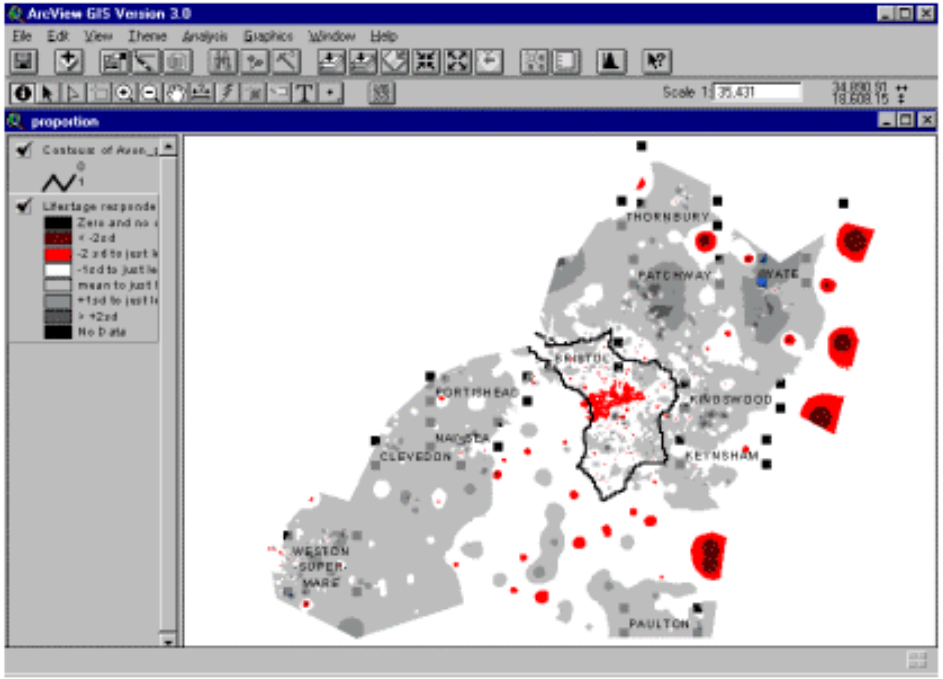

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•2000's – Introduction of Dynamic Data, Real-time updates and Web-based GIS

Geographical Information Systems (GIS)

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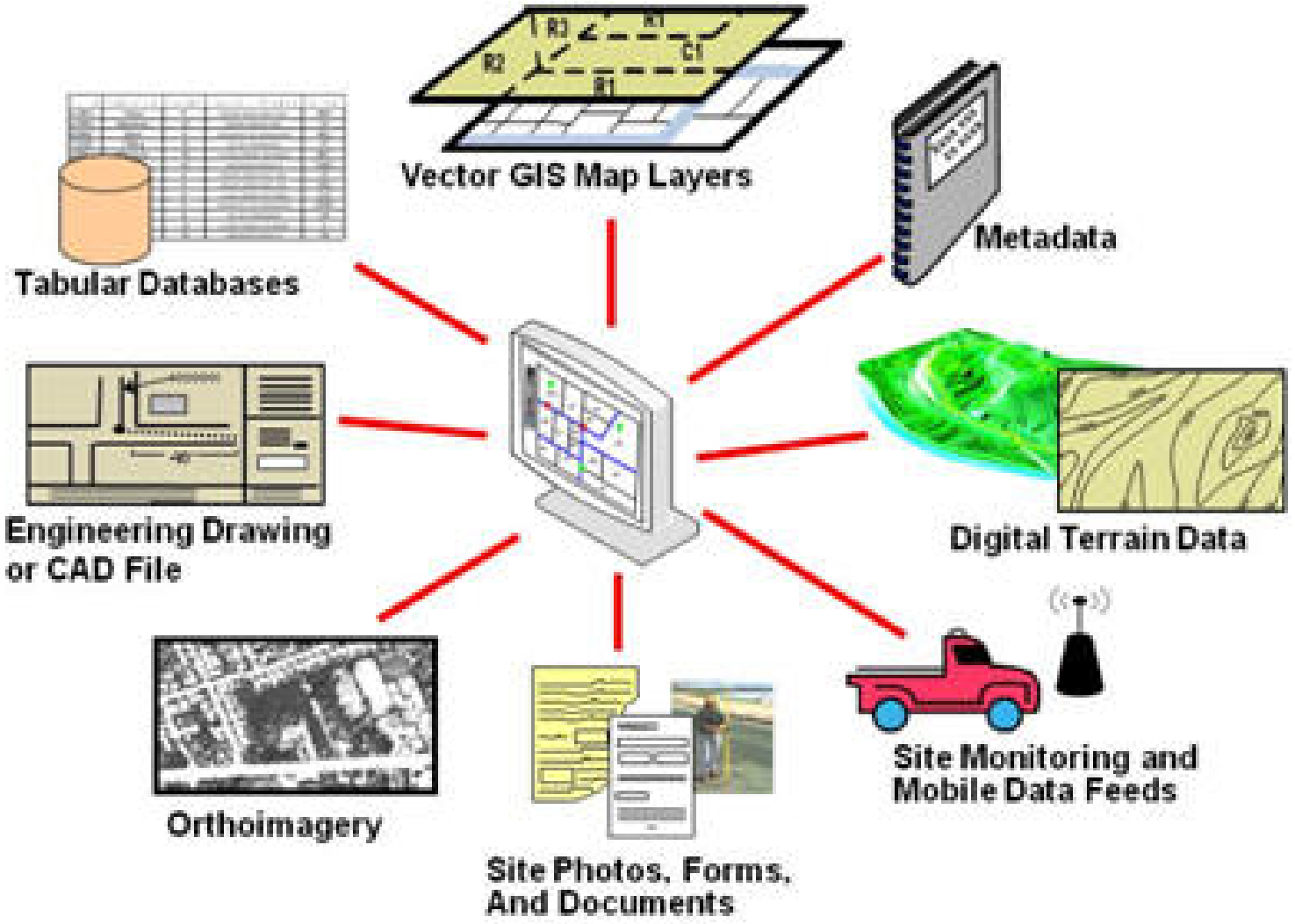
(*data input-types / representation / formats*)

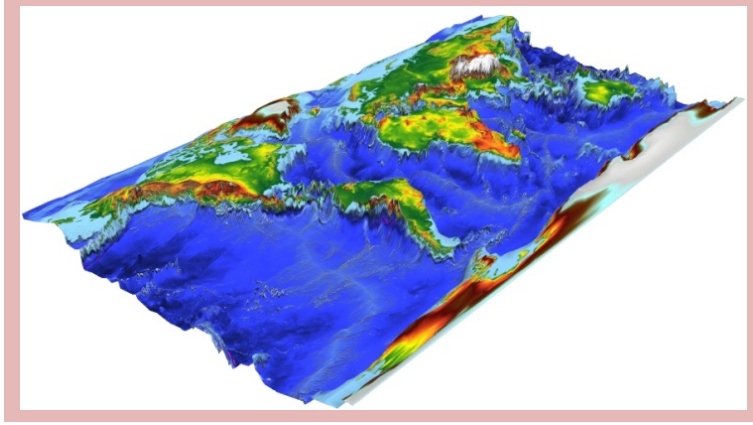


Geographical Information Systems (GIS)

(*data input-types / representation / formats*)

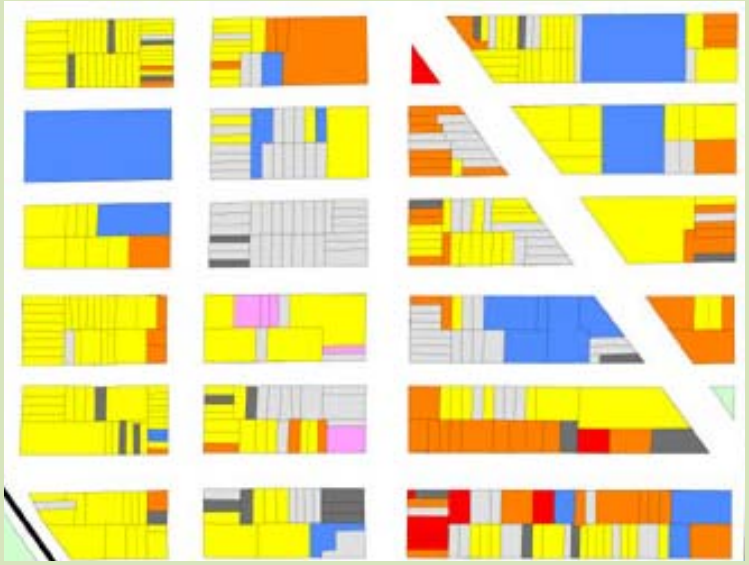
Raster

Any type of digital image represented by reducible and enlargeable grids are raster datasets. Raster data type consists of rows and columns of cells, with each cell storing a single value. Raster data can be images with each pixel (or cell) containing a color value.



