Digital City – 3D City – Smart City. What's next?

Vilnius, 2016-10-18
Riga, 2016-10-19
Tallinn, 2016-10-20

Dr. Arūnas Urbšys
Projects Development Director, UAB „IN RE“

IN RE
Computer-Aided Engineering Services

What is Digital City?

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MINING
MineCycle
OpenPlant
AssetWise APM
Amulet
STAAD
promis•e
Bentley Map
Descartes
Acute3D
InRoads
GEOPAK
gINT
WATER & WASTEWATER
WaterGEMS
SewerGEMS
OpenPlant
AutoPLANT
STAAD
RAM
Engineered Support Modeler
gINT
OpenUtilities
Subsurface Utilities Engineering
CITIES
Bentley Map
Descartes
InRoads
AECOsim
GEOPAK
RM Bridge
LEAP Bridge
Subsurface Utilities Engineering
SITEOPS
NUCLEAR POWER
AutoPIPE
OpenPlant
STAAD
AssetWise APM
SITEOPS
CAMPUSES
Bentley Map
AECOsim
Descartes
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STAAD
GEOPAK
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SITEOPS
BRIDGES
RM Bridge
LEAP Bridge
InspectTech
SUPERLOAD
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PROCESS PLANTS
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OpenPlant
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AssetWise APM
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Acute3D
AutoPIPE
ProSteel
ConstructSim
OpenPlant
gINT
AssetWise APM
Acute3D
Digital City is
a set of information technologies,
that provide functionality,
required to manage data,
actions and processes, related
to City infrastructure
Bentley's 2014 Annual Report 15
New Products
BENTLEY'S PROJECT PLAYBOOKS
MicroStation | ProjectWise | AssetWise | Navigator
Mobile Apps
Bentley

Microsoft CityNext and Partners'

Solution Scenarios

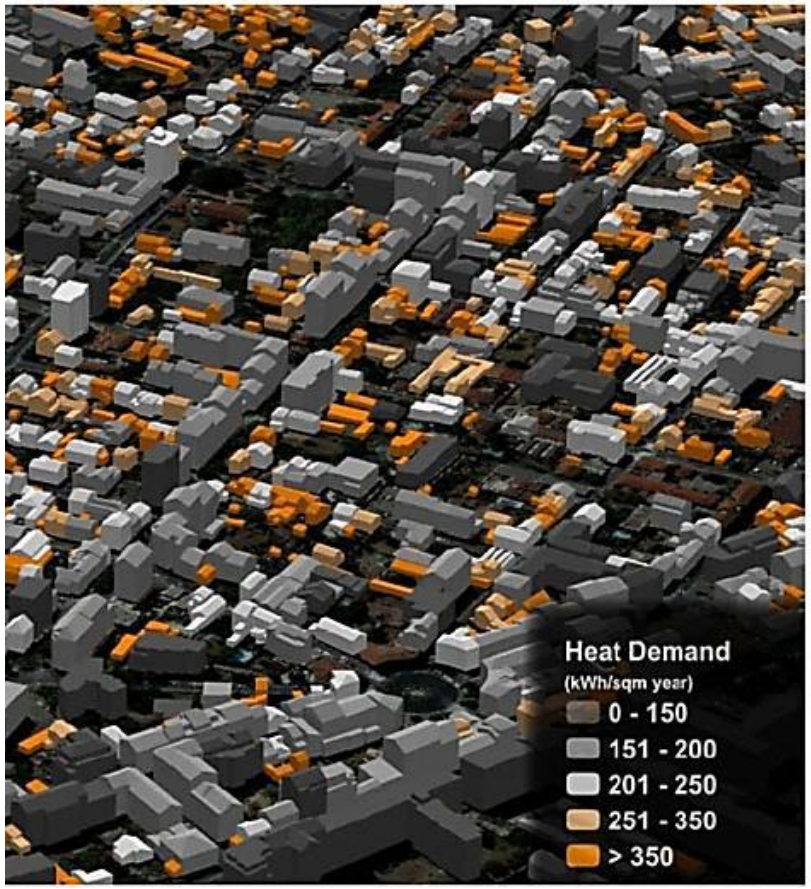
Digital Cities	**Government Admin**	• Tax & Revenue • Social Analytics • Document & Records Management	• Virtual Town Hall • Open Data • Citizen Service: Portals, Call Centers, & Apps	• City Financial Management • City Dashboard Grants Management	**Tourism, Recreation, Culture**	• Mobile Tourism Apps • Tourism portals • Destination management Systems
Safer Cities	**Public Safety & Justice**	• Neighborhood Management • Video Management	• Emergency Management • Intelligence and Analysis	• Court & Judicial Management • Prison & Offender Management		
Healthier Cities	**Health & Social Services**	• Population Health Management • Remote Care & Case Management	• Primary Care • Social Benefits & Administration	• Personal Health & Wellness • Pandemic Management		
Educated Cities	**Education**	• Devices, Mobility, & Apps for Learning • Education Analytics and Research	• School and Campus Administration • Learning Systems			
Sustainable Cities	**Transport**	• Traffic Management • Asset & Fleet Management • Toll & Fare Management • Transportation Safety • Operations Management • Parking Management	**Energy & Water** • Smart Grids • Energy Management & Analytics • Water & Wastewater Management • Carbon Management		**Buildings, Infrastructure, Planning** • Smart Buildings • Street Lighting • Waste Management • Parcel, Zoning, and Land Use	

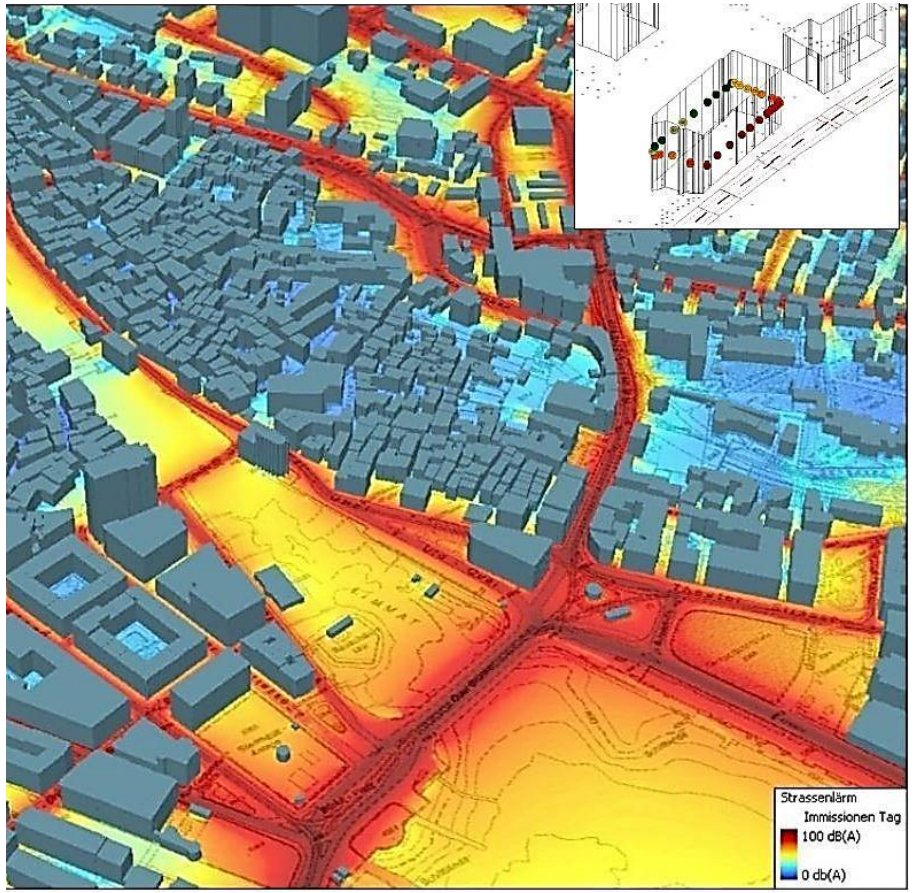
Trusted Cloud Platform Cloud + Productivity + Windows & Devices + Security & Privacy

Google, tell me, what is 3D+City+Virtual?

Digital Helsinki
Started ~2000

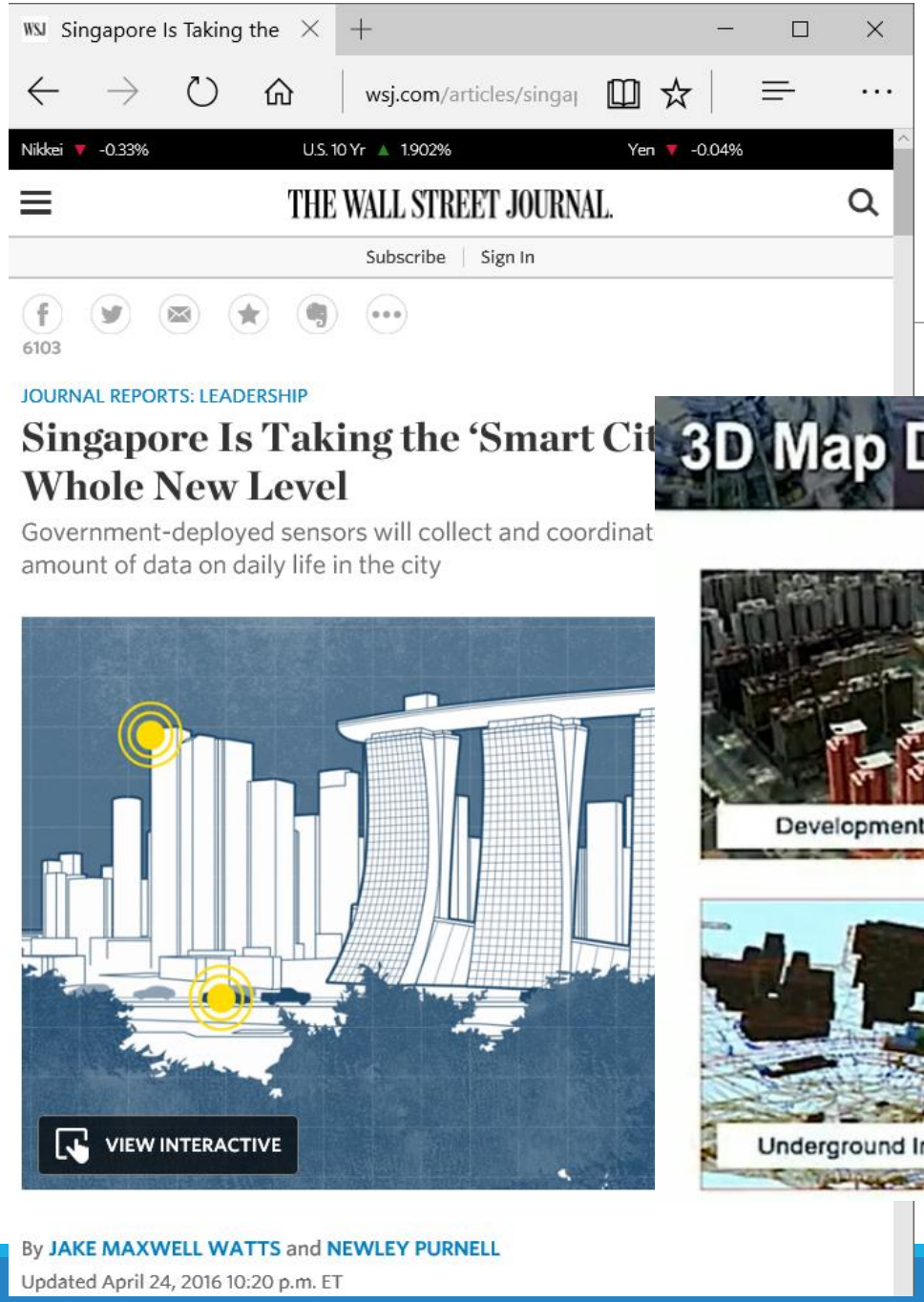
Digital Helsinki
Application areas



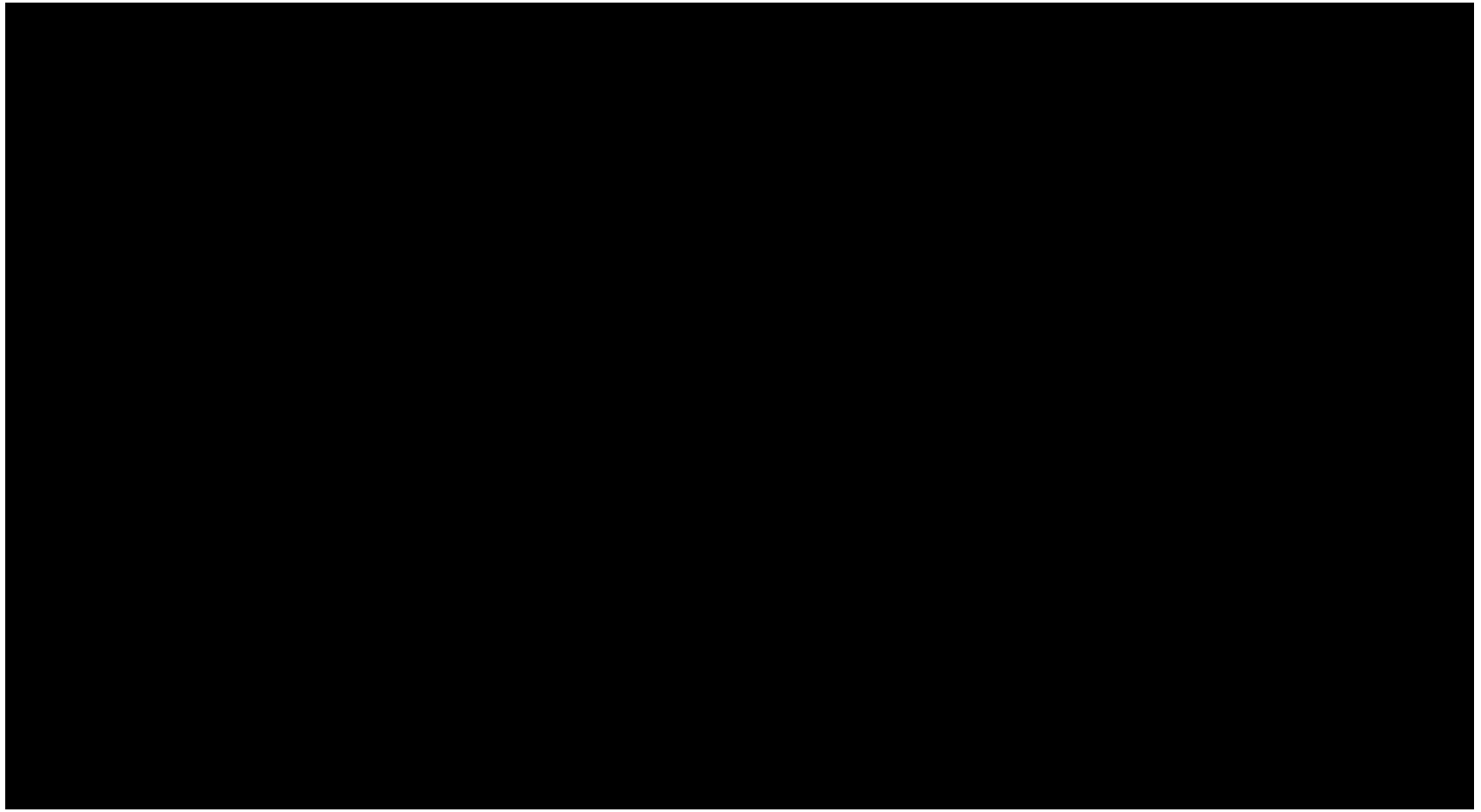


Digital Singapore (Started ~2014)

