Survey to BIM, how to get solids directly from surveying with GNSS or total stations

Thomas Sandström

Survey to BIM, how to get solids directly from surveying with GNSS or total stations

Instead of scanning/point clouds!

Thomas Sandström

Adtollo

Software development company working with systems within infrastructure projects, construction, mapping, design

Two business areas

- Surveying and Mapping
- Document management

Surveying and Mapping

- Topocad is delivered in more than 30 000 licenses world-wide, in 18 languages
- Modules ranging from Net adjustment to Design
- Base module contains survey calculation, communication, CAD, transformation, terrain modeling and solids

BIM in our perspective

BIM in our perspective

Adtollo with Topocad has been using BIM since 2015, key words are solids and metadata.

BIM in our perspective

BIM, with solids, are used for all types of result as volume calculations:

Terrain models, Point clouds, Cross sections, surfaces, etc

BIM in our perspective

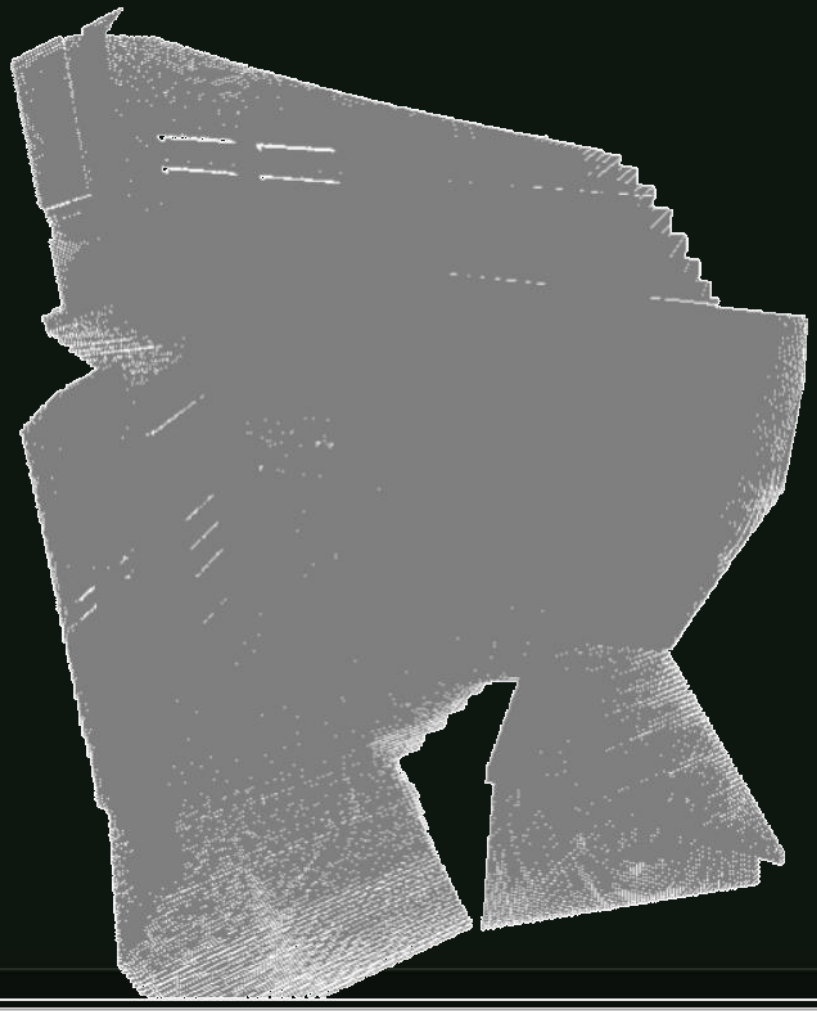
”Traditional” surveying for work
with BIM is definetely not obsolete

