Overlaying LiDAR-scanned Objects on the GIS maps

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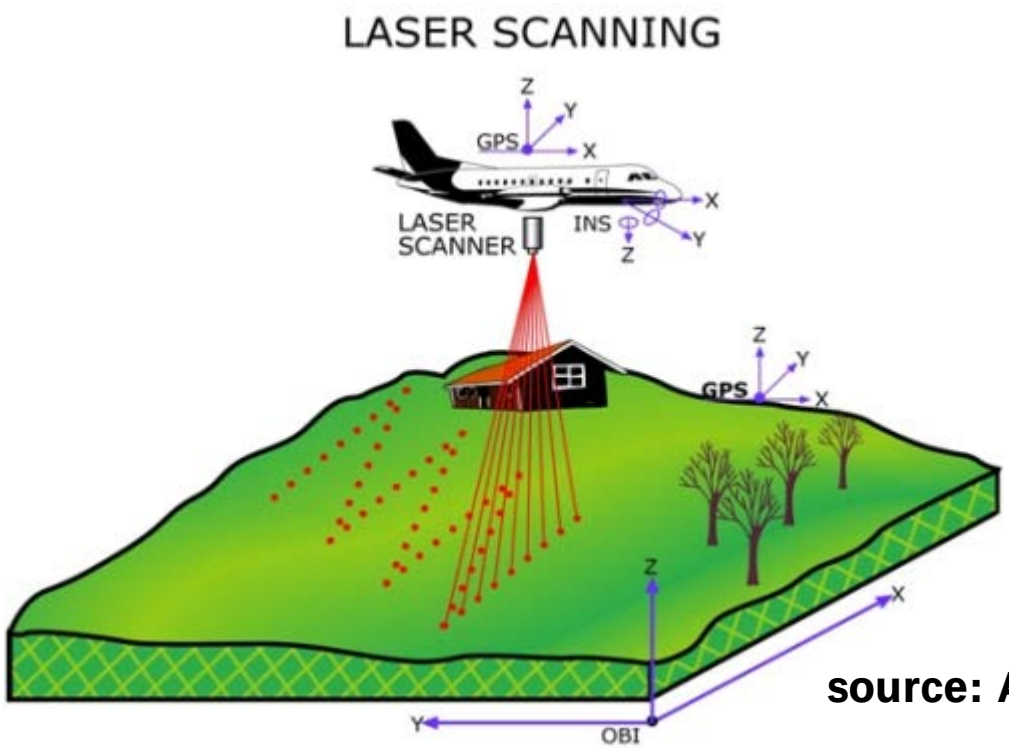
mobile graphics

LiDAR

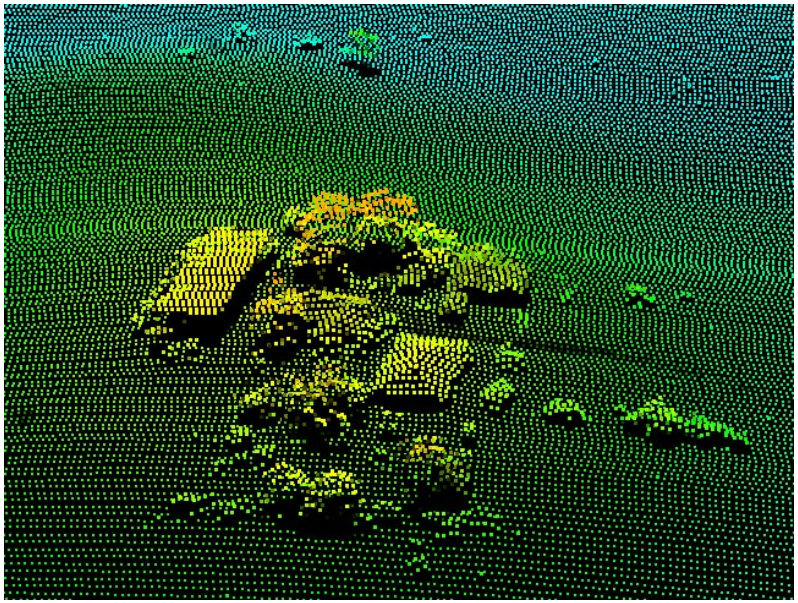
- **Light Detection And Ranging**
  - surveying technology that measures distance by illuminating a target with a laser light
  - technology to make various kinds of geometric and geological data



source: ASPRS

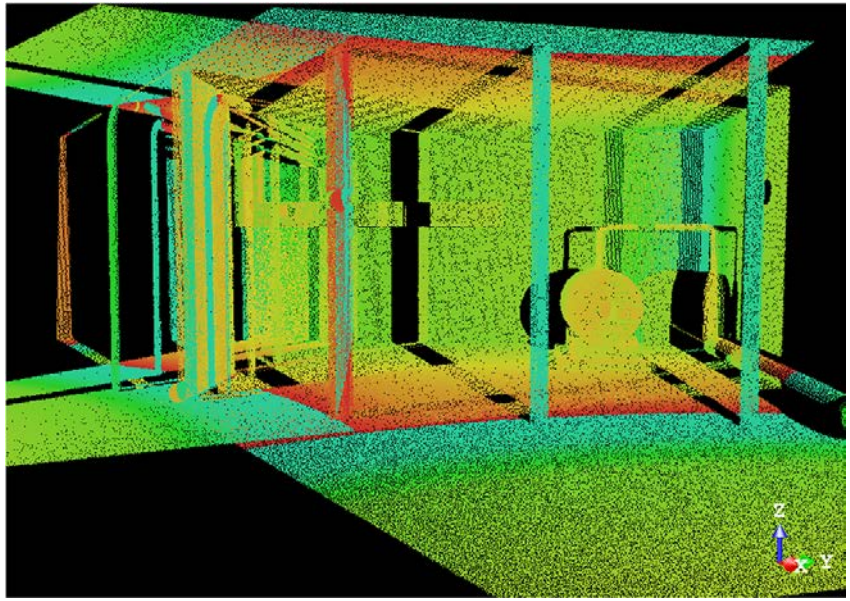
LiDAR Data

- ground data



source: photomapping.com.au

- in-door data



source: opticalengineering.spiedigitallibrary.org

LAS file format

- **file format to store 3D point cloud**
- **from ASPRS**
  - American Society for Photogrammetry and Remote Sensing
  - http://www.asprs.org/

- **libLAS**
  - library for reading and writing geospatial data encoded in the LAS file format
  - available with C, C++, Python
  - http://www.liblas.org/