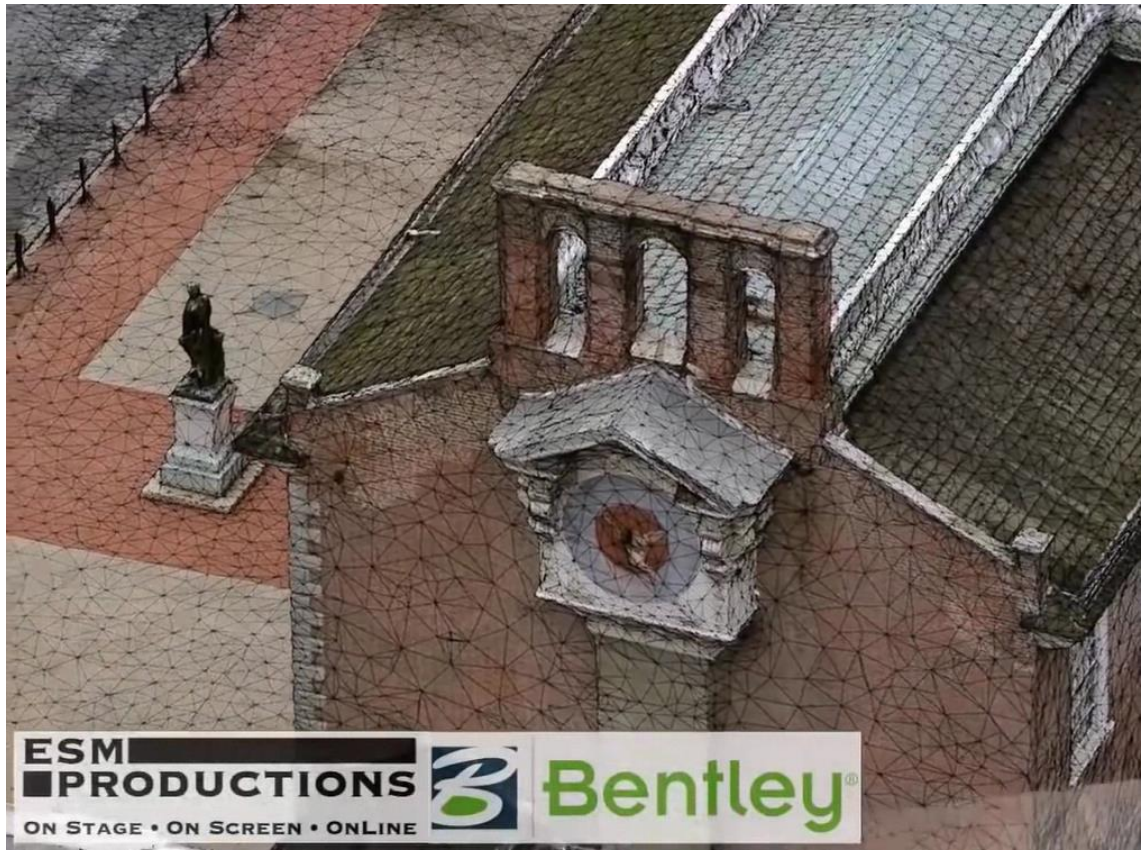
Digital Singapore

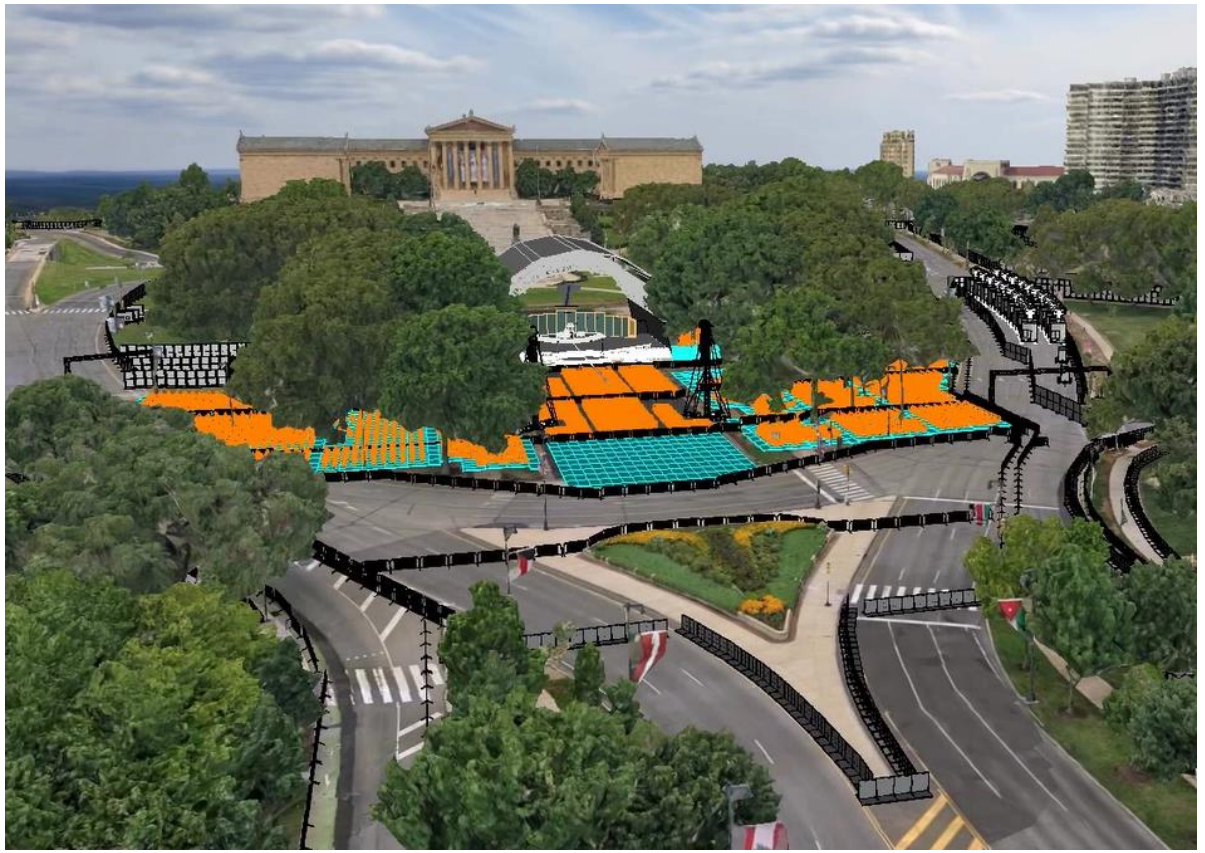


Digital Philadelphia (September 2015)



Digital Philadelphia



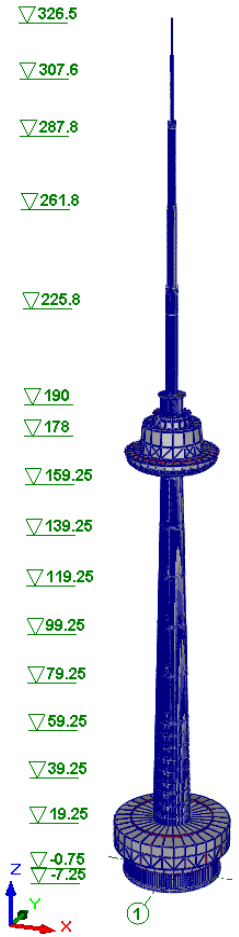


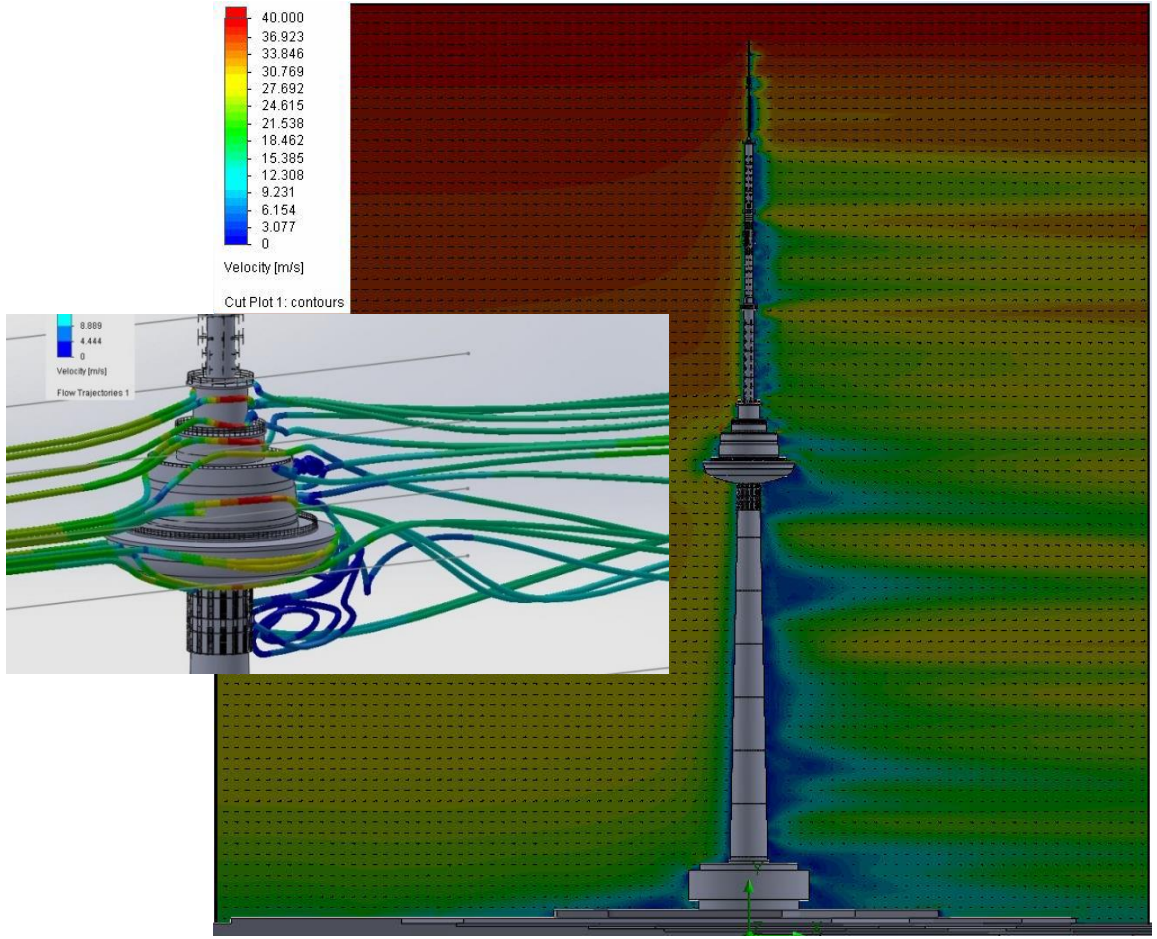
Why Digital Cities are appearing?

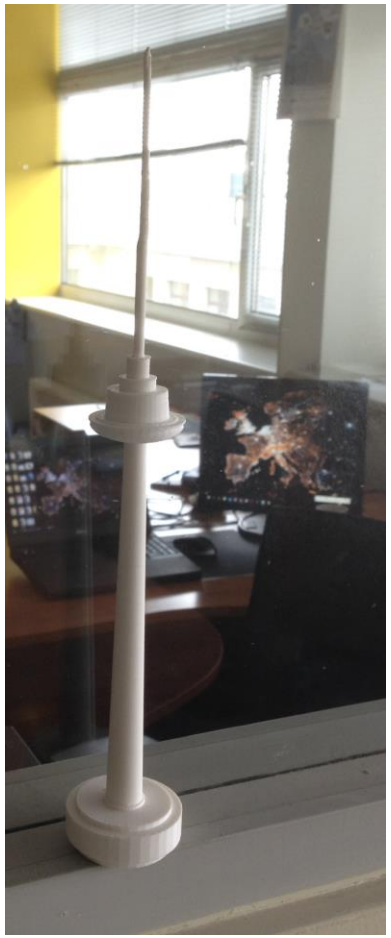
- The city wants a 3D model to use for GIS projects and communication
- They want to increase the frequency and level of details of the modeling at affordable cost what is not achievable by traditional methods (procedural lacks details and manual takes too long and is too expensive)
- The city has a project to publish models on a web portal either public (for citizens) and/or for professionals (contractors)
- Some cities just want their Central Business District to be reconstructed at very high resolution (Melbourne, Adelaide, Philadelphia…)
- Some others want their complete city + suburbs (+smaller villages in their vicinity) (Stockholm, Paris, Marseille…)

Digital Linköping
Digital Helsinki
Digital Stockholm
Digital Paris
Digital Luxembourg
Digital Graz
Digital Philadelphia
Digital Tokyo
Old Town of Jerusalem
Digital Singapore
Digital Melbourne
Digital Adelaide

How about Digital Vilnius?

