Geospatial Data and its Implementation in BIM.

Marios Messios
Architect, CEO & Co-Founder at Parametricos

Marios Messios

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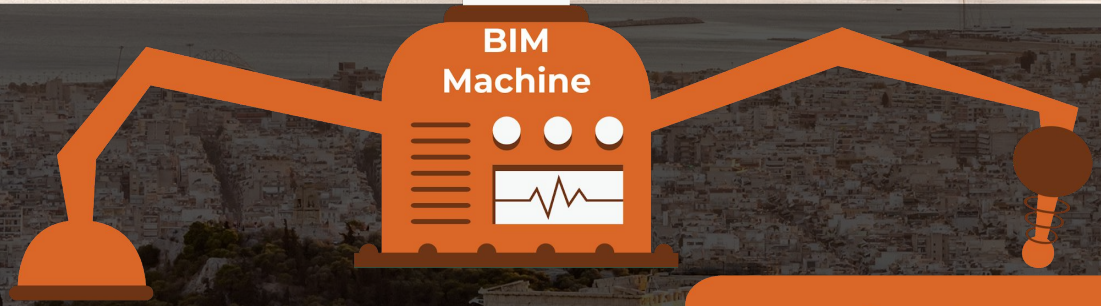
mm@parametricos.com



As we look into these things we get an aesthetic pleasure from them directly on observation. There is also a rhythm and a pattern between the phenomena of nature which is not apparent to the eye, but only the eye of analysis; and it is these rhythms and patterns which we call physical laws.

- Richard Feynman, Theoretical Physicist

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- Marios Messios, Architect

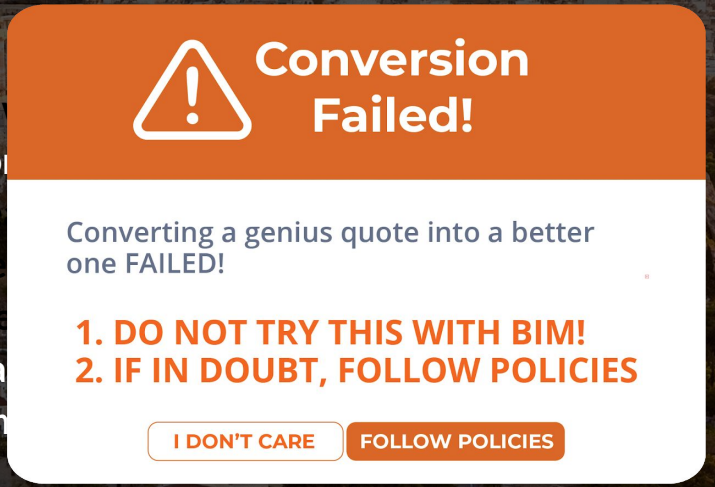


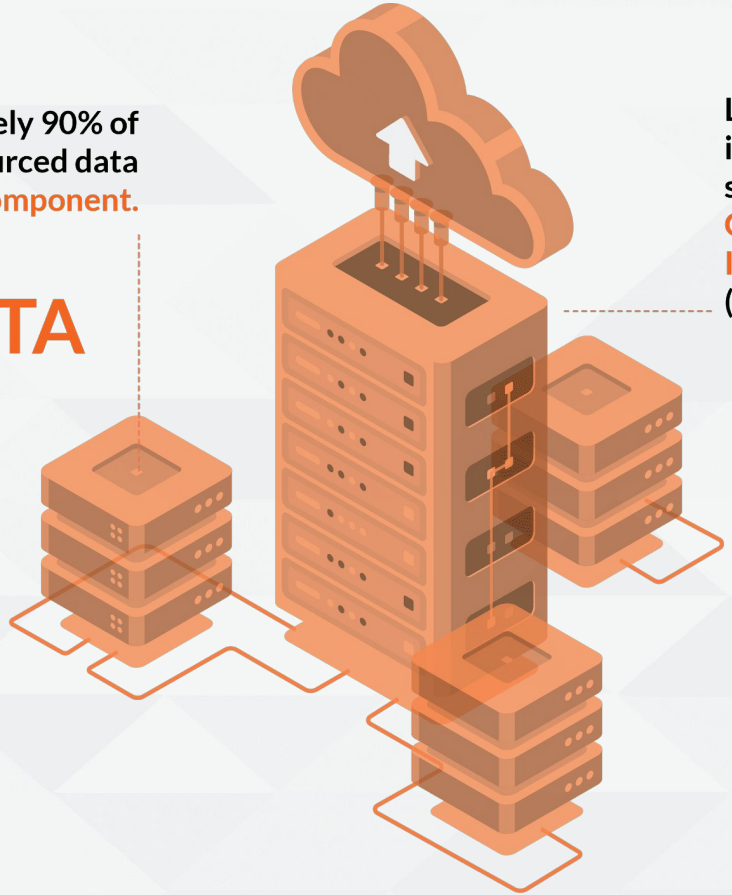
Image Source: qantas.com

Approximately 90% of government sourced data has a location component.

GEOSPATIAL DATA

Geospatial data have an implicit or explicit association with a location relative to Earth.

TRY IT NOW



Location information is stored in a Geographic Information System (GIS)

Coordinate System

ERATOSTHENIS

200 BC

The invention of a geographic coordinate system is generally credited to Eratosthenes of Cyrene in 200 B.C

Earth Projection

GERARDUS MERCATOR

1569

Gerardus Mercator creates his famous 1569 map of the world where he describes the projection that is named after him.

Information

DR. ROGER TOMLINSON

1963

The Canada Geographic Information System (CGIS), initiated in 1963 by the Agriculture Rehabilitation and Development Agency, was the first operational land resource GIS


GPS
in 1978
Global Positioning System
Geospatial Data/ Origin/ GPS/
T+00:24:41
STAGE 2 TELEMETRY
LIVE
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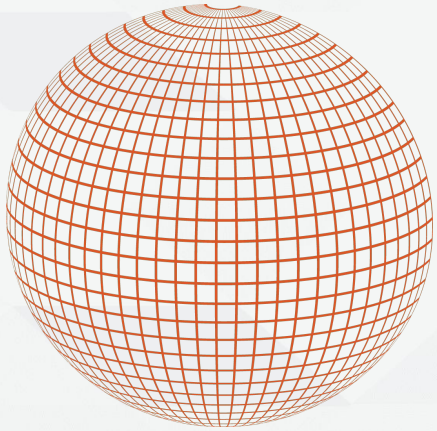
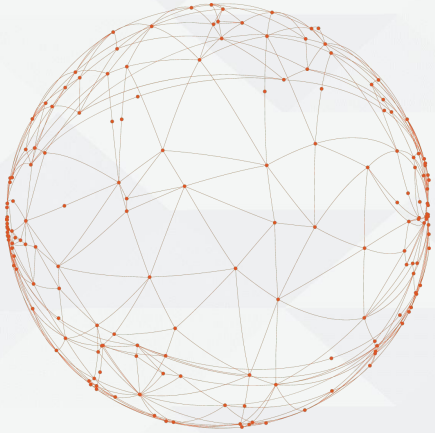
Earth Projection v

Cassini
Equirectangular
Mercator



Coordinate System v

WGS84 (EPSG:4326)
NAD 1983



Information v

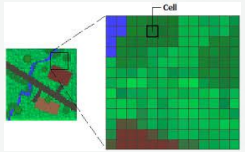
Valuation
Land Use
Place of Interest

GIS

Data Types

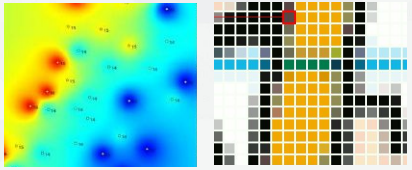
Spatially Referenced Data

Vector Data



Raster Data

Polygons Lines Points



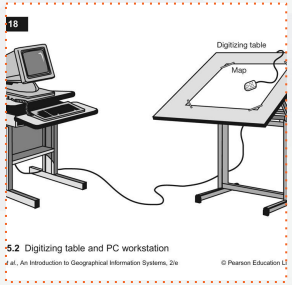
Continuous Data Discrete

Attribute Tables Tabular Format

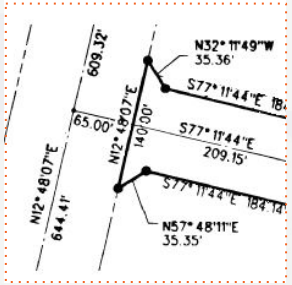
	ATTRIBUTES				
RECORDS	**Building ID**	**Building Name**	**Building Type**	**Longitude**	**Latitude**
	34342	H.R Labs	Laboratory	83.545646	34.575876
	34343	Flish School	School	90.342344	33.670876
	34344	Supri-Mar	Supermarket	89.234535	32.570076
	34345	Athenaeum	Exhibition Hall	85.545646	35.175016
	34346	Aristoman	Private School	92.342344	34.287876

Gathering and digitising Geospatial Data

Digitising 2D Data

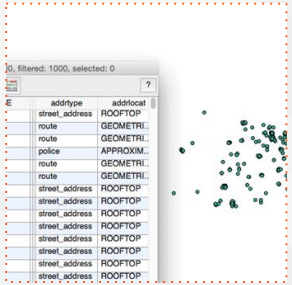


Heads up Digitising



Coordinate Geometry

Global Positioning Systems



Geocoding

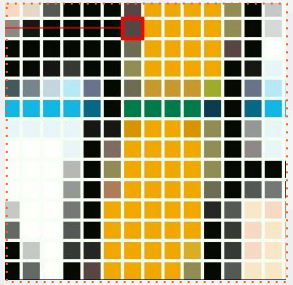
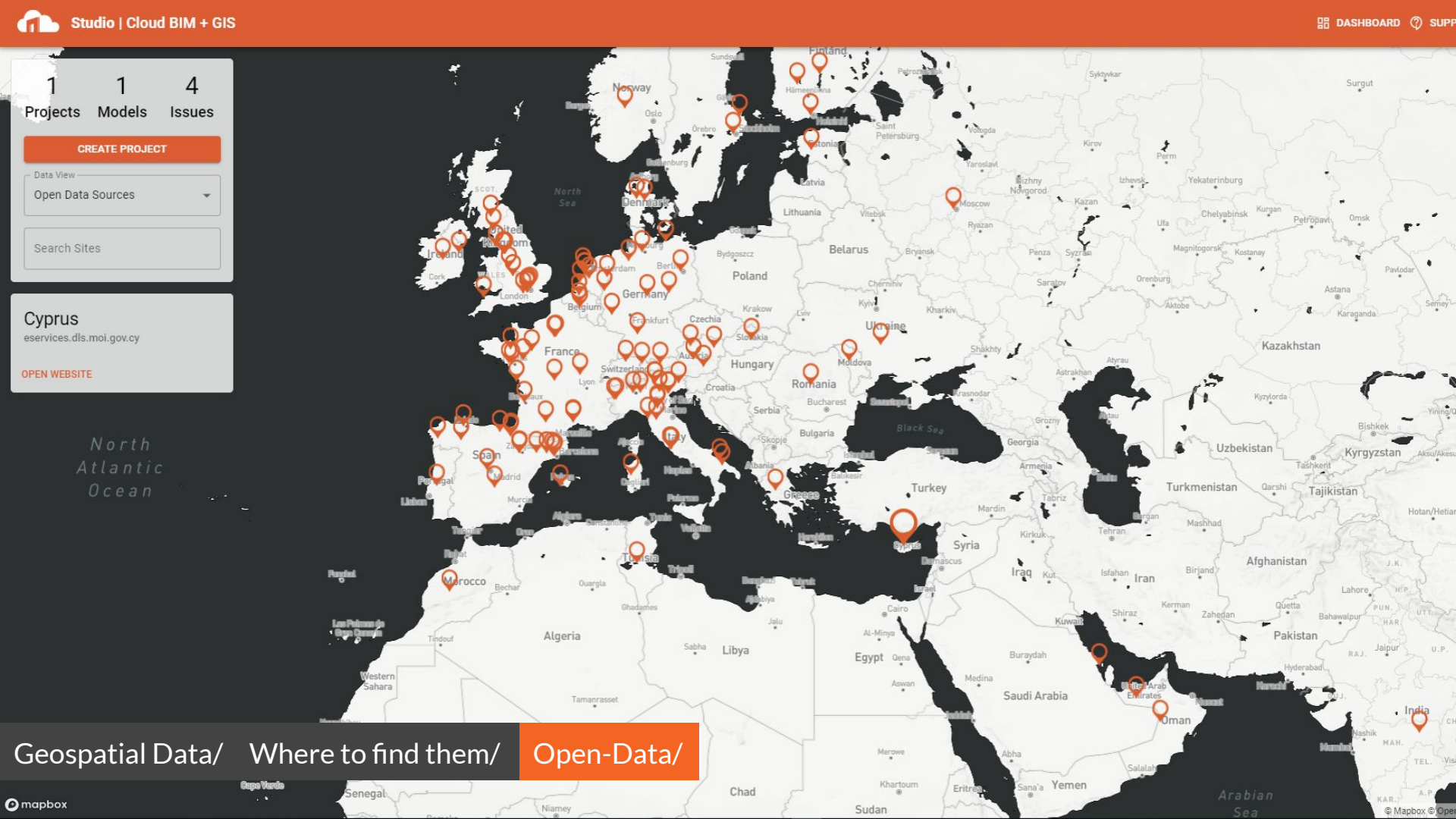


Image Processing


Studio | Cloud BIM + GIS
DASHBOARD
SUPP
1
Projects
1
Models
4
Issues
CREATE PROJECT
Data View
Open Data Sources
Search Sites
Cyprus
eservices.dls.moi.gov.cy
OPEN WEBSITE
North Atlantic Ocean
Geospatial Data/
Where to find them/
Open-Data/
mapbox

Use of Geospatial Data in other industries

Business Development
Geographic information systems help businesses gain true customer insight. By using GIS for business geography, professionals can uncover data like brand preferences and buying habits.