Vector

Geographical features are often expressed as vectors, by considering those features as geometrical shapes. Different geographical features are expressed by different types of geometry and Each of these geometries are linked to a row in a database that describes their attributes



Geographical Information Systems (GIS)

(*data input-types / representation / formats*)

Raster formats

ADRG - National Geospatial-Intelligence Agency (NGA)'s ARC Digitized Raster Graphics

BIL - Band Interleaved by Line (image format linked with satellite derived imagery)

CADRG - National Geospatial-Intelligence Agency (NGA)'s Compressed ARC Digitised Raster Graphics (nominal compression of 55:1 over ADRG)

ECRG - National Geospatial-Intelligence Agency (NGA)'s Enhanced Compressed ARC Raster Graphics (Better resolution than CADRG and no color loss)

CIB - National Geospatial-Intelligence Agency (NGA)'s Controlled Image Base (type of Raster Product Format)

Digital raster graphic (DRG) - digital scan of a paper USGS topographic map

ECW - Enhanced Compressed Wavelet (from ERDAS). A compressed wavelet format, often lossy.

Esri grid - proprietary binary and metadataless ASCII raster formats used by Esri

GeoTIFF - TIFF variant enriched with GIS relevant metadata

IMG - ERDAS IMAGINE image file format

JPEG2000 - Open-source raster format. A compressed format, allows both lossy and lossless compression.

MrSID - Multi-Resolution Seamless Image Database (by Lizardtech). A compressed wavelet format, often lossy.

netCDF-CF - netCDF file format with CF medata conventions for earth science data. Binary storage in open format with optional compression. Allows for direct web-access of subsets/aggregations of maps through OPeNDAP protocol.

DEM – Digital Elevation Model

Vector formats

Geography Markup Language (GML) - XML based open standard (by OpenGIS) for GIS data exchange

Keyhole Markup Language (KML) - XML based open standard (by OpenGIS) for GIS data exchange

AutoCAD DXF - Contour elevation plots in AutoCAD DXF format

Shapefile - Esri's open, hybrid vector data format using SHP, SHX and DBF files

Simple Features - Open Geospatial Consortium specification for vector data

MapInfo TAB format - MapInfo's vector data format using TAB, DAT, ID and MAP files

TIGER - Topologically Integrated Geographic Encoding and Referencing

Cartesian coordinate system (XYZ) - Simple point cloud

Vector Product Format - National Geospatial-Intelligence Agency (NGA)'s format of vectored data for large geographic databases.

GeoMedia - Intergraph's Microsoft Access based format for spatial vector storage.

ISFC - Intergraph's MicroStation based CAD solution attaching vector elements to a relational Microsoft Access database

Personal Geodatabase - Esri's closed, integrated vector data storage strategy using Microsoft's Access MDB format

File Geodatabase - Esri's file-based geodatabase format, stored as folders in a file system. Esri also has an enterprise Geodatabase format for use in an RDBMS.

Coverage - Esri's closed, hybrid vector data storage strategy. Legacy ArcGIS Workstation / ArcInfo format with reduced support in ArcGIS Desktop lineup

Spatial Data File - Autodesk's high-performance geodatabase format, native to MapGuide

Digital Line Graph (DLG) - a USGS format for vector data

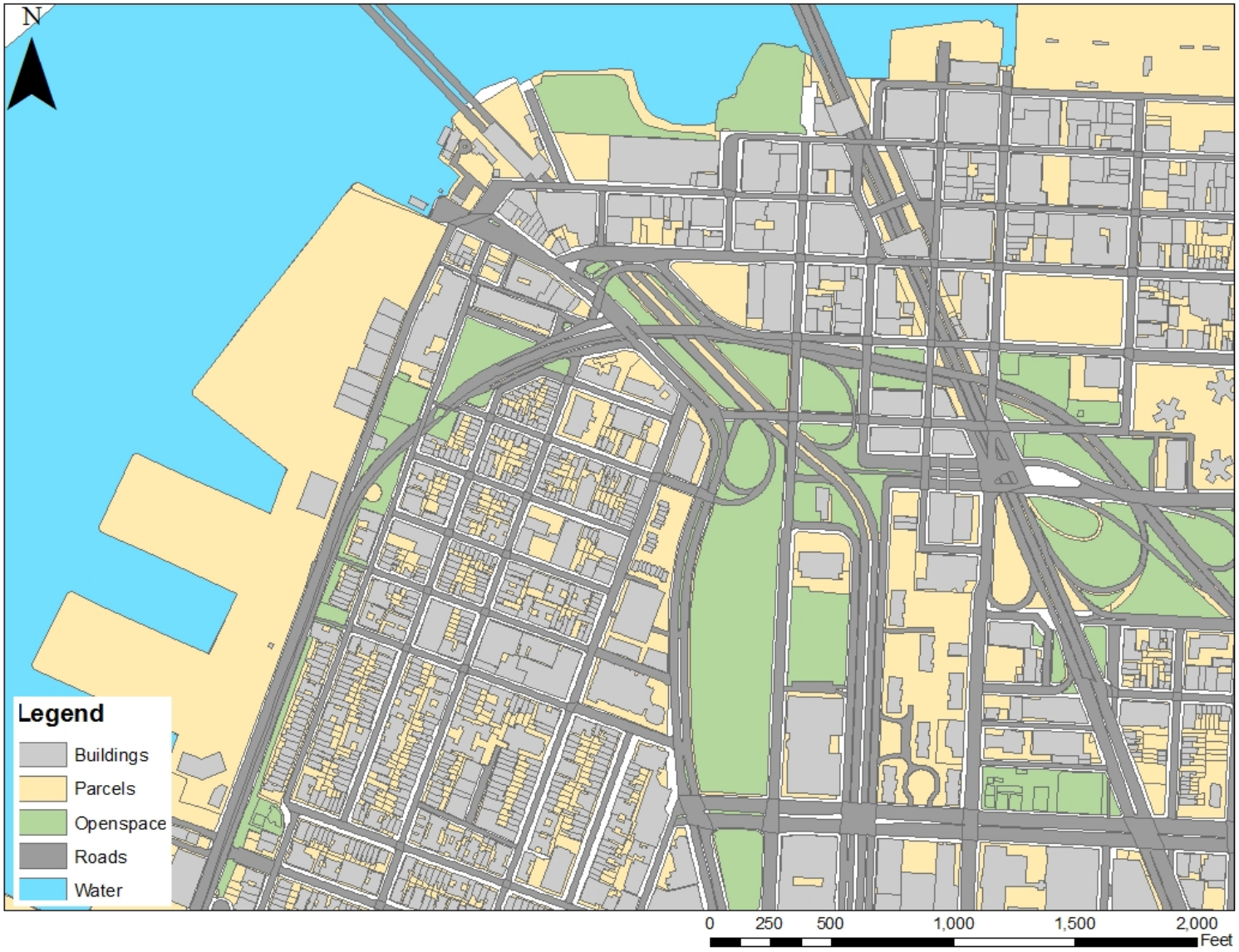
Geographical Information Systems (GIS)

(*New York City Data and Sources*)

Data Center	Source	Dataset	Contents	Fee	weblink
Bytes of the Big Apple	Department of City Planning	MapPluto	tax lot data with extensive landuse and geographic information	$300 per Borough	http://www.nyc.gov/html/dcp/html/bytes/applbyte.shtml
		NYS GIS Zoning Features	zoning boundries	free	
NYC DOITT	Department of Information Technology and Telecommunicitaions	Building Footprints	Polygons of building footprints	free	http://www.nyc.gov/html/doitt/html/eservices/eservices_gis_downloads.shtml
		Street Centerline	Street Names	free	
		Pavement Edge	Block Outlines and Paved Surface Edges	free	
		Hydrography	Water Features	free	
		Open Space	Publicly available open spaces and parks	free	
		Railroad Lines	Railroad lines for surface and subsurface (not including subway)	free	
		Roadbed	Sidewalk and Road edges	free	
		Shoreline	Shorelines and Pier edges	free	
		Elevation	Elevation readings of roads and rooftop elevations	free	
NYC DataMine	Most City Agencies	Many	some of the above and extra datasets available for 3rd parties, available for application developers for smart phones	free	http://www.nyc.gov/html/datamine/html/data/geographic.shtml
NYS GIS Clearinghouse	New York State	Many	State datasets are available	free	http://www.nysgis.state.ny.us/
Seamless Data Warehouse	USGS	topographic	Digital Elevation Model (DEM) and Aerial Images	free	http://seamless.usgs.gov/