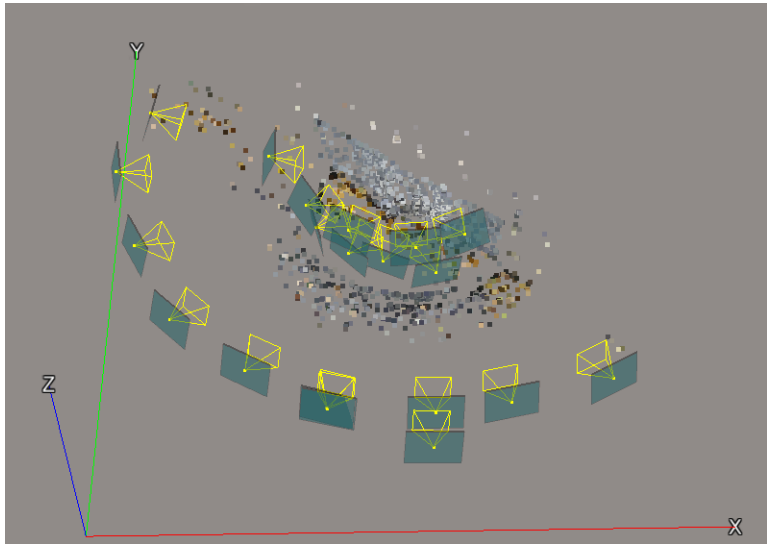


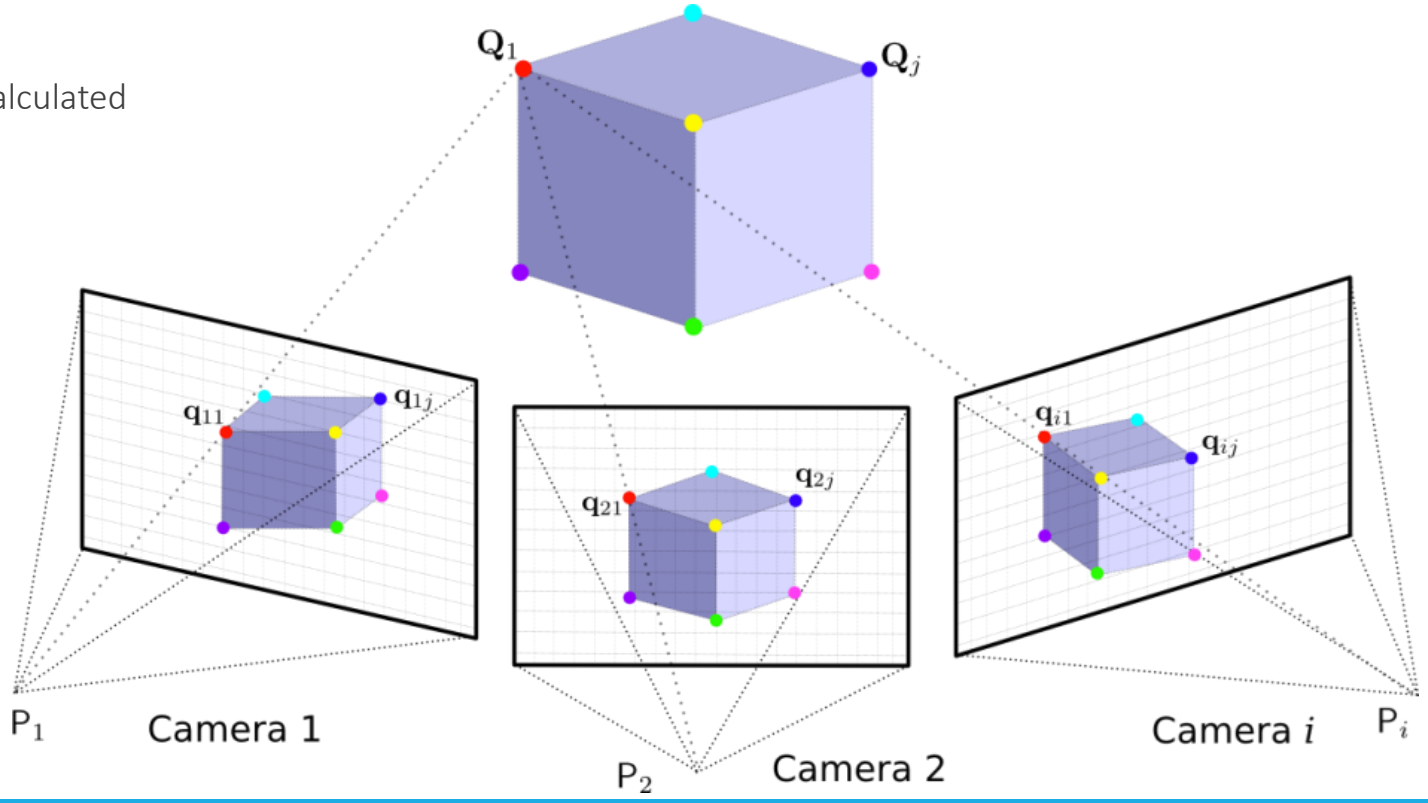




Solution for Digital Philadelphia
Automatic Aero Triangulation (Magic)

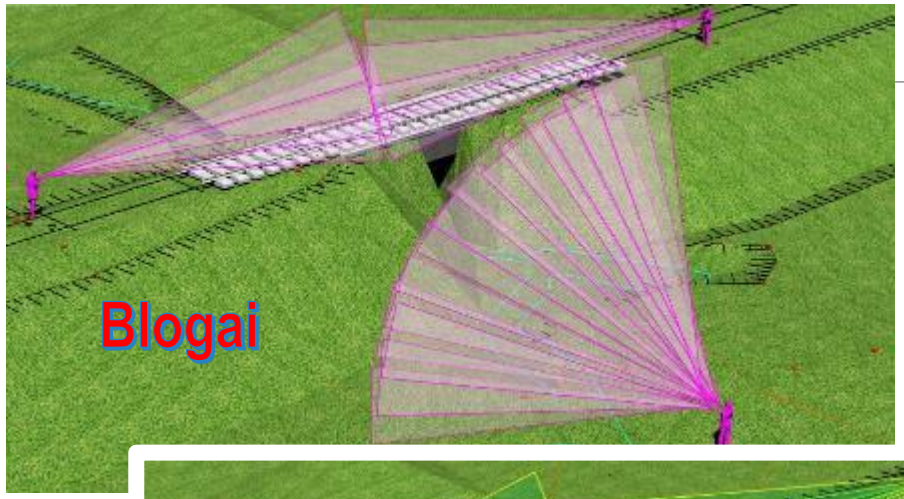
- 3D modelio sudarymas iš fotonuotraukų
  - Finding Tie Points in photos
  - Same Tie Points found in several photos
  - Relative position and view direction of photo is calculated
  - 3D mesh is generated with textures from photos