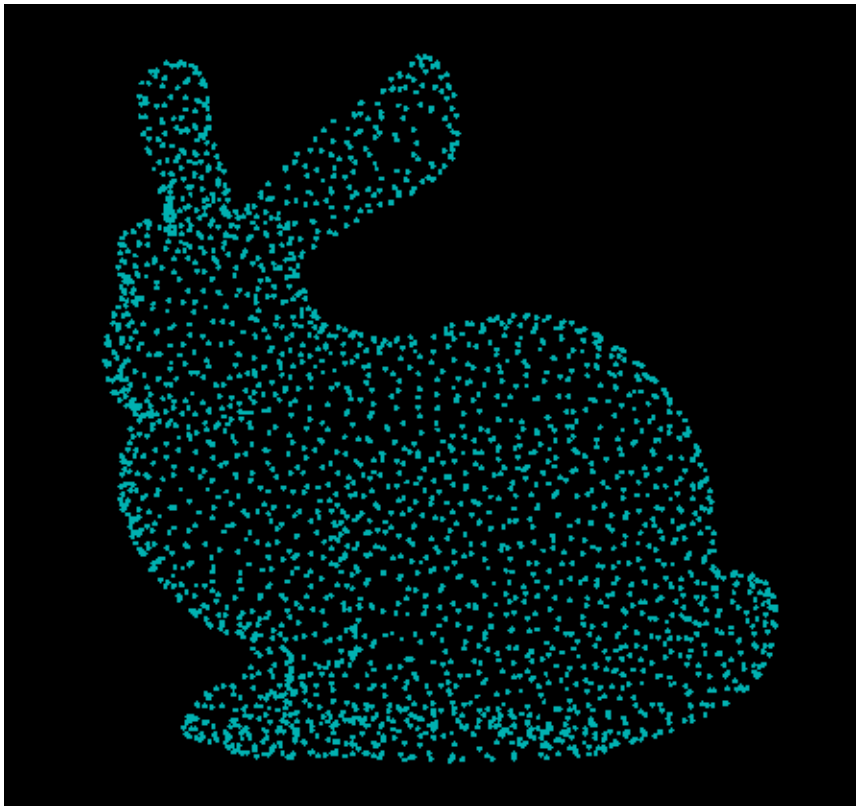
E57 file format

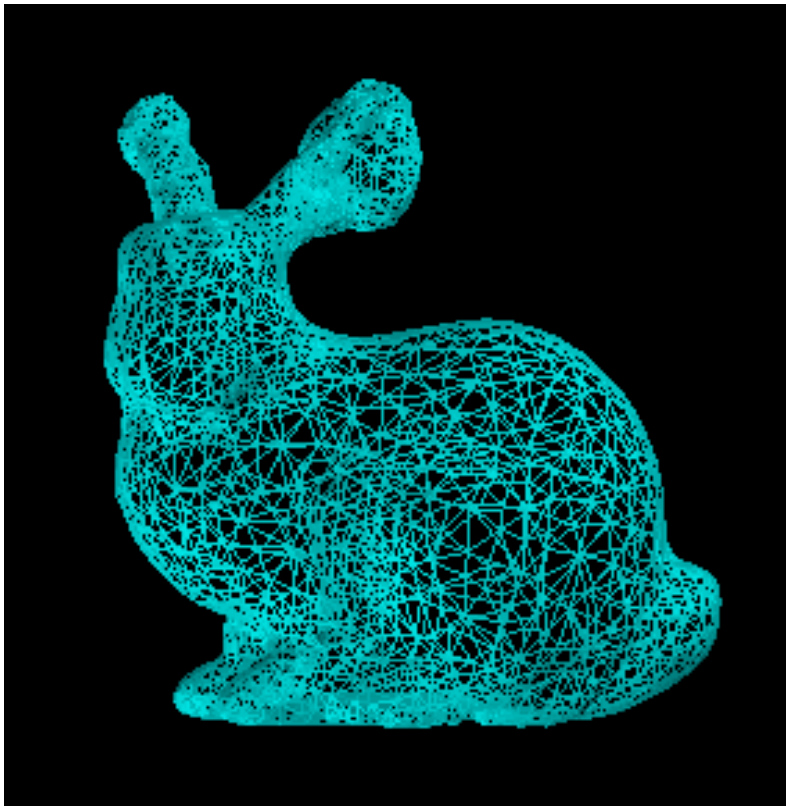
- **a compact, vendor-neutral file format for storing point clouds, images, and metadata produced by 3D imaging systems**
  - hierarchical tree structure
  - based on the XML data format
  - from ASTM International
  - http://www.astm.org/COMMITTEE/E57.htm

- **libE57**
  - library, supporting utilities, example programs, and documents
  - for reading, writing, and manipulating E57 files
  - http://www.libe57.org/

LiDAR data to geometric model

- using CGAL operations



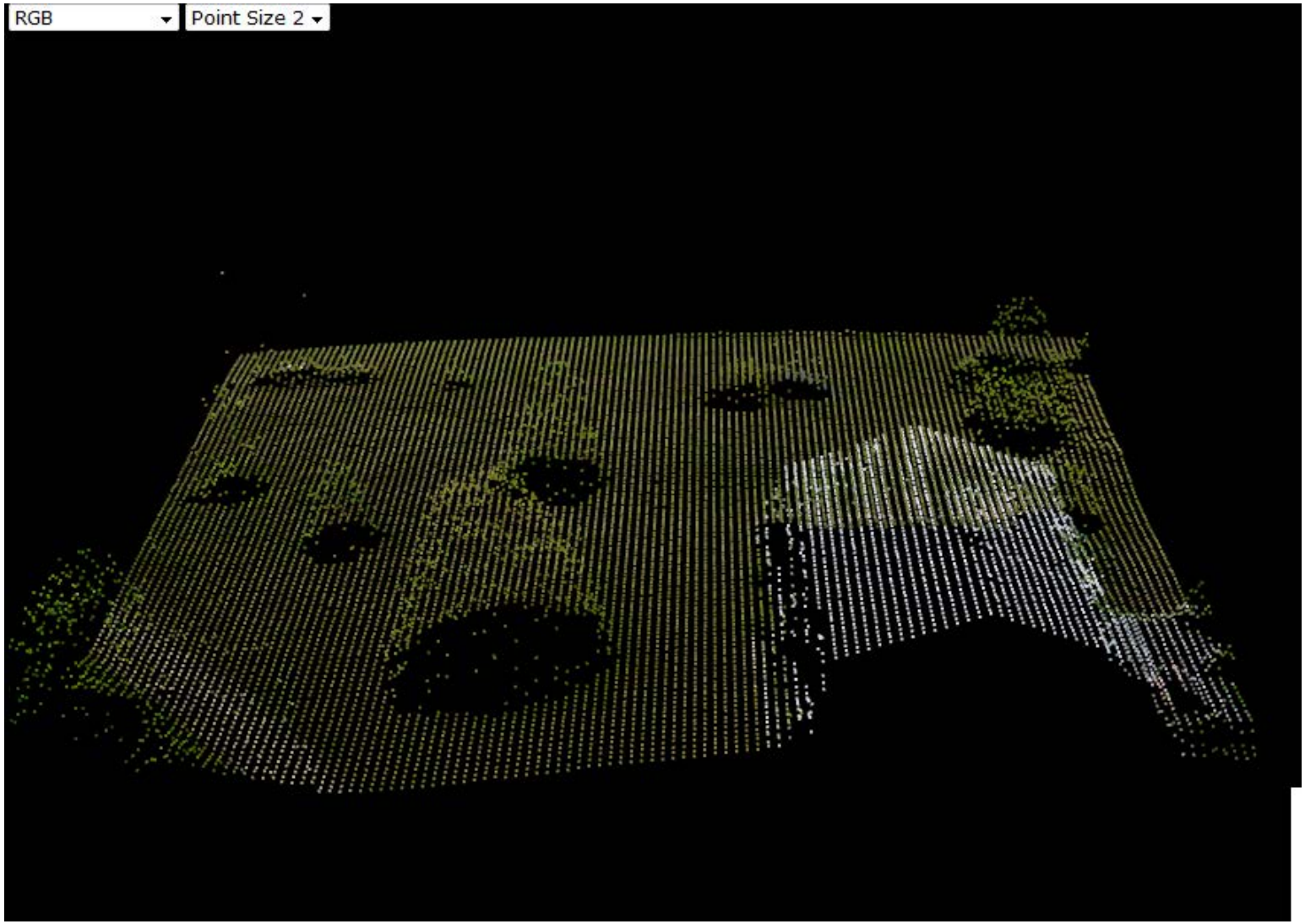


CGAL library

- **Computational Geometry Algorithms Library**
  - software library of computational geometry algorithms
  - C++ library with easy access to efficient and reliable geometric algorithms
  - http://www.cgal.org/

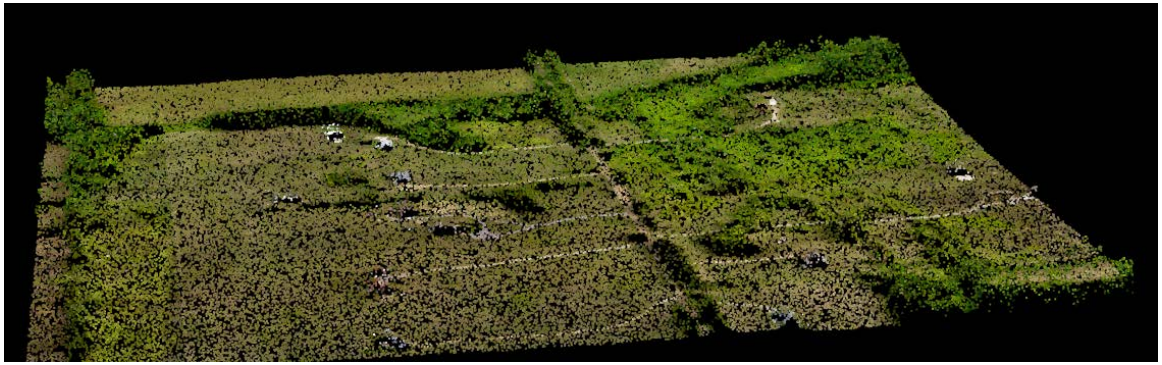
- **point set processing components**
  - interpreting the LiDAR data as point clouds,
  - we get various geometry information
- **point set shape detection components**
  - estimate parameters of a mathematical model
  - from a set of observed data