Public Economic Development
Departments for aggregation of demographic data.

Fiber Network Management
Fiber Network Management for interdepartmental network assets.

Public Safety Operations
Public safety operations include virus outbrakes (e.g Coronavirus).

Politics
Public Administration for election data, property records, and zoning/management.

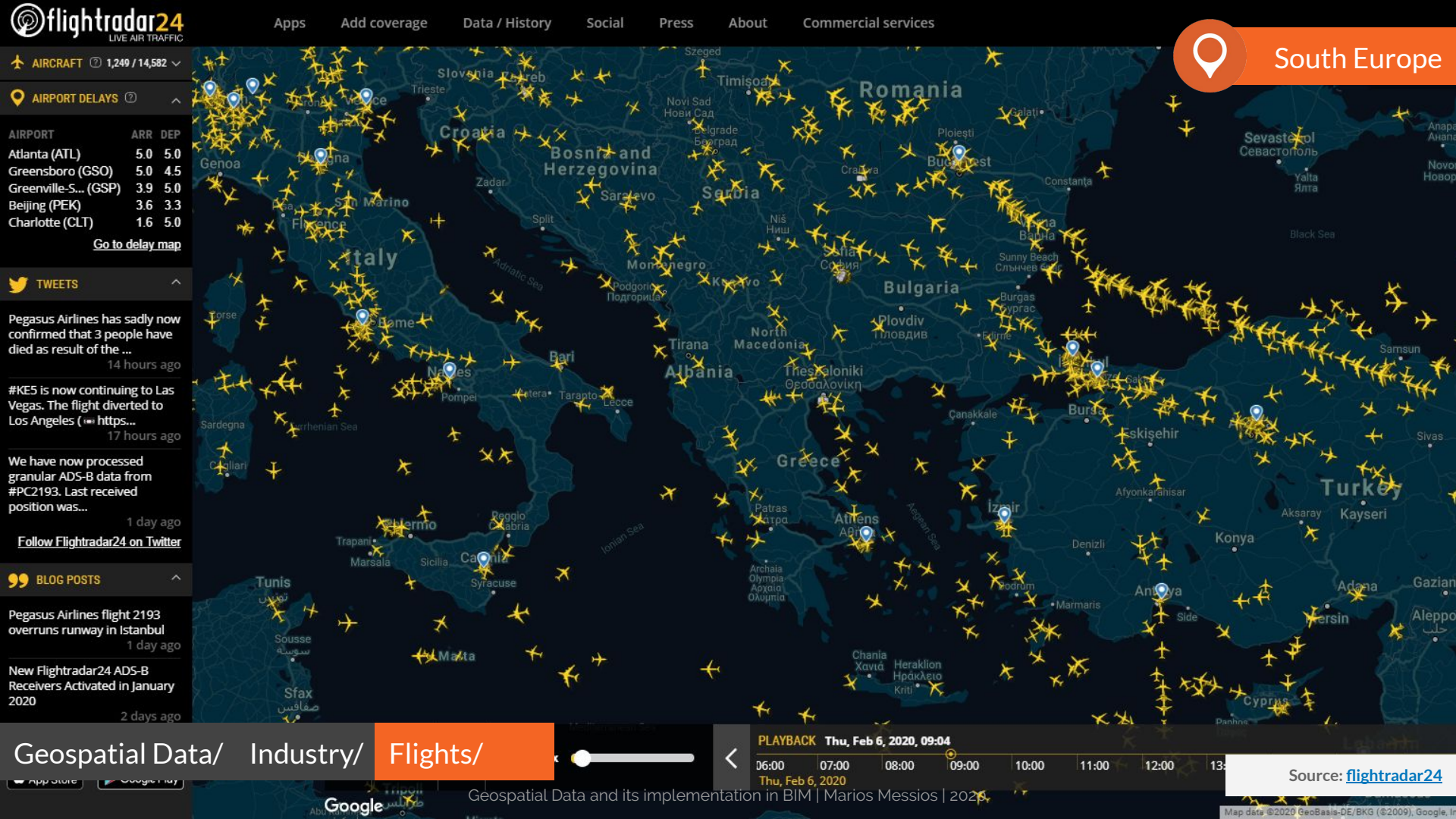
Governmental Land Management (Lands & Survey Department)
Parks and Recreation departments and their functions in asset inventory, land conservation, land management.

Space, Air, Water
Cargo Freights
Commercial Flights
Space Explorations
Satellite launches and maintenance.

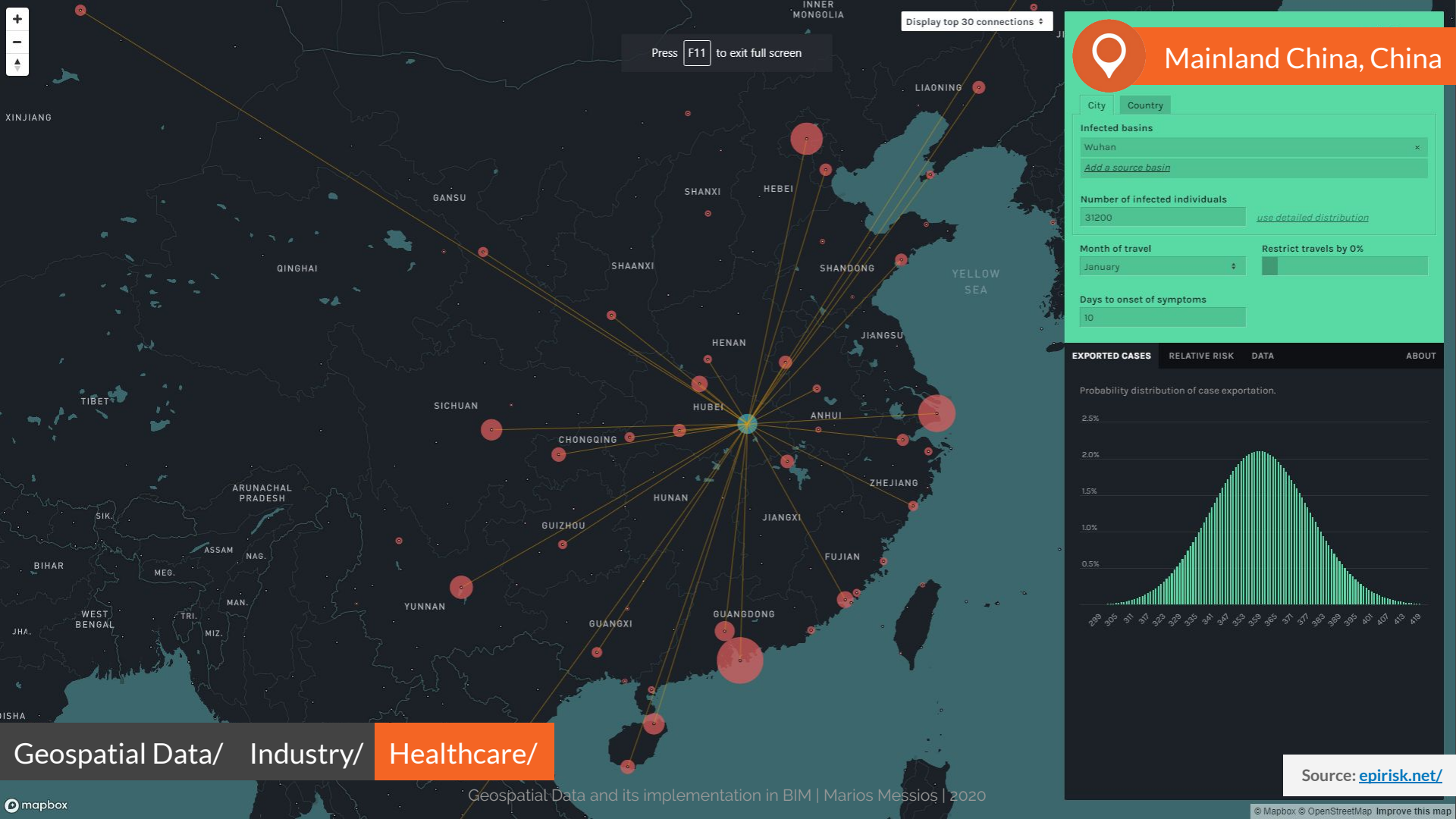
Public Works & Utilities
Public Works and Utilities, tracking water and stormwater drainage, electrical assets, engineering projects.