Create BIM objects from any survey

Surveying vs scanning

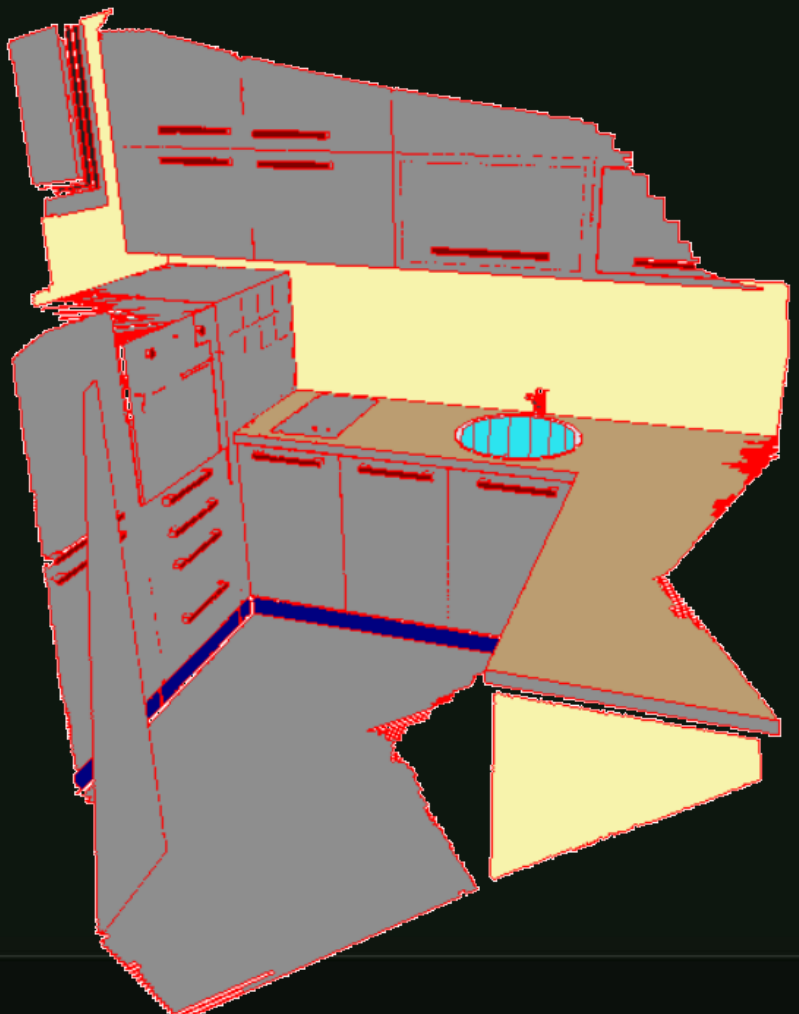
Create BIM objects from any survey

Surveying vs scanning



Create BIM objects from any survey

Surveying vs scanning

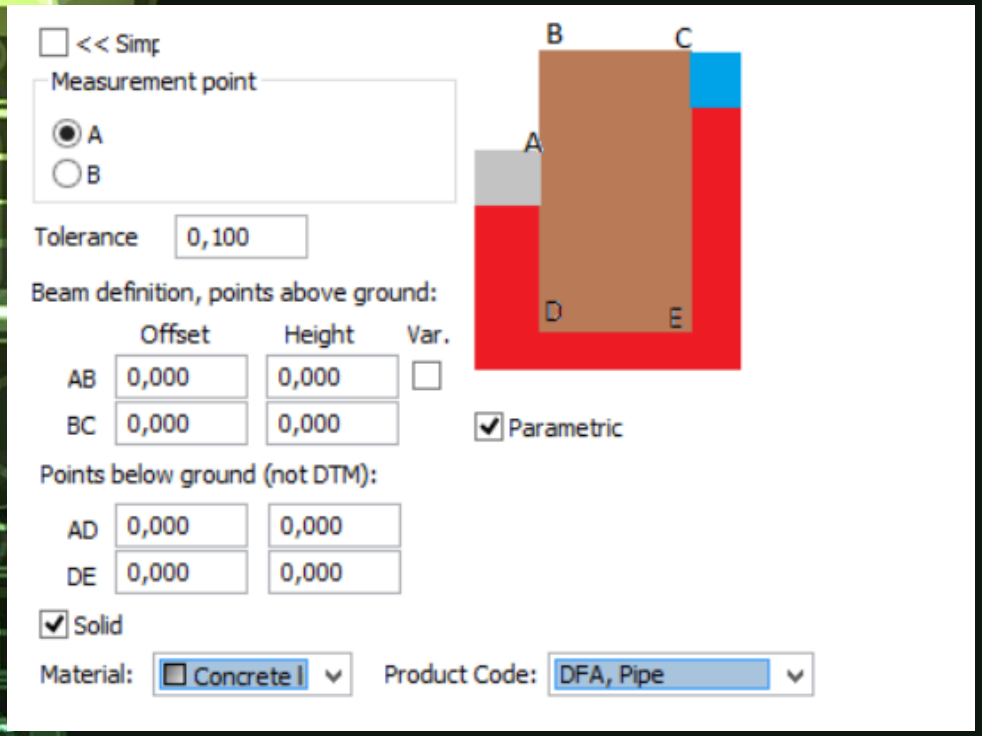


Creating solids from survey

Survey with total station or GNSS and create solids as:

- 3D Beam
- 3D Building – Cube – LOD 1
- 3D Building – LOD 2
- 3D Cylinder
- 3D Horizontal sloping pipe
- 3D Pile, squared, circular
- 3D rectangular pillar
- 3D surface
- 3D Sweep

Survey 3D Beams



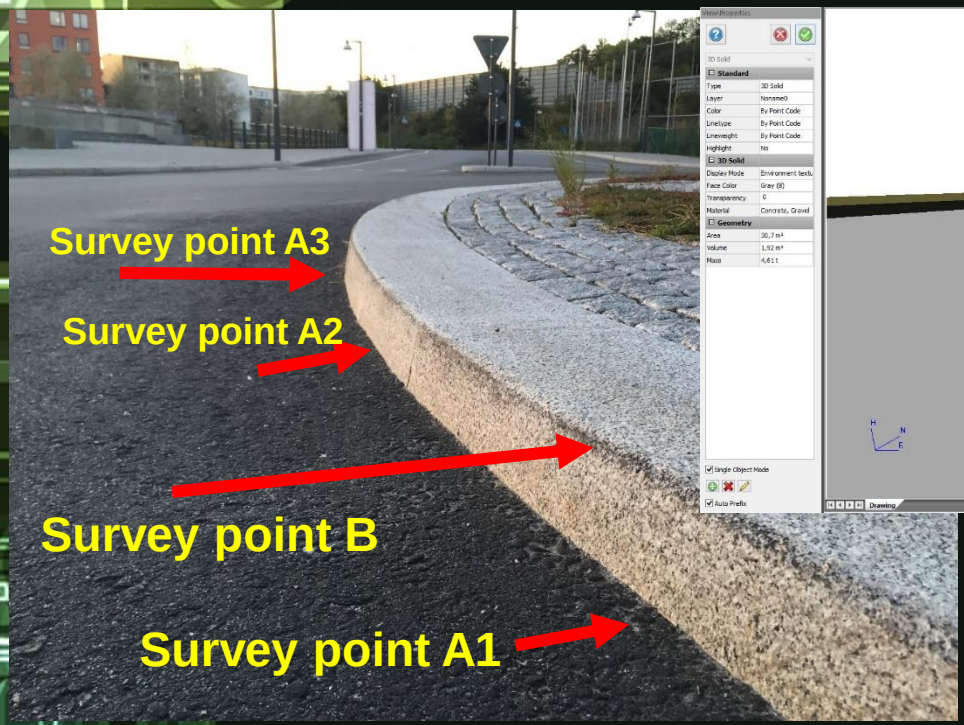
Survey beam, like kerbstone, along the road edge