Geographical Information Systems (GIS)

(*New York City Data and Sources*)



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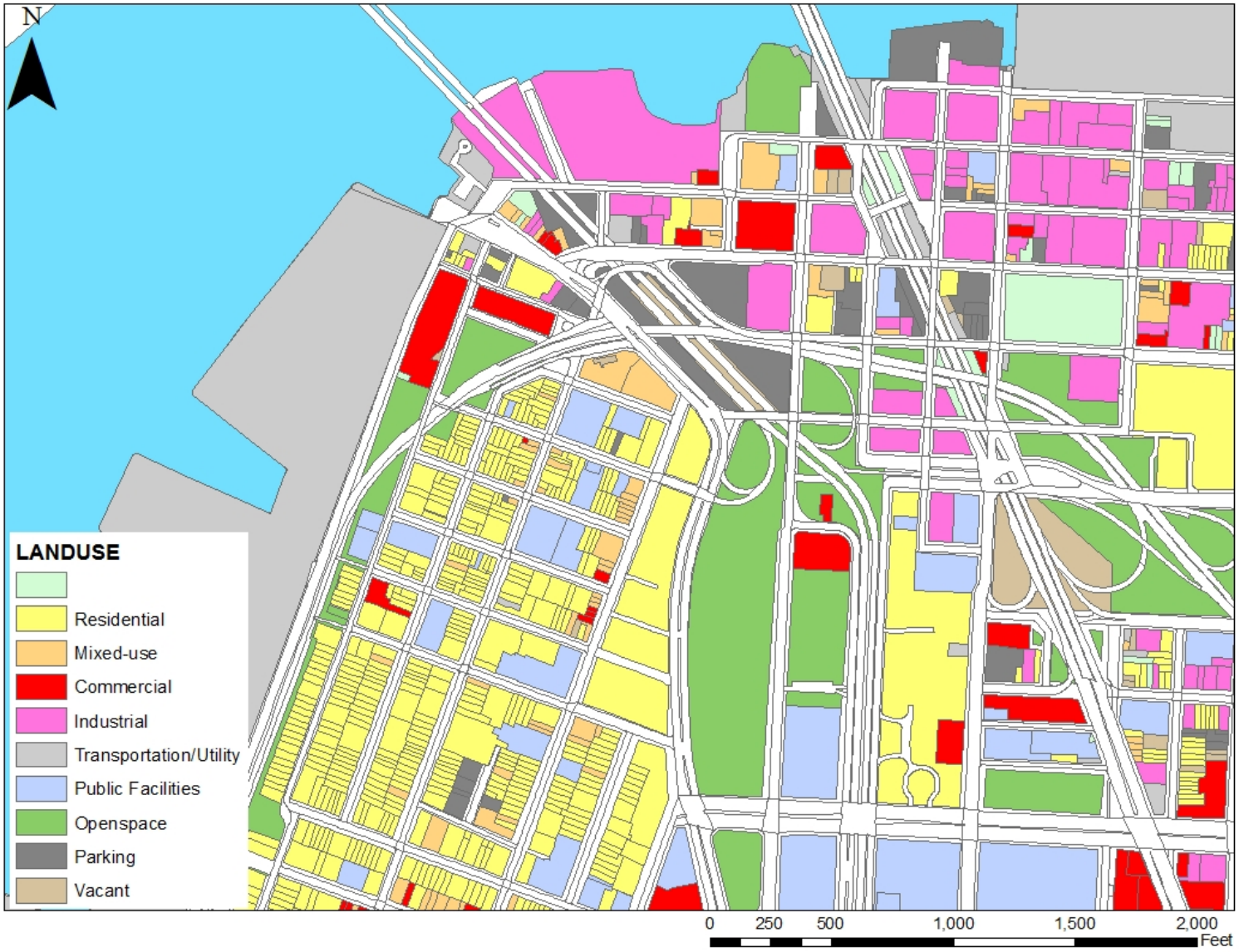

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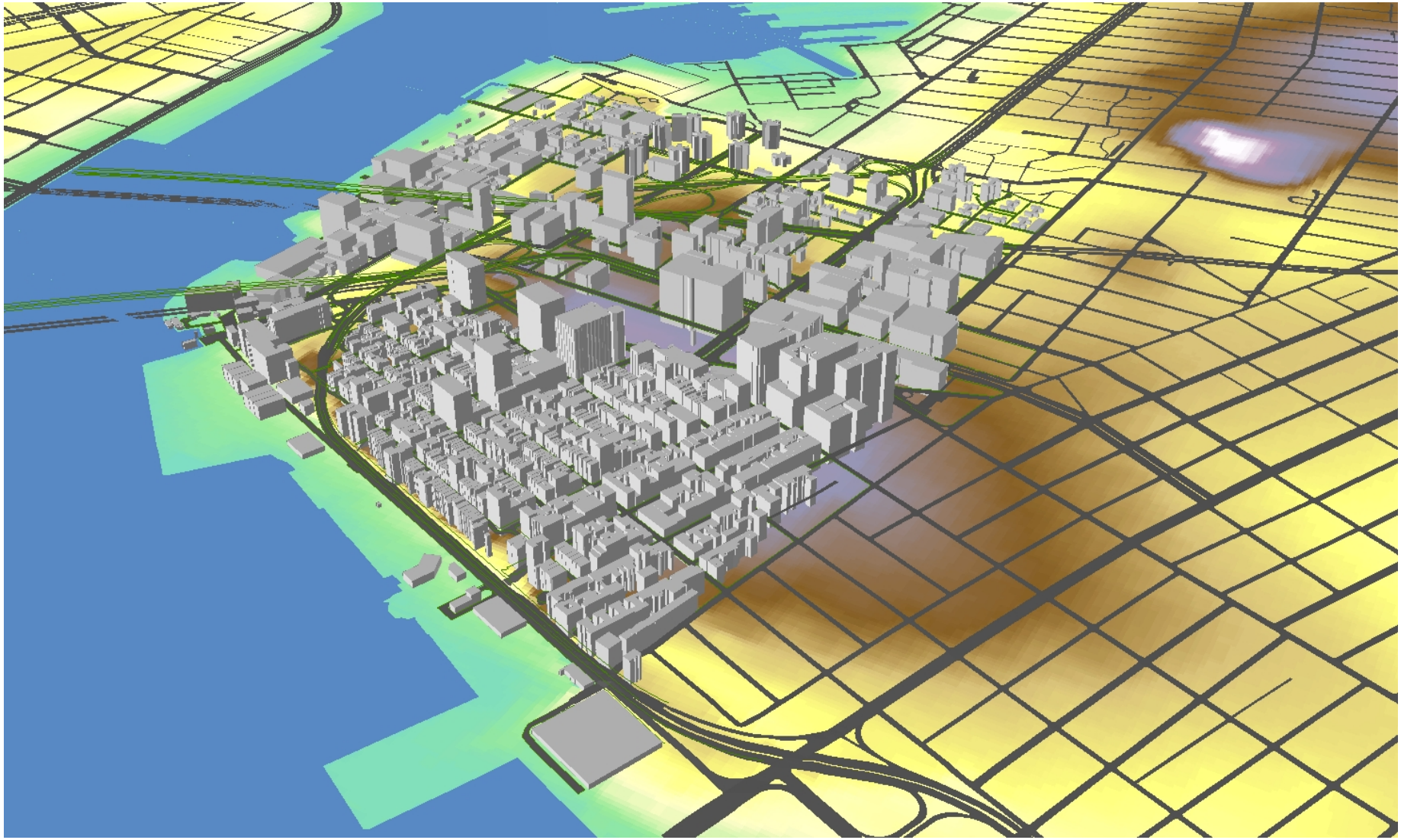