Geospatial Data/ Industry/ Other/

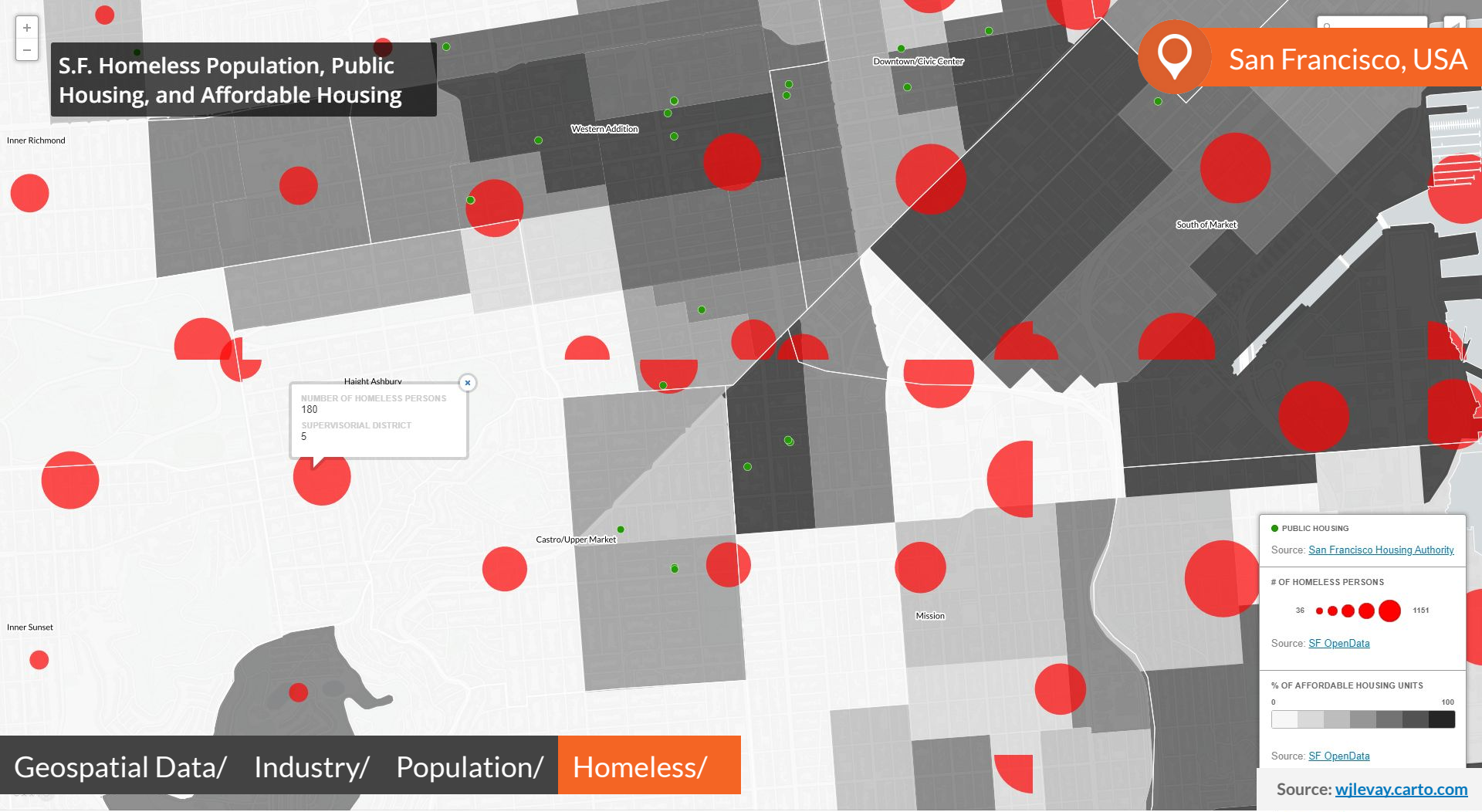
DESIGNS BY AUTHOR



Geospatial Data/ Industry/ Flights/

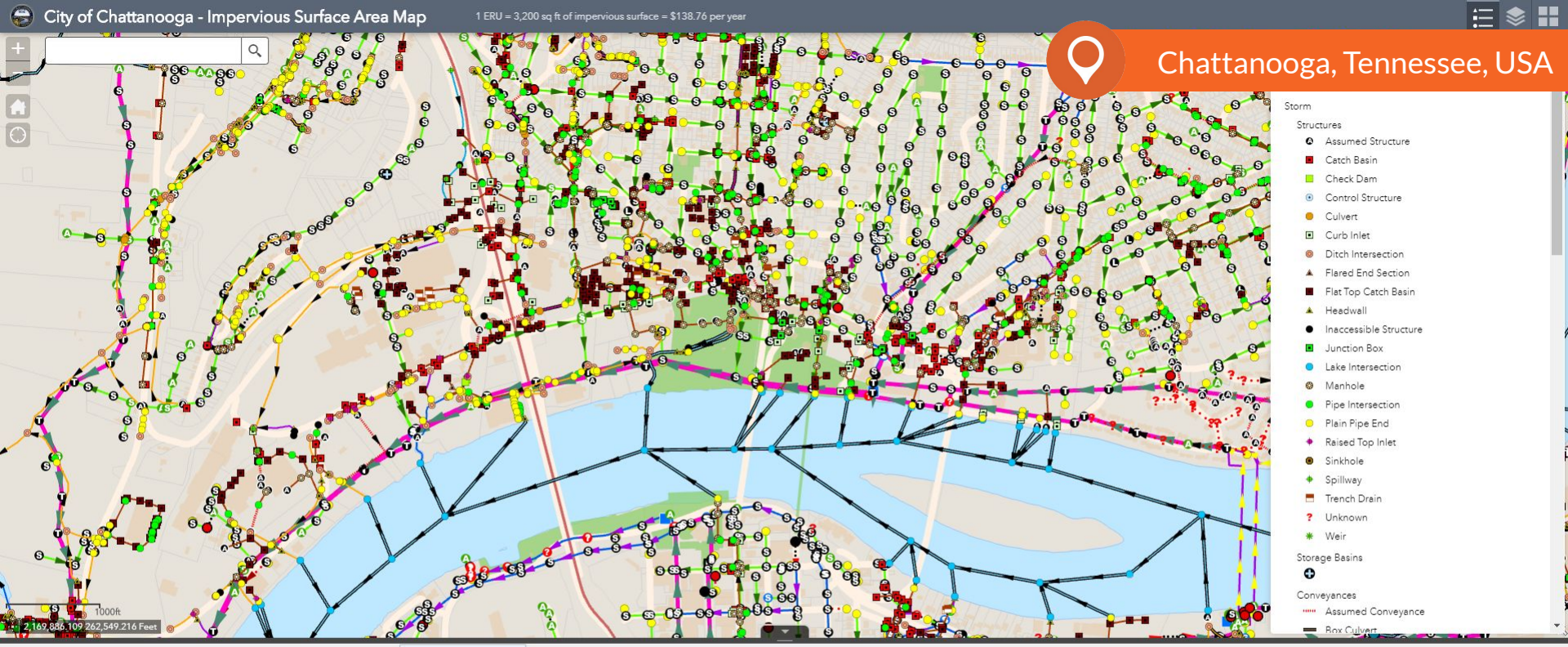


Geospatial Data/ Industry/ Healthcare/



Geospatial Data/ Industry/ Population/ Homeless/

Map created by Bill Levay



Structures | Storage Basins | Conveyances | Sewer Manholes | Sewer Control Valves | Sewer Network Structures | Sewer Pump Stations | Sewer Gravity Mains | Sewer Pressurized Mains | Impervious_Areas | Parcels

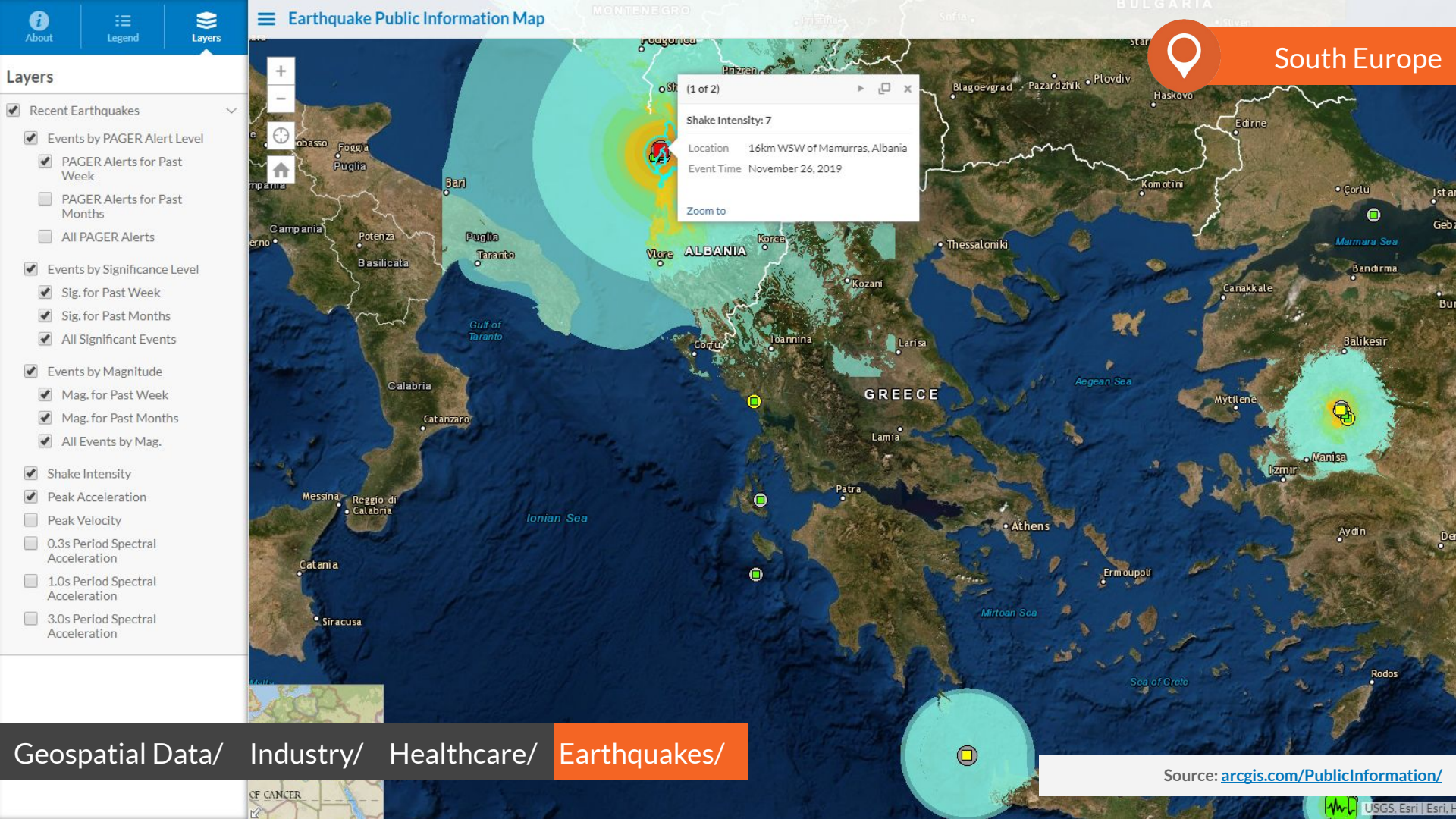
Options | Filter by map extent | Zoom to | Clear selection | Refresh

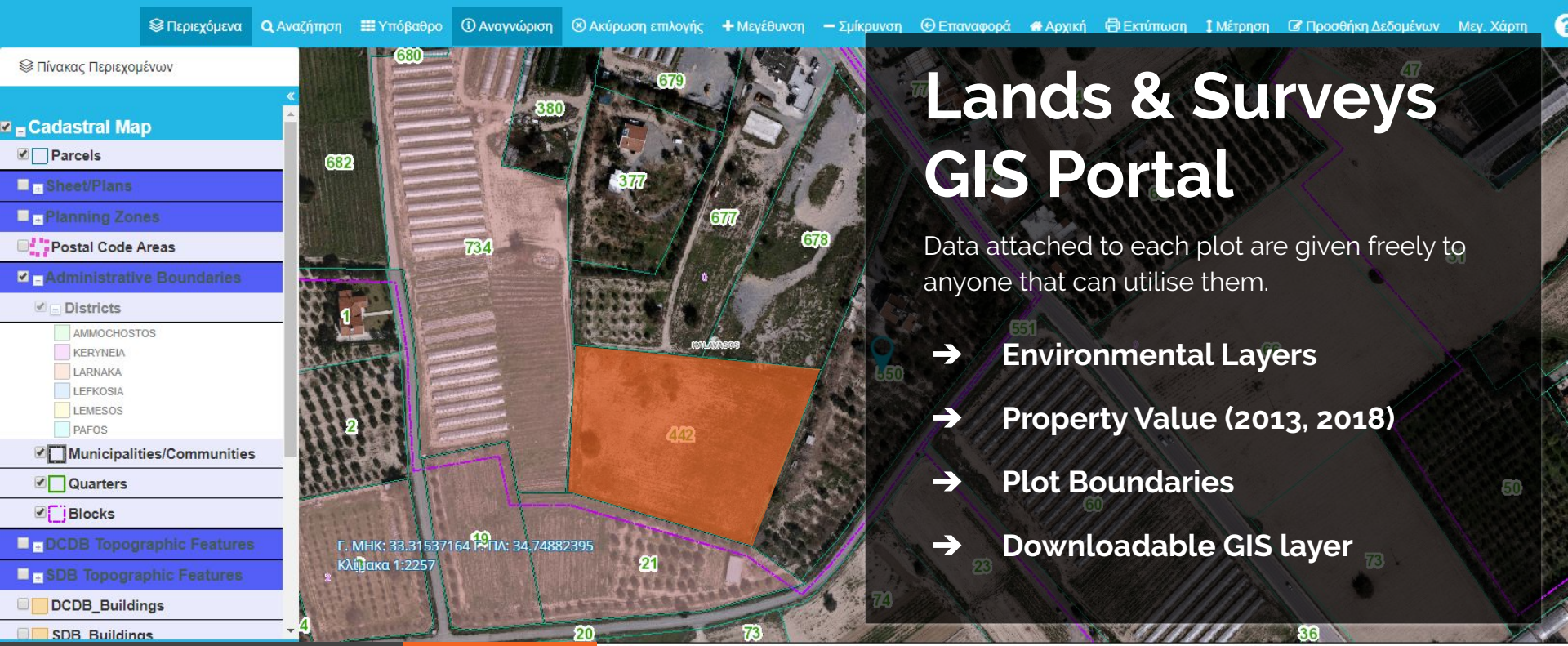
OBJECTID	Facility Identifier	Install Date	Location Description	Rotation	Name	Operational Date	Structure Type	Active Flag	Owned By	Managed By	Last Update Date	Last Editor	AncillaryRole	ADMINISTRATIVE	LEGACYID	LIFECYCLESTATU	WATERTYPE	ACCESSDIAM
3399	S136A332						Virtual Junction						None			Active	Sewage	
													None					

263 features 0 selected

Geospatial Data/ Industry/ Waste Management/

Source: pwgis.chattanooga.gov


About
Legend
Layers
Earthquake Public Information Map
South Europe
Layers
Recent Earthquakes
Events by PAGER Alert Level
PAGER Alerts for Past Week
PAGER Alerts for Past Months
All PAGER Alerts
Events by Significance Level
Sig. for Past Week
Sig. for Past Months
All Significant Events
Events by Magnitude
Mag. for Past Week
Mag. for Past Months
All Events by Mag.
Shake Intensity
Peak Acceleration
Peak Velocity
0.3s Period Spectral Acceleration
1.0s Period Spectral Acceleration
3.0s Period Spectral Acceleration
(1 of 2)
Shake Intensity: 7
Location 16km WSW of Mamurras, Albania
Event Time November 26, 2019
Zoom to
ALBANIA
GREECE
Gulf of Taranto
Ionian Sea
Aegean Sea
Marmara Sea
Mirtoan Sea
Sea of Crete
Bari
Foggia
Puglia
Taranto
Potenza
Basilicata
Campania
Calabria
Catanzaro
Messina
Reggio di Calabria
Catania
Siracusa
Vlore
Korce
Kozani
Thessaloniki
Corfu
Ioannina
Larisa
Lamia
Patra
Athens
Ermoupoli
Mytilene
Balikesir
Canakkale
Bandirma
Izmir
Manisa
Aydin
Rodos
Komotini
Haskovo
Plovdiv
Pazardzhik
Blagoevgrad
Edirne
Çorlu
Pristina
Prizren
Podgorica
MONTENEGRO
BULGARIA
Sofia
Geospatial Data/ Industry/ Healthcare/ Earthquakes/
Source: arcgis.com/PublicInformation/
USGS, Esri | Esri, H



Geospatial Data/ Industry/ Land/

Parcels | Cassini 1:5000 | Cassini 1:2500 | Districts | Municipalities/Communities | Quarters | Blocks

Α. ΓΕΝΙΚΕΣ ΠΛΗΡΟΦΟΡΙΕΣ ΤΕΜΑΧΙΟΥ:

ΕΠΑΡΧΙΑ	**ΛΑΡΝΑΚΑ**	ΕΜΒΑΔΟ ΤΕΜΑΧΙΟΥ (σε τ.μ)	11
ΔΗΜΟΣ/ΚΟΙΝΟΤΗΤΑ	**ΚΑΛΑΒΑΣΟΣ**	ΠΕΡΙΜΕΤΡΟΣ ΤΕΜΑΧΙΟΥ	
ΕΝΟΡΙΑ		ΑΞΙΑ 1.1.2018	
ΤΜΗΜΑ/ΑΡΙΘΜΟΣ ΕΓΓΡΑΦΗΣ	**0/19621**	ΑΞΙΑ 1.1.2013	

Source: pwgis.chattanooga.gov

Archeological Land

General Plot Information	
District	Larnaca
Municipality	Kalavasos
Plot Registration Number	0/19234
Total Area	11063 sqm
Plot Valuation (2018)	Eur 543,000.00
Plot Valuation (2013)	Eur 604,300.00
Building Zone	Z2
Building Permit Area	10%
Floors	2

Source: **Lands & Surveys Department of Cyprus**

Λύση: Ψηφιακός Χάρτης

ONEclickL.I.S.
Land Information System

Δυνατότητα έκδοσης διοικητικής πράξης δεσμευτικής για τις ΘΕΣΜΙΚΕΣ ΓΡΑΜΜΕΣ, τους όρους δόμησης και τις χρήσεις γης

Δυνατότητα έκδοσης ηλεκτρονικά ΑΔΕΙΑΣ μέσα από την ΗΛΕΚΤΡΟΝΙΚΗ ΠΛΑΤΦΟΡΜΑ του, η οποία είναι ήδη έτοιμη να λειτουργήσει!