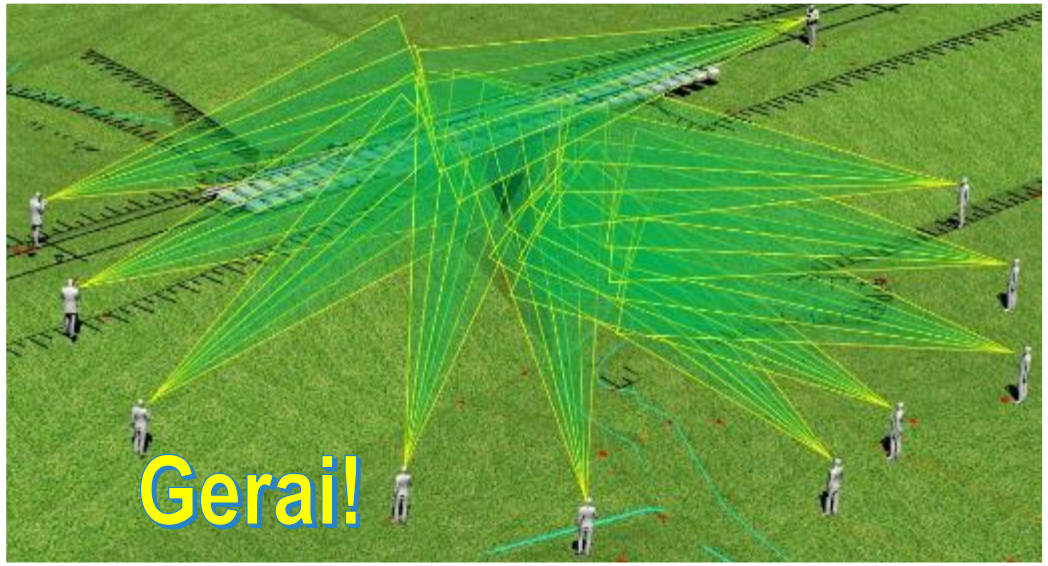


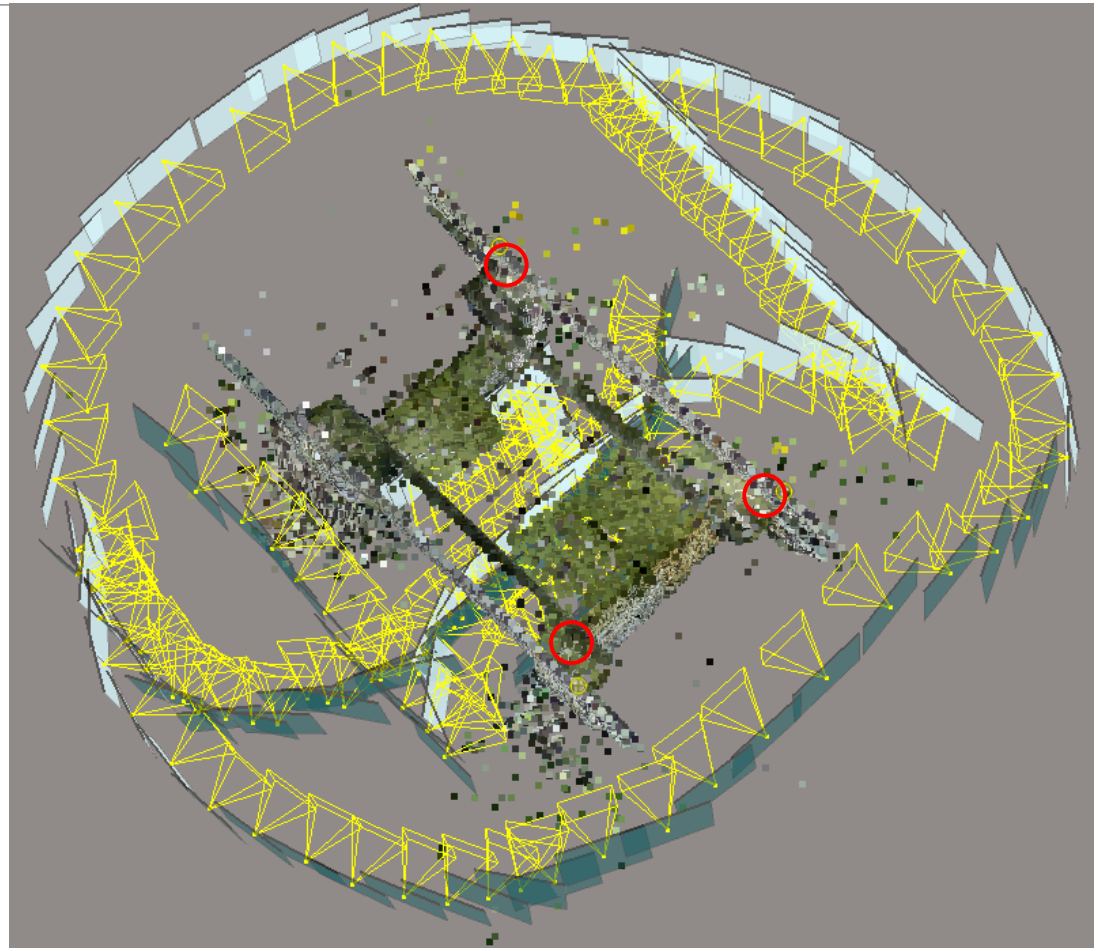


Small Objects – Hand-held Camera

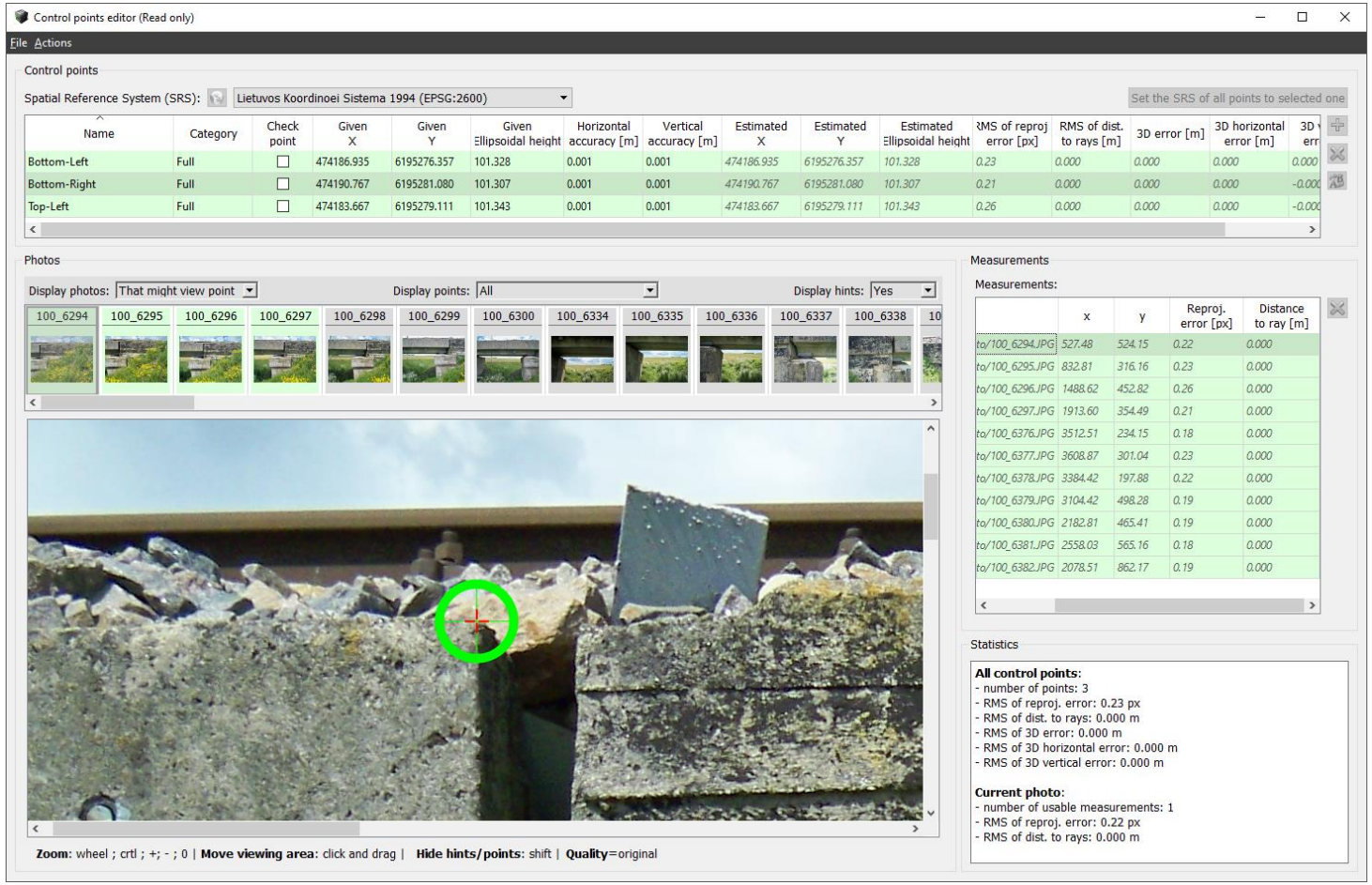
Methodology of Data Acquisition

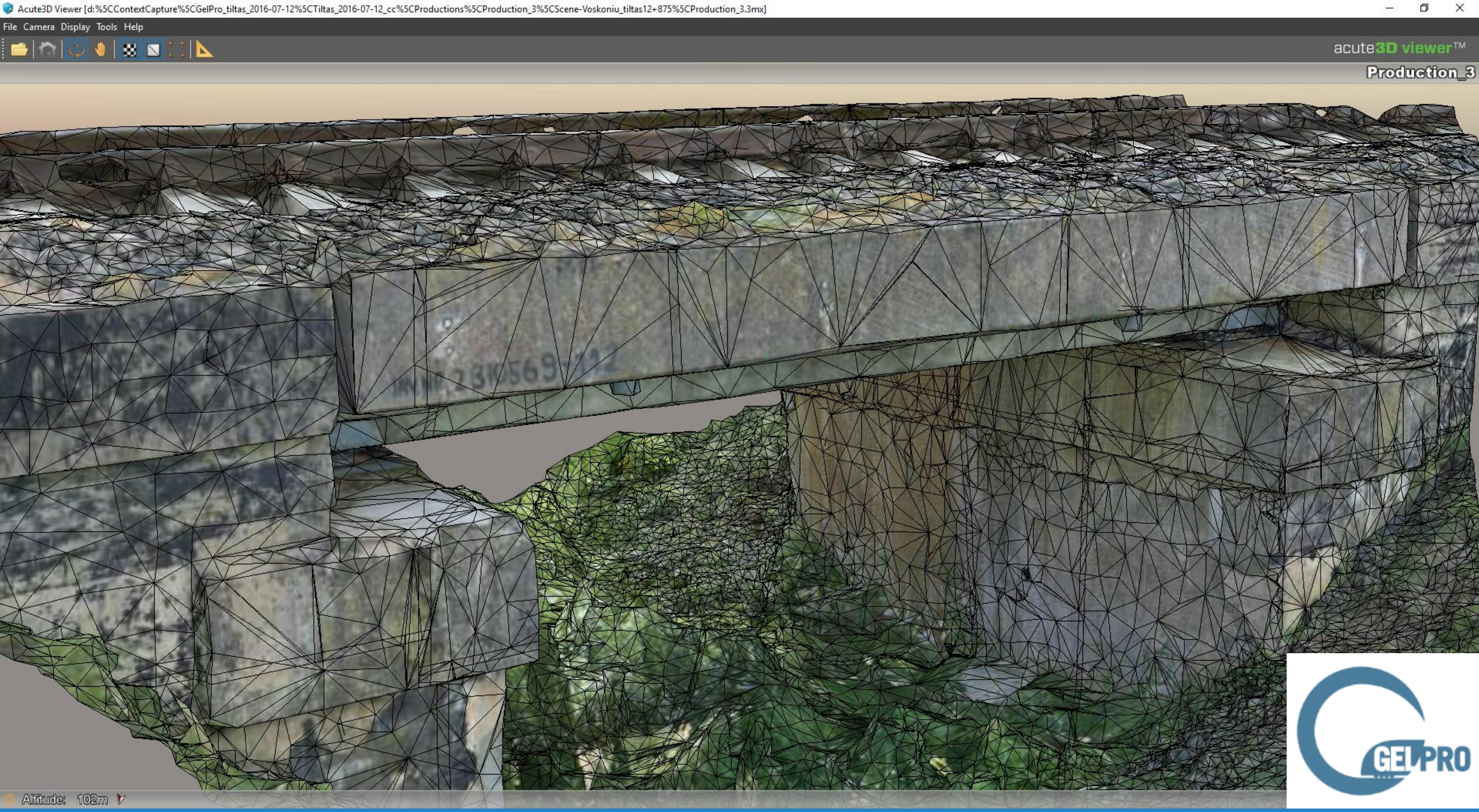






Assigning Control Points

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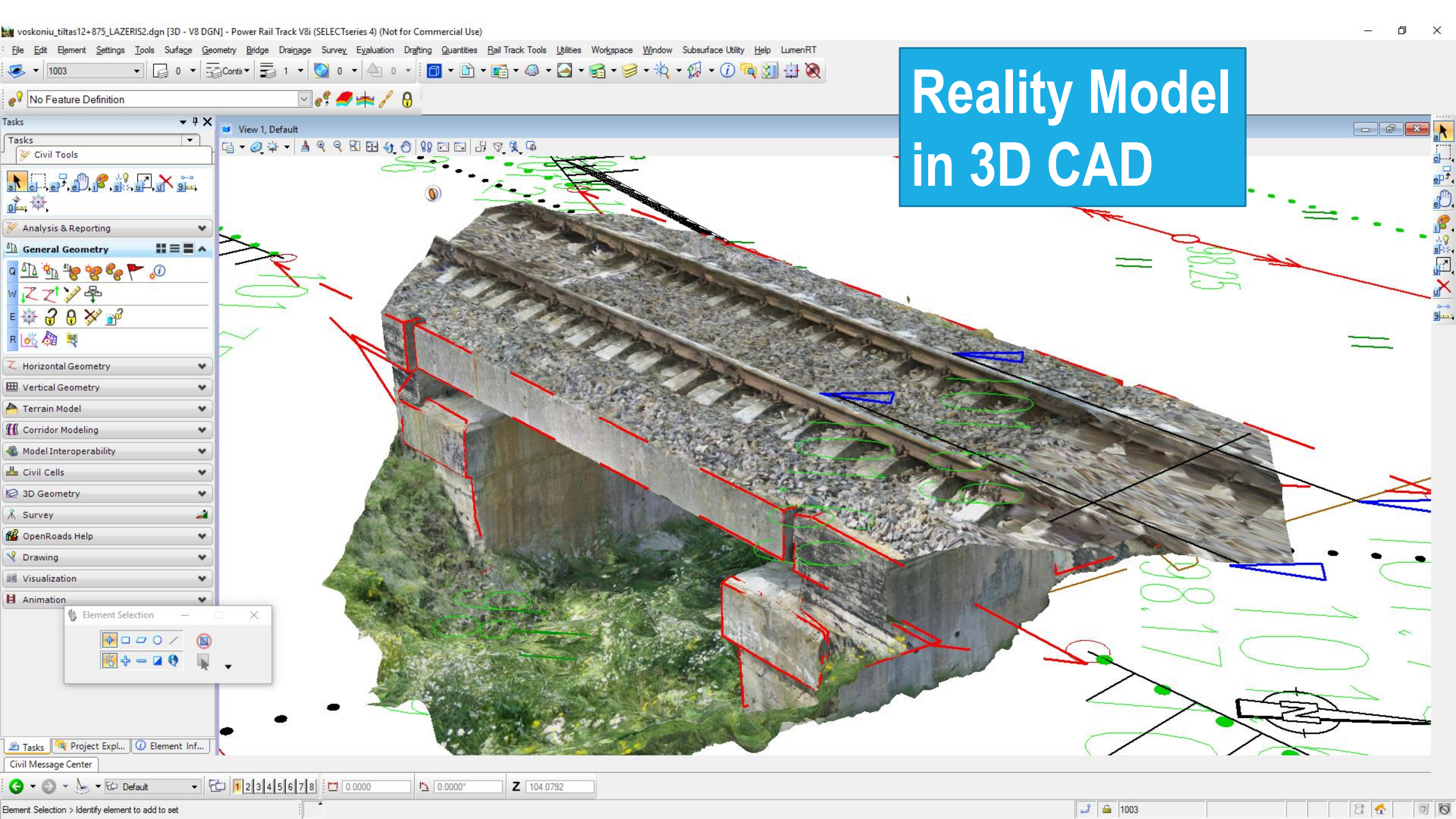
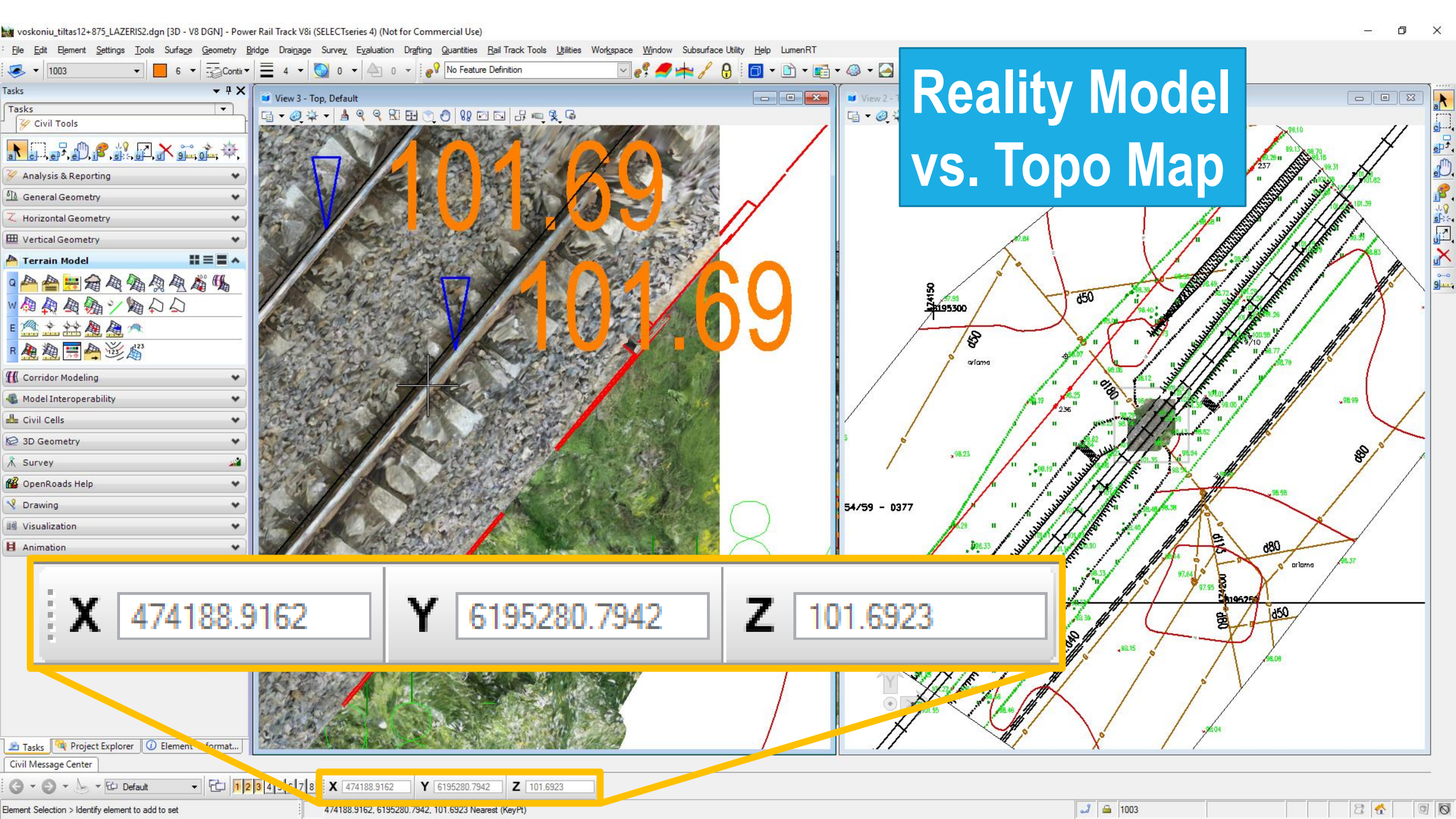
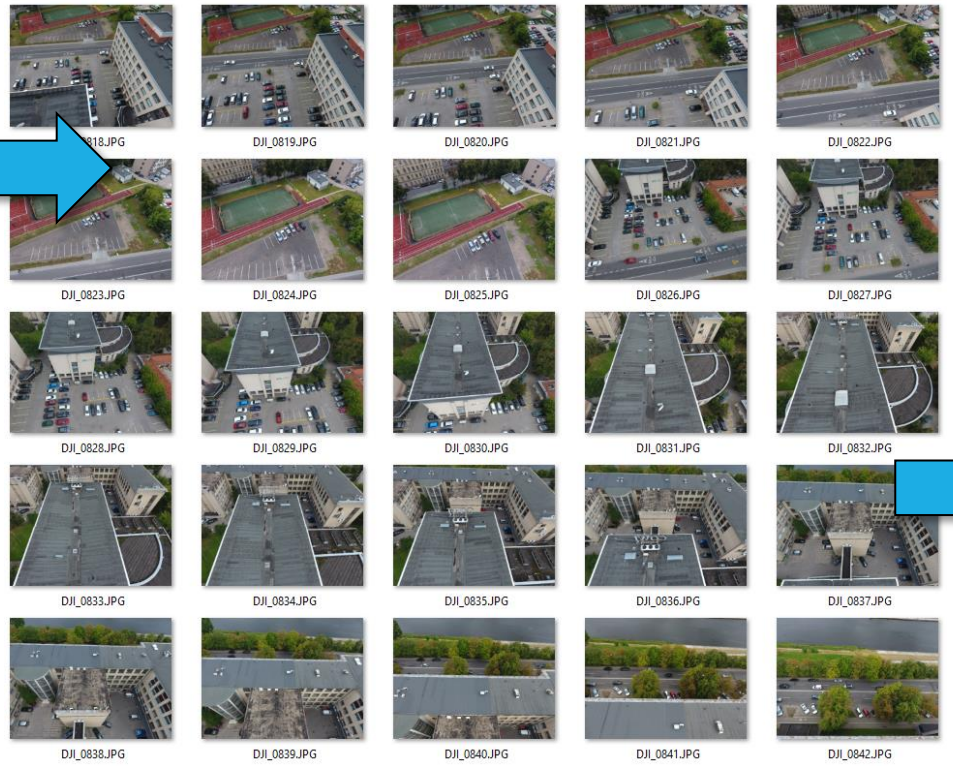
File Camera Display Tools Help
acute3D viewer™
Production_3
Altitude: 102m
GEL PRO

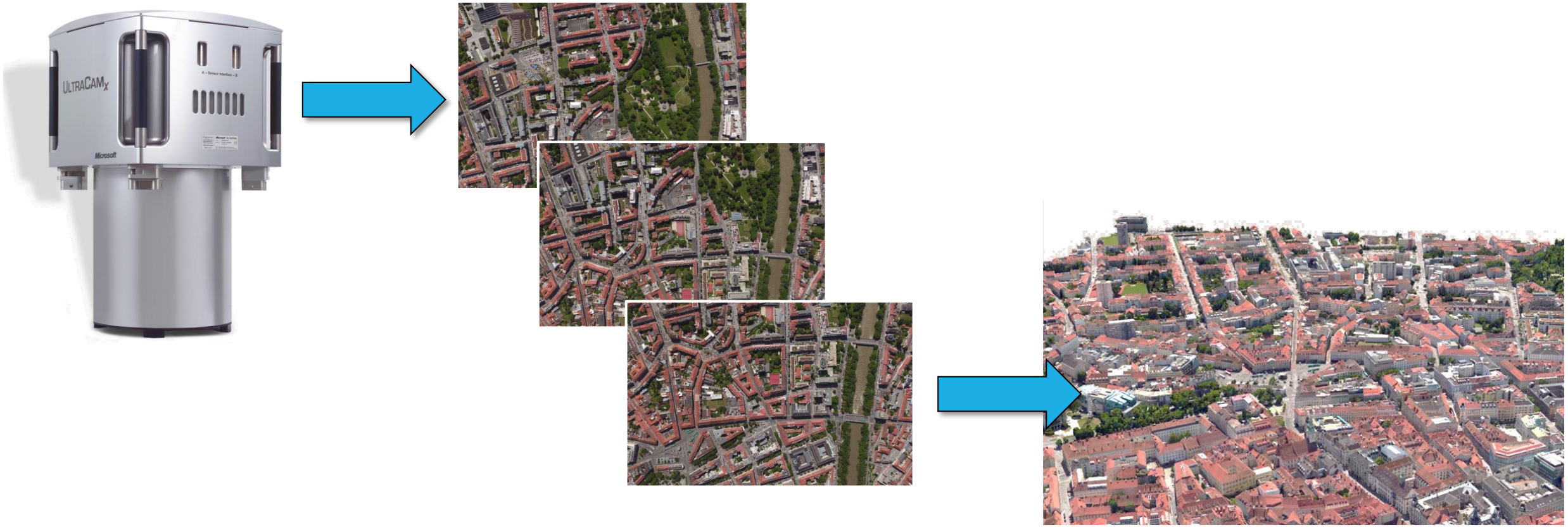

voskoniu_tiltas12+875_LAZERIS2.dgn [3D - V8 DGN] - Power Rail Track V8i (SELECTseries 4) (Not for Commercial Use)
File Edit Element Settings Tools Surface Geometry Bridge Drainage Survey Evaluation Drafting Quantities Rail Track Tools Utilities Workspace Window Subsurface Utility Help LumenRT
No Feature Definition
Tasks
Civil Tools
Analysis & Reporting
General Geometry
Horizontal Geometry
Vertical Geometry
Terrain Model
Corridor Modeling
Model Interoperability
Civil Cells
3D Geometry
Survey
OpenRoads Help
Drawing
Visualization
Animation
Element Selection
View 1, Default
Reality Model
in 3D CAD
Tasks
Project Expl...
Element Inf...
Civil Message Center
Default
Element Selection > Identify element to add to set