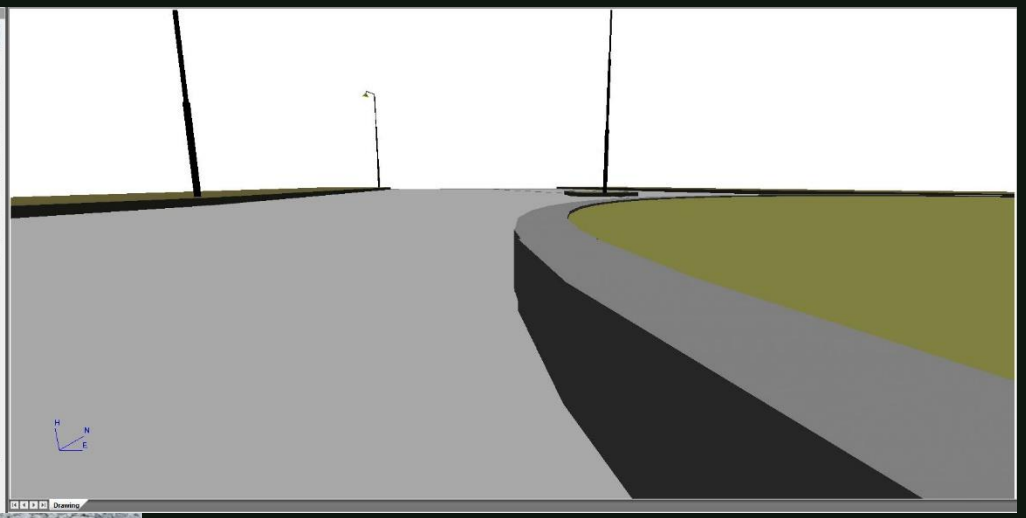
Result: Solid

LOD >1

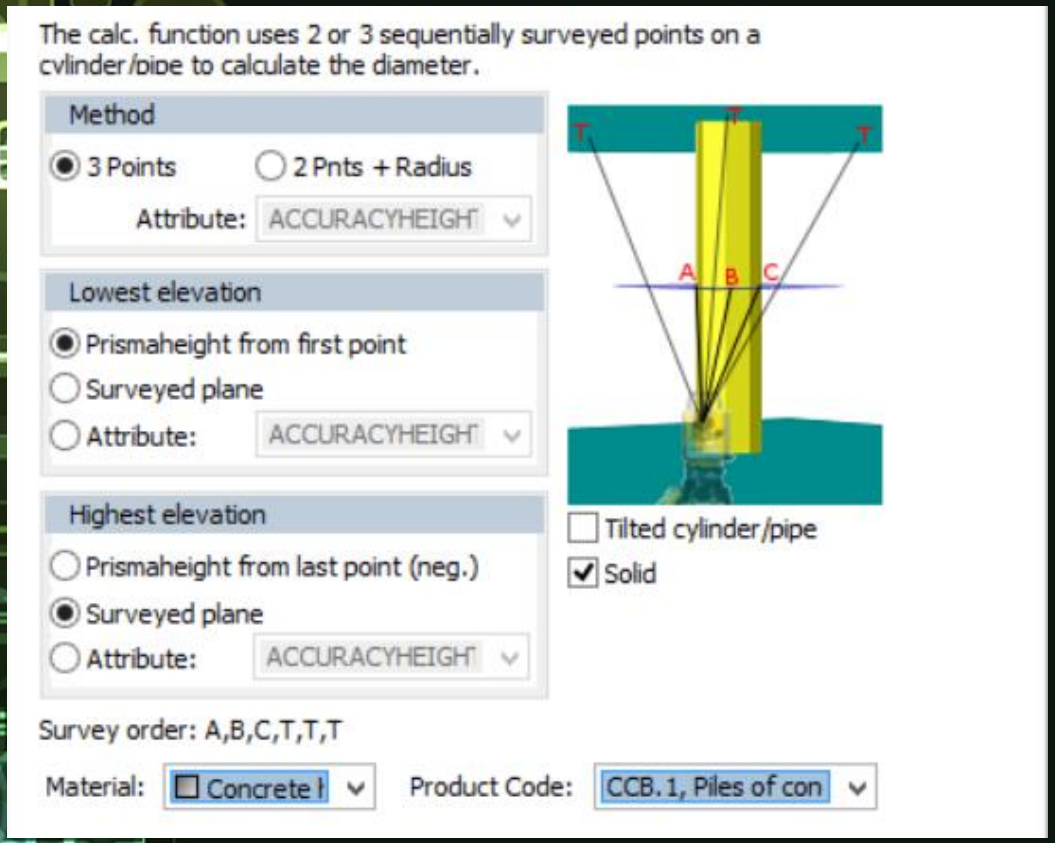
Type = Beam

Survey 3D Beams





Survey 3D Cylinder (pillar)



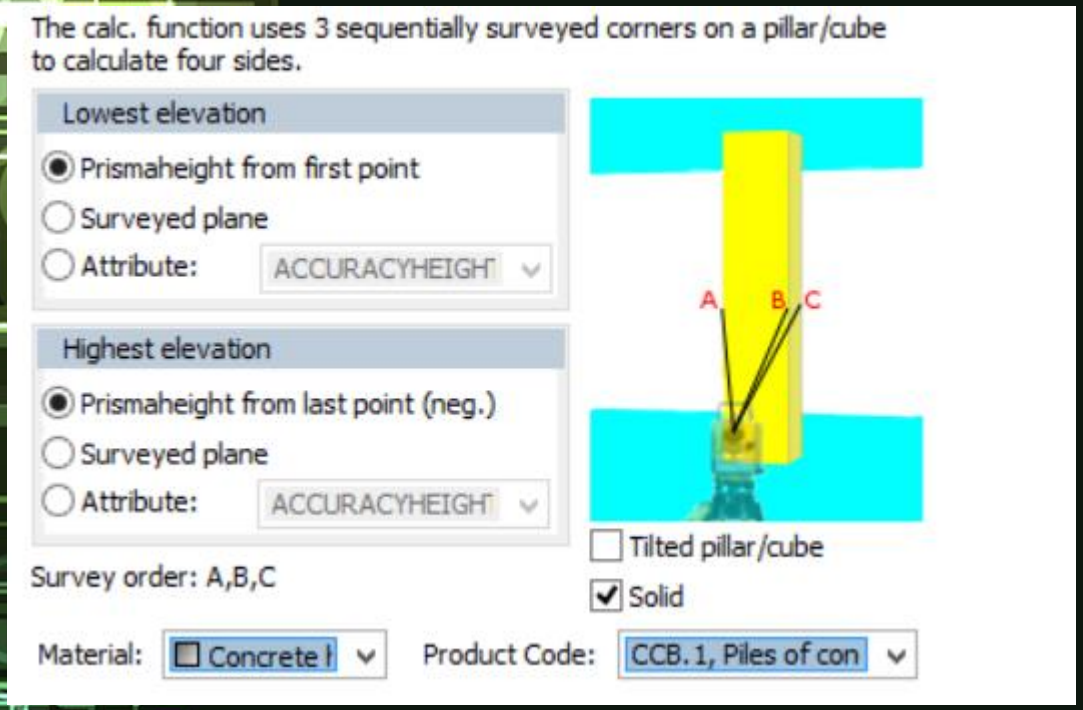
Pillars vertical or sloping, measure three points on them and decide the length up and down.

Result: Solid

LOD >1

Type = Pile

Survey 3D pillar



Pillars vertical or sloping, measure three points on them and decide the length up and down.

Result: Solid

LOD >1

Type = Pile

Survey 3D pillar

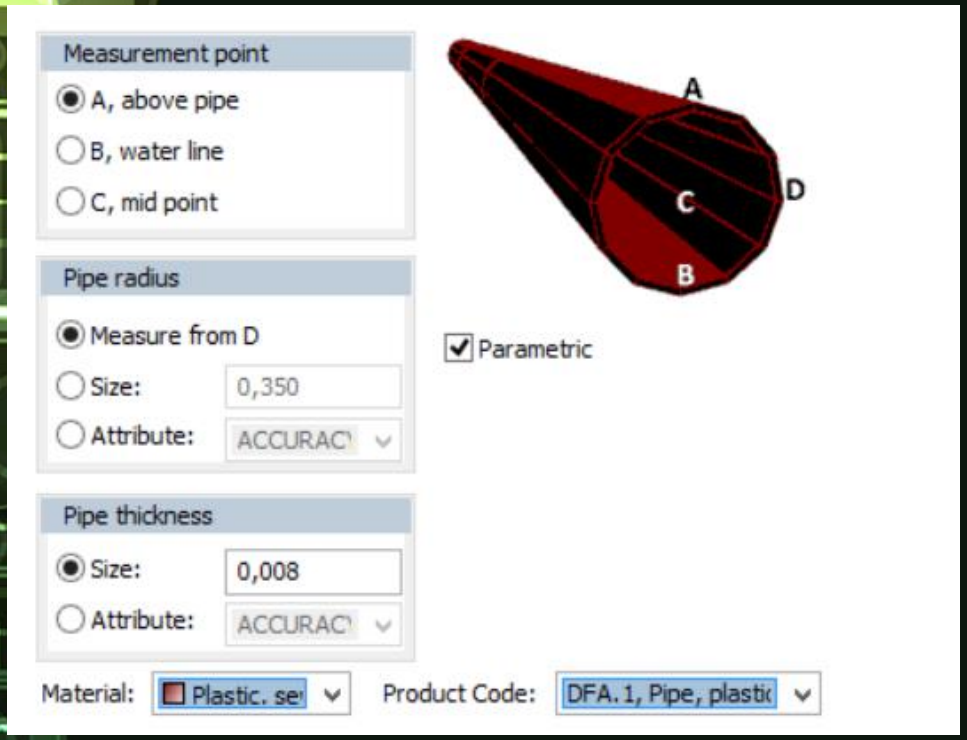
Pillars vertical or sloping, measure three points on them and decide the length up and down.