Πληροφορίες από Ψηφιακό Χάρτη

- Όροι Δόμησης
- Χρήσεις Γης
- Ρυμοτομική και Οικοδομική Γραμμή /Όριο οικισμού
- Εκτάσεις Δασικής Προστασίας (Δάση, Δασικές και Αναδασωτέες εκτάσεις)
- Αρχαιολογικοί Χώροι και Ζώνες
- Αιγιαλός (αιγιαλός, παραλία, παλαιός αιγιαλός)
- Όρια Ιδιοκτησίας - Κτηματολόγιο
- Προστατευόμενες Περιοχές (Natura, ΚΑΖ, κ.λπ.)
- Όρια Υδατορεμάτων

Υφιστάμενη κατάσταση για την έκδοση Άδειας Δόμησης και Εκτιμώμενος Χρόνος

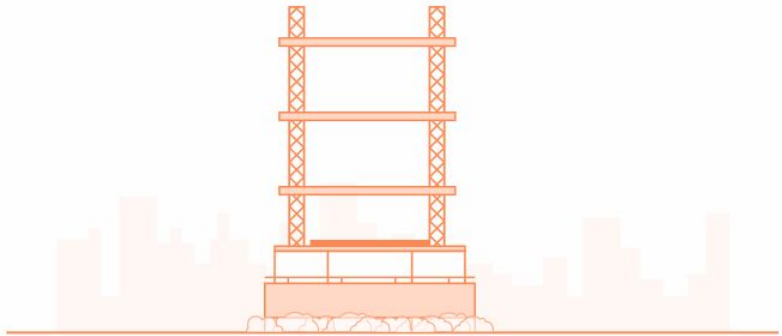
Κτηματογραφικό Απόσπασμα	1-5 ημέρες	Αρχαιολογία για έγκριση	2-12 μήνες
ΥΔΟΜ για Όρους Δόμησης, Οικοδομική και Ρυμοτομική Γραμμή, Χρήσεις γης	1-3 ημέρες	Τεχνική Υπηρεσία Δήμου για βεβαίωση Υψομέτρου (εντός σχεδίου)	3-15 ημέρες
Δασαρχείο για Βεβαίωση ότι το ακίνητο δεν είναι Δάσος ή Δασική Έκταση (εκτός σχεδίου)	1-12 μήνες	Συμβούλιο Αρχιτεκτονικής για έγκριση	1-3 μήνες

Υπηρεσία Δόμησης — 2-8 μήνες

- Με αλλαγή στις πολεοδομικές διατάξεις
  - Επανάληψη της διαδικασίας από την αρχή
  - Εγκατάλειψη της επένδυσης
- Χωρίς αλλαγές στις πολεοδομικές διατάξεις
  - Έκδοση άδειας σε συνολικά 5-30 μήνες

Source: TEE

Use of Geospatial Data in Design Construction Operations.



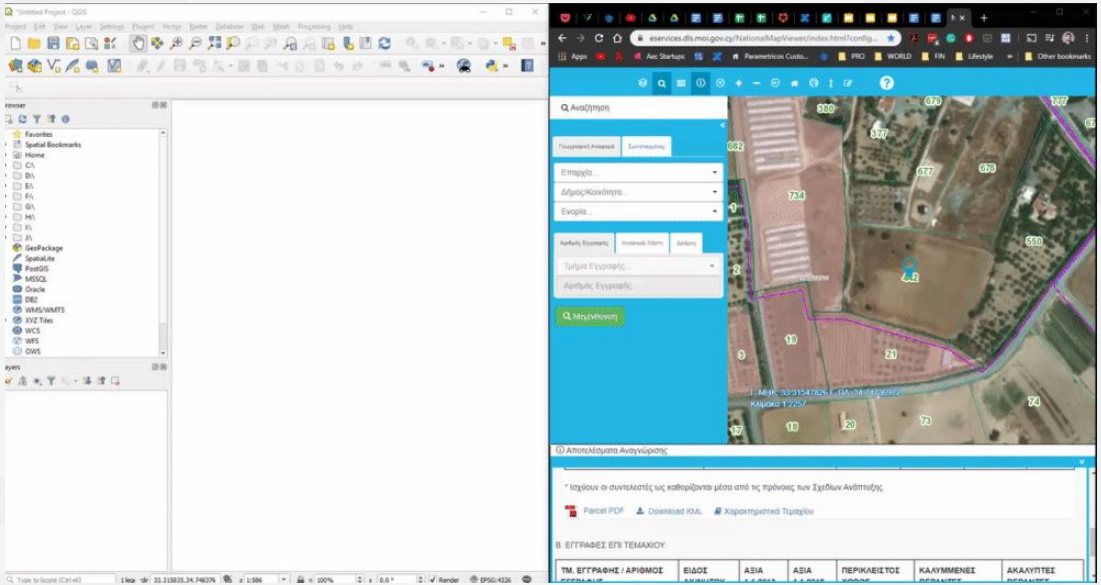
Geospatial Data/ Industry/ Architecture, Construction, Engineering/

Source: BIM 360

Visualise and understand the attributes of this Geospatial Data

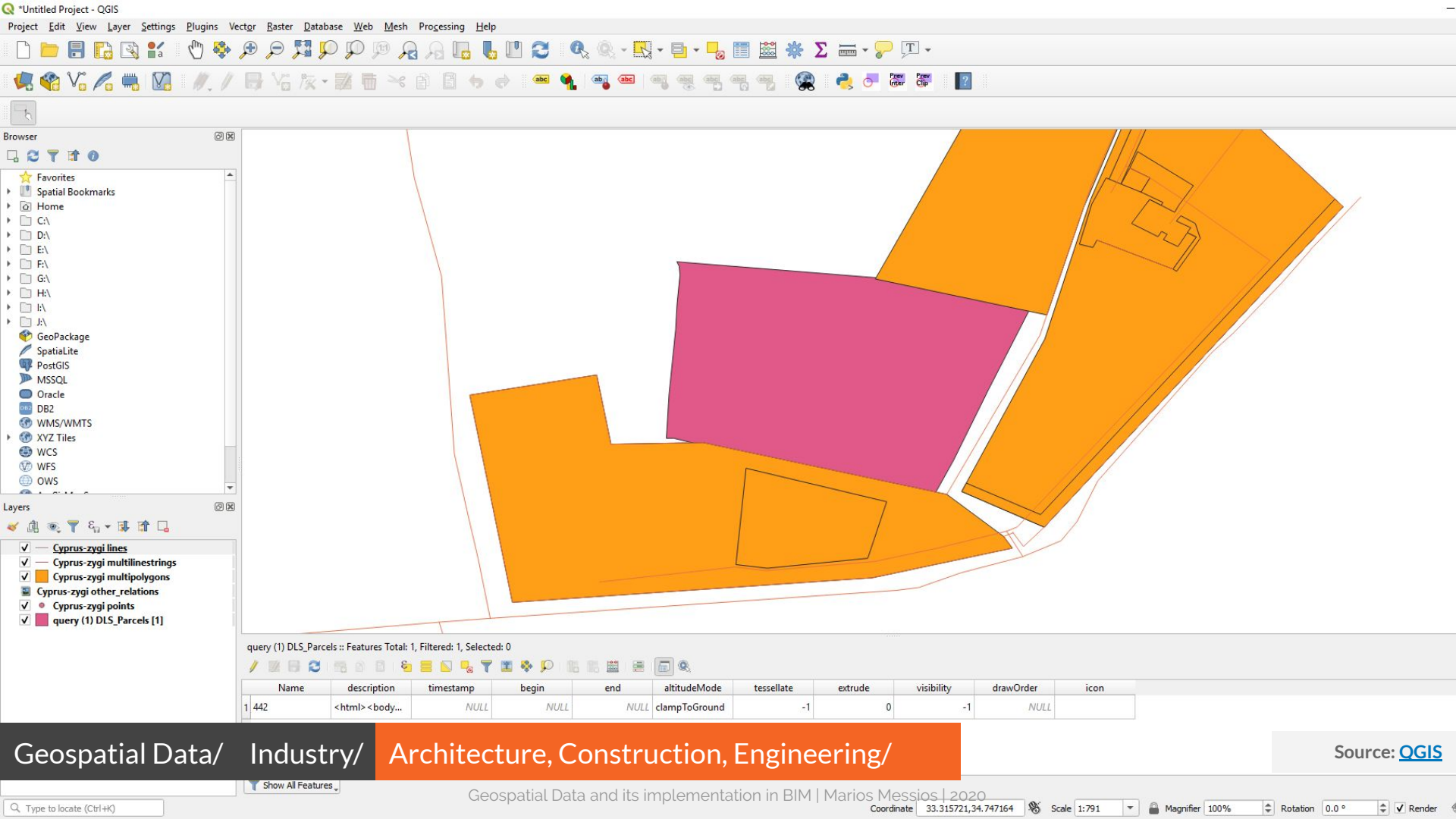
Plot Layer: Cyprus Lands & Surveys Department Plot no. 0/19234

Software: QGIS (Open)



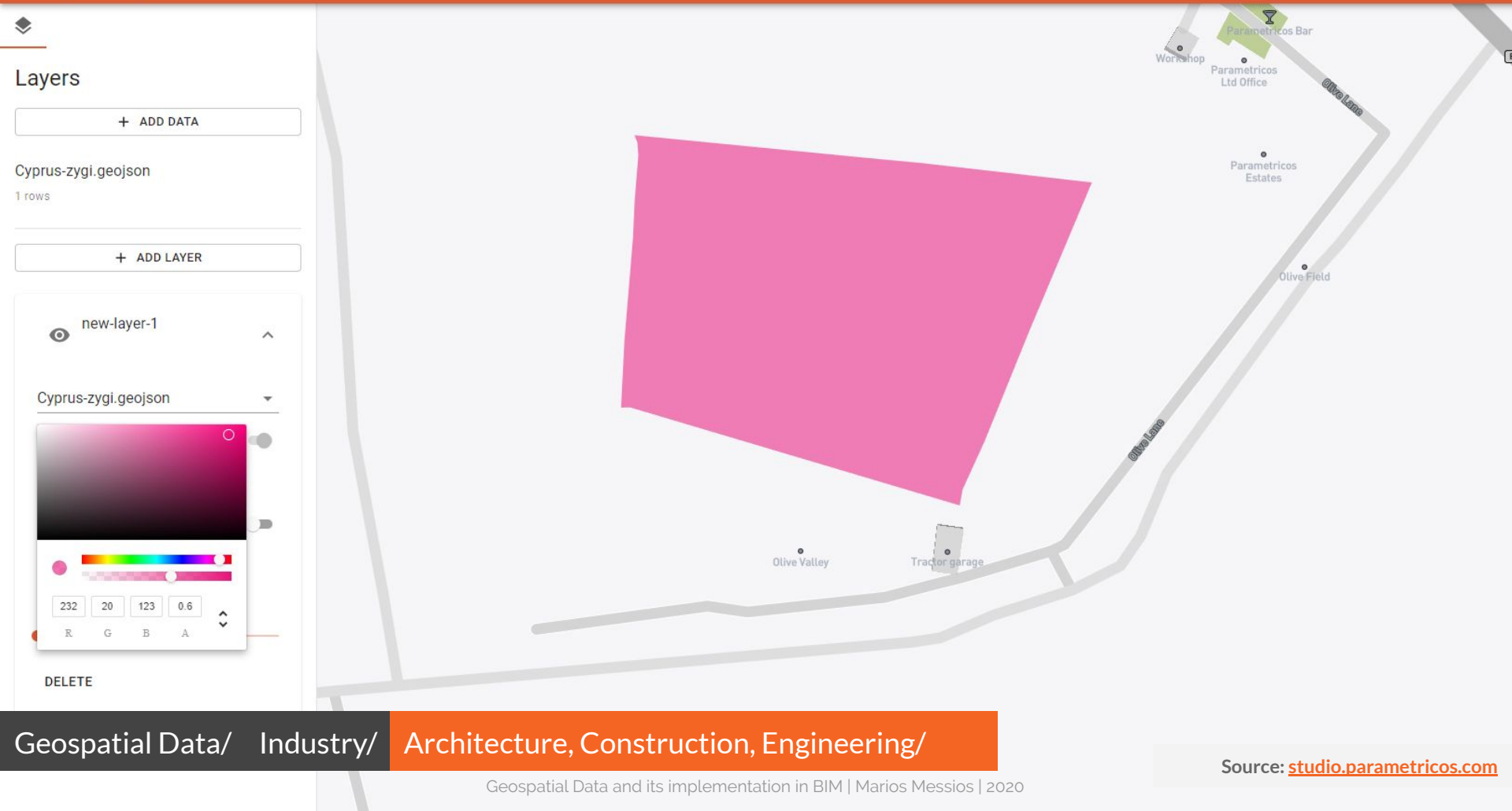
Geospatial Data/ Industry/ Architecture, Construction, Engineering/