Ground LiDar Data Example

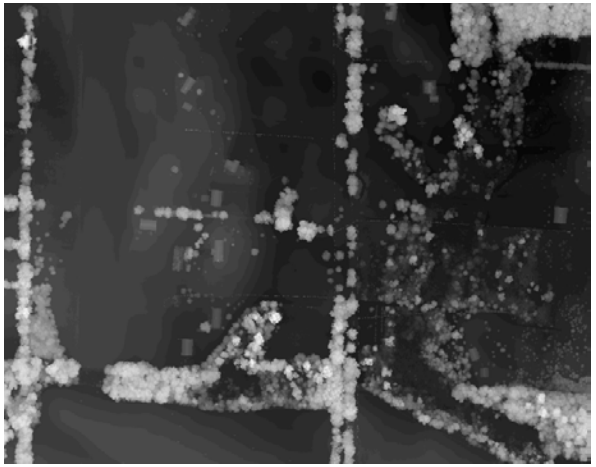


Terrain Editor

- original ground LiDar data : point cloud

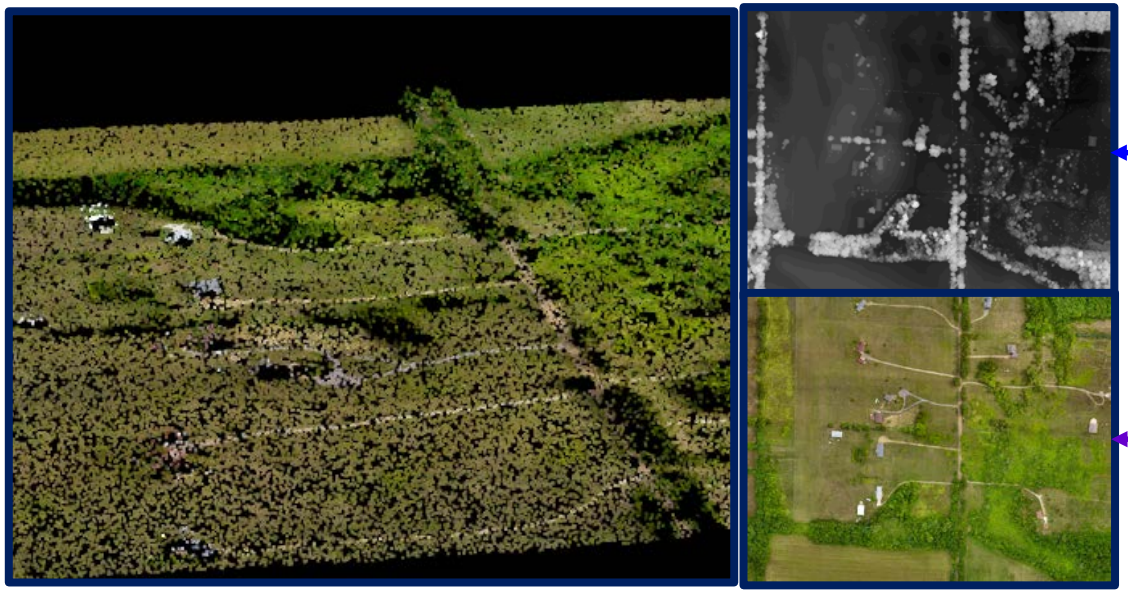


- height map (DEM) + texture image



Terrain Editor

- left window: show 3D view
- right windows : interactive and direct manipulation



modifying the DEM data

touching
the landscape colors

Terrain Editor

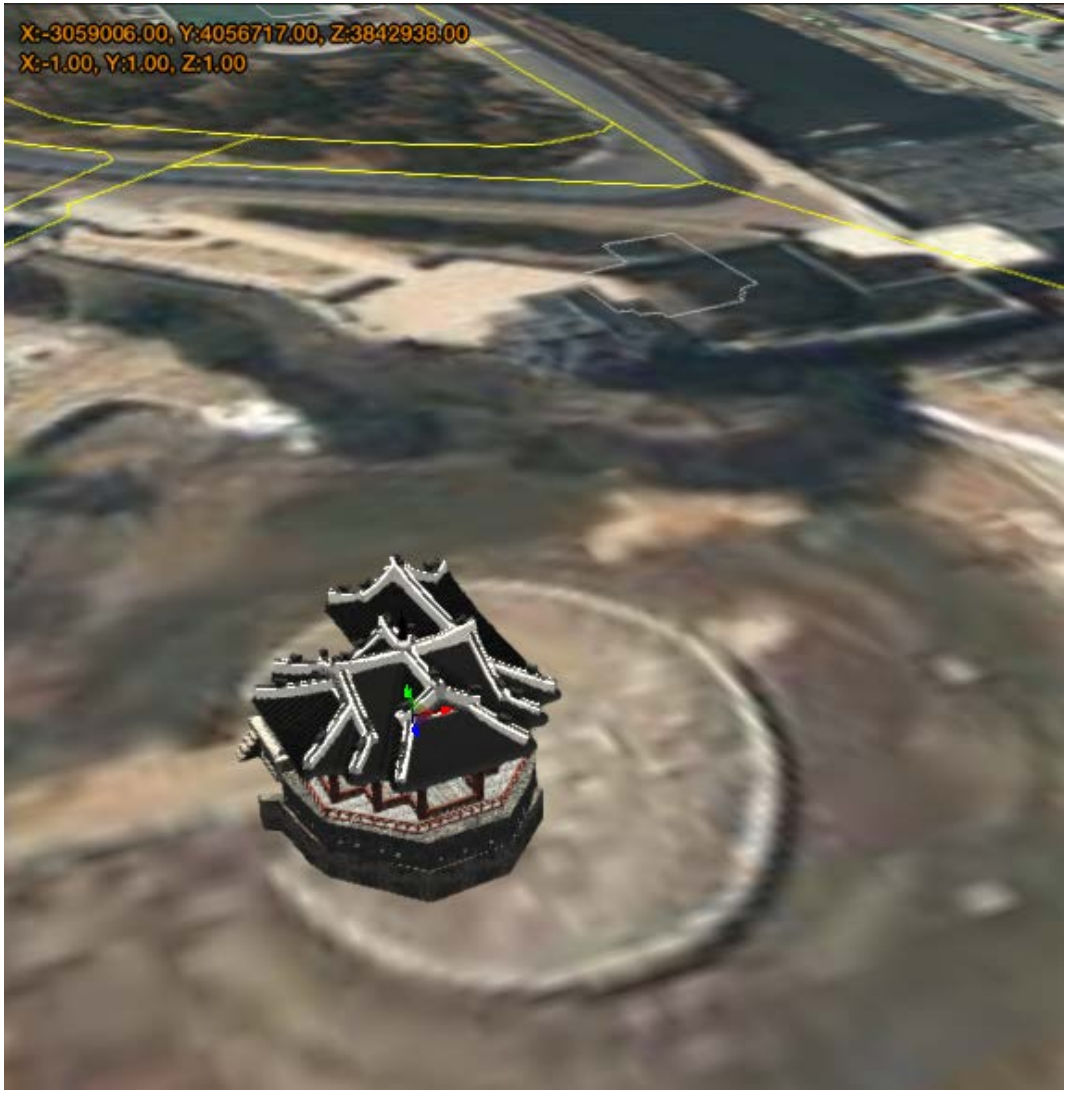
- **3D view:**

Geometry Models

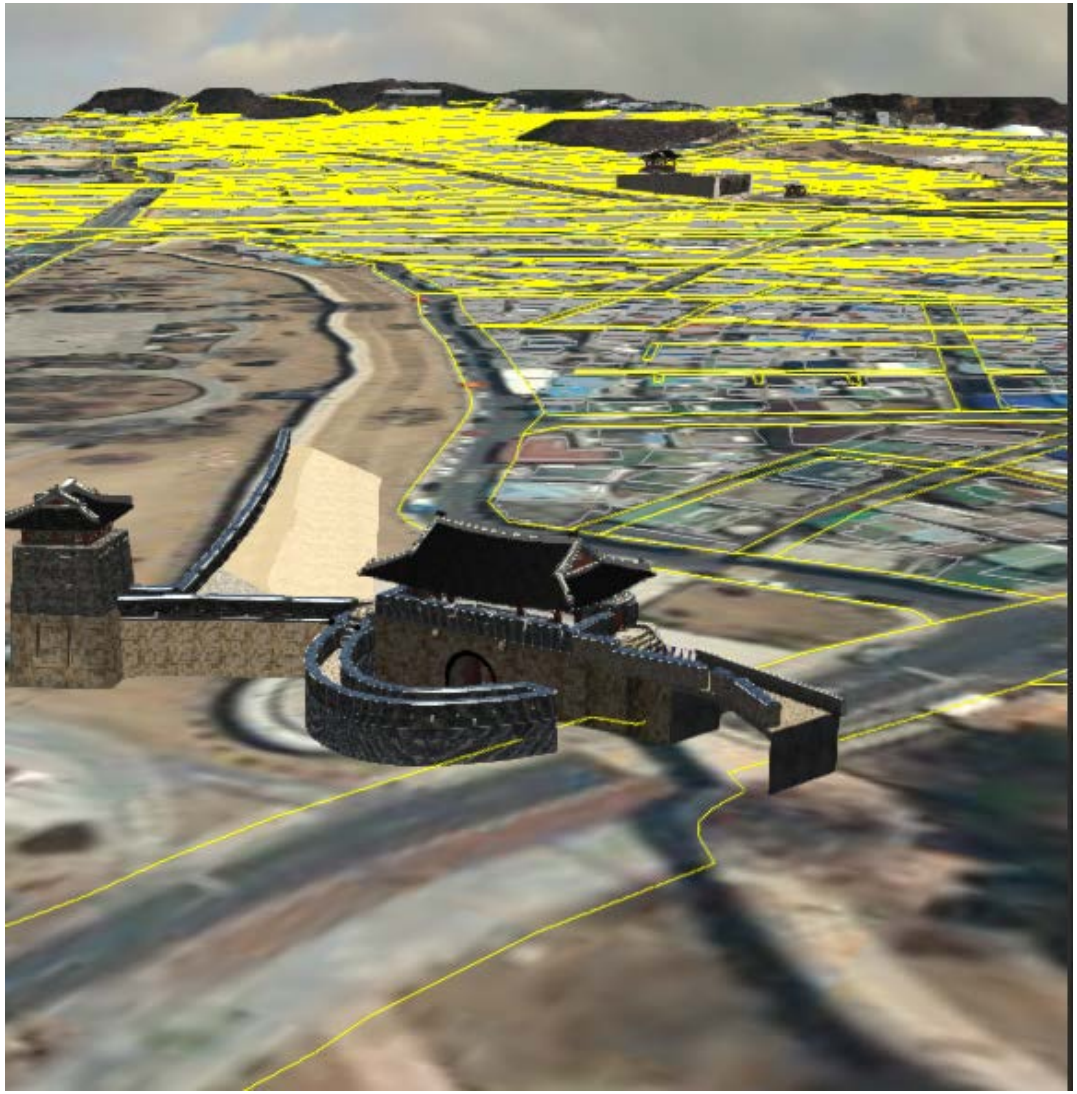
- also can be used with LiDAR data and/or GIS-based landscape
- a customized geometry model