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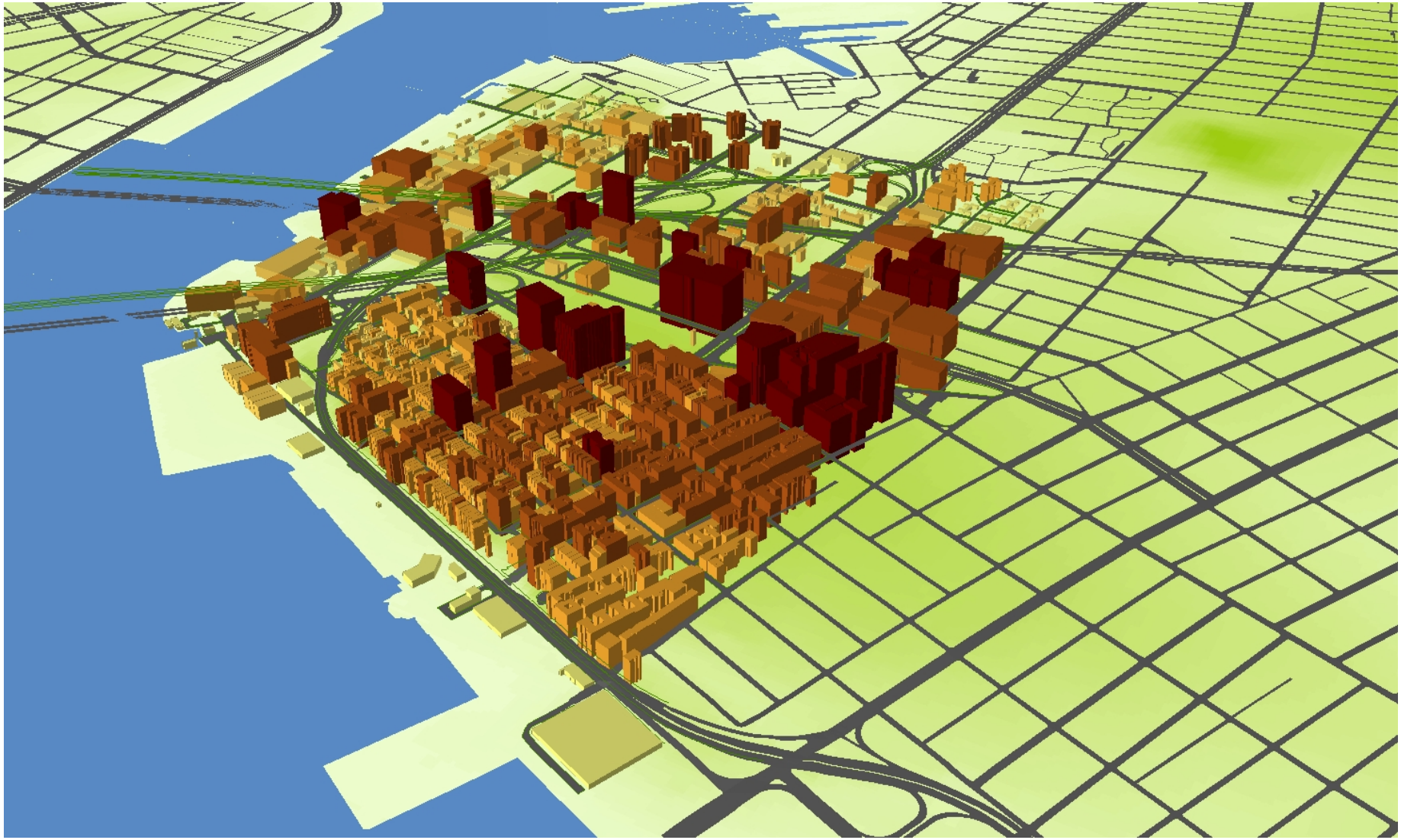


How do we Visualize the GIS Data

ENVIRONMENTAL

SIMULATION

CENTER, LTD.

Hypothetical Build Outs

Coney Island Ave.

LEGEND

Study Area

Zoning District

Footprints

Massing

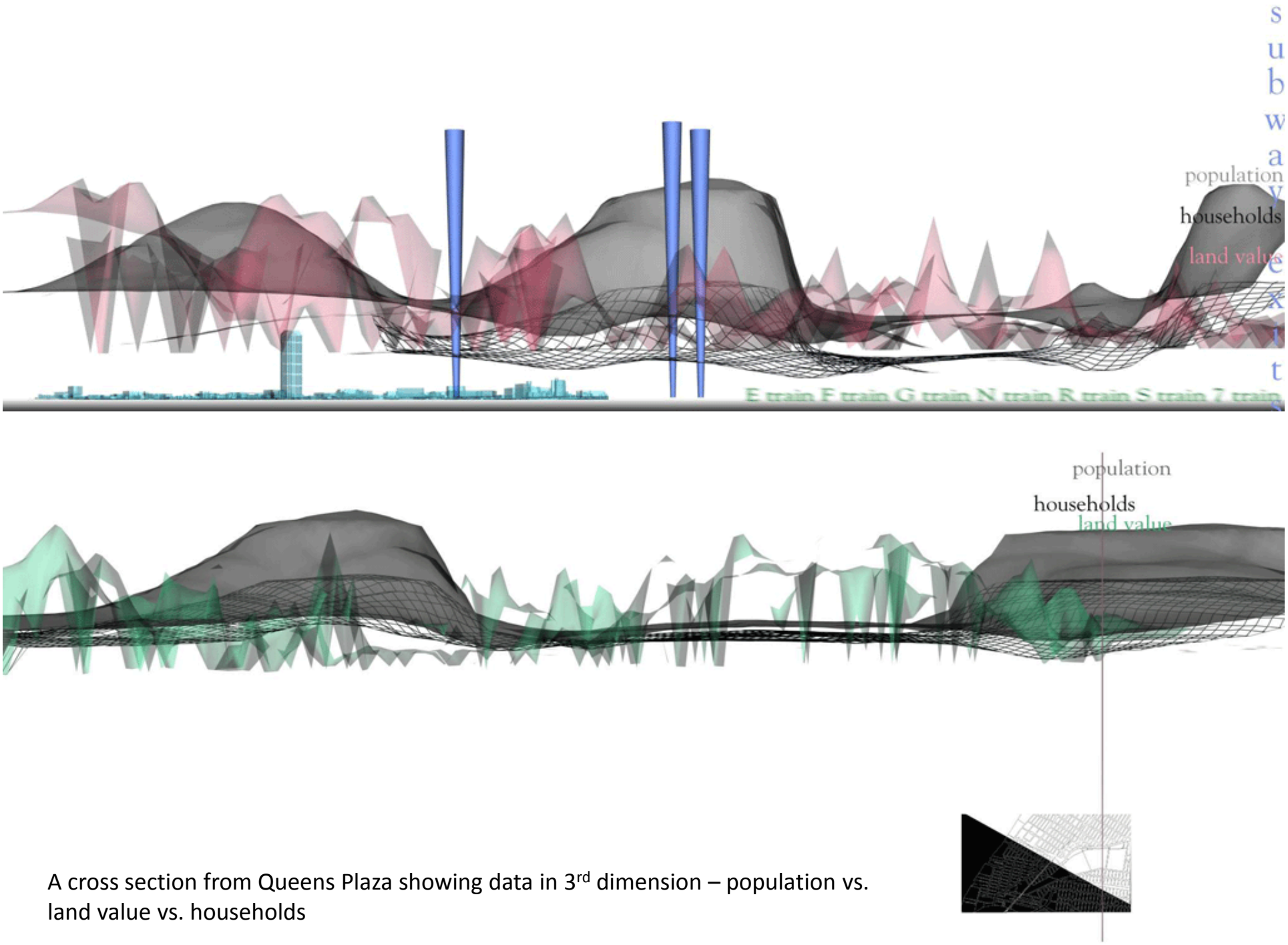
Build-Outs

Land Use

- Residential
- Mixed Residential and Commercial
- Commercial and Office Buildings
- Industrial and Manufacturing
- Transportation and Utility
- Public Facilities and Institutions
- Parking Facilities
- Vacant Land
- Other