Source: Lands & Surveys, Cyprus & QGIS



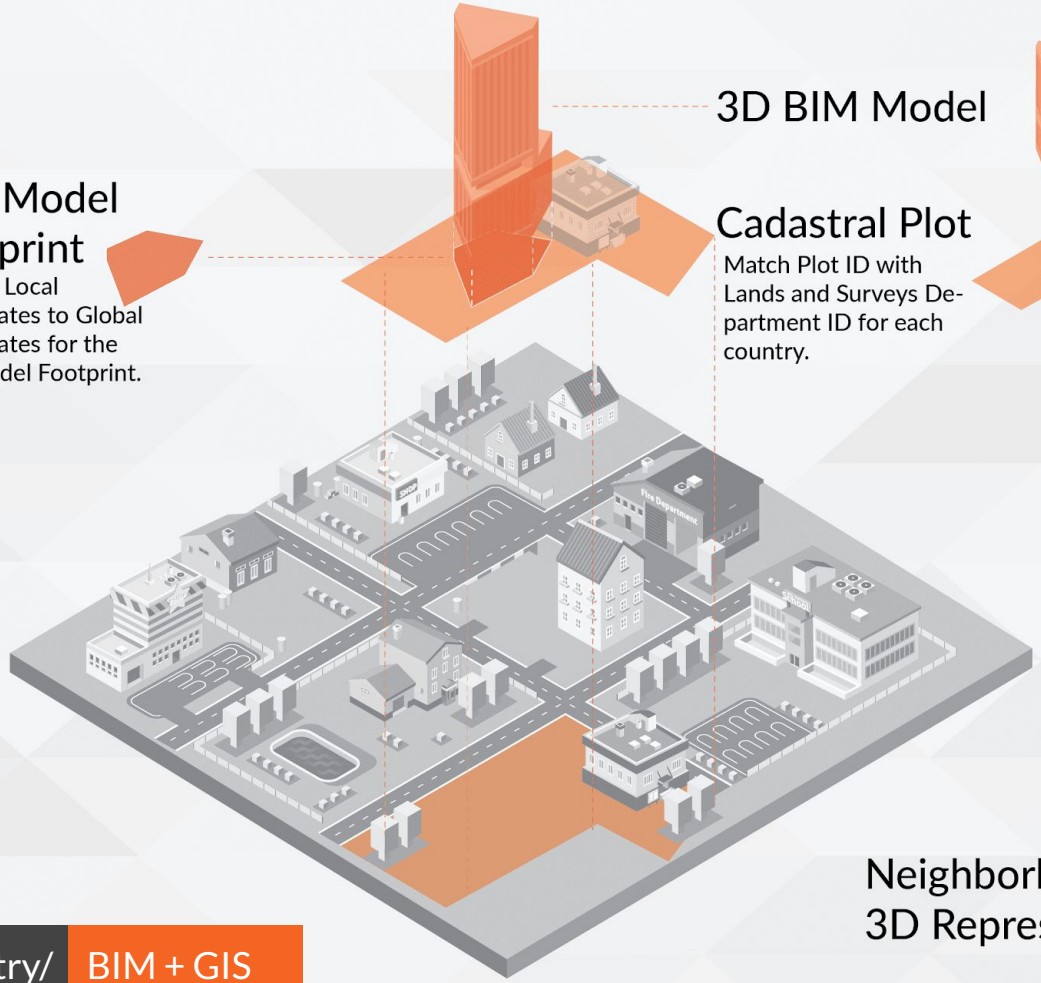
Geospatial Data/ Industry/ Architecture, Construction, Engineering/

Source: QGIS



Geospatial Data/ Industry/ Architecture, Construction, Engineering/

Source: studio.parametricos.com



Geospatial Data/ Industry/ BIM + GIS

IFC Project Location with IFC SITE

3D BIM Project

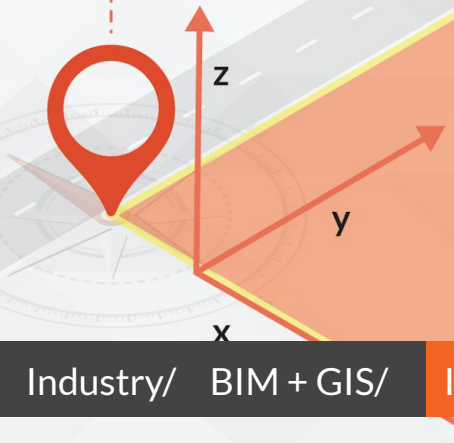
```
>/ IFCSITE('1wXMFLzpz04OagliOwH2Oo',#41,'Default',$,'',#2165346,$,$,.ELEMENT.,
  (34,41,20,754089),(33,3,58,114929),0.,$,$);
```

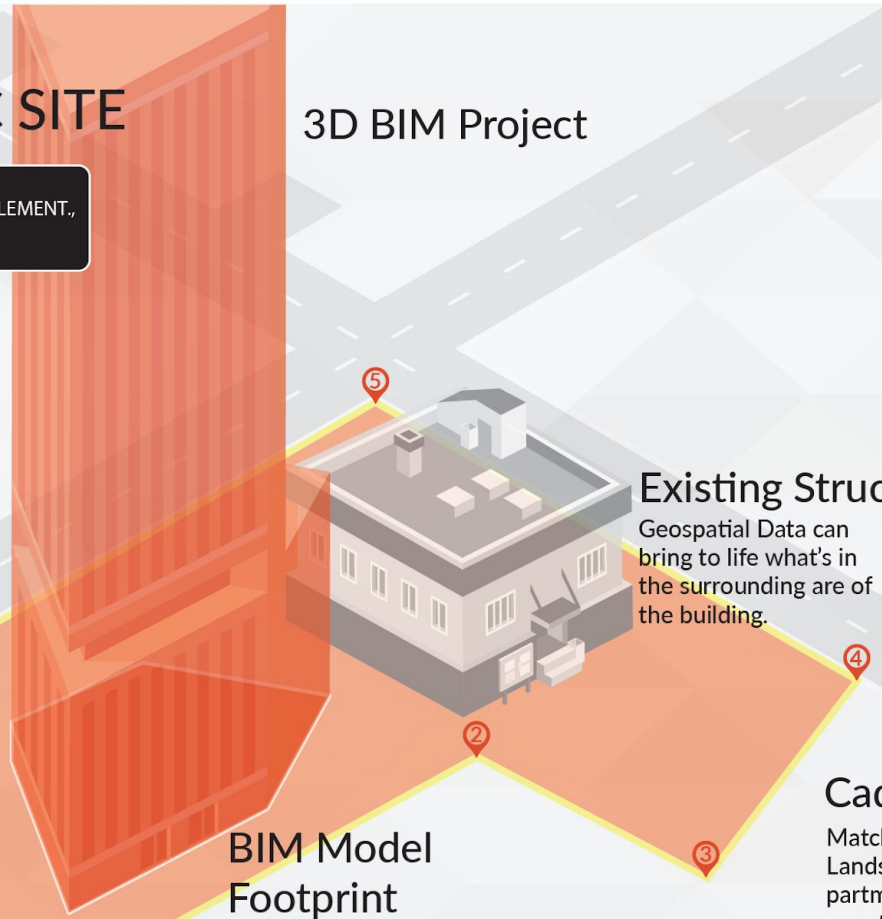
34	41	20,754089	33	3	58,114929
Degrees, Minutes, Seconds			Degrees, Minutes, Seconds		

Elevation
0 m

Geographic Coordinate System
WGS84

Origin Point
Latitude
34.688889
Longitude
33.066111





Existing Structures

Geospatial Data can bring to life what's in the surrounding are of the building.

Cadastral Plot

Match Plot ID with Lands and Surveys Department ID for each country.

BIM Model Footprint

Convert Local Coordinates to Global Coordinates for the BIM Model Footprint.

Geospatial Data/ Industry/ BIM + GIS/ IFC Site/

Studio | Cloud BIM+GIS

Powered by Parametricos

Project: NRB01 by XIV-Services
Andrea Zaimi, 3107 Limassol, Cyprus
Latitude : 34.688889 | Longitude : 33.066111

Geospatial Data/ Industry/ **BIM + GIS**

3D BIM Model provided by:

XIV

Source: studio.parametricos.com

Studio

Geospatial Map Studio | Cloud BIM+GIS

Geospatial Data/ Industry/ BIM + GIS

Rhino 3D

Grasshopper

VisualARQ: Flexible BIM

Kangaroo Physics (Interactive Simulations, Optimisations)

Heron by Esri (GIS Data)

Human UI (User Interface)

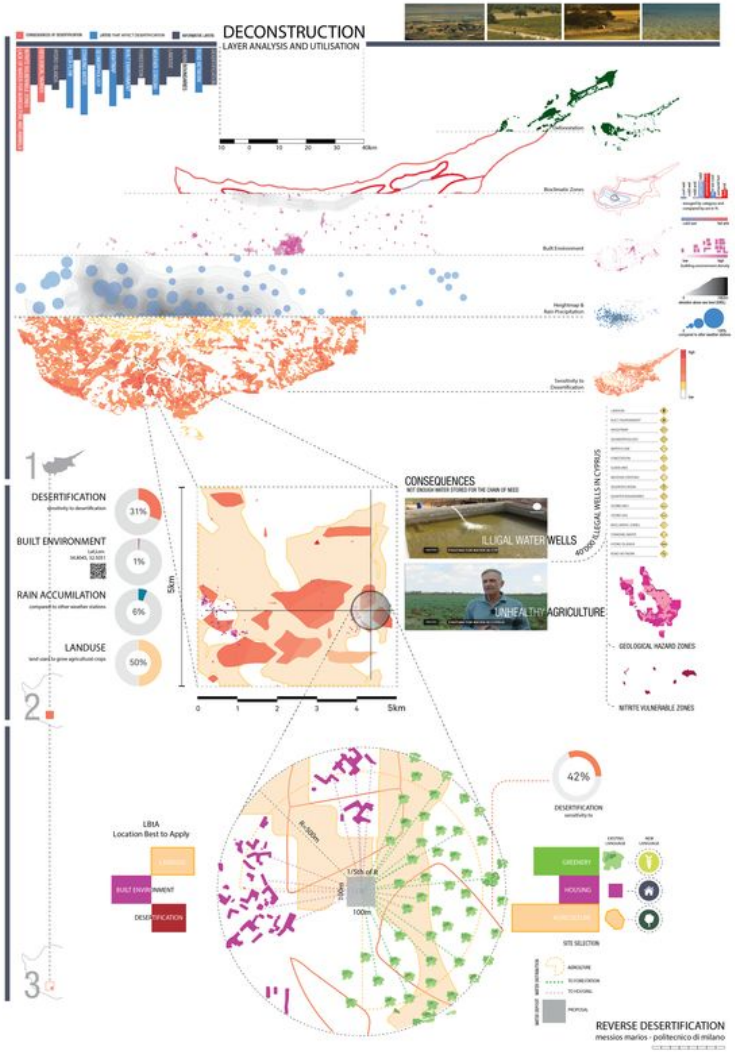
Karamba 3D (Structural Simulations)

13 more tools & plugins & custom code.