Result: Solid

LOD >1

Type = Pile

Survey 3D Sloping pipe



Measurement of pipe, select measurement point, eventual radius

Result: Solid

LOD >1

Type = Pipe

Survey 3D Sloping pipe

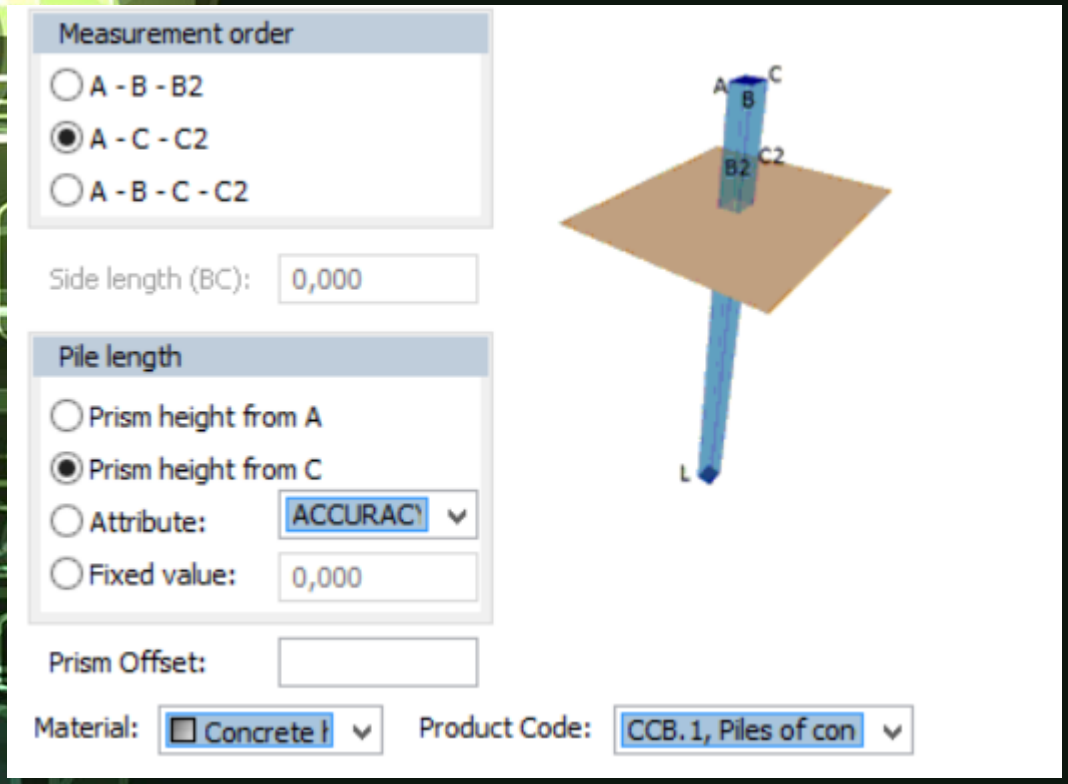
Measurement of pipe, select measurement point, eventual radius

Result: Solid

LOD >1

Type = Pipe

Survey 3D Pile



Measurement of pile, measure 2-3 corners, along one of the corners, enter length

Result: Solid

LOD >1

Type = Beam

Survey 3D Pile

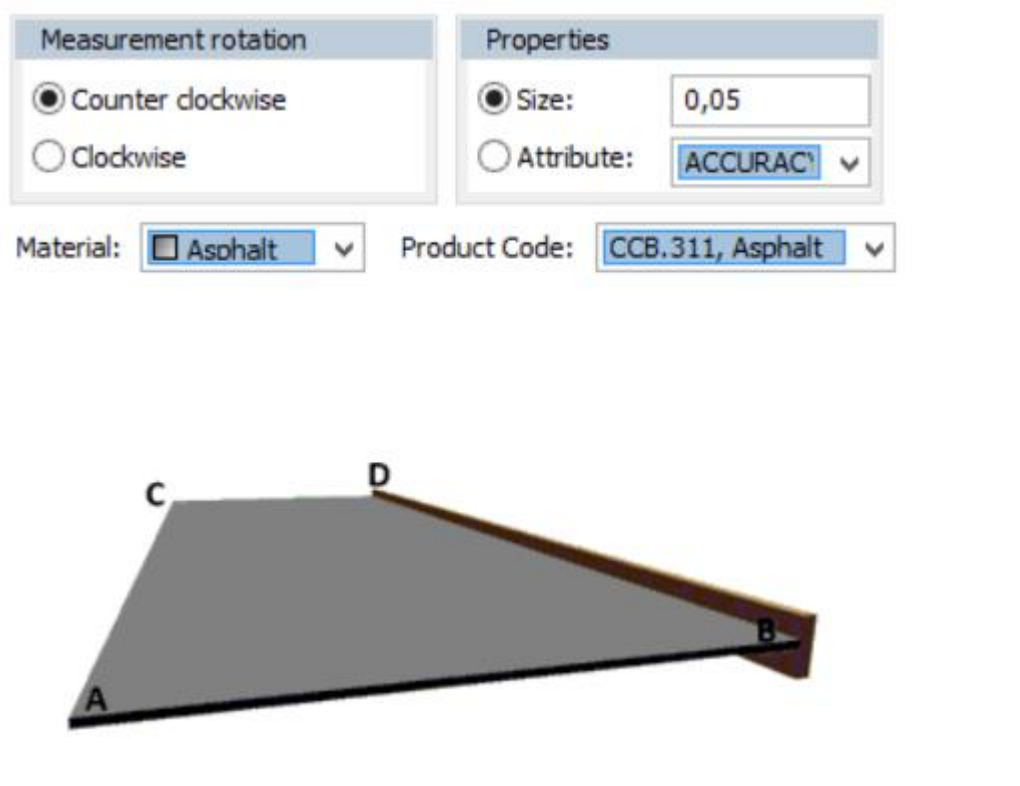
Measurement of pile, measure 2-3 corners, along one of the corners, enter length

Result: Solid

LOD >1

Type = Beam

Survey 3D Surface



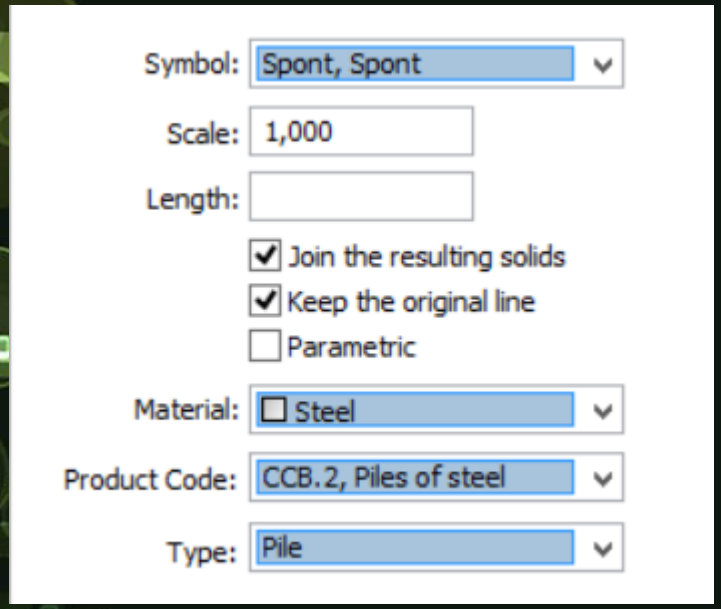
Measurement of surfaces of varying thicknesses

Result: Solid

LOD >1

Type = Surface

Survey 3D sweep



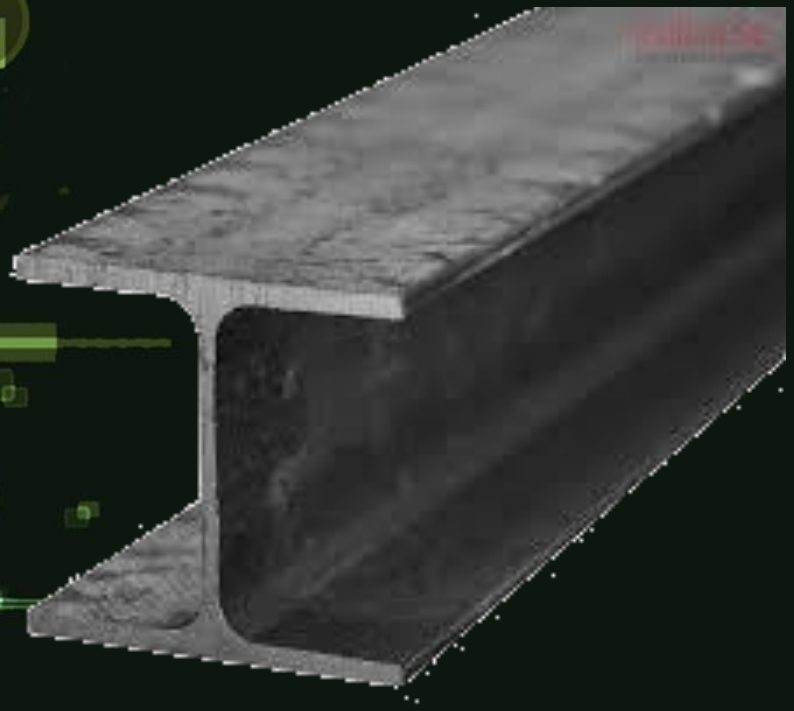
Measurement of any kind of polygon thru measured line.