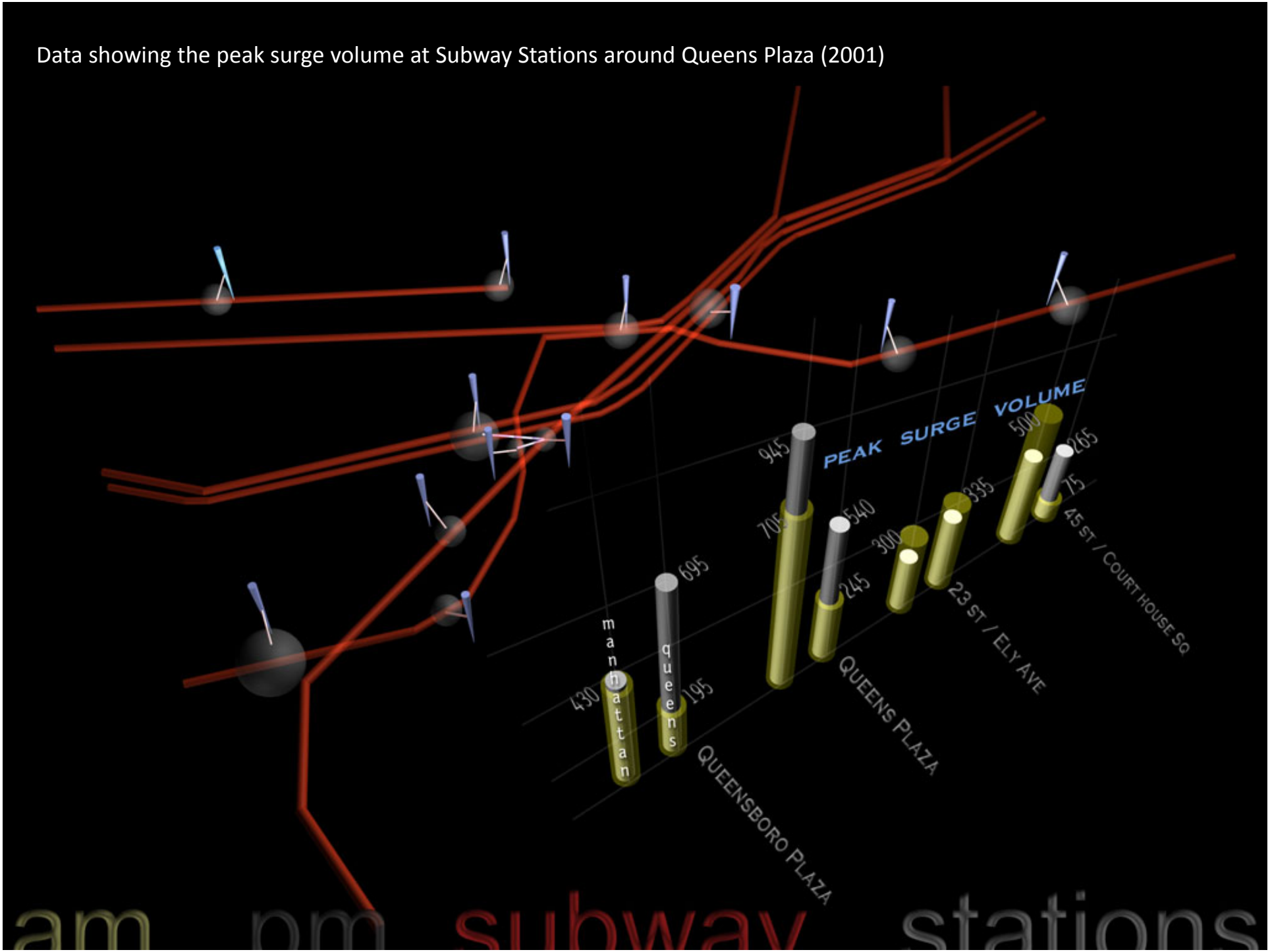
Development Sites

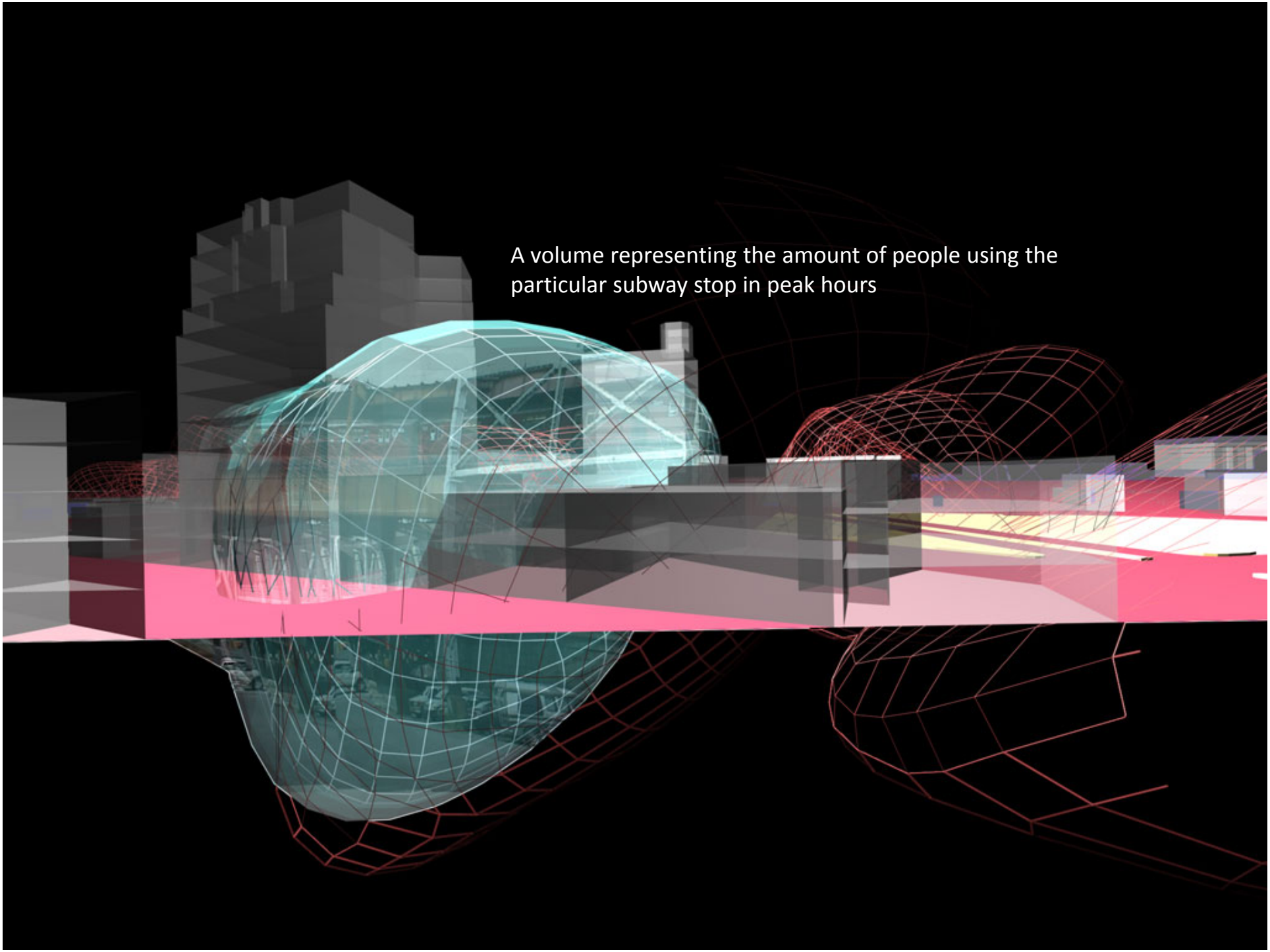
- Developable
- Non Developable



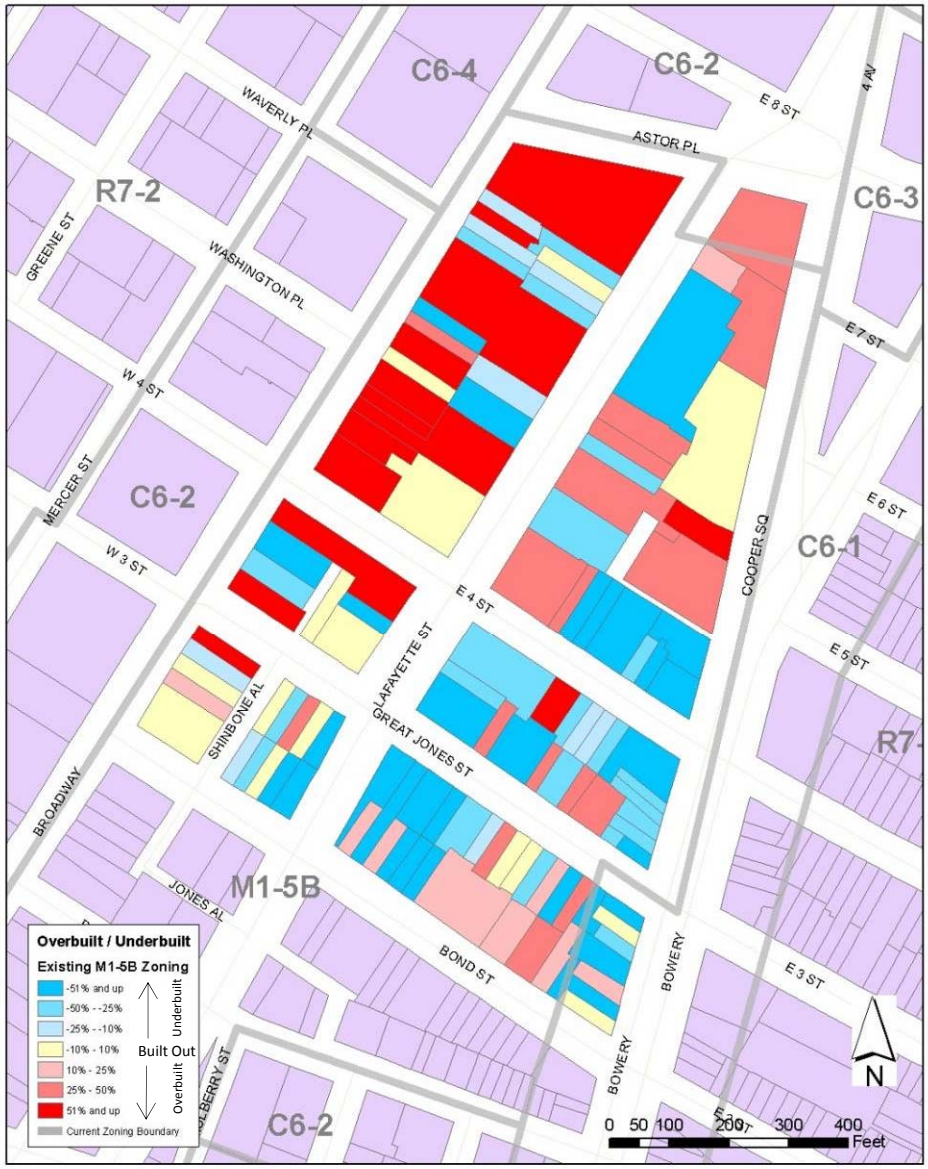
A cross section from Queens Plaza showing data in 3rd dimension – population vs. land value vs. households