Geospatial Data/ Industry/ BIM + GIS

#1 Desertification

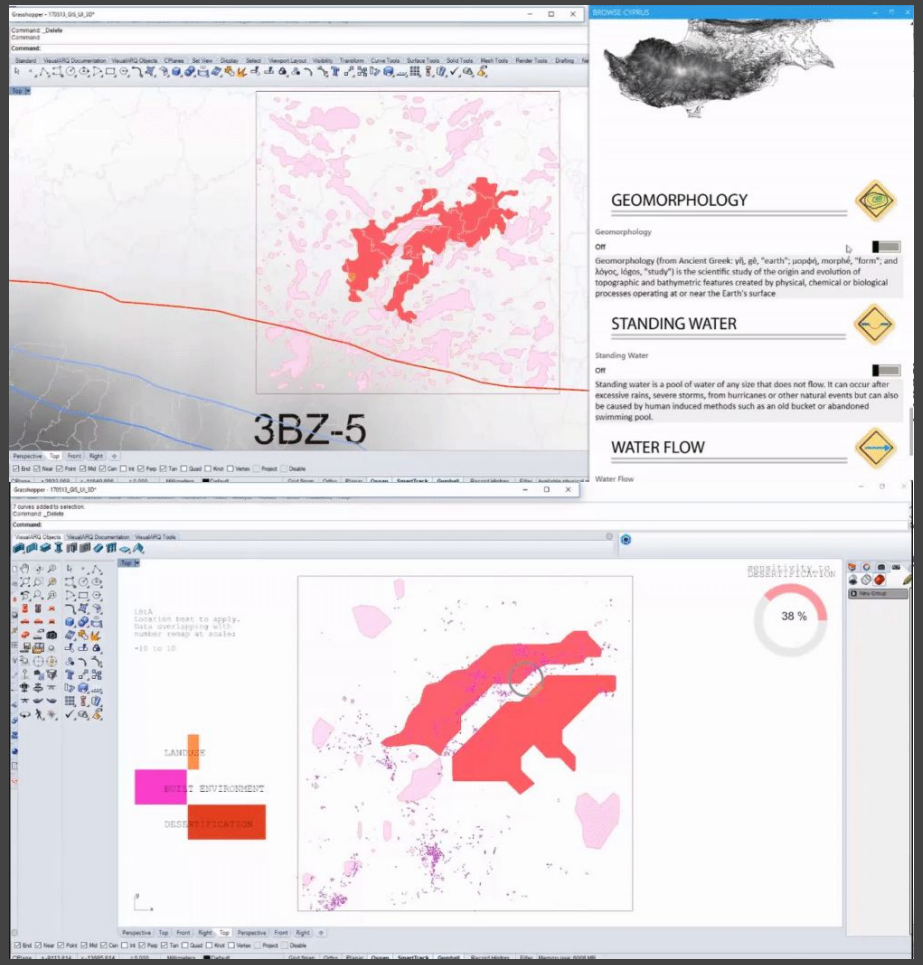
Cyprus



Parametric BIM 3D design with Geospatial Data

- ➔ High Rainwater Gathering
- ➔ Desertification Levels
- ➔ Housing Needs
- ➔ Bioclimatic Zones

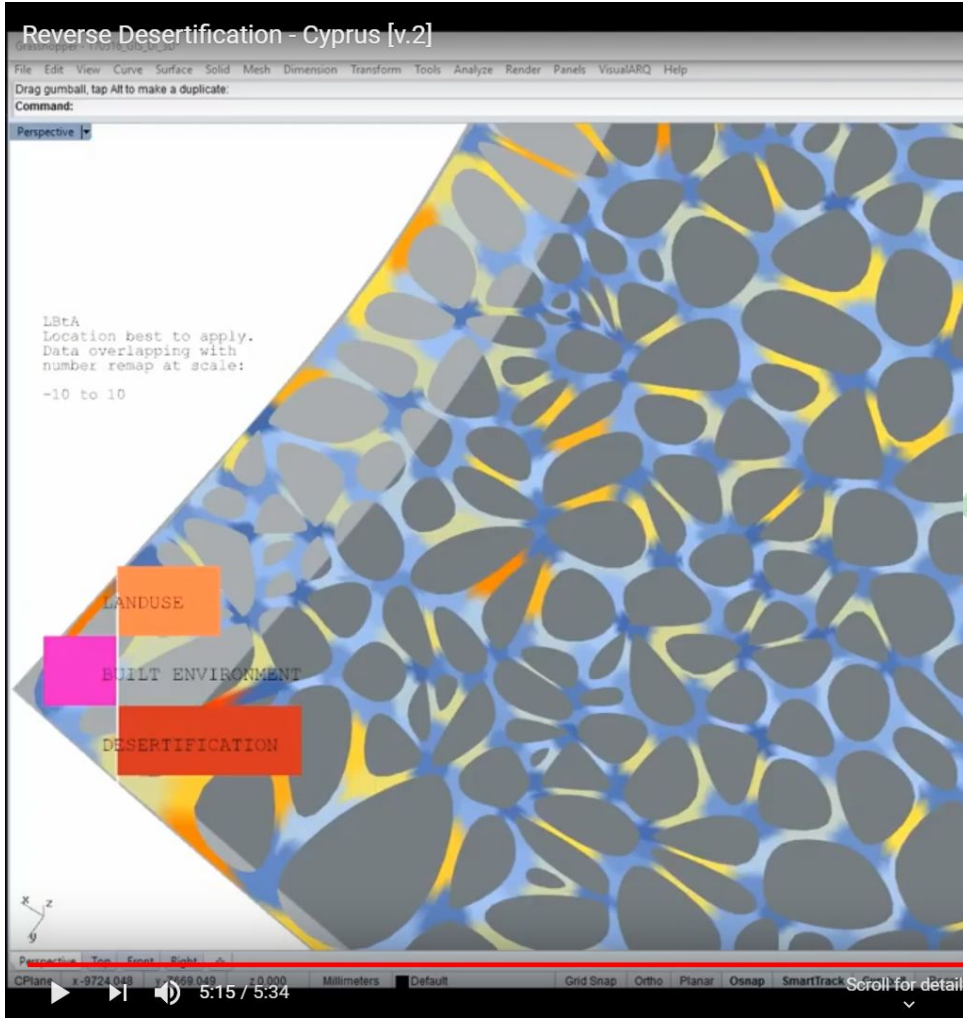
Source: [Reverse Desertification]



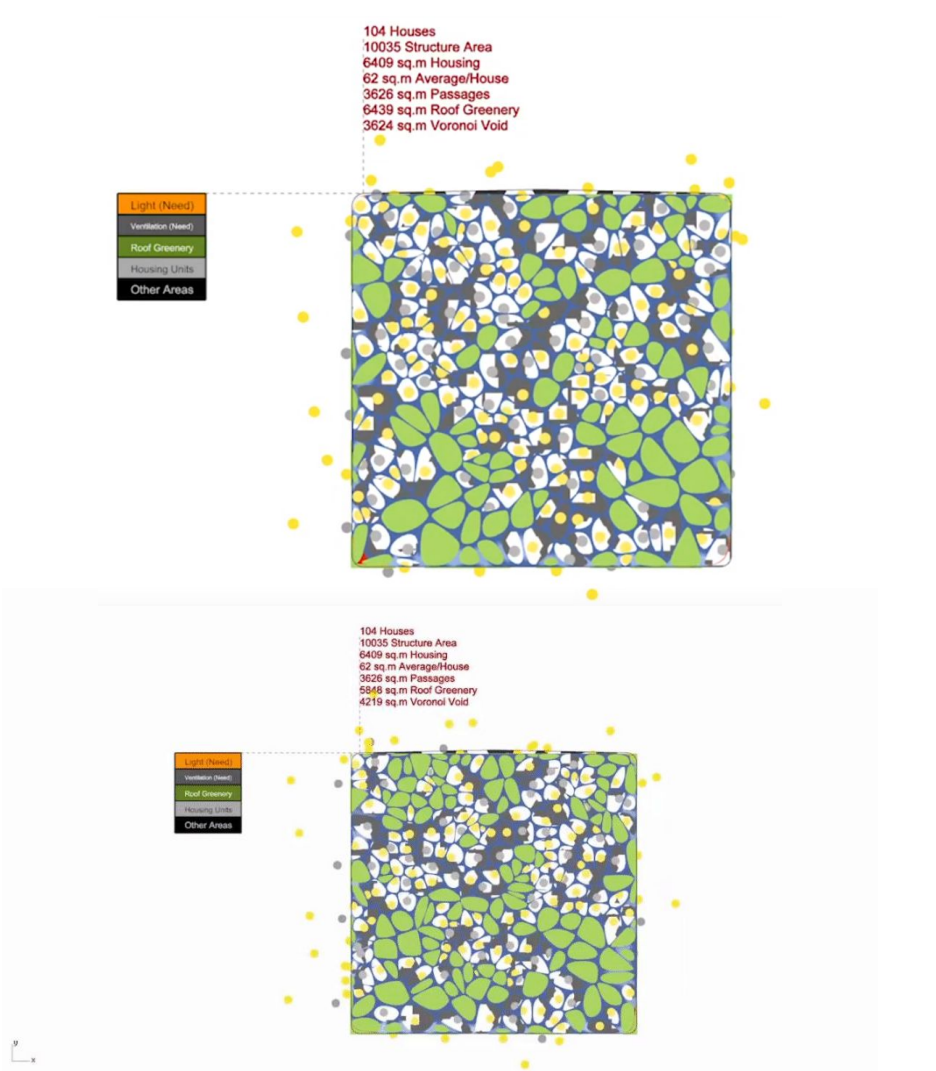
Overlapping GIS layers in Rhino to identify affected areas and narrow down location.

Optimising specific location finding with setting parameters. (Land use, Built Environment, Desertification)

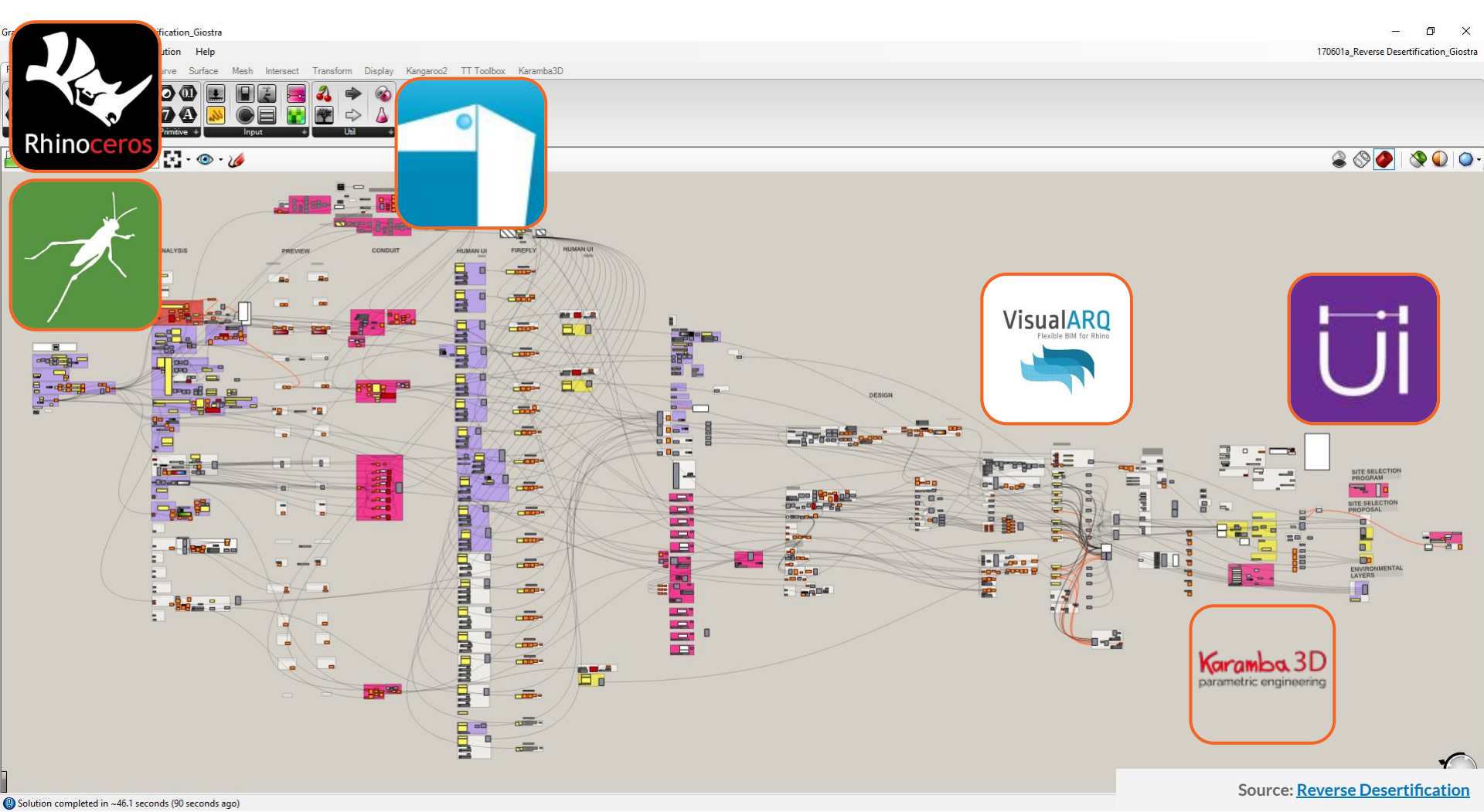
Source: [Reverse Desertification]



Source: Reverse Desertification



Source: [Reverse Desertification]



Source: [Reverse Desertification]

#2 3D City

What the BIM am I doing?

Game Engines with IFC format interoperability.