Putting it on the Landscape

Putting it on the Landscape

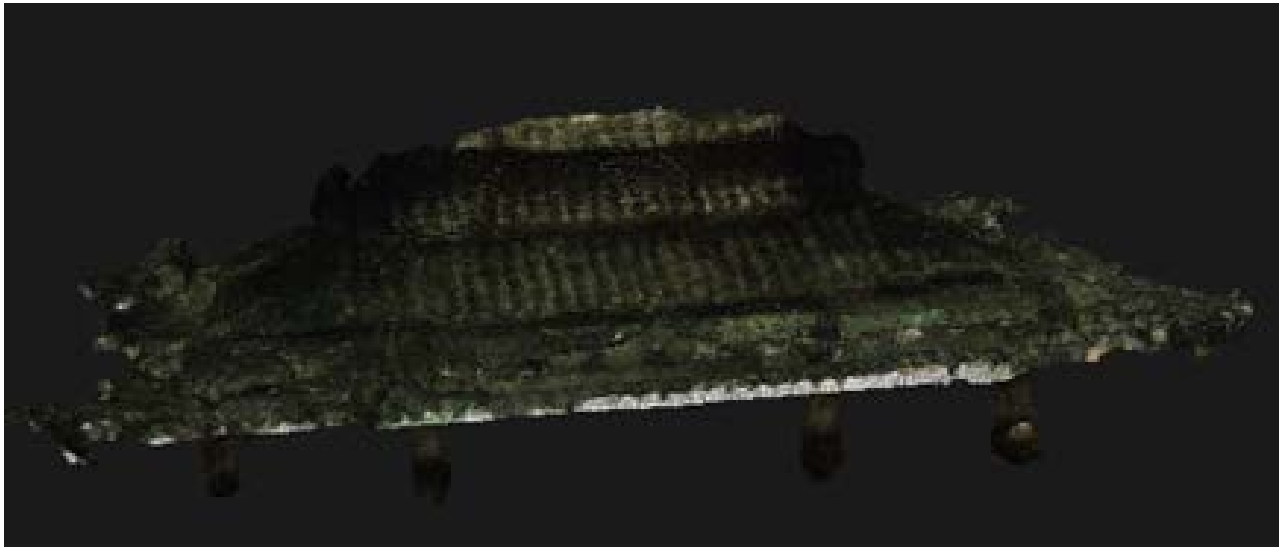


Putting it on the Landscape



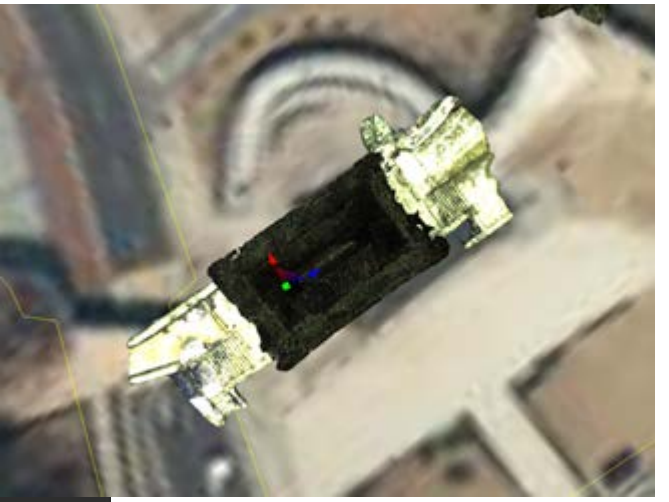
Object Modeling

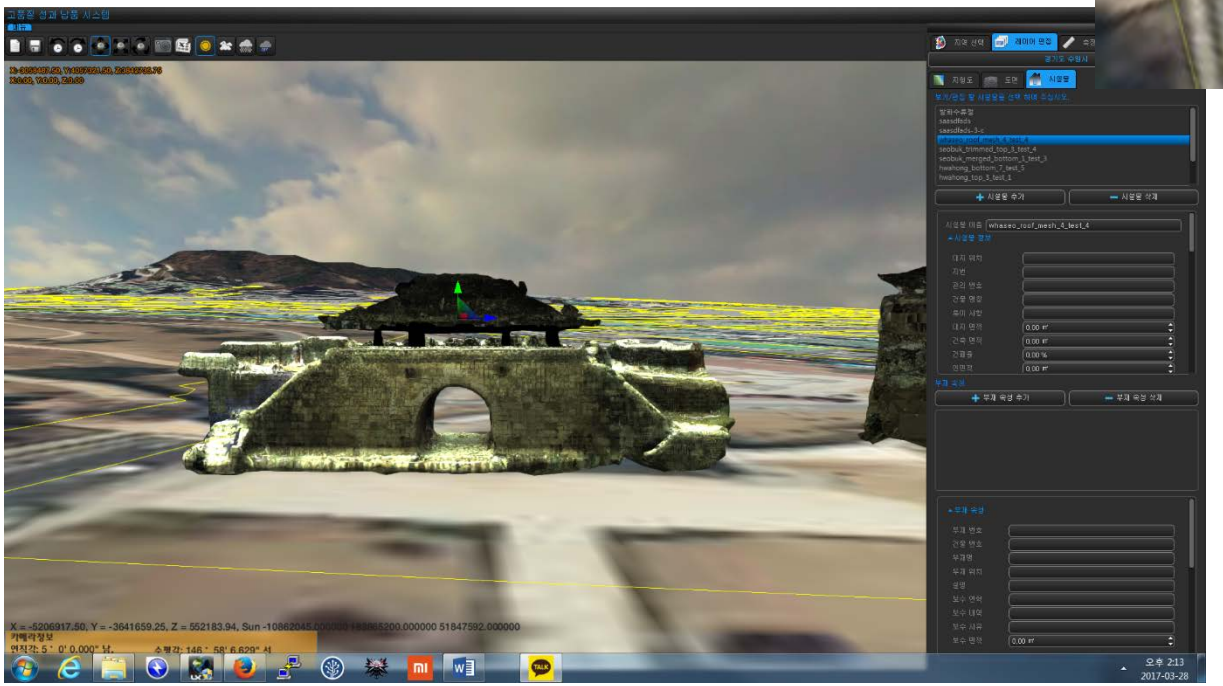
- the roof and the building



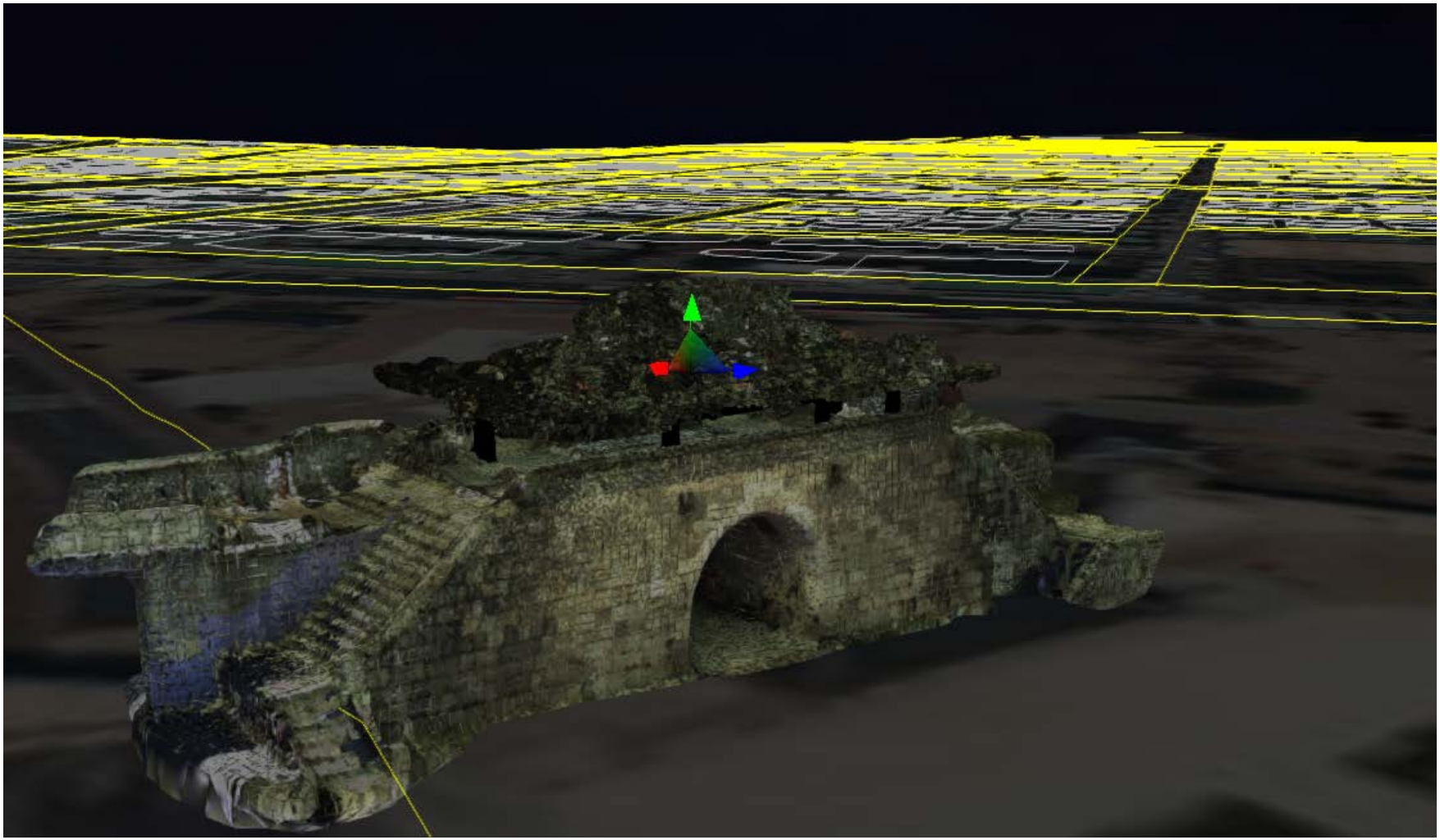