Data showing the peak surge volume at Subway Stations around Queens Plaza (2001)




A volume representing the amount of people using the particular subway stop in peak hours

ENVIRONMENTAL
ENVIRONMENTAL SIMULATION
SIMULATION CENTER, LTD.
CENTER, LTD.



Edison Properties Zoning Analysis
Source: NYC Pluto Data and ESC Survey
Date: April 4, 2008

Overbuilt/ underbuilt by lot under existing M1-5B zoning

Lots to the northwest of the study area are most overbuilt, the smaller lots to the south of the study area are most underbuilt under current zoning densities.

Map shows only tax lots. Zoning lot mergers are not shown.

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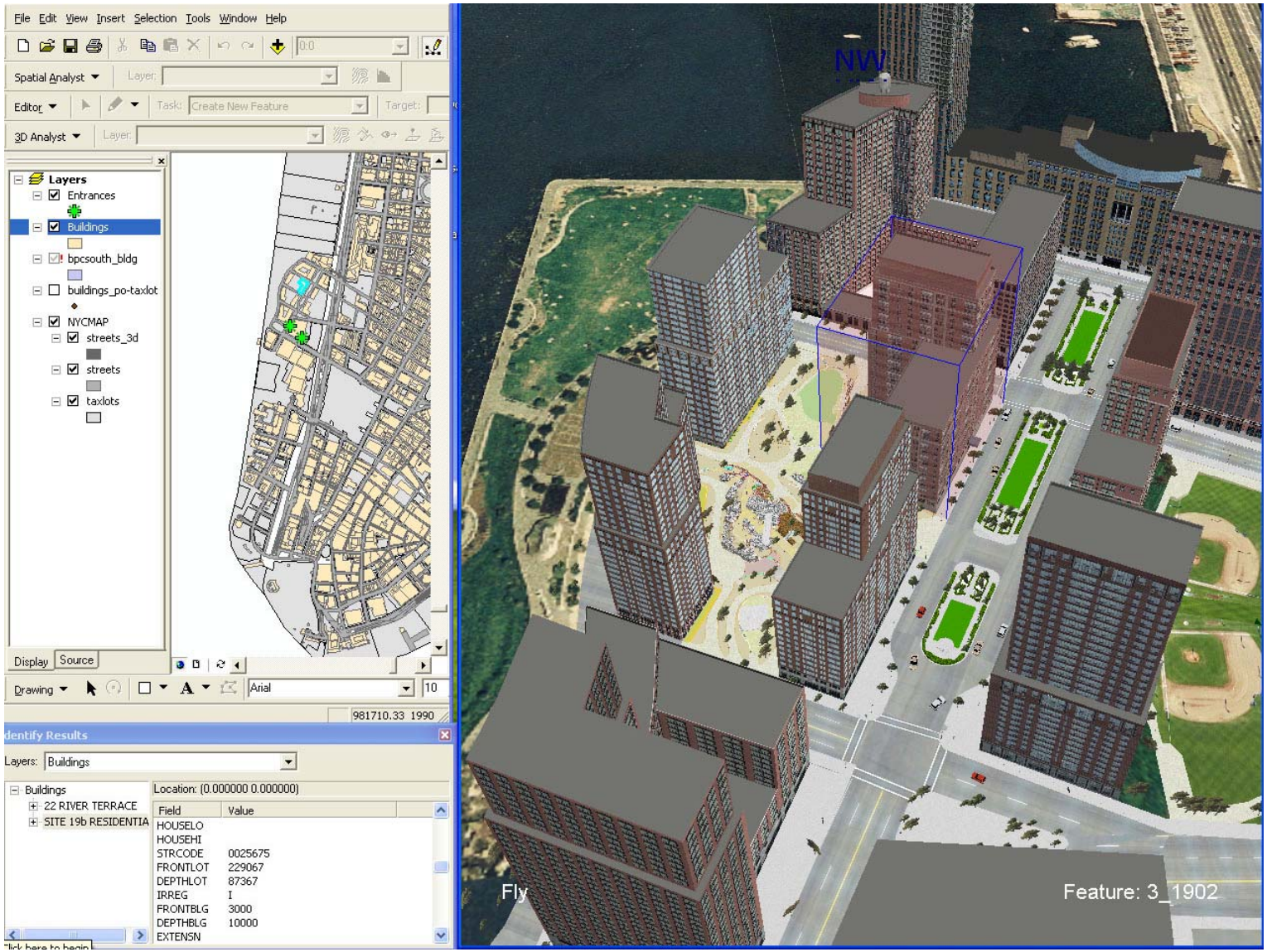


Decision Making Process

Linking 2D and 3D Data

Web Based GIS / Geospatial Design

(*concepts*)

Access to spatial data as well as advanced mapping and spatial analysis over the Internet

Faster data processing speeds, introduction of wireless broadband and faster cellular systems (edge-3G-4G)

Easier interface for everyone who is computer savvy, visually rich and attractive layout

Immediate access to data and resource management

Participatory GIS and Individual contribution of geospatial data

A higher rate of public participation and awareness especially in local communities