Reality Model
vs. Topo Map
X 474188.9162
Y 6195280.7942
Z 101.6923

Buildings, Complex Structures – Camera on the Drone



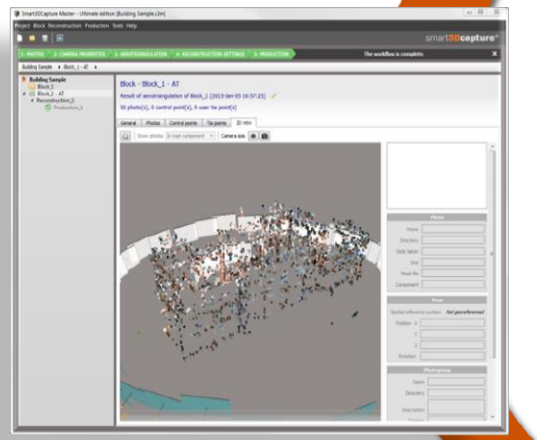
Whole Cities – Special High Resolution Cameras

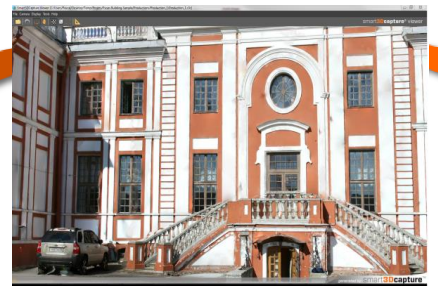


From Photogrametry to BIM

Computer-Aided Engineering Services

3D mesh /
Point cloud





CAD

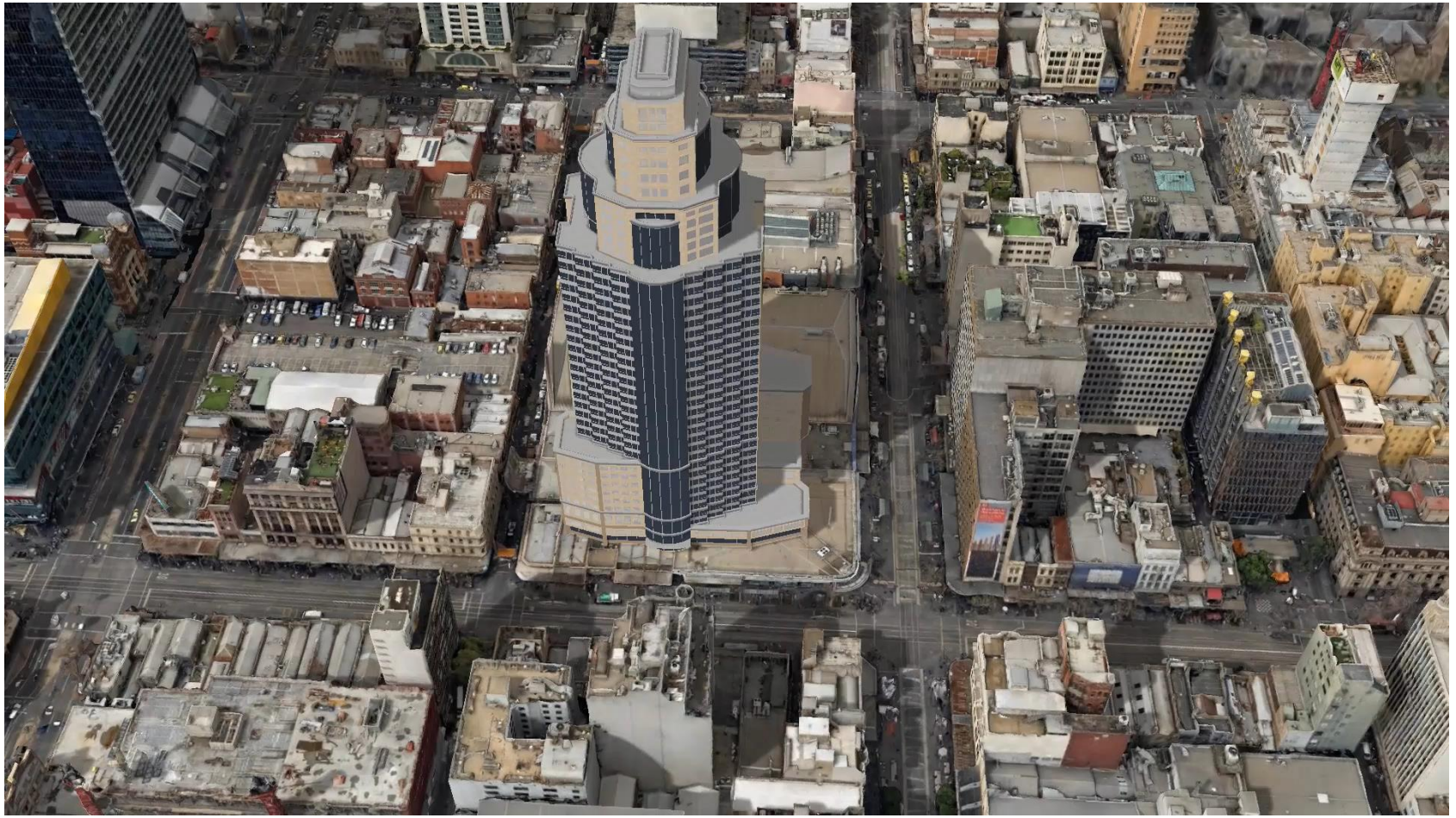
BIM

GIS

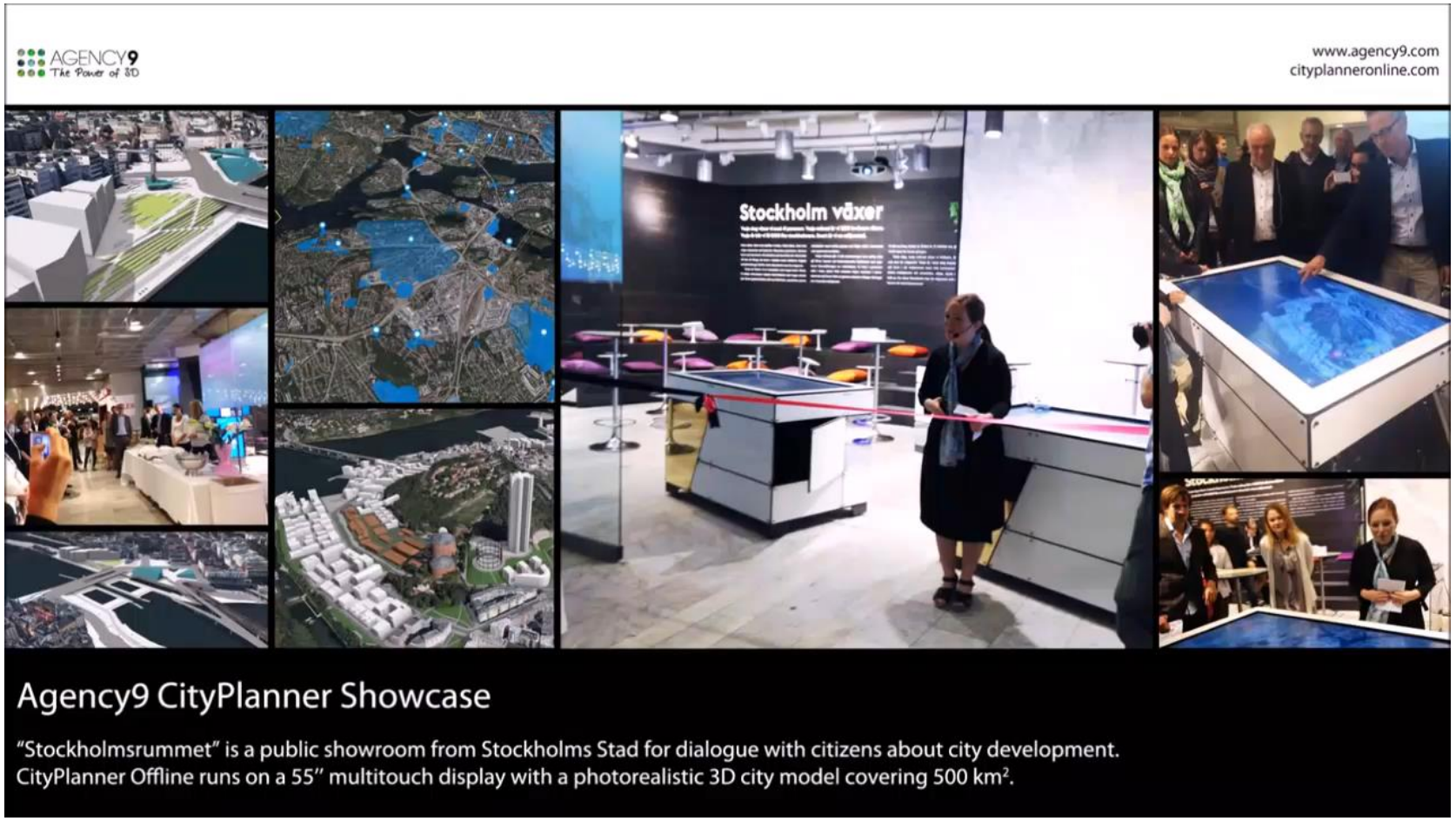
3D mesh/
Orthophoto/
DTM

Development Projects

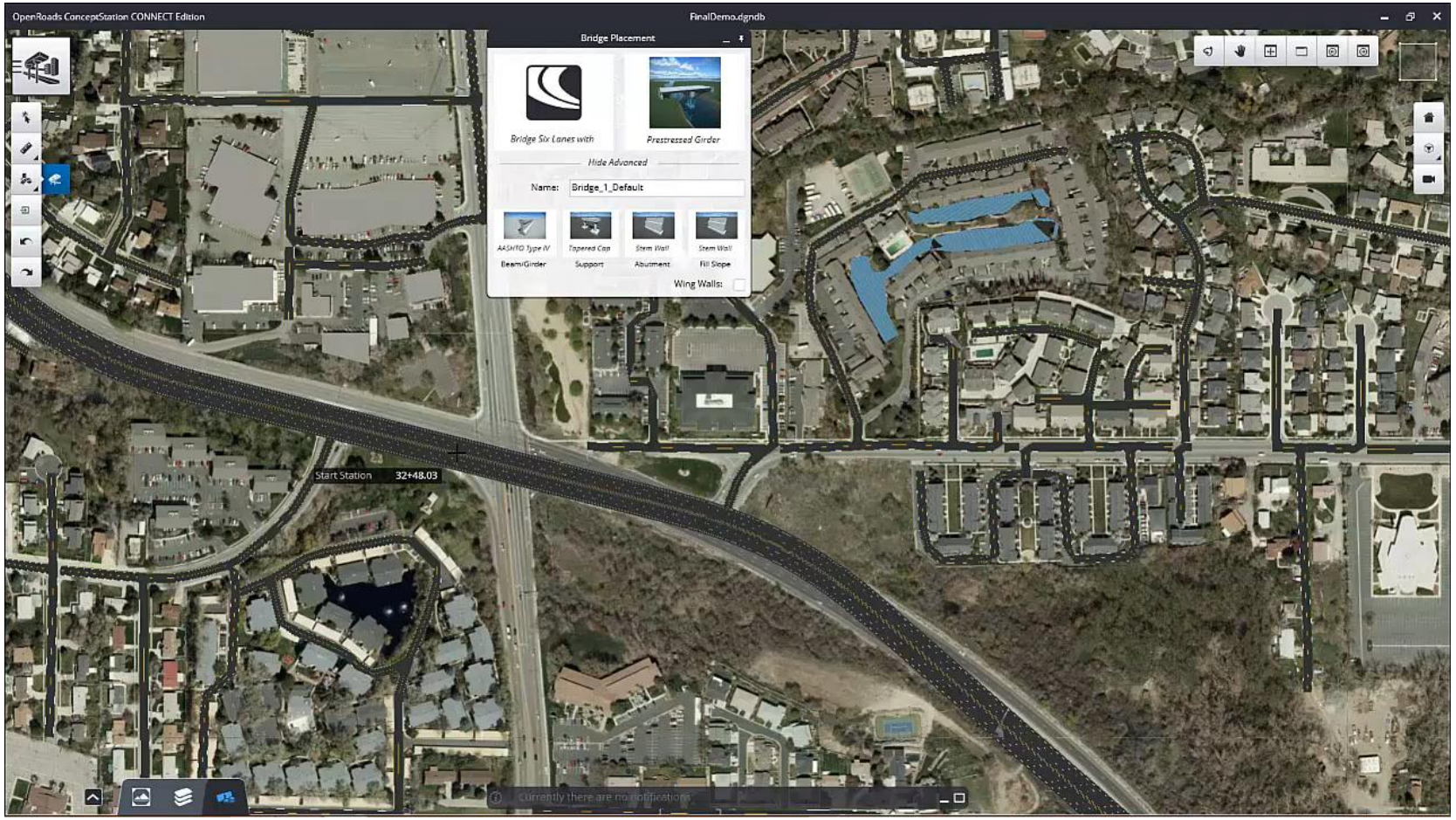
Environmental Impact Analysis



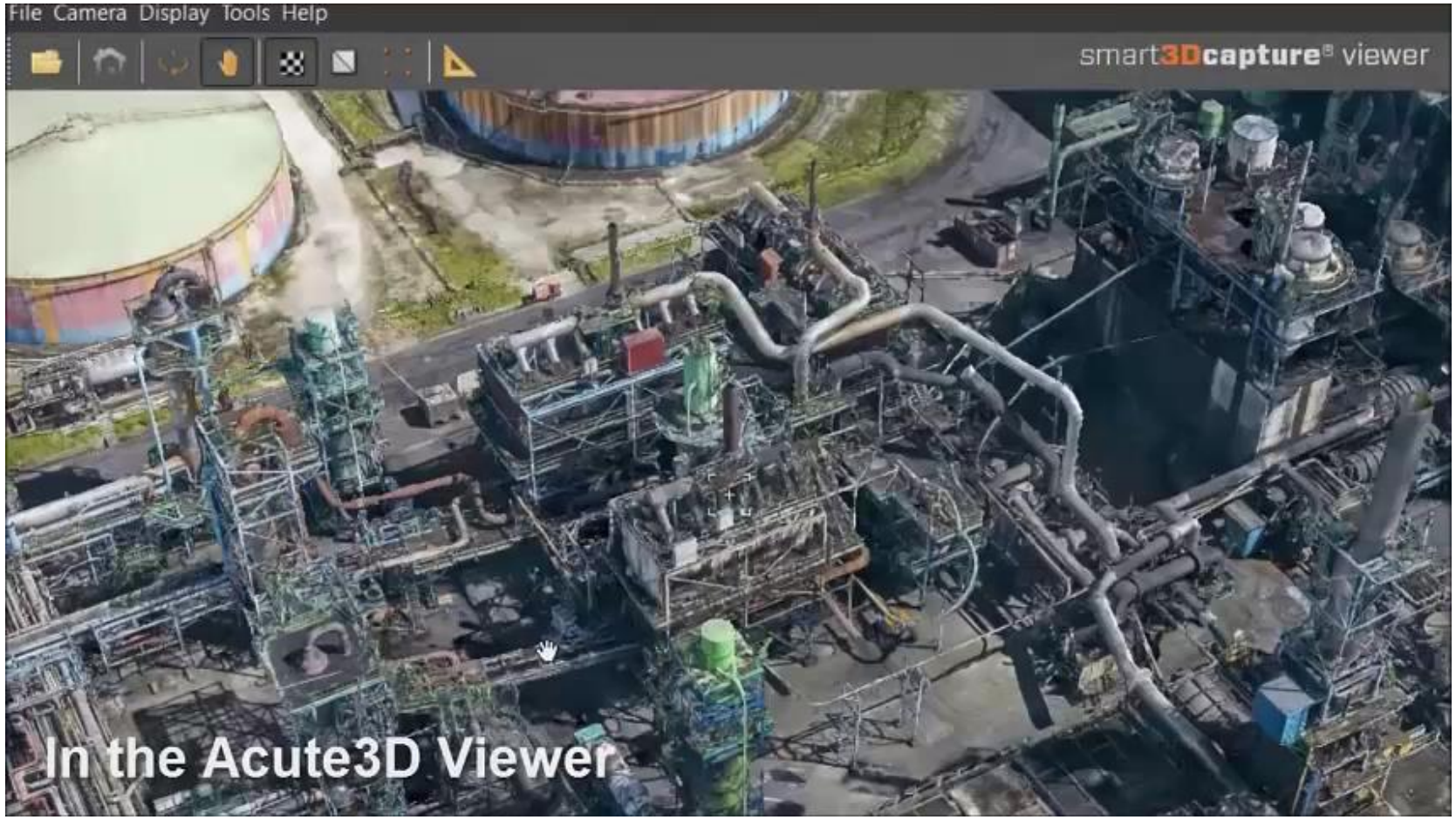
Presentation to Society