Putting the objects on the map

- **objects overlaid on the map**



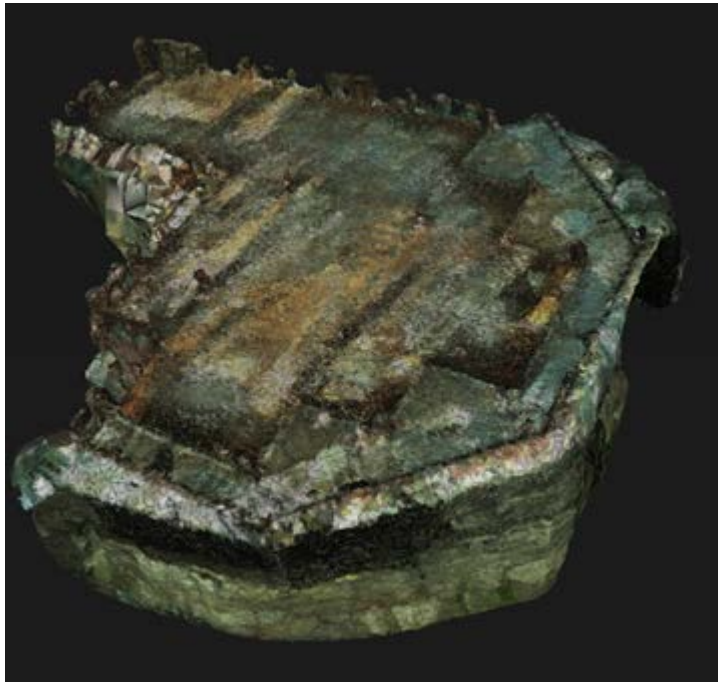


Combining the objects



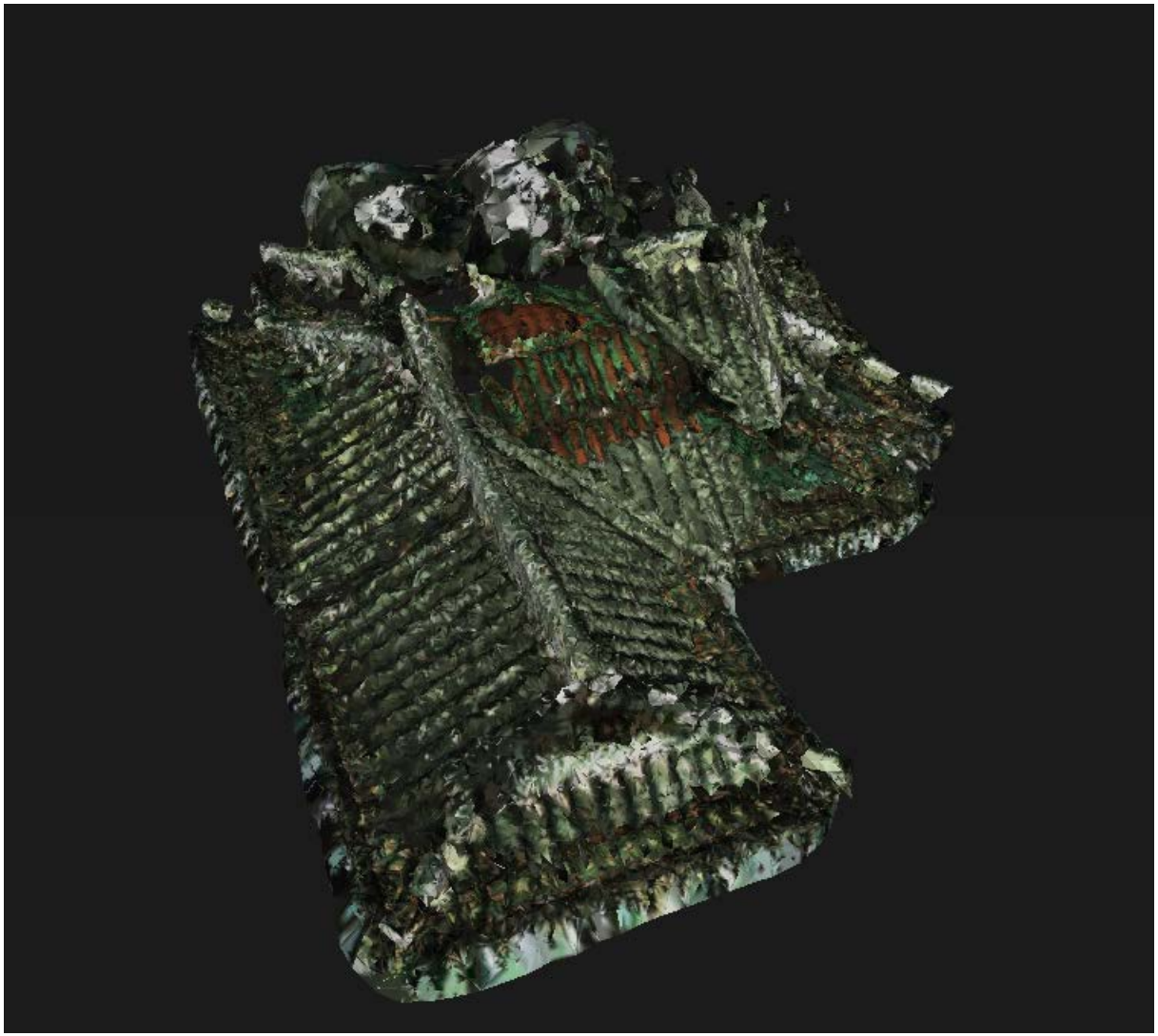
Another object – Hwa-Heung Gate

Bang-Hwa Pavilion

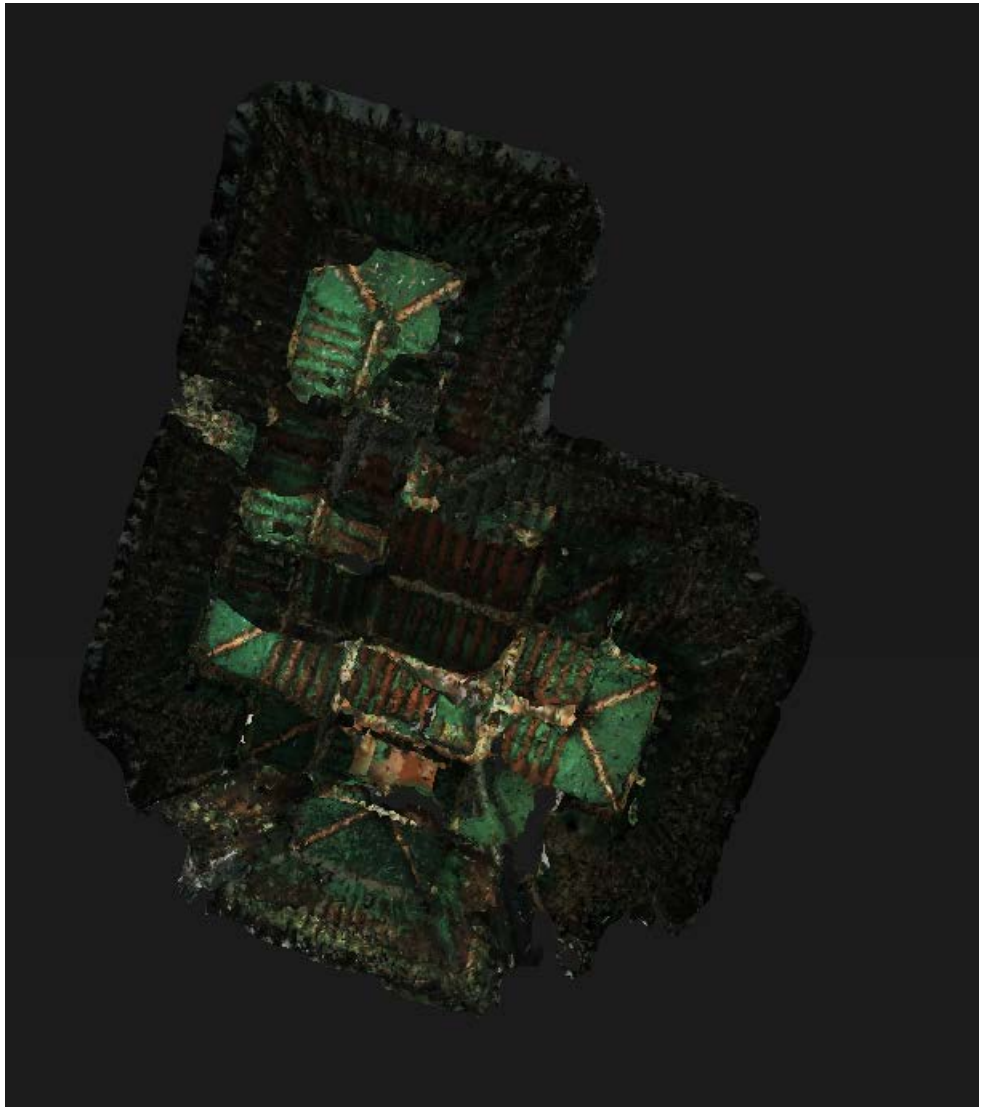


3D model for the pavilion