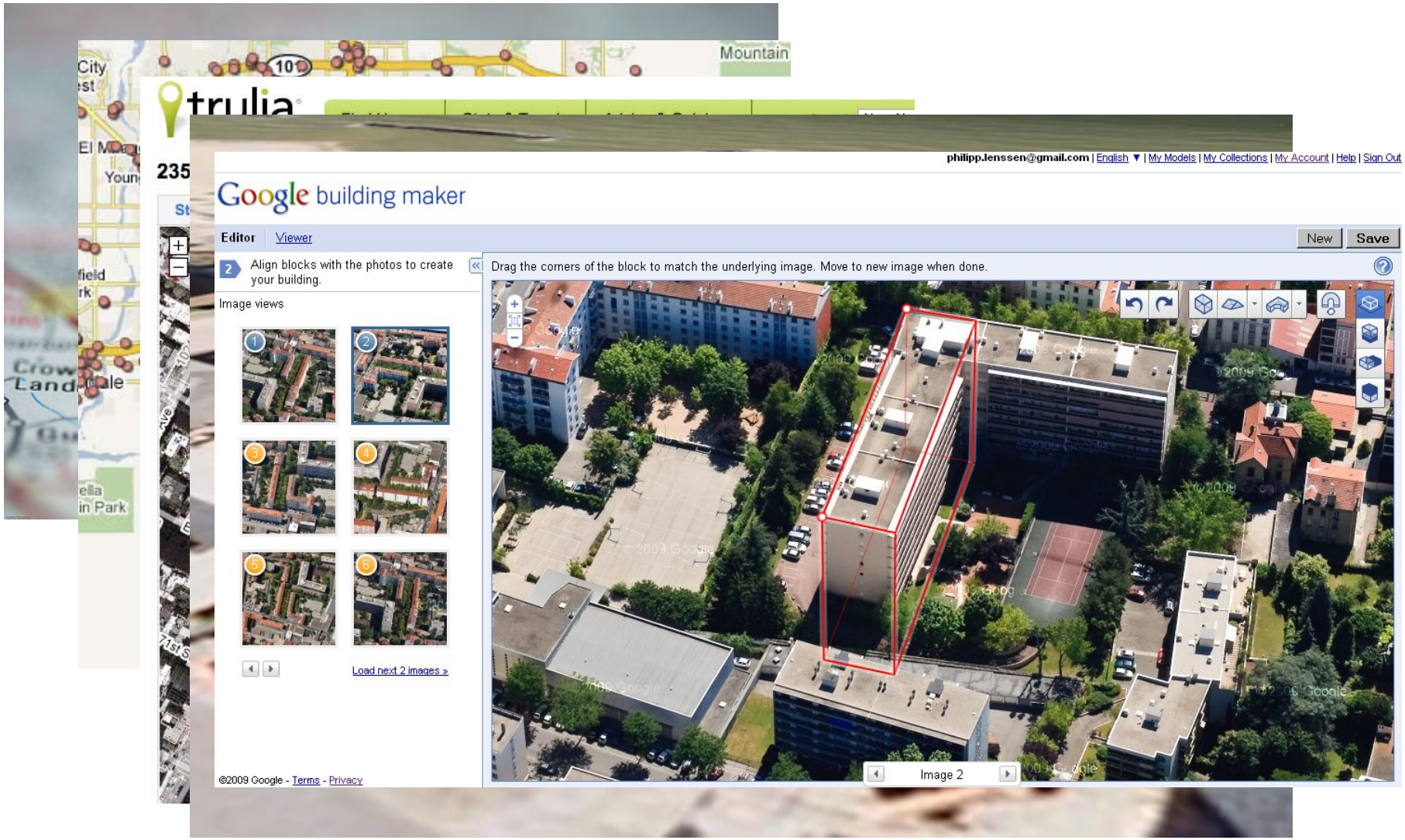
Web Based GIS / Geospatial Design

(*timeline*)

Evolution of web based geospatial services

Web Based GIS / Geospatial Design

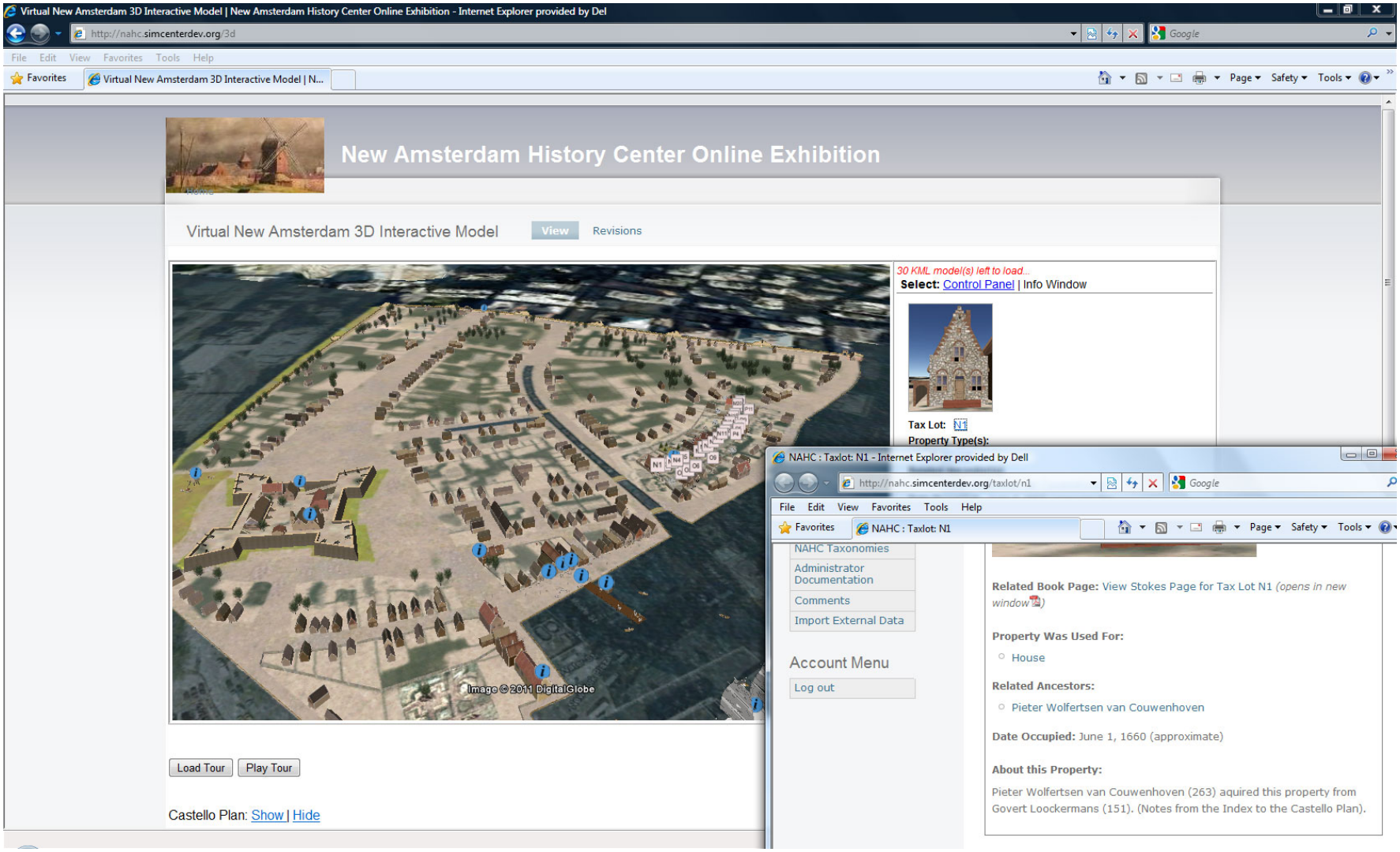
(*user contributed data*)



Evolution of web based geospatial services

Web Based GIS / Geospatial Design

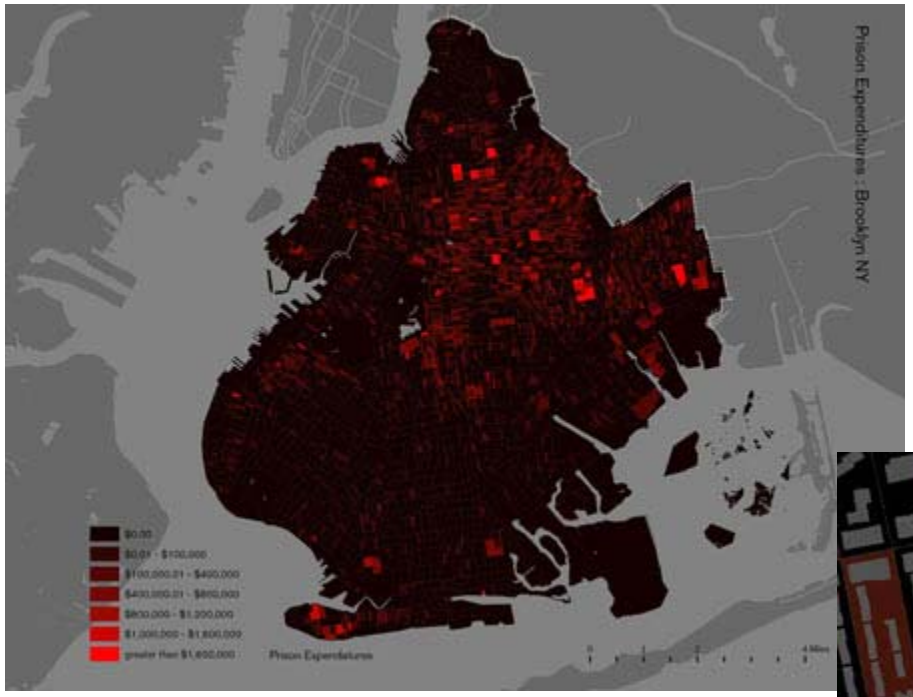
(*applications*)