Conceptual Transportation Projects

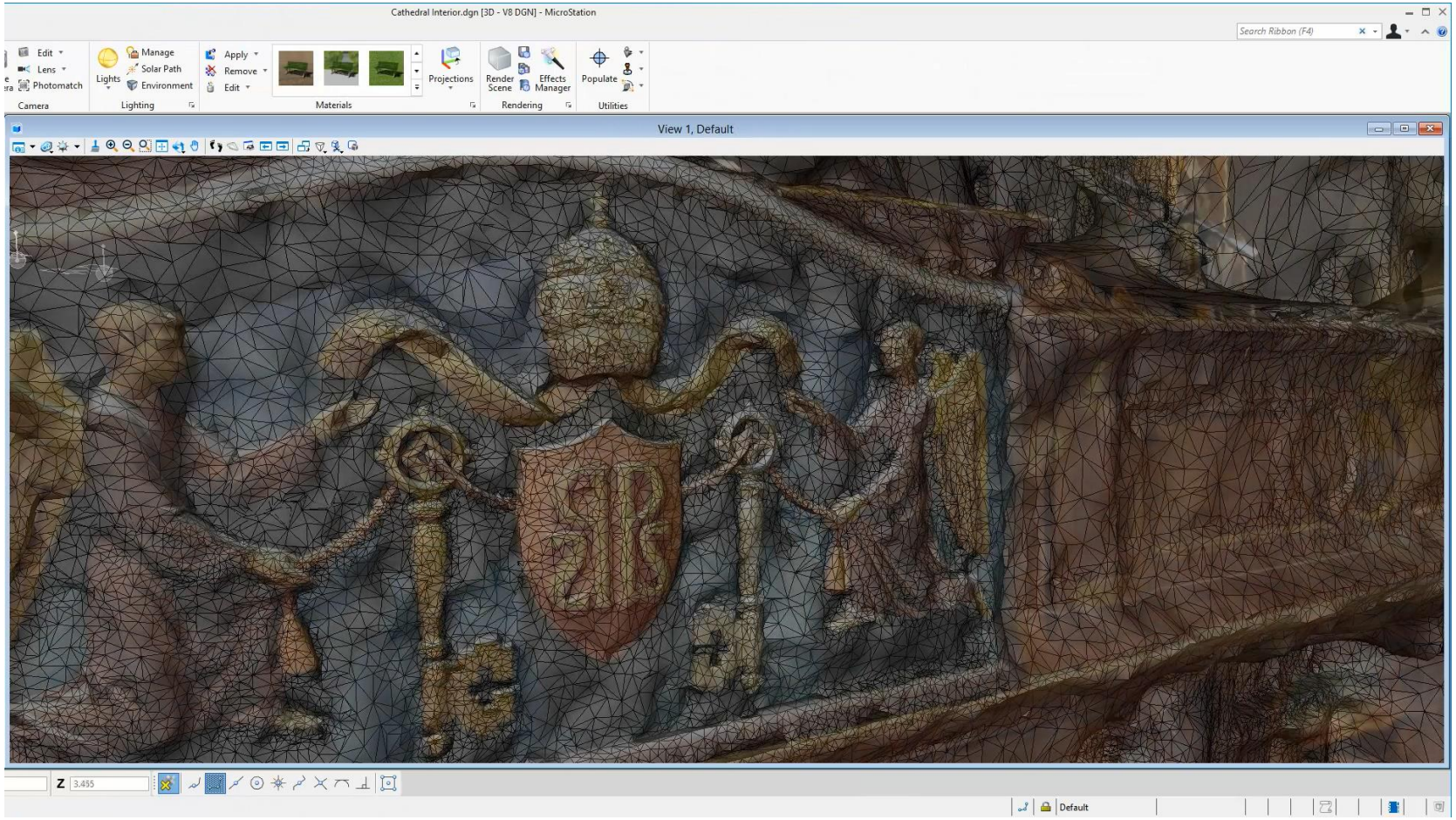


Maintenance and Expansion of Plants



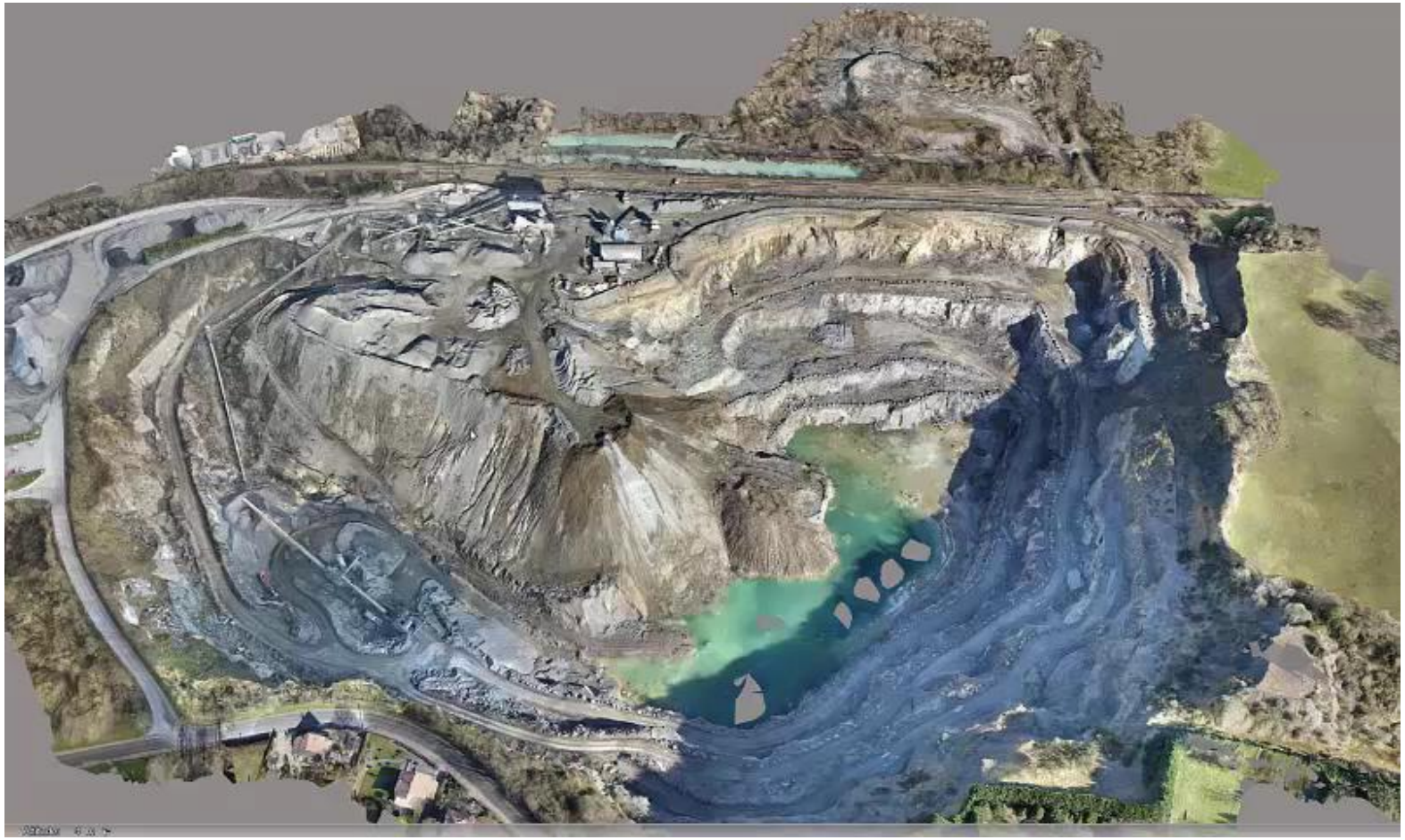
Tourism

Tourism and Heritage



Heritage

Environmental Survey



Disaster Management

Supervision of Construction

Investigation, Expertise

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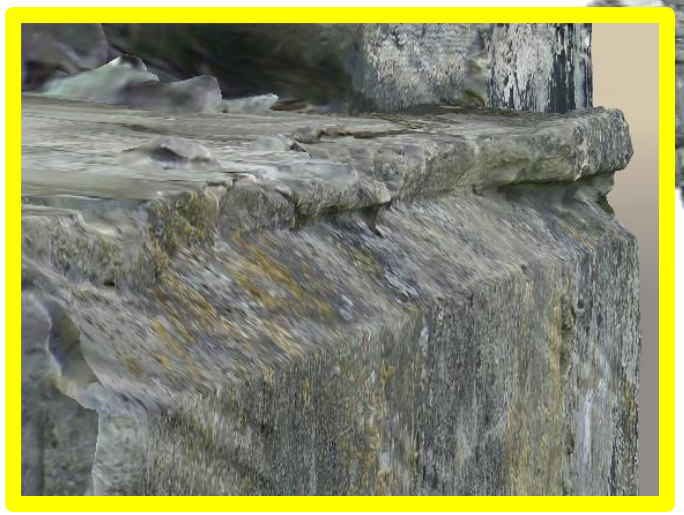
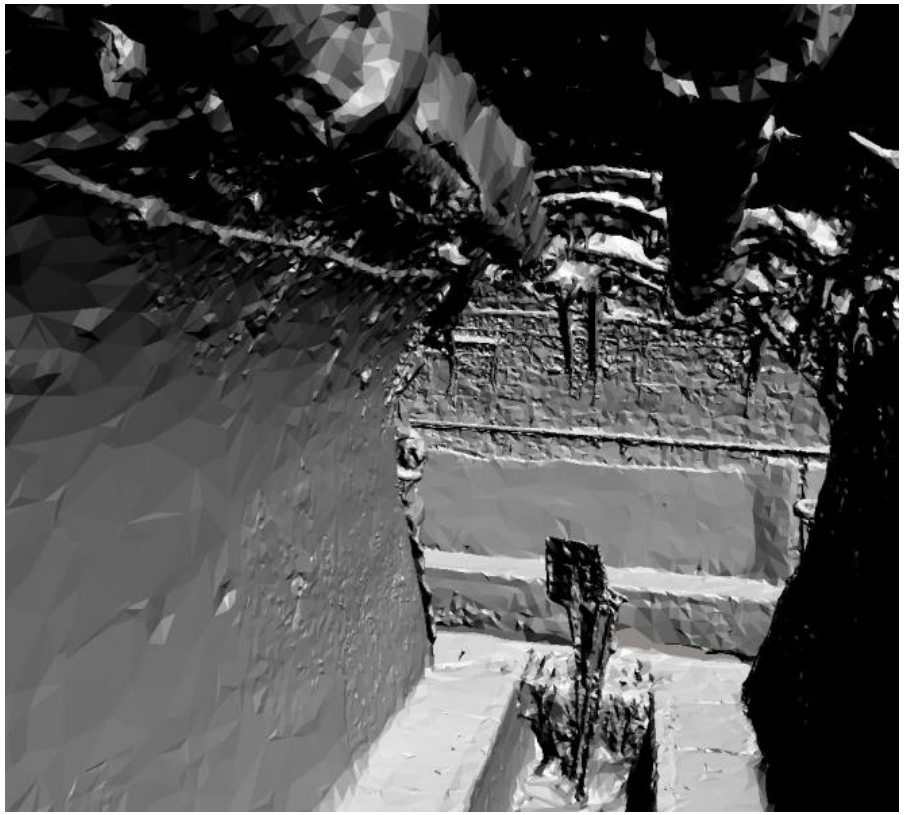


Underground Surveying

IN RE
Computer-Aided Engineering Services



Prototype of Digital Vilnius

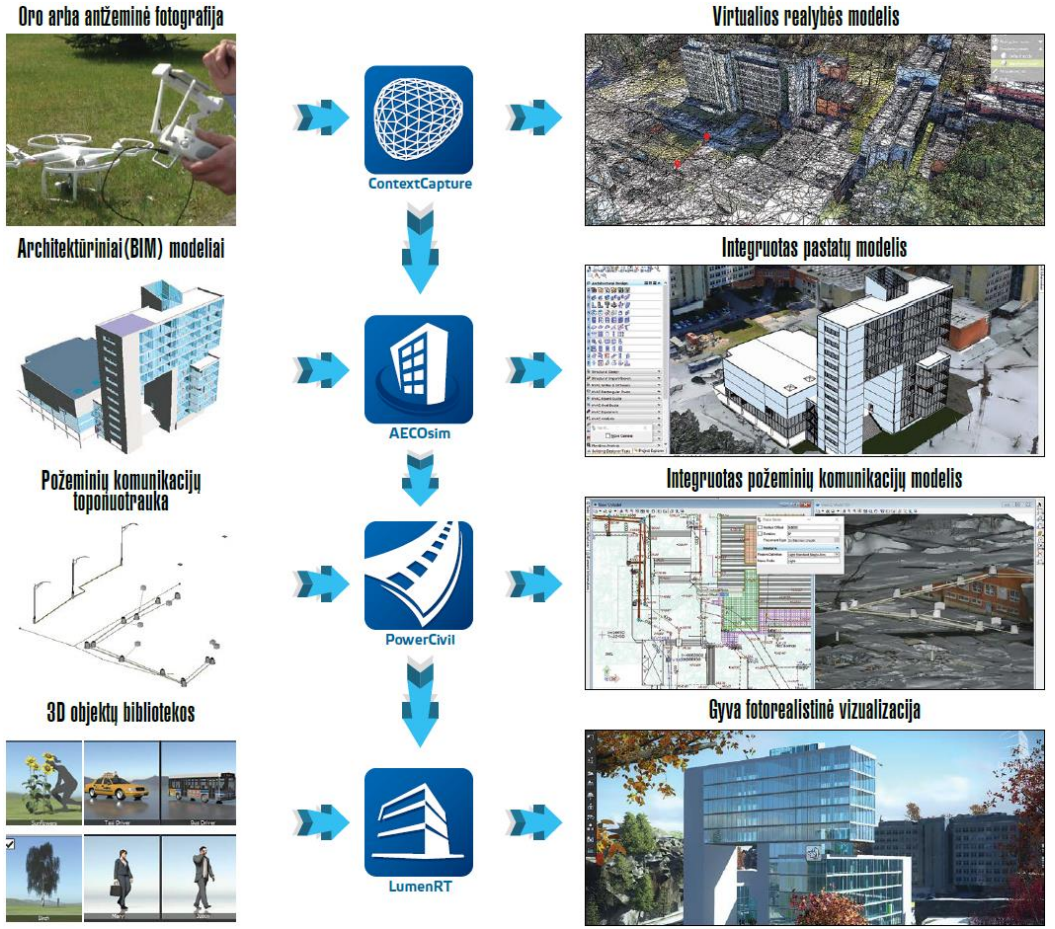
Pilot Project at Vilnius Gediminas Technical University Campus