Result: Solid

LOD >1

Type = Beam, Pipe, etc

Survey 3D sweep



Measurement of any kind of polygon thru measured line.

Result: Solid

LOD >1

Type = Beam

Survey 3D sweep

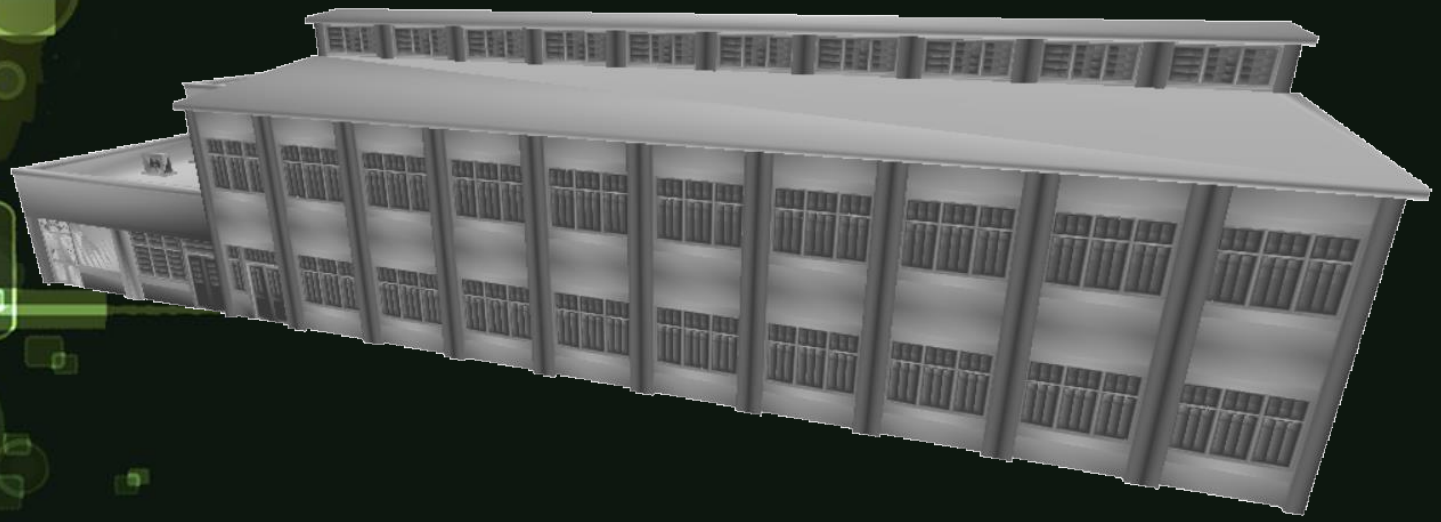
Measurement of any kind of polygon thru measured line.

Result: Solid

LOD >1

Type = Beam

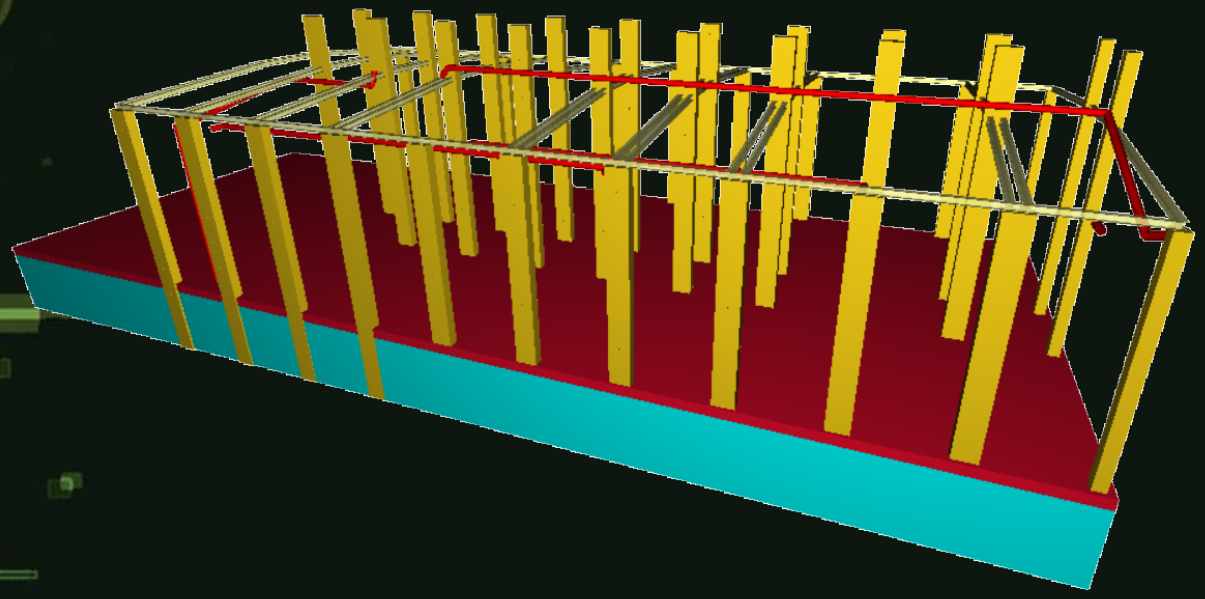
Survey of a factory



We measure this factory, industry building to see how we end up.

Demonstration

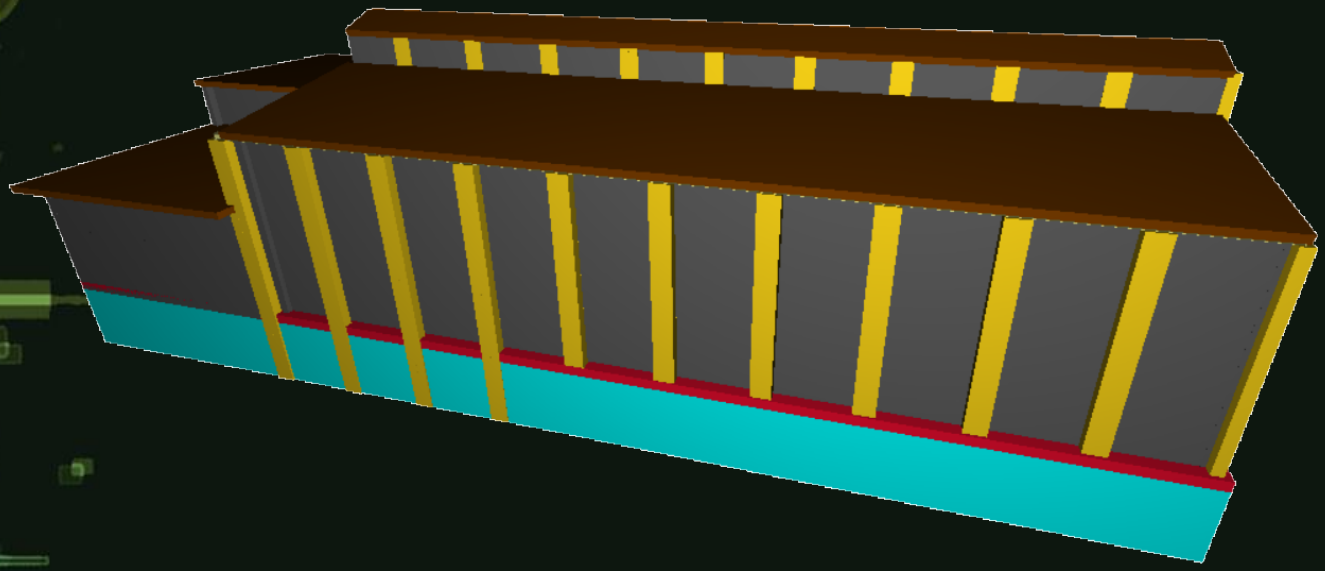
Survey of a factory



The result.