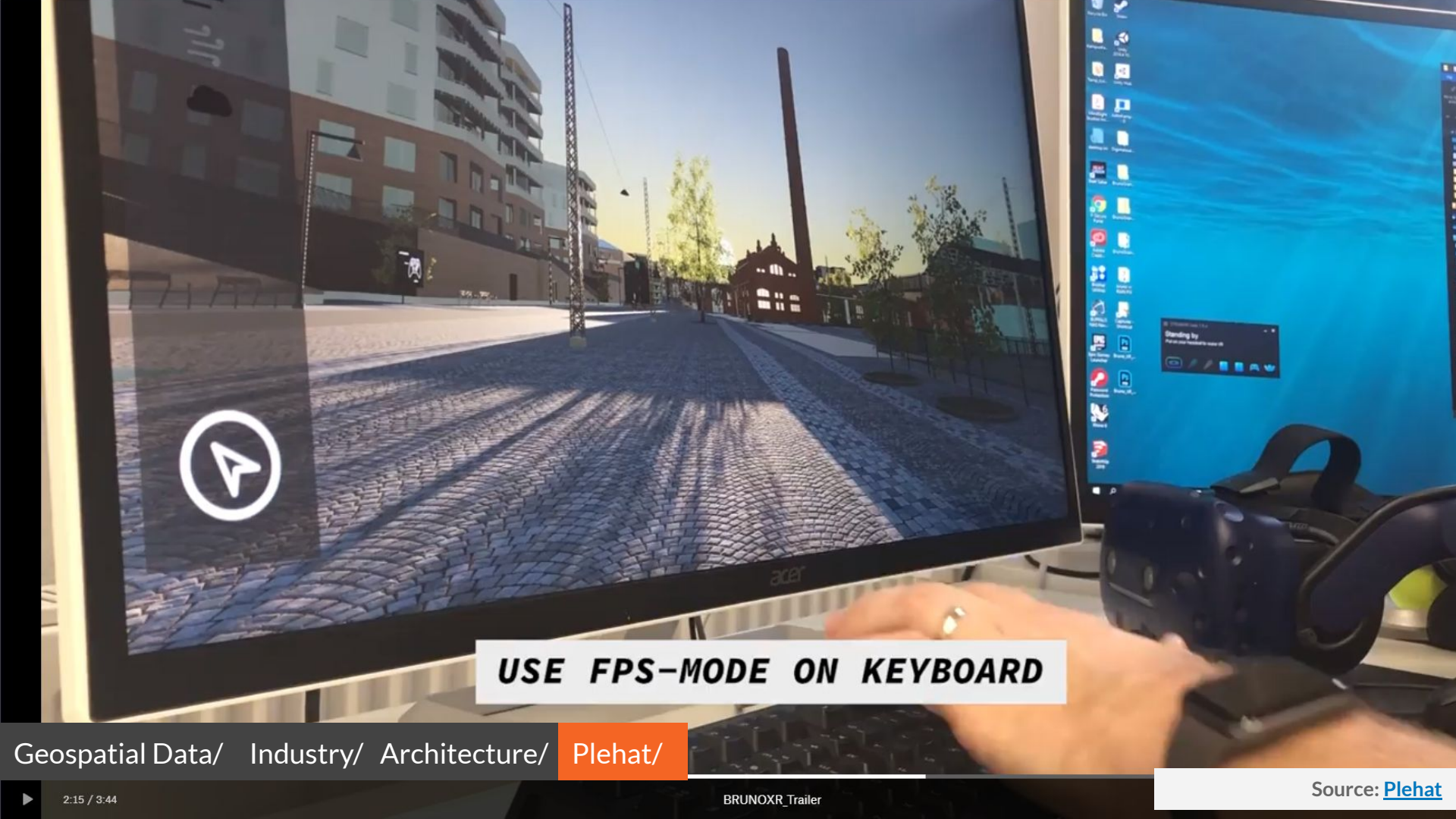
There are solutions to visualise large geometric files with city scale projects such as game engines with IFC interoperability.

- ➔ **Plehat (Unity)**
- ➔ **Unreal Engine**

Geospatial Data/ Industry/ Architecture/ City Scale/

Source: Plehat


2040
KESÄKUU
5
9 : 56
15 °C
RAUDUS-
KOIVU
HAIHDUTUS
VÄLTETYT
HULEVEDET
1,0 m³
/vuosi
HIILI-
VARASTO
2238 kg
IMEYTYMINEN
PISARAVIIVYTYS
HIILEN
SITOMINEN
35,1 kg
/ vuosi
4 x
METSÄ-
VAHTERA
GET ECOSYSTEMSERVICE INFORMATION
BRUNOXR_Trailer
Geospatial Data/
Industry/
Architecture/
Plehat/
00:01:39
Source: Plehat



Geospatial Data/ Industry/ Architecture/ Plehat/

2:15 / 3:44

BRUNOXR_Trailer

Source: Plehat

3D Model without textures

(+ Filtered by Energy Efficiency)

3D Model with textures

Accessible and Open 3D CityGML Model (LOD 2)

City scale model surveyed by the city of Helsinki empowers professionals.

- ➔ **Sparks creativity**
- ➔ **Benefits all stakeholders**
- ➔ **Limited design errors**
- ➔ **All professionals start with the same model.**
- ➔ **Empowers collaboration**

Geospatial Data/ Industry/ Architecture/ Helsinki City Model/

Source: Helsinki Climate and Energy Atlas

Construction
BIM + GIS Applications

Integration of BIM and GIS in construction projects on-site and off-site.

- ➔ **Visualise and locate what's underground, so that mistakes are avoided.**
- ➔ **Construction Management can track delivered materials and prefabricated elements on-site.**
- ➔ **Safety in construction**

Geospatial Data/ Industry/ Architecture/ Underground/

Source: Autodesk

Facility & Asset Management Applications

Integration of BIM + GIS solutions that benefit in facility management and investments.

- ➔ **Managing digital assets**
- ➔ **Space Management** (Interior Spaces, Common Spaces, Parking, Airport Runways, Shops etc.)
- ➔ **Investments** (Commercial Analytics, Real Estate Ana., Population, Transportation, Market Values etc.)

Geospatial Data/ Industry/ Architecture/ **Facility Management/**

Source: Esri

#3 Nagpur Metro

India

Nagpur Metro

Case Study #3

Transit system for the city of **Nagpur** in India was completed in **March 2019** at a total cost of **US $1.3 billion.**

Construction begun on May 2015 and project finished March 2019

Maharashtra

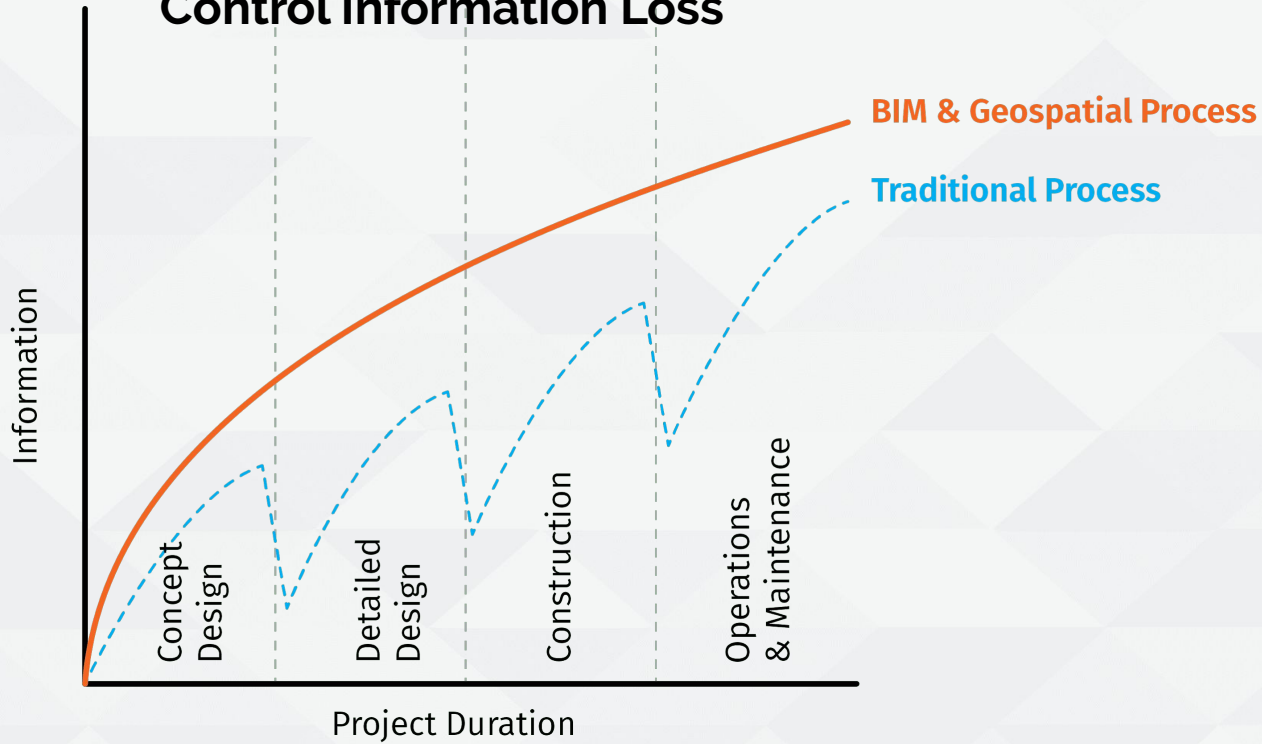
Metro Rail Corporation Limited

41 km

$1.3 billion.

Nagpur Metro

Control Information Loss



ORIGINATOR | LEVELS & LOCATIONS | ROLE | NUMBER | REVISION (Metadata)

SC1-SFT-V1-01-M3-A-30_10_30-0001-S1-P02

PROJECT | VOLUME OR SYSTEM | TYPE | CLASSIFICATION | SUITABILITY (Metadata)

Linked Assets: File Naming Convention

Bentley

Design & Geolocate 2D & 3D BIM

RIB running together

5D BIM Entreprise Solution

ORACLE PRIMAVERA P6

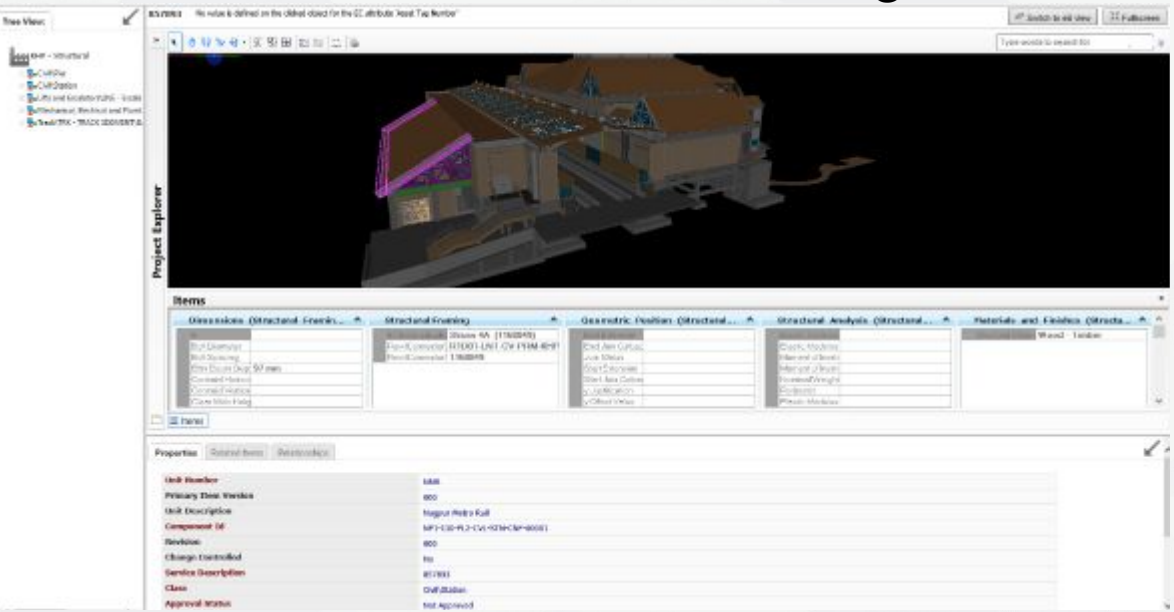
Schedule

Financial SAP

Design: Author

Nagpur Metro

Benefits in Design to Build



$400,000

Save from Plan, Design and Build.

20%

Reduction in operating manpower.

महा मेट्रो
NAGPUR METRO

Nagpur Metro

Benefits Long-term

The total savings over the lifetime of the project are estimated to exceed **US $225 million** i.e. over **17%** of the **total cost of the project.**

$225 million

for 25 years.