Participants:

- VGTU Centre Technologies of Digital and Information Modeling of Buildings
- VGTU Department of Surveying
- Institute of Space Science and Technologies
- IN RE

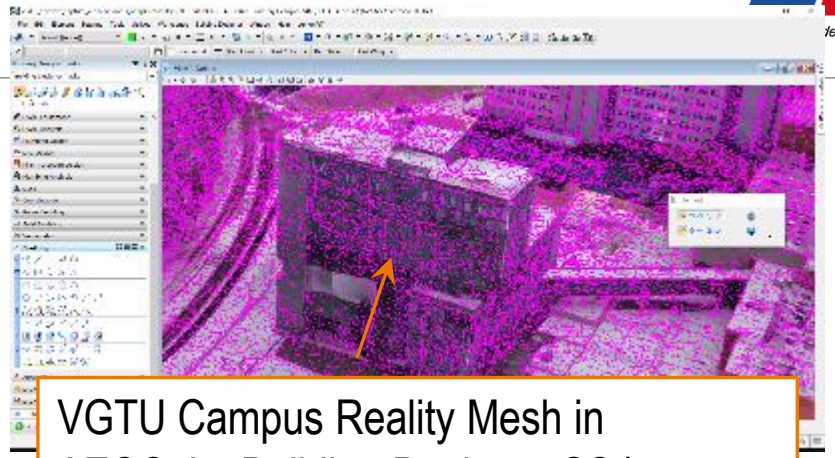
Results:

- Reality Model of Campus - a Prototype of 3D City - generated
- Integration of BIM Models with Context of Reality tested
- Reconstruction of 3D Subsurface Utilities tested
- Live photorealistic visualization prepared
- Model for 3D Printing created

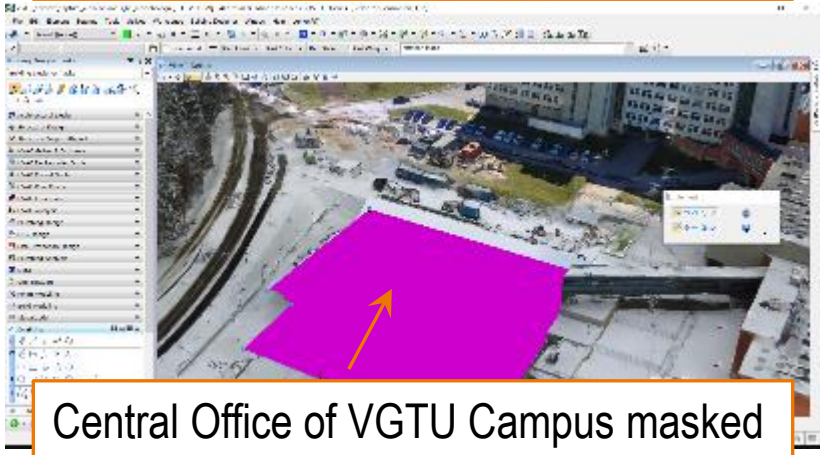


Reality Modelling Pilot Project

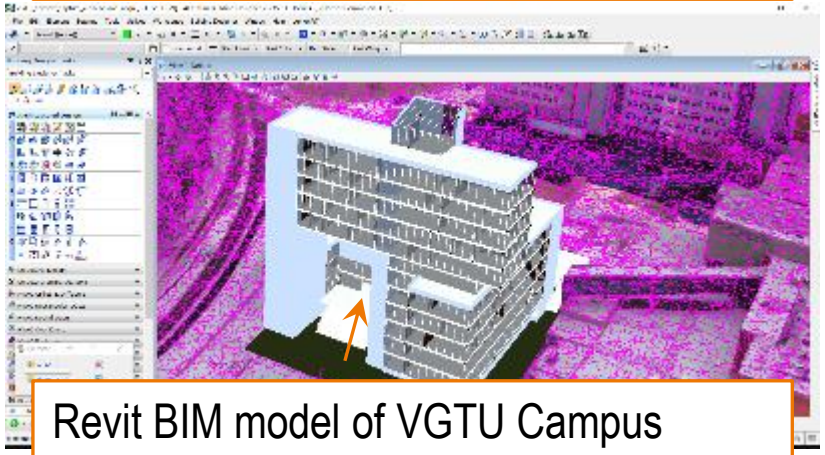
VGTU Campus Reality Mesh made with Context Capture and opened in Web App



VGTU Campus Reality Mesh in AECOsim Building Designer SS4

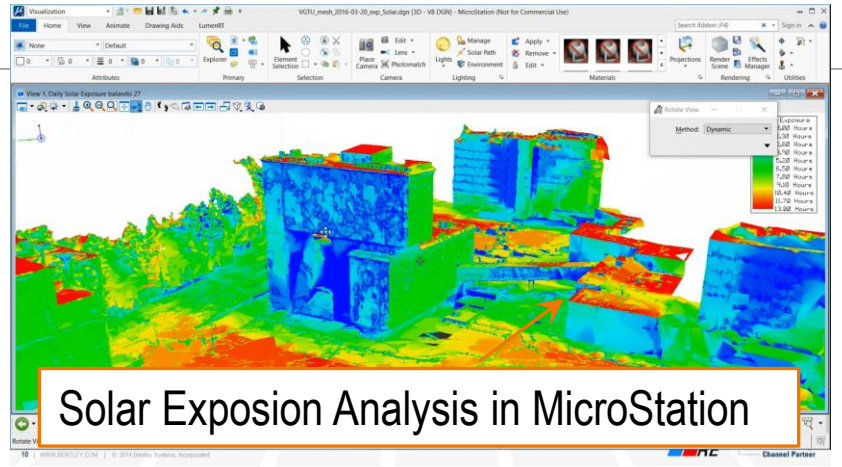


Central Office of VGTU Campus masked out from Reality Mesh with MRMESH MASK command

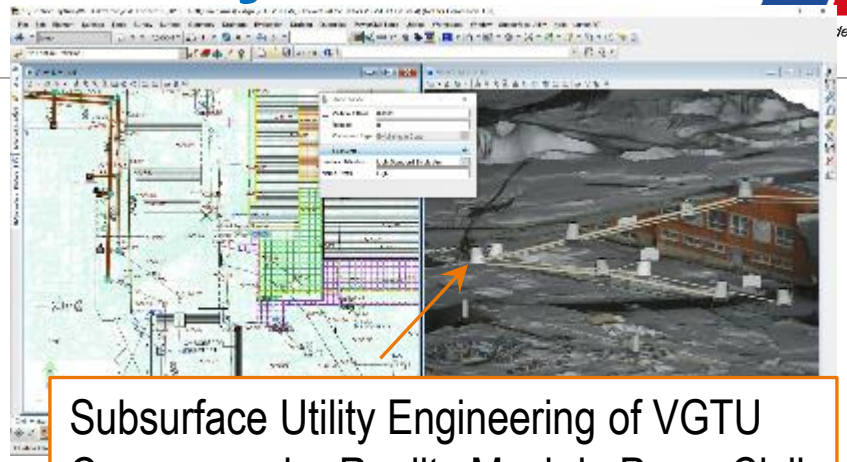


Revit BIM model of VGTU Campus Central Office, imported into AECOsim through IFC format

Reality Modelling Pilot Project

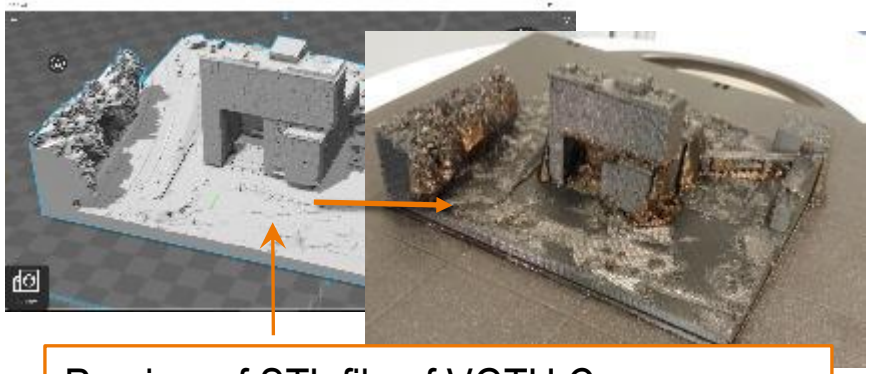


Solar Exposion Analysis in MicroStation



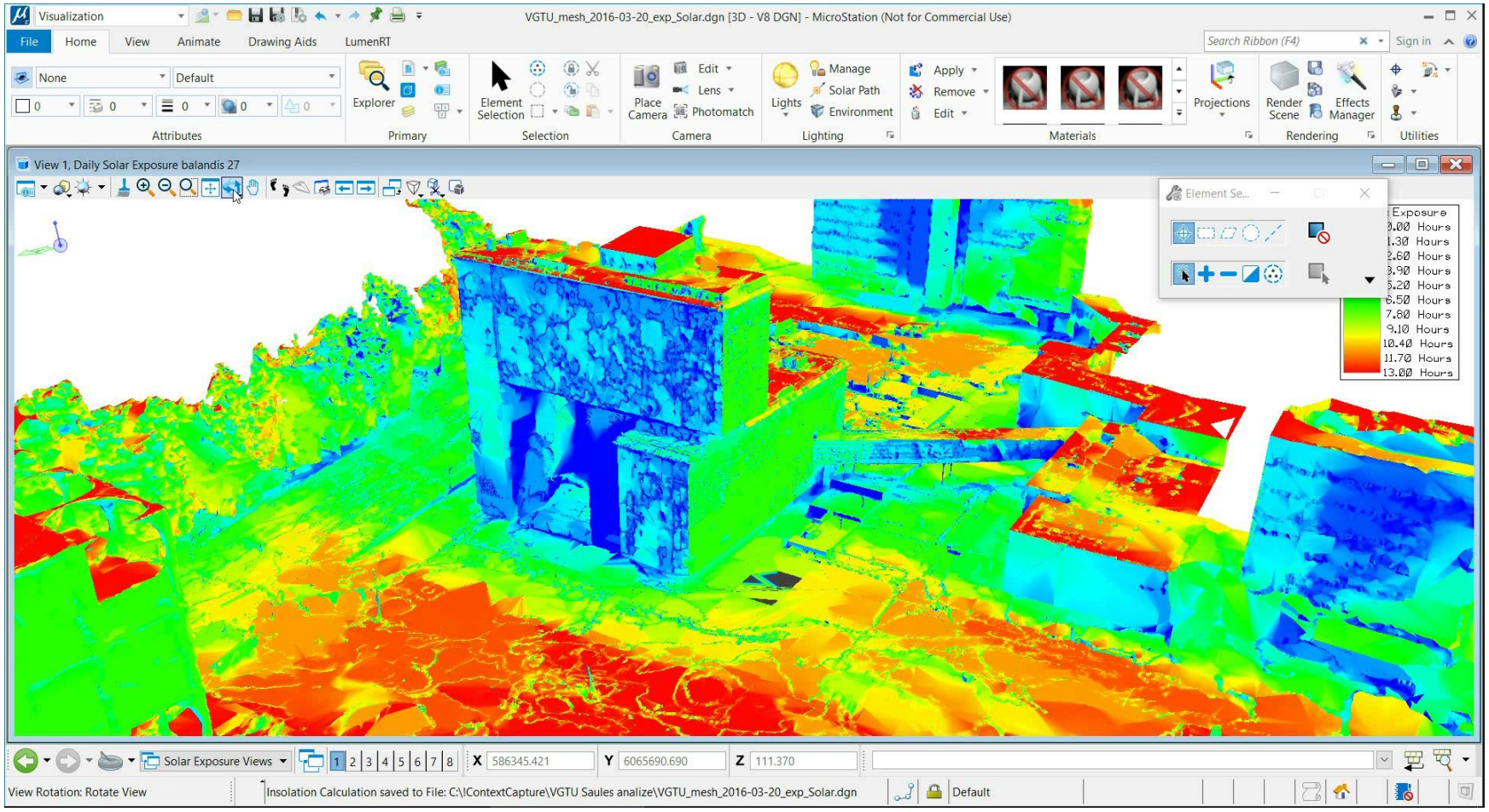
Subsurface Utility Engineering of VGTU Campus under Reality Mesh in PowerCivil

VGTU Campus Reality Mesh with BIM model, visualised in LumenRT



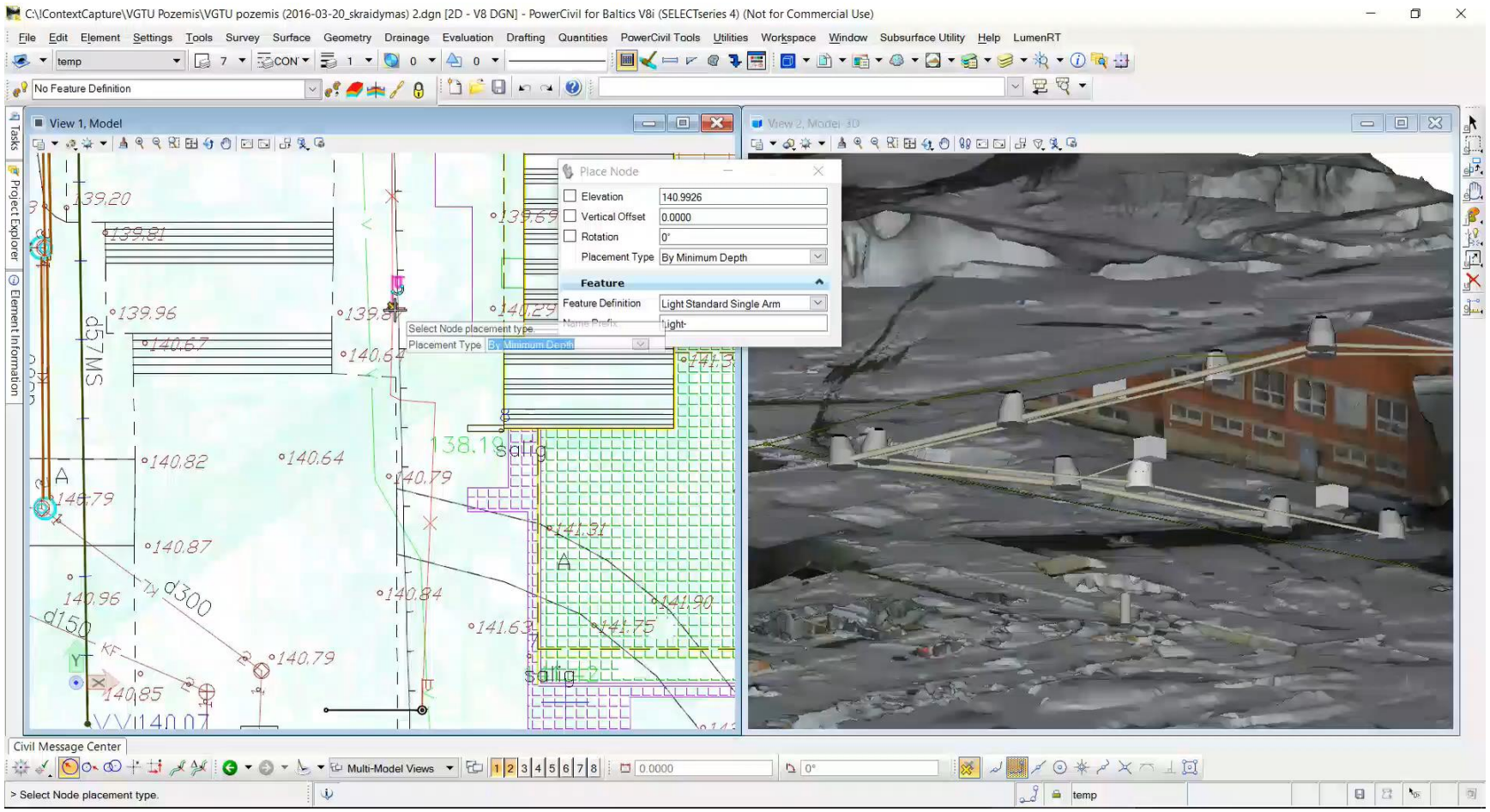
Preview of STL file of VGTU Campus Reality Mesh and actual 3D printed model