260 observations

Survey of a factory



The result.

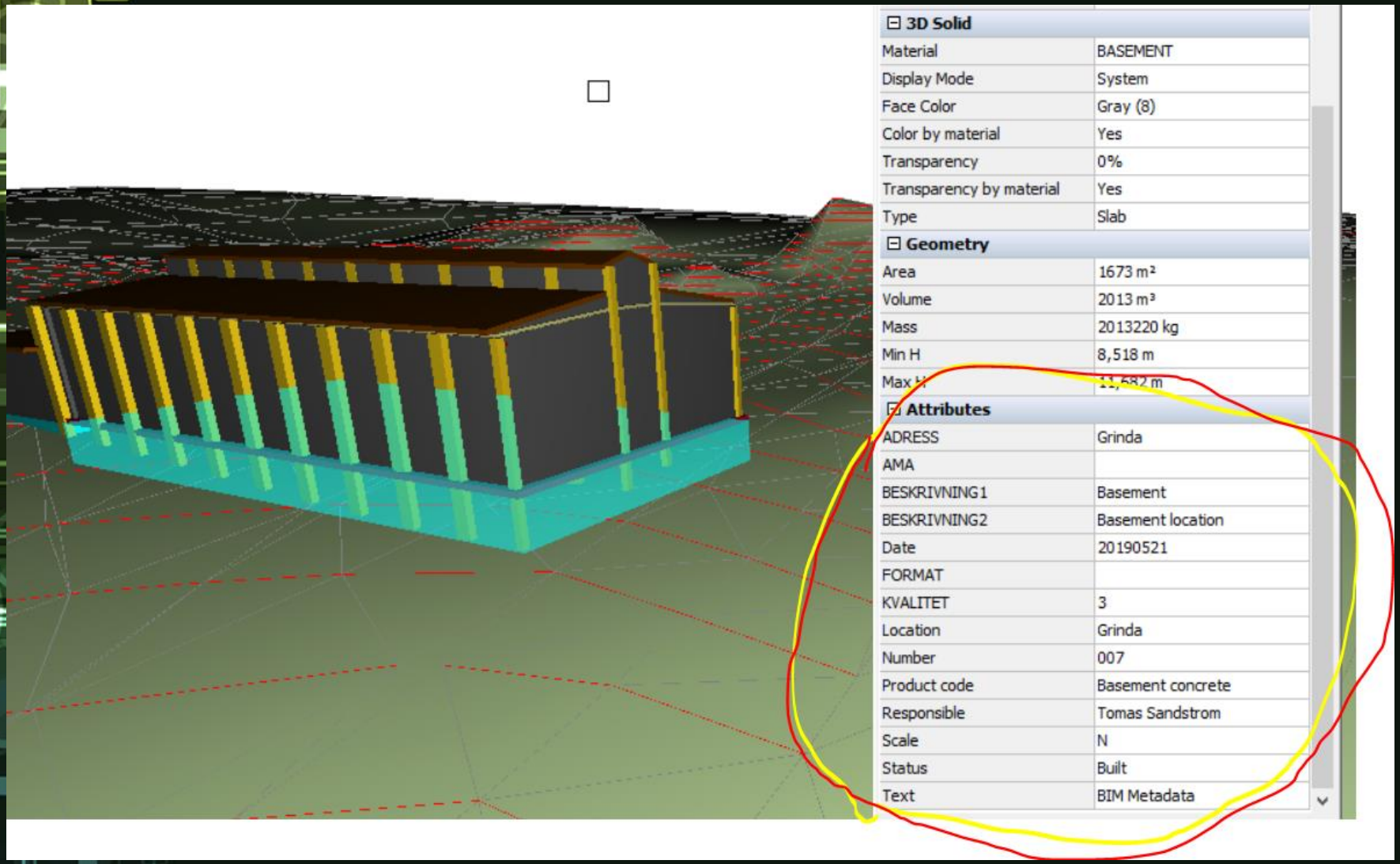
260 observations

Adding metadata, the ”I” in BIM

There are several options to add metadata to objects in Topocad:

- Use of attributes in field, will give possibility for unique values.
- Adding attributes, with or wothout values, for each point code
- Add attributes in multiple with a special command.
- Copy attributes from one object to other object(s)

Adding metadata, the ”I” in BIM



3D Solid	
Material	BASEMENT
Display Mode	System
Face Color	Gray (8)
Color by material	Yes
Transparency	0%
Transparency by material	Yes
Type	Slab
Geometry	
Area	1673 m²
Volume	2013 m³
Mass	2013220 kg
Min H	8,518 m
Max H	11,582 m
Attributes	
ADRESS	Grinda
AMA	
BESKRIVNING1	Basement
BESKRIVNING2	Basement location
Date	20190521
FORMAT	
KVALITET	3
Location	Grinda
Number	007
Product code	Basement concrete
Responsible	Tomas Sandstrom
Scale	N
Status	Built
Text	BIM Metadata