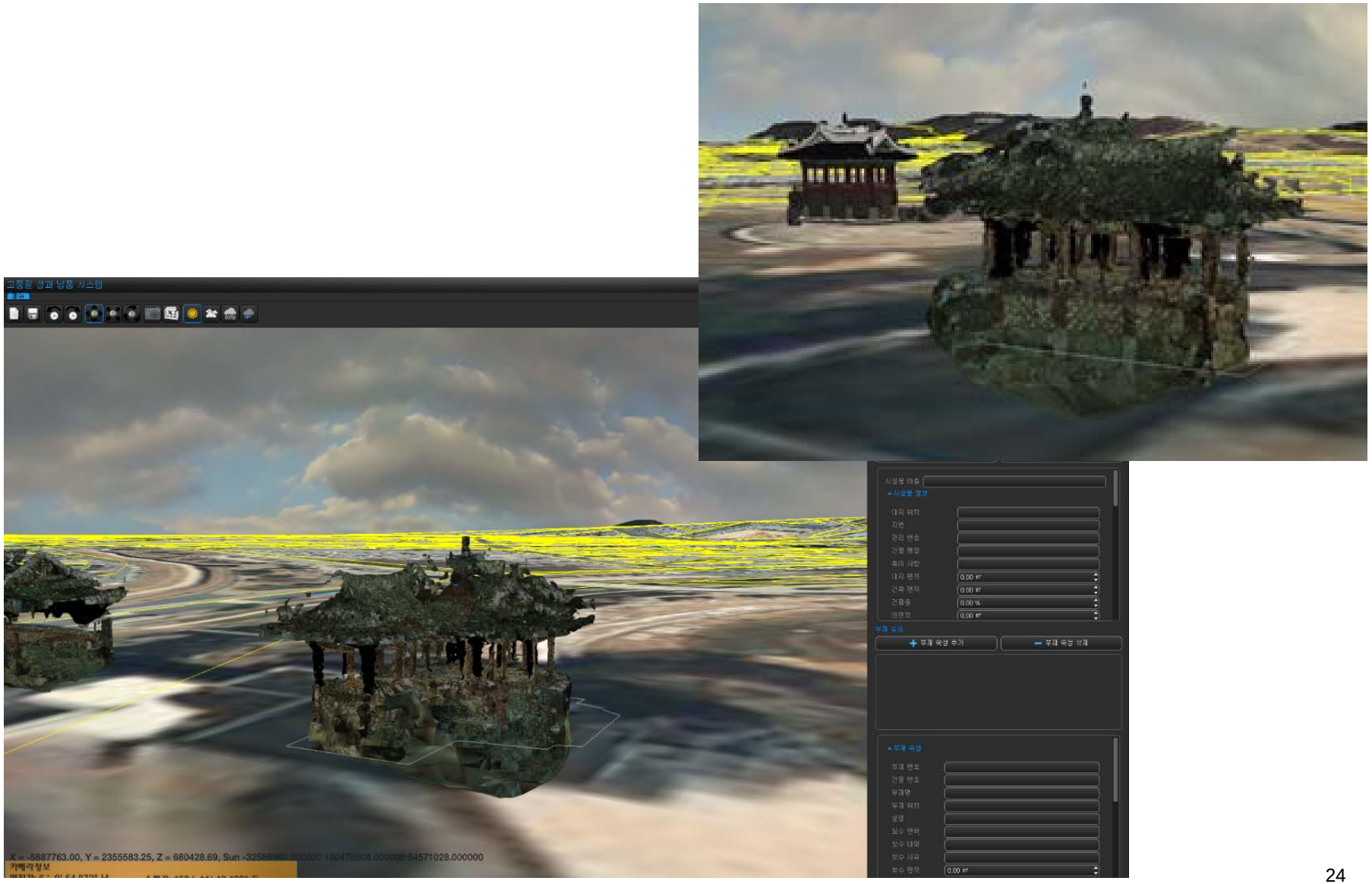
Roof for the pavilion



Combining all the parts

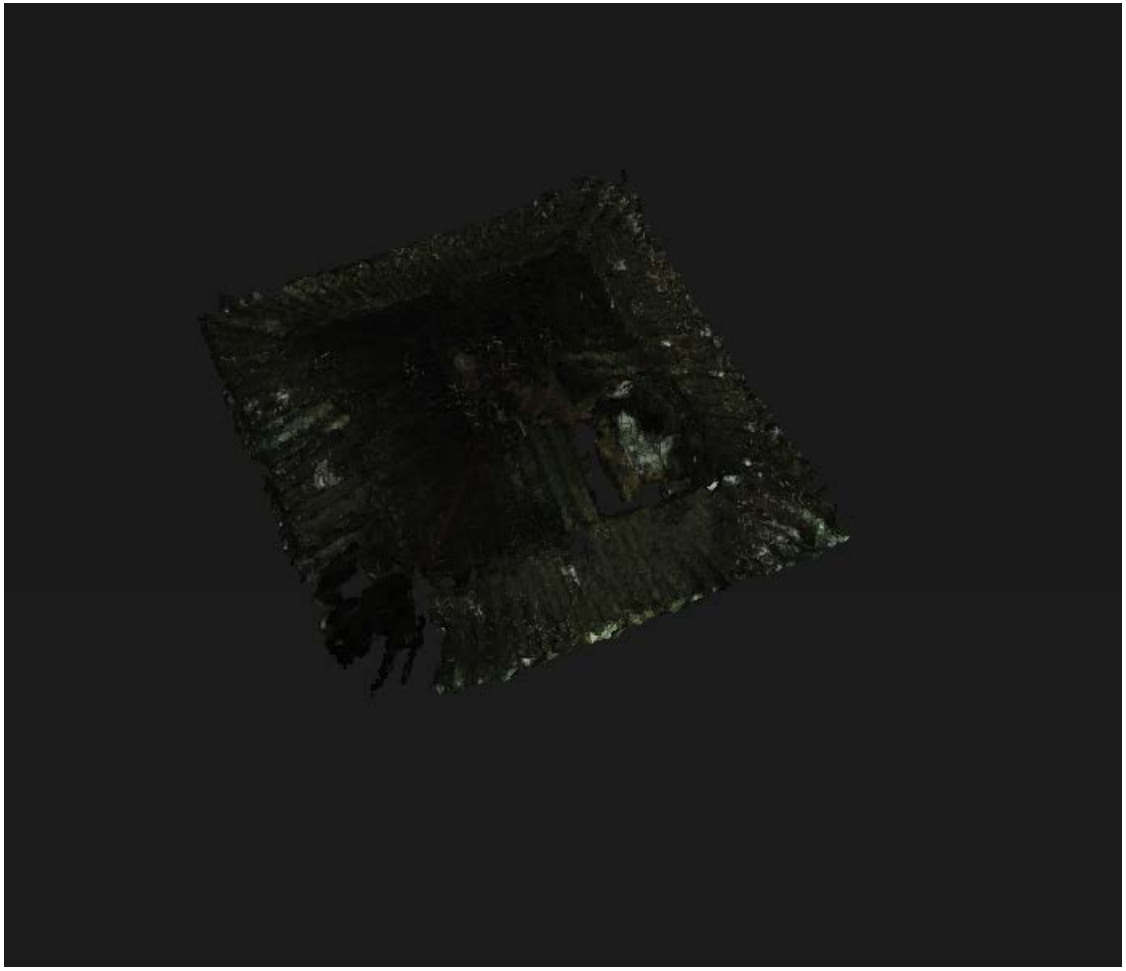


Overlaid on the map

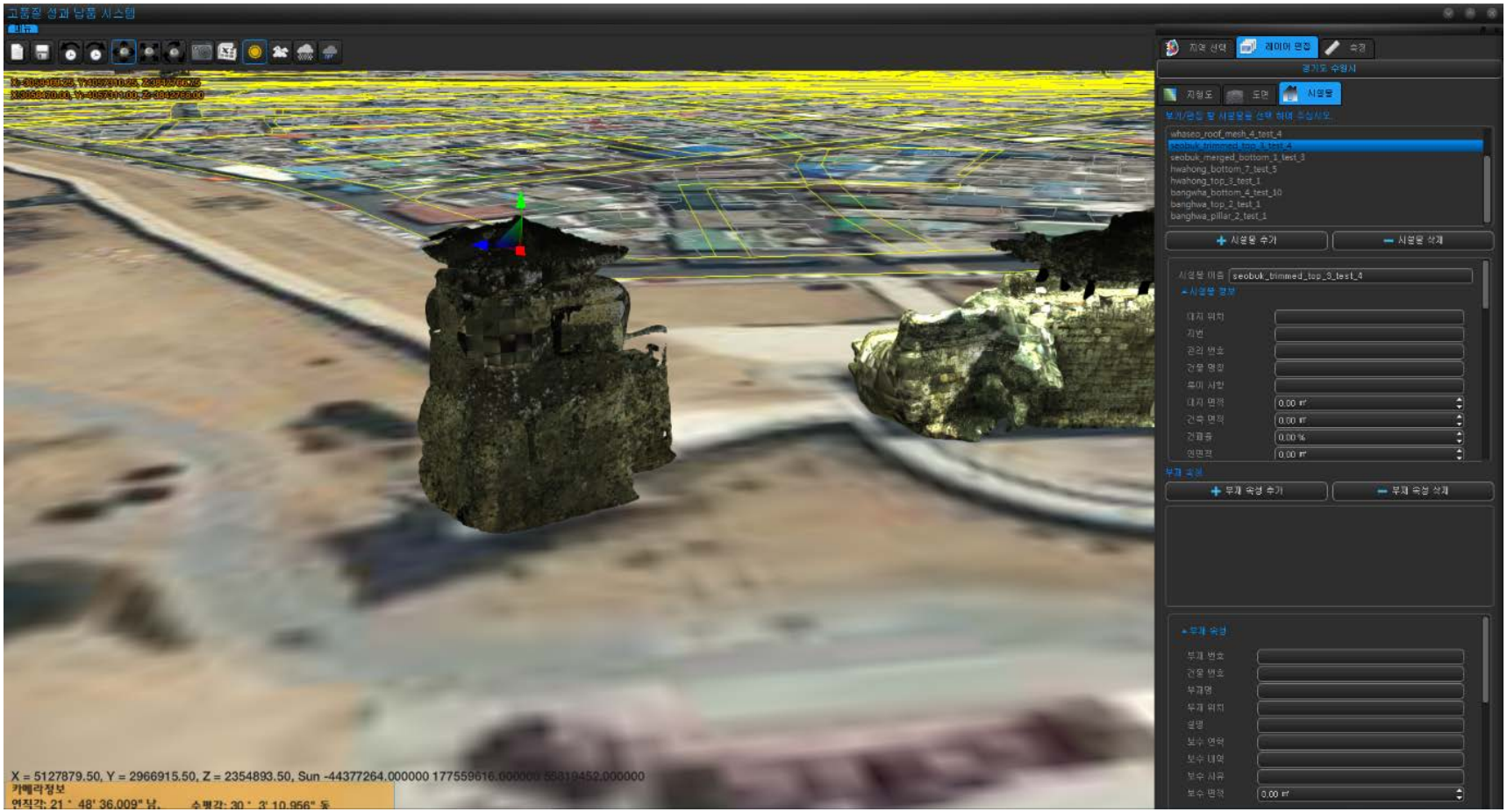


Additional Buildings

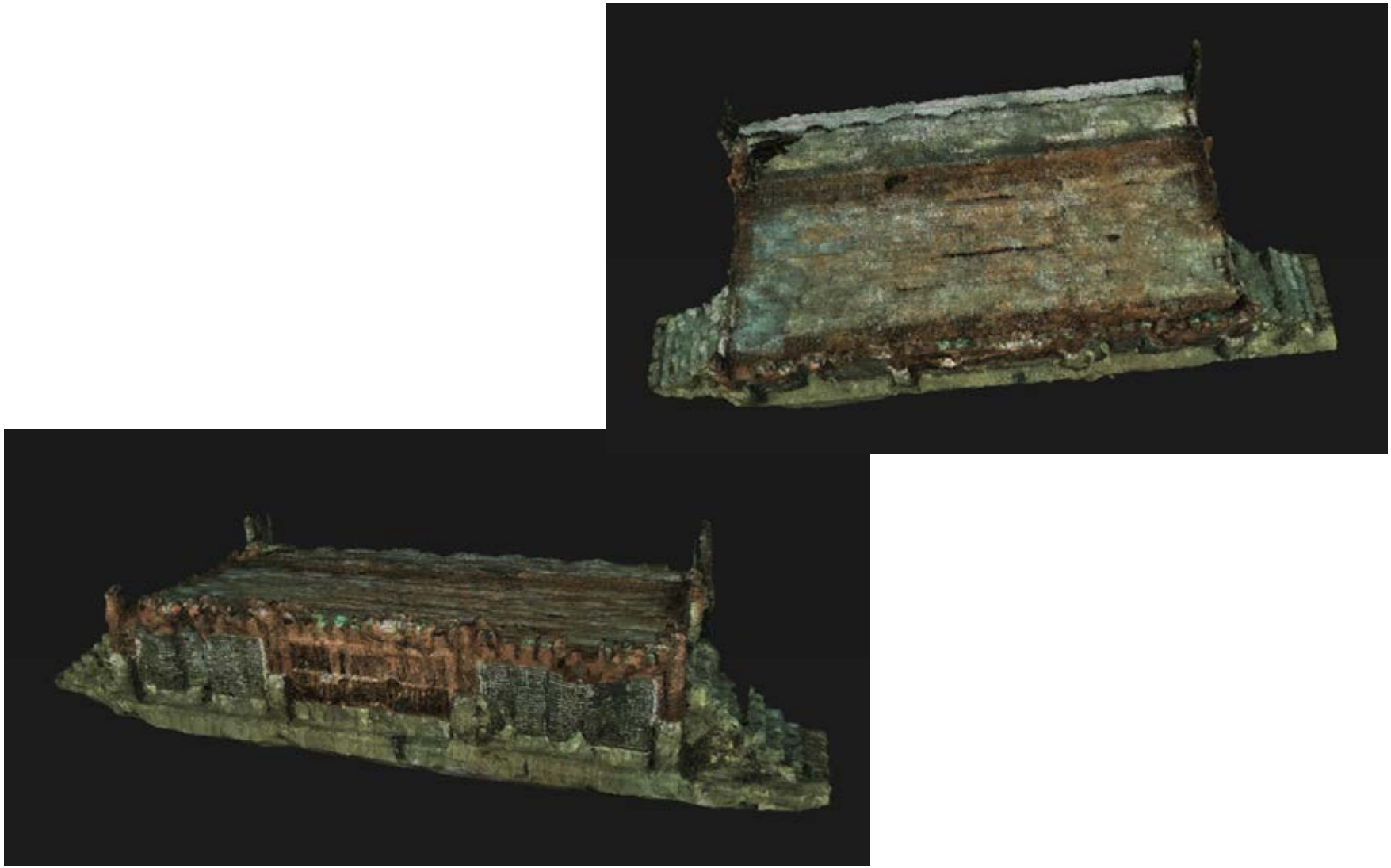
Roof for the building



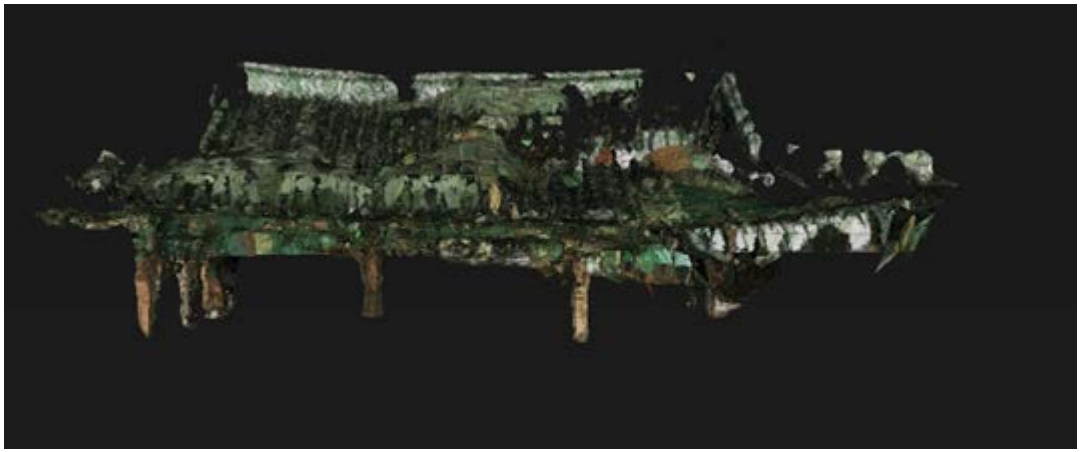