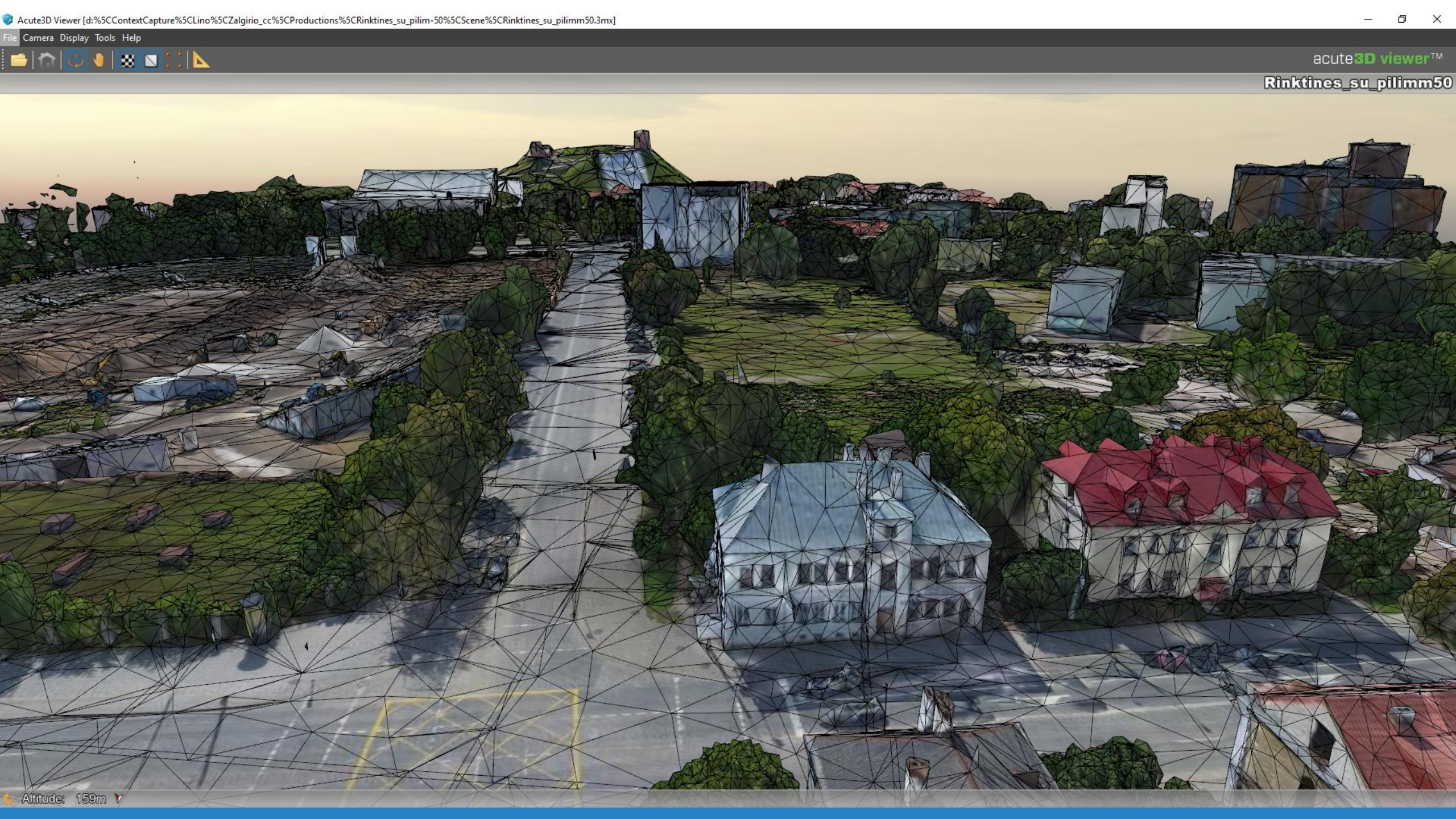
Solar Exposion Analysis



Reconstruction of Subsurface Utilitie

Computer-Aided Engineering Services

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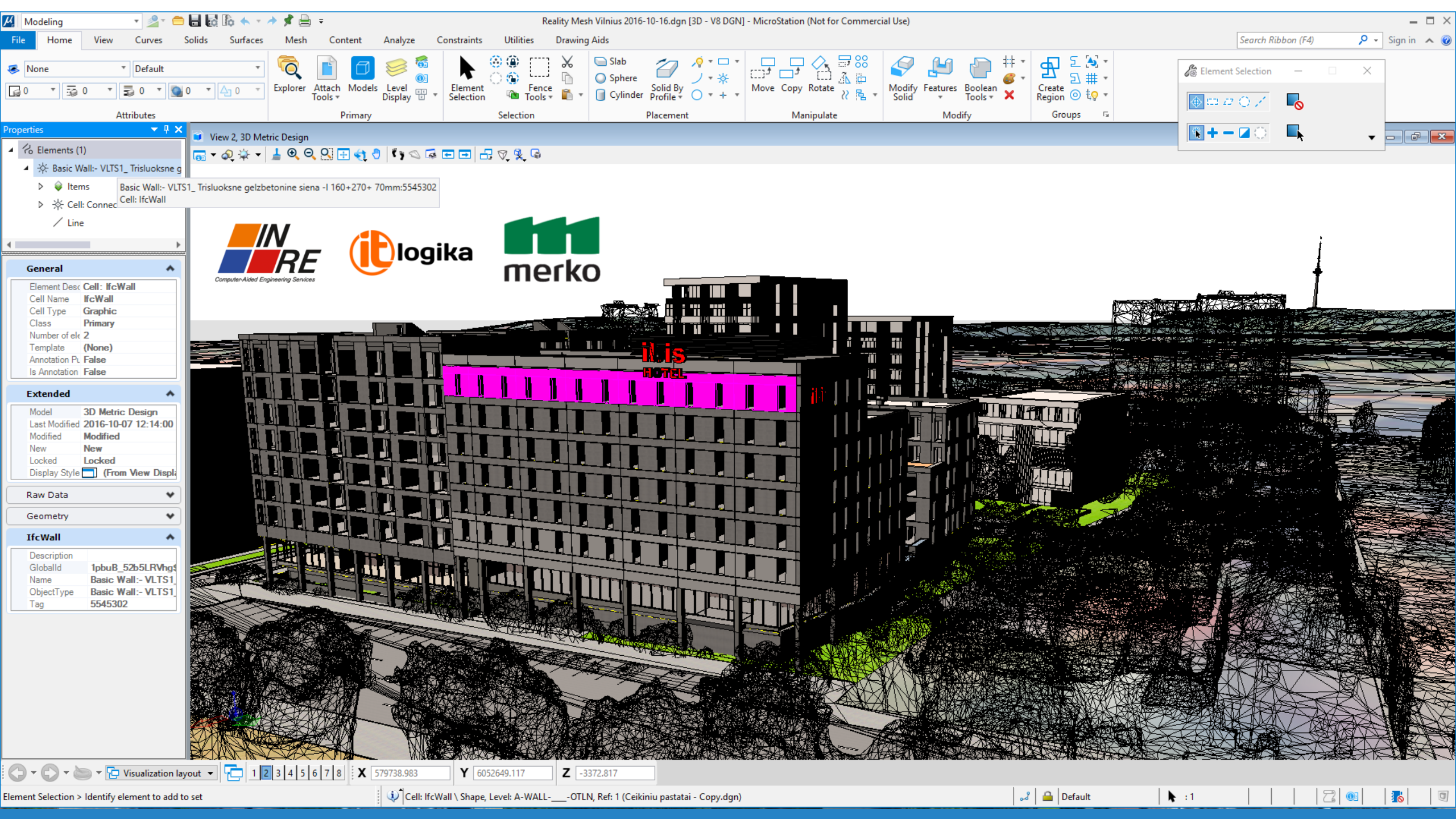
File
Camera
Display
Tools
Help
acute3D viewer™
Rinktines_su_pilimm50
Altitude: 159m


Modeling
Reality Mesh Vilnius 2016-10-16.dgn [3D - V8 DGN] - MicroStation (Not for Commercial Use)
File
Home
View
Curves
Solids
Surfaces
Mesh
Content
Analyze
Constraints
Utilities
Drawing Aids
Search Ribbon (F4)
Sign in
None
Default
Attributes
Explorer
Attach Tools
Models
Level Display
Primary
Element Selection
Fence Tools
Selection
Slab
Sphere
Cylinder
Solid By Profile
Placement
Move
Copy
Rotate
Manipulate
Modify Solid
Features
Boolean Tools
Modify
Create Region
Groups
Element Selection
Properties
Elements (1)
Basic Wall:- VLTS1_ Trisluoksne g
Items
Cell: Connec
Line
Basic Wall:- VLTS1_ Trisluoksne gelzbetonine siena -I 160+270+ 70mm:5545302
Cell: IfcWall
General
Element Desc Cell: IfcWall
Cell Name IfcWall
Cell Type Graphic
Class Primary
Number of ele 2
Template (None)
Annotation Pt False
Is Annotation False
Extended
Model 3D Metric Design
Last Modified 2016-10-07 12:14:00
Modified Modified
New New
Locked Locked
Display Style (From View Displ
Raw Data
Geometry
IfcWall
Description
GlobalId 1pbuB_52b5LRVhg5
Name Basic Wall:- VLTS1_
ObjectType Basic Wall:- VLTS1_
Tag 5545302
View 2, 3D Metric Design
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Computer-Aided Engineering Services
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merko
il.is
HOTEL
Visualization layout
1 2 3 4 5 6 7 8
X 579738.983
Y 6052649.117
Z -3372.817
Element Selection > Identify element to add to set
Cell: IfcWall \ Shape, Level: A-WALL-___-OTLN, Ref: 1 (Ceikiniu pastatai - Copy.dgn)
Default
: 1

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PROFESIONALUMAS
PATIKIMUMAS
KOKYBĖ

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www.inre.lt » www.spausdinu3D.lt »
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www.aec.lt » www.pcscad.lt »

Modeling of 3D Cities - Facts

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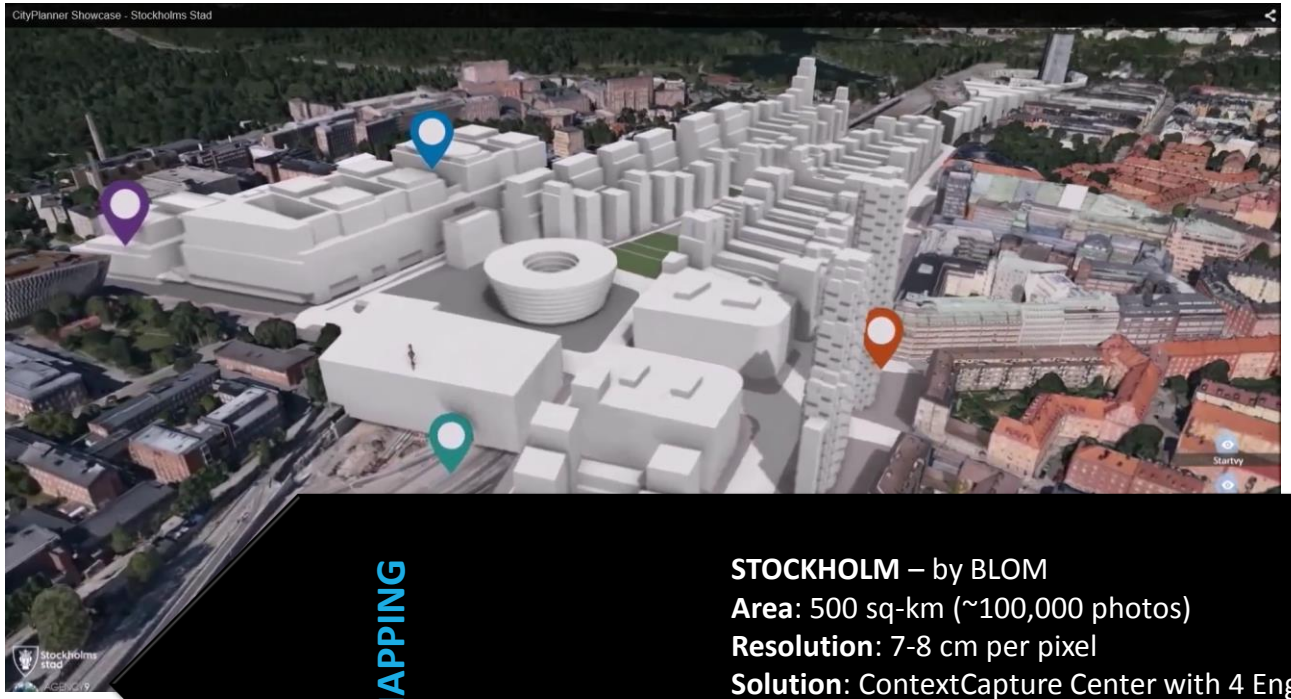
Sakae district, Nagoya, Japan
Dataset : 552 21Mpix aerial vertical and oblique photographs
Computation : 20 hours on 3 computers
Area : 0.5 km^2
Resolution: 5 cm / pixel
Output: 3D DSM

Paris (subset), France
Dataset : 8000 aerial vertical (210Mpix) and oblique (80Mpix) photographs
Computation : 4 days on 10 computers
Area : 100 km^2
Resolution: 7-8 cm / pixel
Output: 3D DSM

Marseille, France
Dataset : 15470 aerial vertical **(210Mpix)** and oblique **(80Mpix)** photographs
Computation : 12 days on 10 computers
Area : 200 km^2
Resolution: 5-7 cm / pixel
Output: 3D DSM



CITY MAPPING

STOCKHOLM – by BLOM
Area: 500 sq-km (~100,000 photos)
Resolution: 7-8 cm per pixel
Solution: ContextCapture Center with 4 Engines - 3 months (expected – 18 months)
Deliverable: Georeferenced Textured 3D mesh + True orthophotos
Price: ~150.000 EUR (~1/6 of expected budget)