Volume report at once

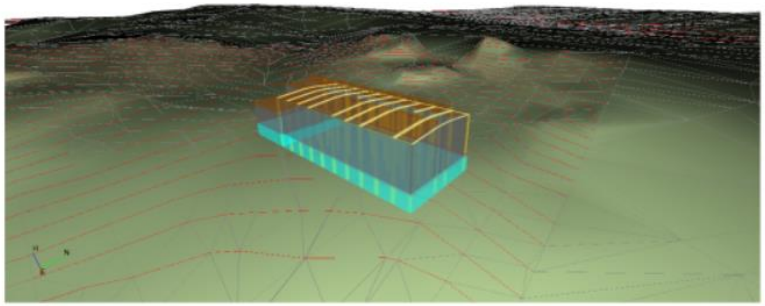
Topocad

Page 1 of 1

3D-solid Report

Filename: Factory Result

Coordinate system: SWEREF99 18 00

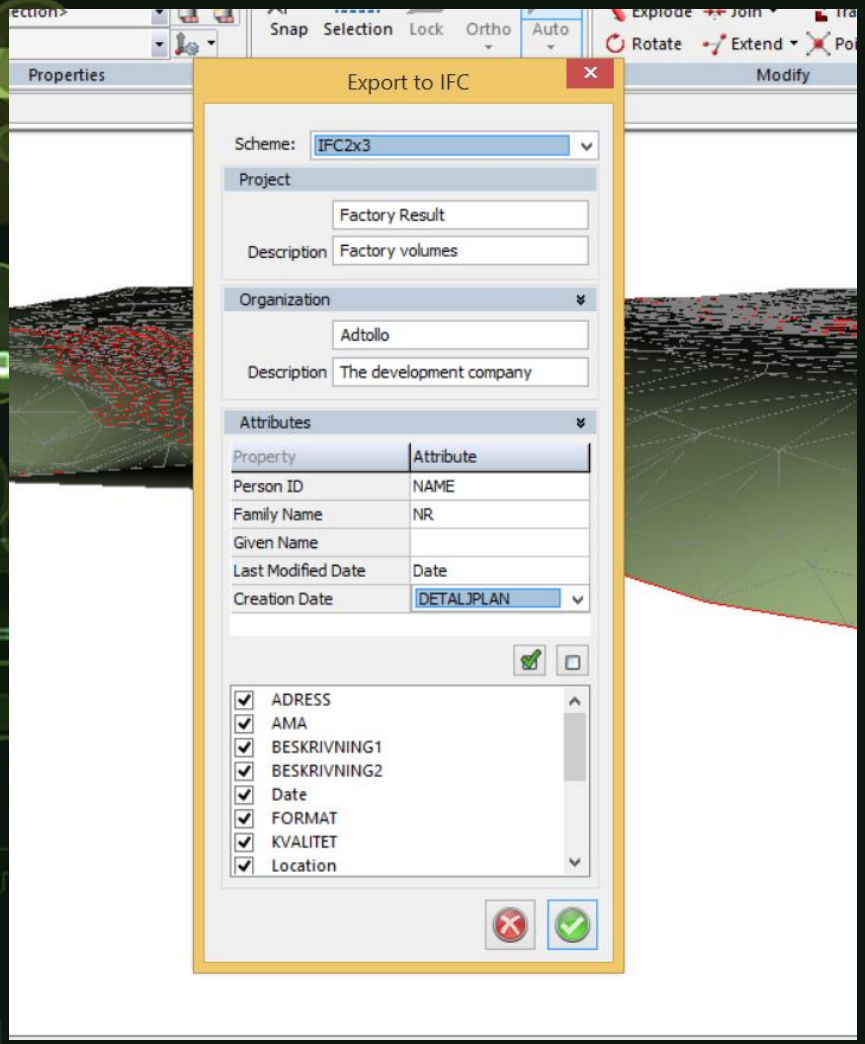


Solids

Group	Volume	Area	Count
Building, Facade	403 m³	2913 m²	18
Building, Pipes	0 m³	25 m²	9
Building, basement	2595 m³	2233 m²	2
Building, beams	2 m³	382 m²	55
Building, floor	346 m³	1797 m²	2
Building, pillar	163 m³	1657 m²	80
Building, roof	268 m³	1909 m²	6

Solids are volumes so it is a 1 to 1 report of volumes.

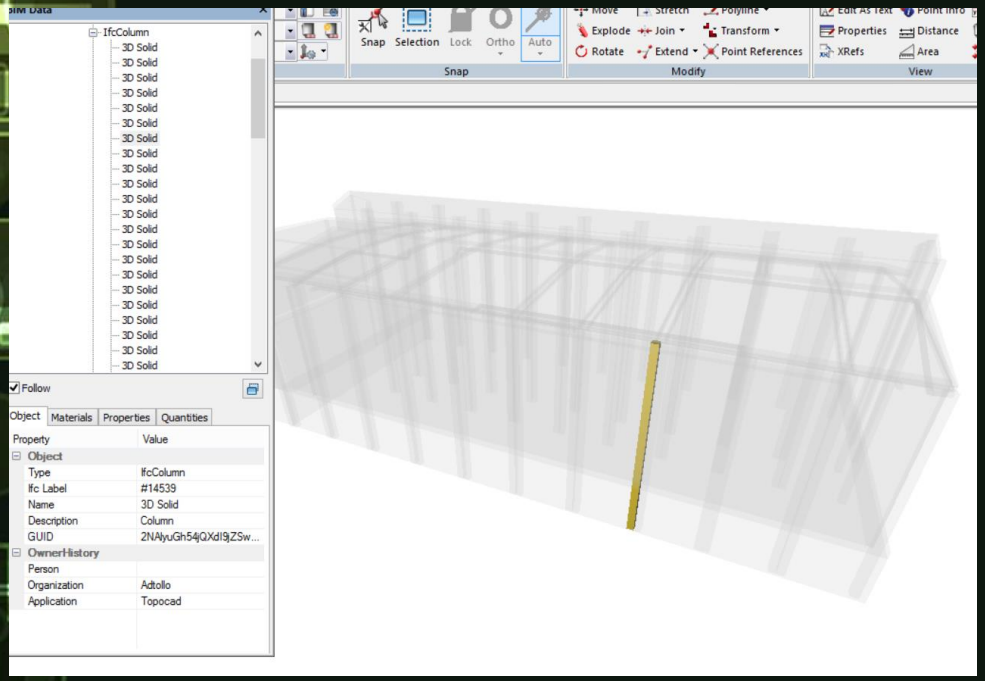
Export to ifc or CityGML



Export to ifc or CityGML.

Attributes are transferred to metadata.

Import of the ifc



Import of our ifc file back to Topocad.

Metadata is transferred to attributes.

GUID is added

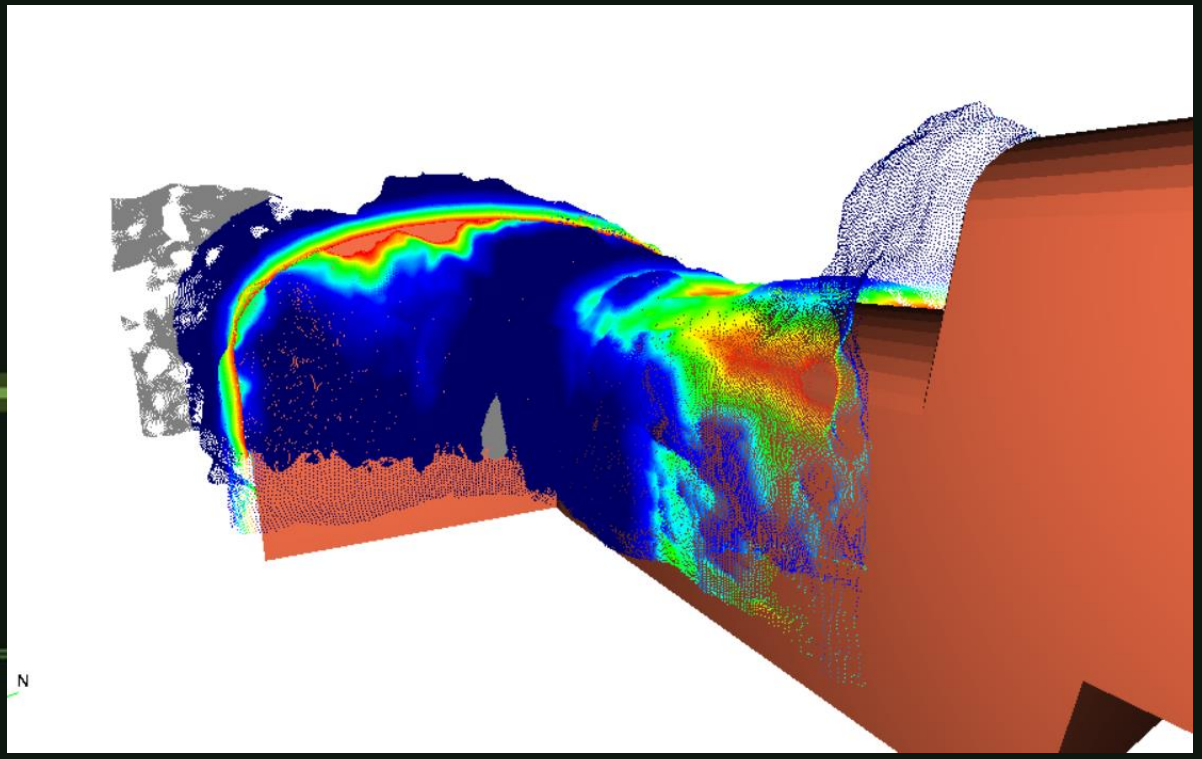
Conclusion

Surveying with traditional methods is not a bad option for creating BIM data!