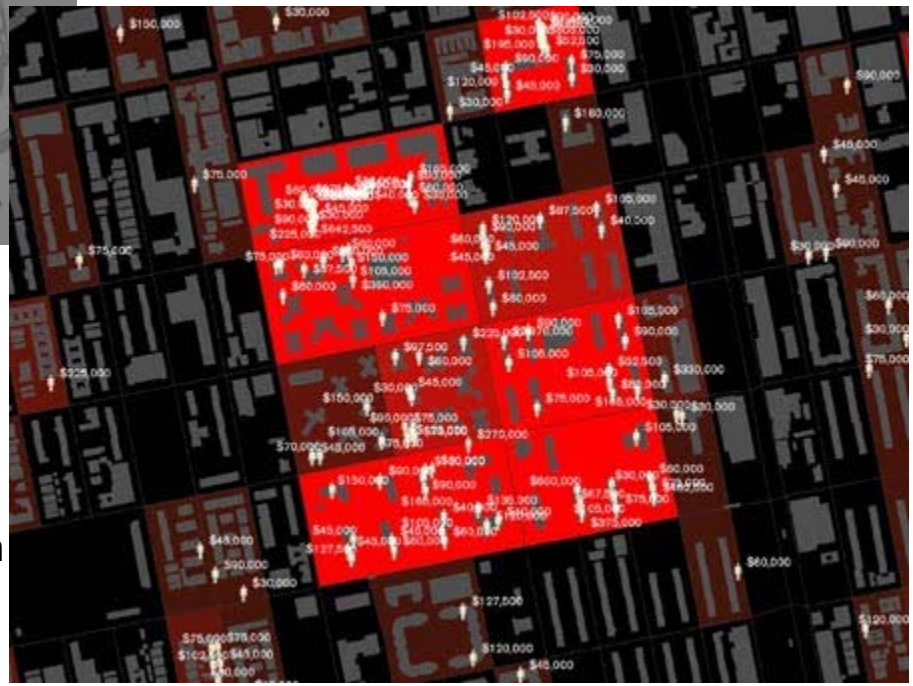
New Amsterdam History Center / 1660 New Amsterdam Model

Other Geospatial Data Analysis Examples

(*million dollar blocks*)



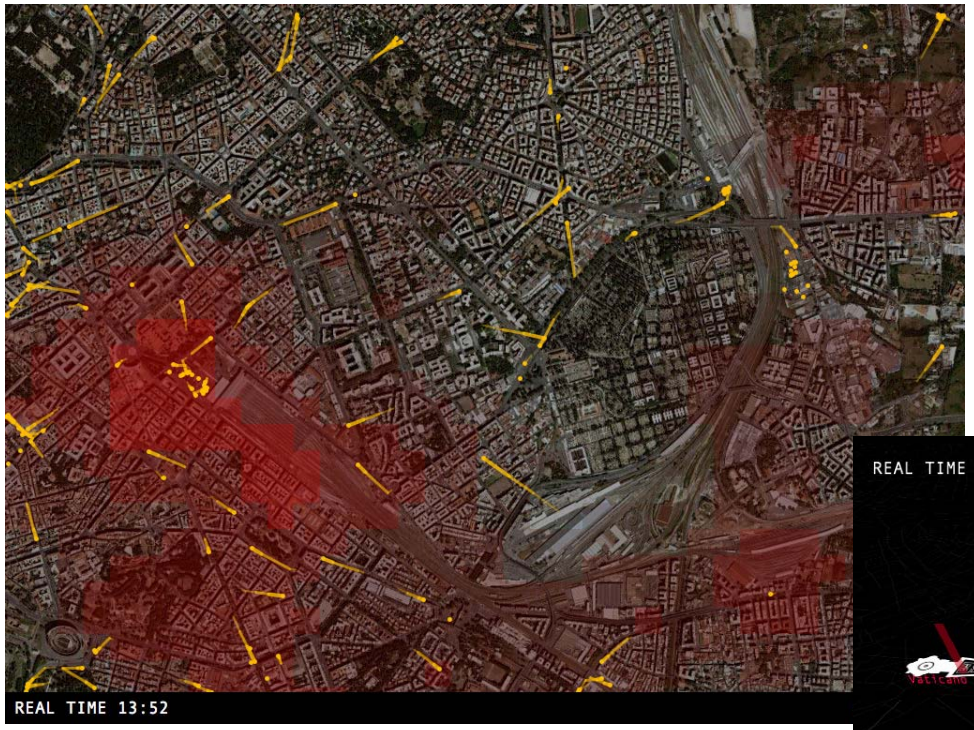
The United States currently has more than 2 million people locked up in jails and prisons. A disproportionate number of them come from a very few neighborhoods in the country's biggest cities. In many places the concentration is so dense that states are spending in excess of a million dollars a year to incarcerate the residents of single city blocks. When these people are released and reenter their communities, roughly forty percent do not stay more than three years before they are reincarcerated.



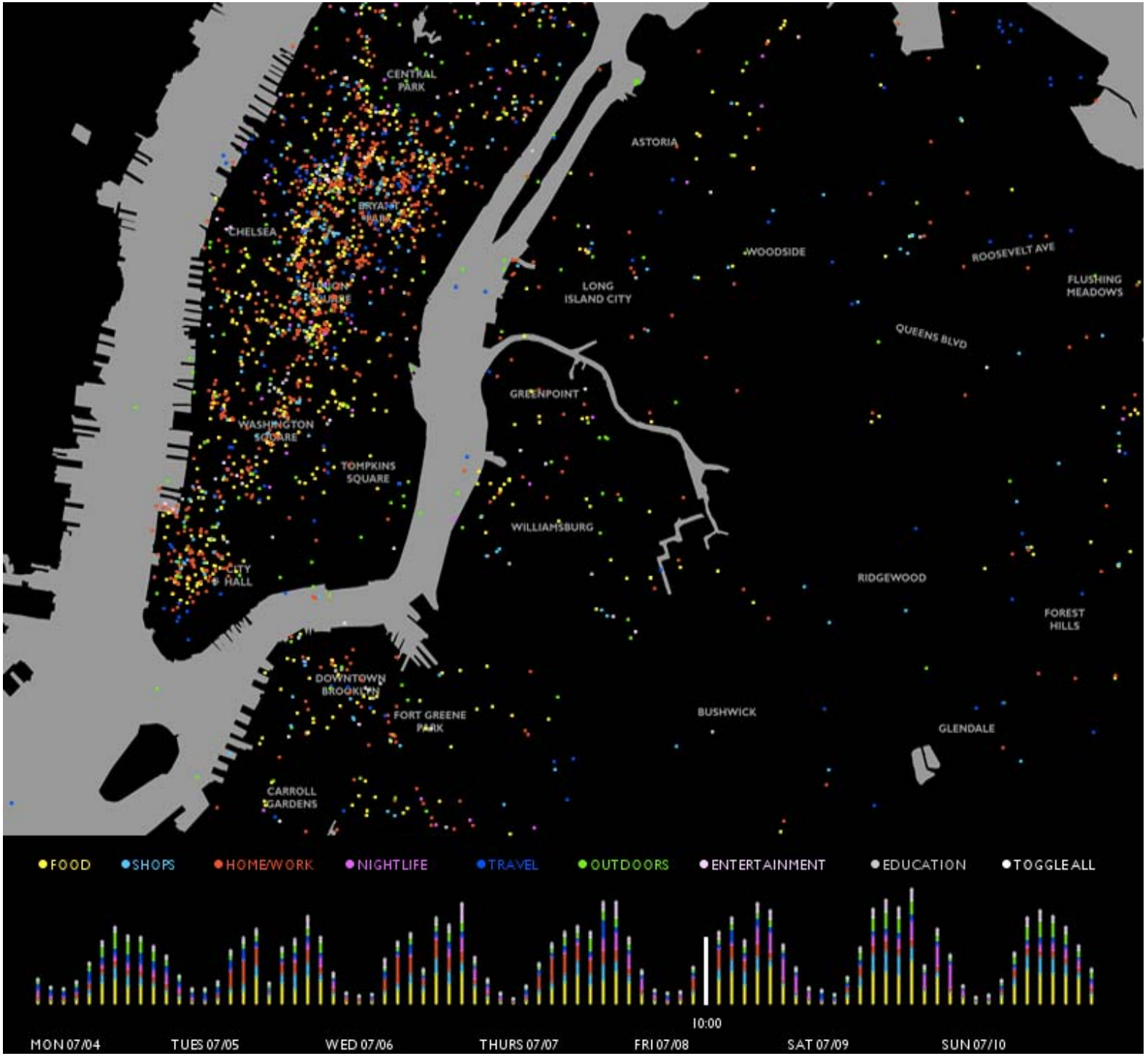
Using rarely accessible data from the criminal justice system, the Spatial Information Design Lab and the Justice Mapping Center have created maps of these "million dollar blocks" and of the city-prison-city-prison migration flow for five of the nation's cities. The maps suggest that the criminal justice system has become the predominant government institution in these communities and that public investment in this system has resulted in significant costs to other elements of our civic infrastructure — education, housing, health, and family.

Other Geospatial Data Analysis Examples

(*digital rome*)



Real Time Rome is the MIT SENSEable City Lab's contribution to the 2006 Venice Biennale, directed by professor Richard Burdett. The project aggregated data from cell phones (obtained using Telecom Italia's innovative Lochness platform), buses and taxis in Rome to better understand urban dynamics in real time. By revealing the pulse of the city, the project aims to show how technology can help individuals make more informed decisions about their environment.



Map Showing One Week of NYC Foursquare Check-Ins

Geospatial Data Application Examples

(*microsoft photosynth*)