Final snap-shot

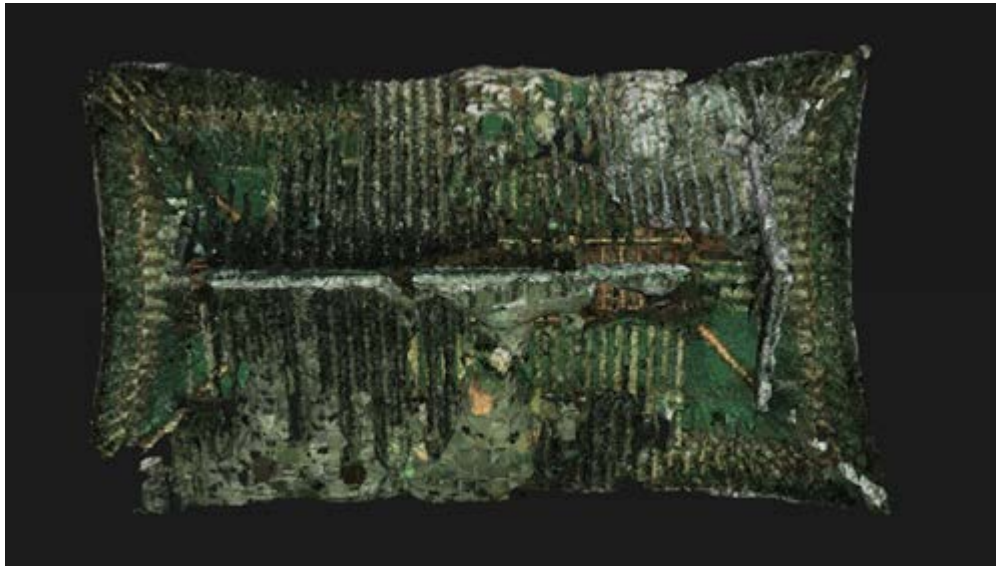


Another Object – Hwa-Heung Gate



Other parts – Hwa-Heung Gate





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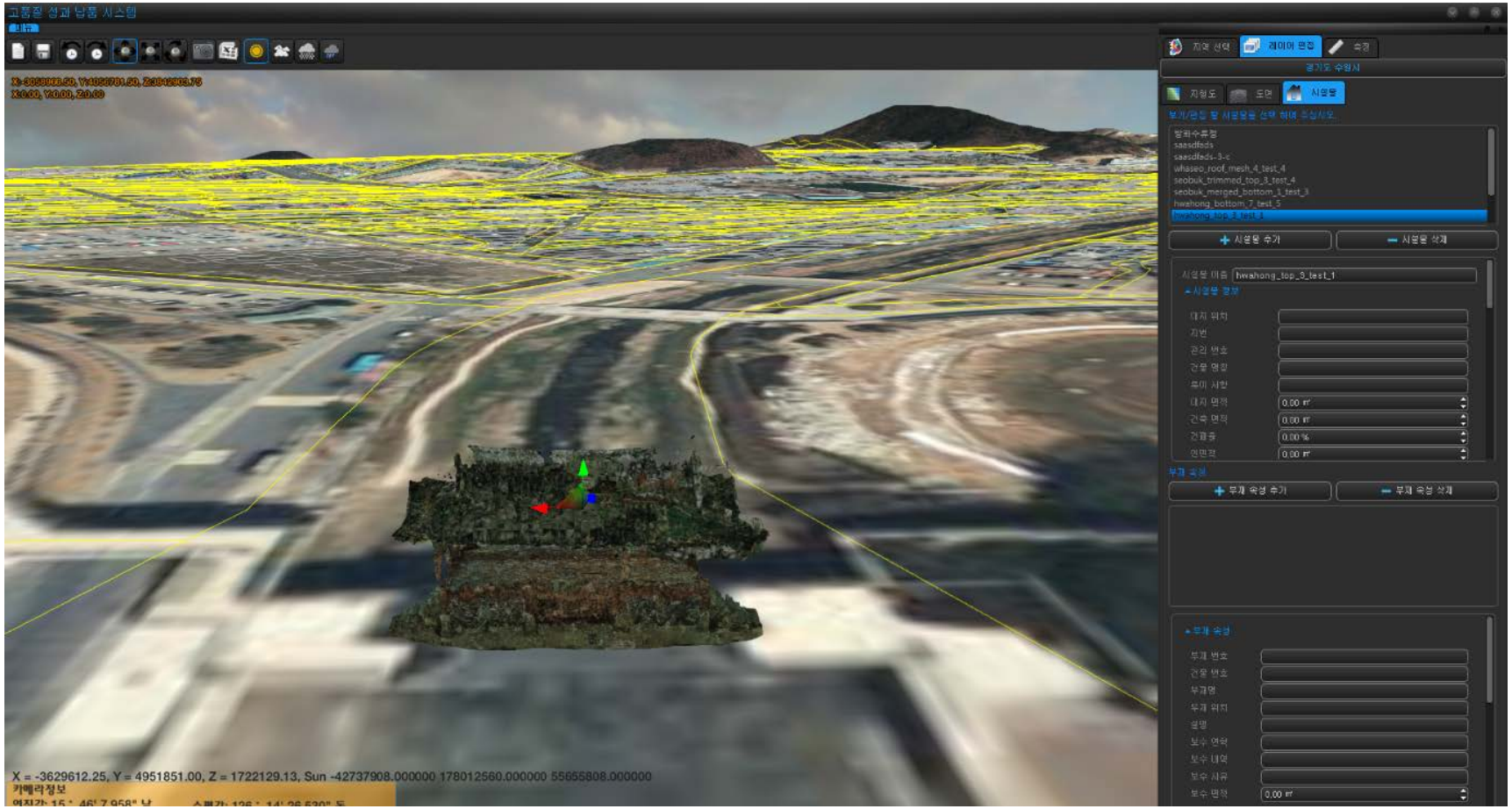

Conclusion

- **a 3D GIS platform**
  - landscape viewer / editor
  - terrain editor
- **geometry models constructed from LiDAR data**
  - point cloud from the LiDAR data
  - geometric primitives extracted
  - combining them to make 3D models
  - overlaying the model on the maps
- **effective way of integrating GIS systems and 3D virtual objects from real-world structurs**