$75k

/ Month

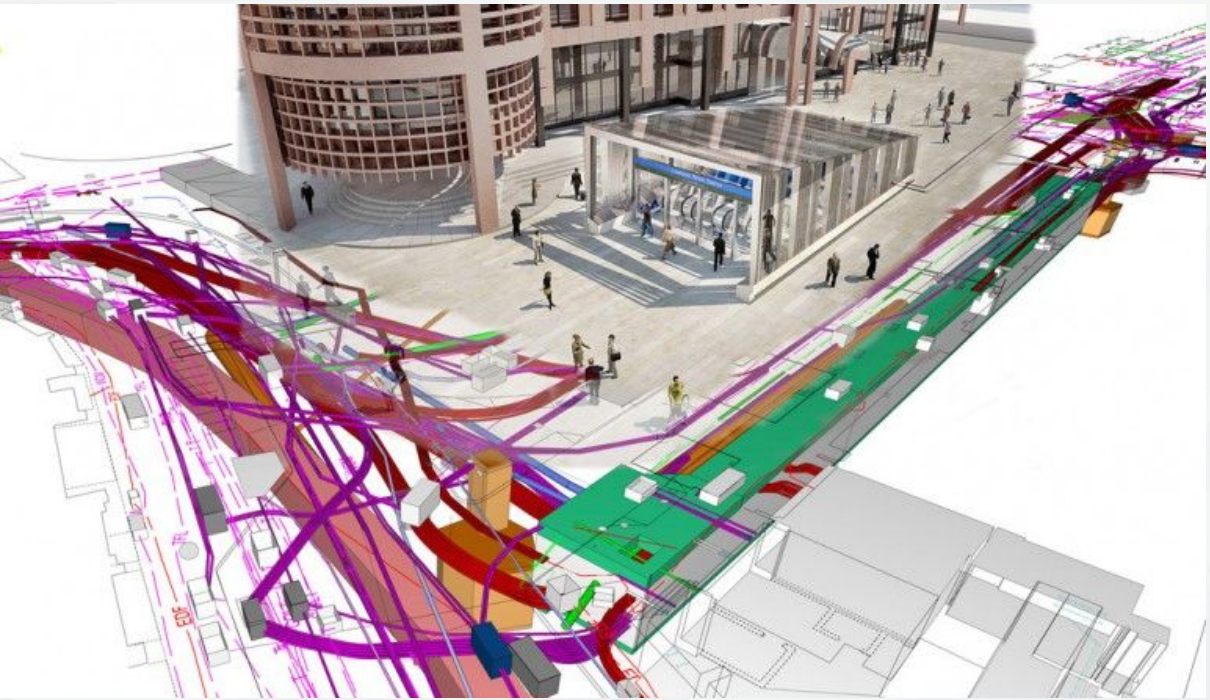
17%

Total Savings

#4 Crossrail London

Crossrail London

Case Study #4



London

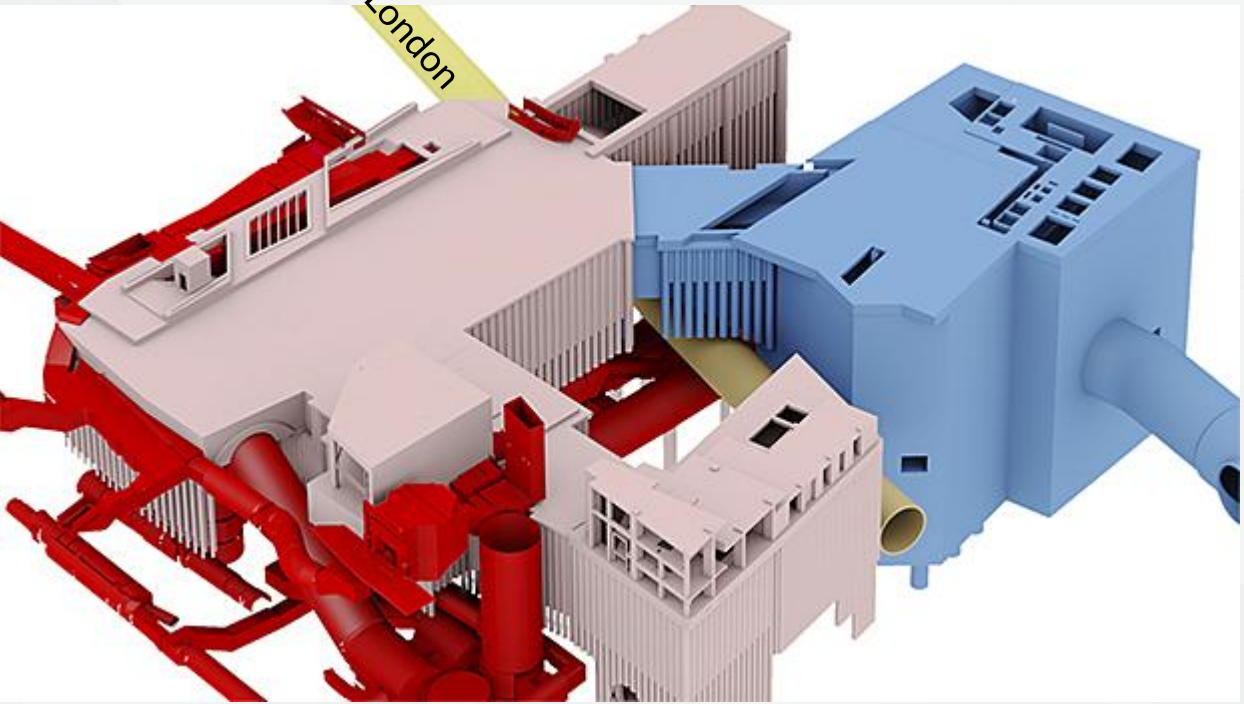
42 km

£14.8 billion Budget

Source: Crossrail London Company Ltd.

Crossrail London

Management



1

Centralised Database

25

Design Contracts

30

Construction Contracts

60

Logistics Main Works Contracts

Source:
Crossrail London Company Ltd.

Crossrail London

Assets & Management

1’000’000

CAD files created, approved and integrated within centralised information model.

Source:
Crossrail London Company Ltd.

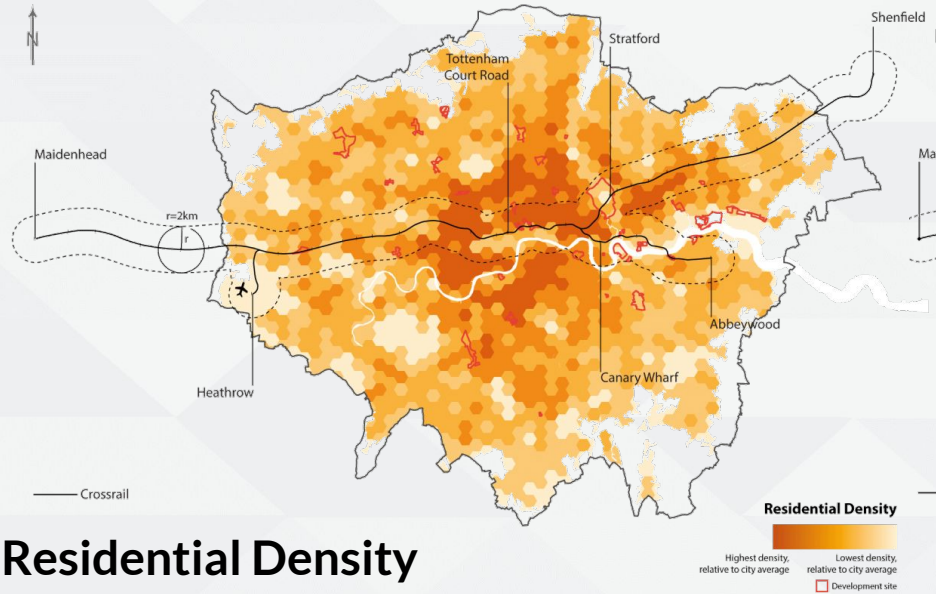
Crossrail London

Benefits

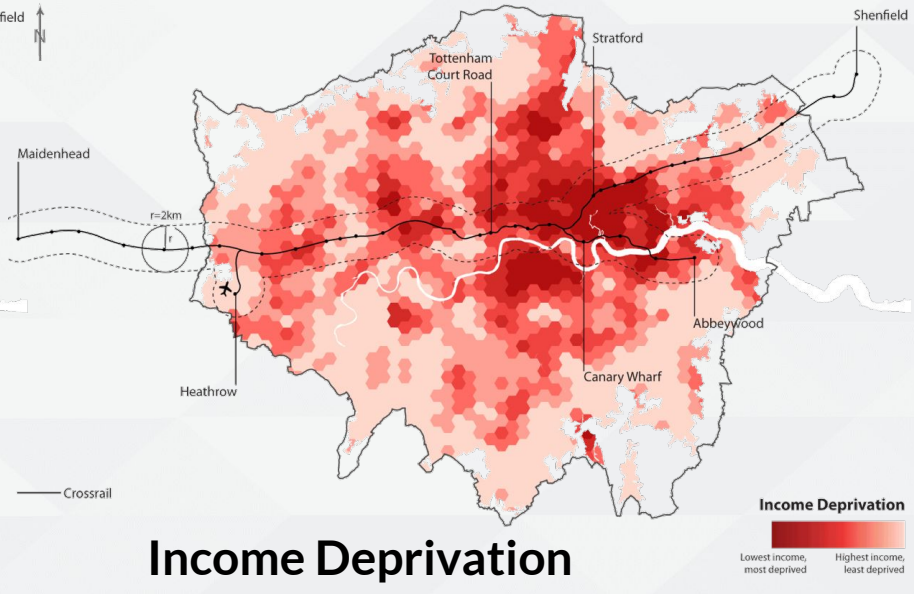
Source:
Designed by Author

Crossrail London

Transport & Social Equity



Residential Density



Income Deprivation

Source:
urbanage.lsecities.net

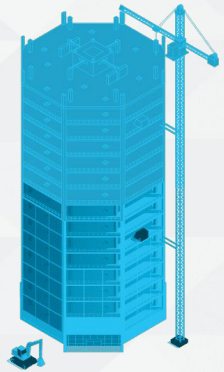
Gather & Reuse Data

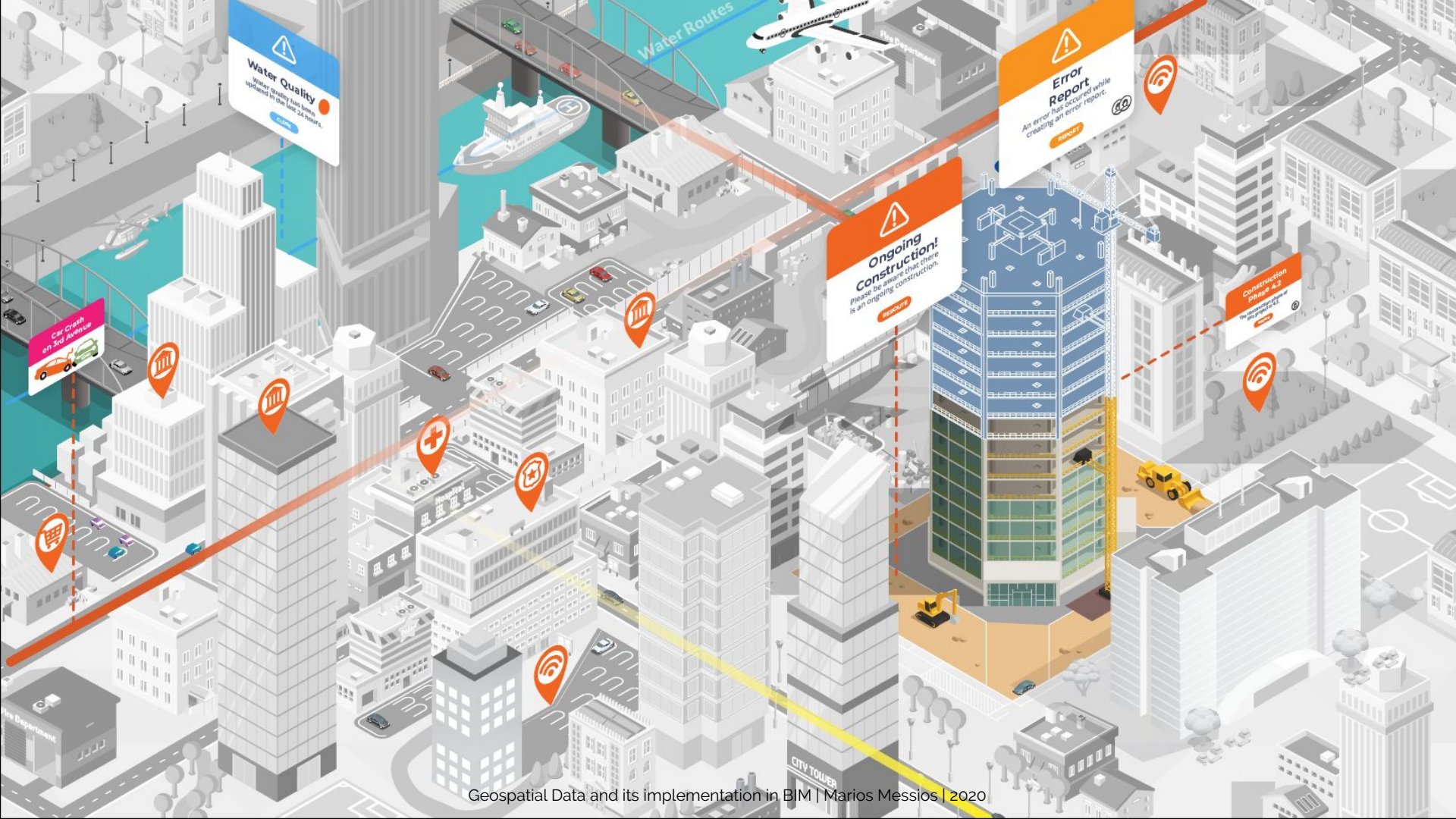
Design & Simulate

Smart Cities

Operations

Construct & Preserve




Water Quality
Water Routes
Error Report
An error has occured while creating an error report.
REPORT
Ongoing Construction!
Please be aware that there is an ongoing construction.
REROUTE
Car Crash on 3rd Avenue
Construction phase 4.2
Hospital
CITY TOWER


Water Quality
Car Crash on 3rd Avenue
Studio | Cloud BIM + GIS
4 Projects
34 Models
MAP | LIST
CREATE PROJECT
Search Projects
Project Types
All
City Tower Project Camera
Project / City Tower
Processed with no errors
13 Dec 2019
Marios Messios
Error Report
Download

Geospatial Data and its Implementation in Smart Cities.

Marios Messios
Architect, CEO & Co-Founder at Parametricos