Thanks for your interest!

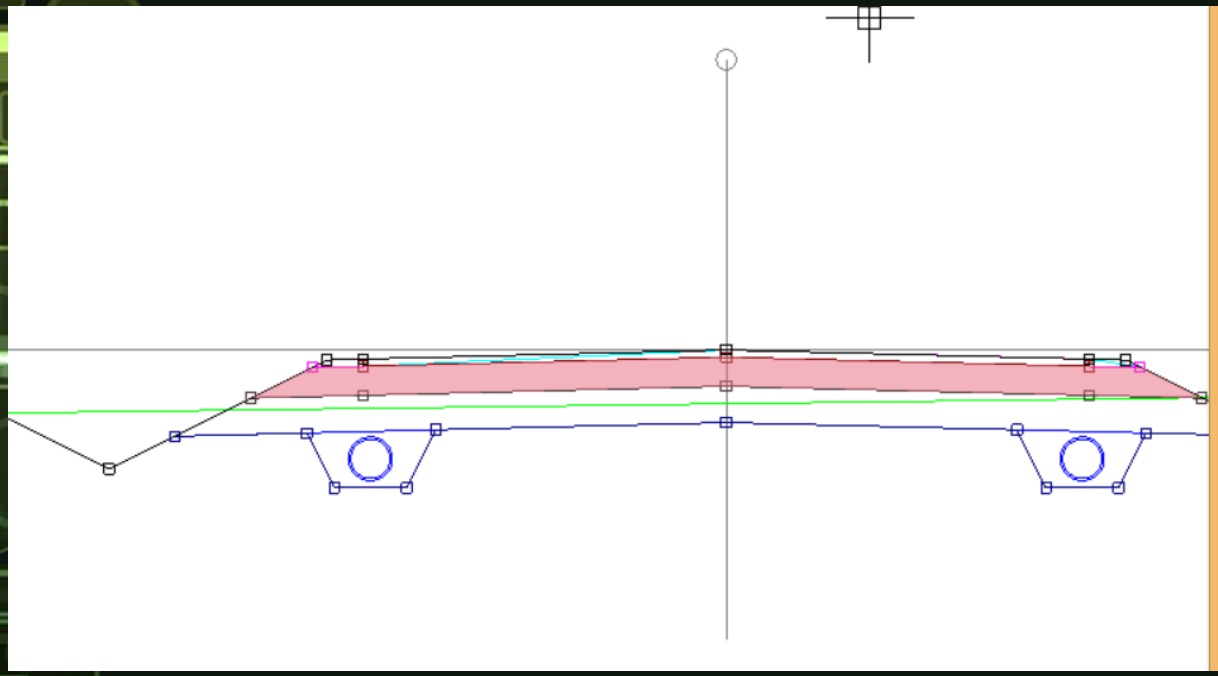
Thomas Sandström

Comparisons



Comparisons of a point cloud vs a solid model.
Red = inside, Blue = too much outside!

Volumes = solids

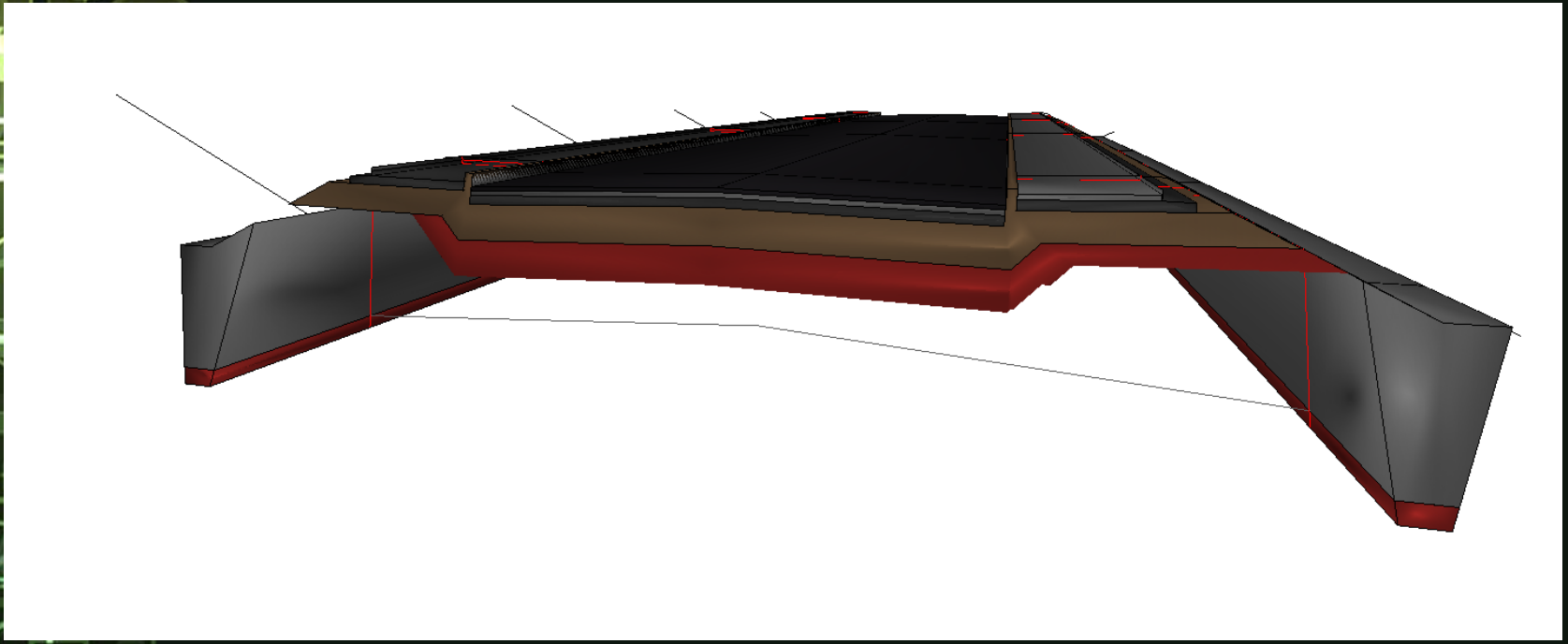


Areas

	Type	Value	Radius adjusti
1	Area Soil	2,710 m	2,710 m²
2	Length Soil	11,331 r	11,331 m
3	Area Fill	0,000 m	0,000 m²
4	Length Fill	0,000 m	0,000 m
5	Area Superstr.	3,191 m	3,191 m²
6	Asphalt Area	0,063 m	0,063 m²
7	Asphalt Length	9,000 m	9,000 m
8	Support layer Area	0,020 m	0,020 m²
9	Support layer Length	9,000 m	9,000 m
10	Drainage Area	0,000 m	0,000 m²
11	Drainage Length	9,000 m	9,000 m
12	Support strip Area	0,000 m	0,000 m²
13	Support strip Length	9,000 m	9,000 m
14	Top layer	0,250 m	0,250 m²
15	Support strip	0,029 m	0,029 m²
16	Support carrier	1,226 m	
17	Reinforcement layer	1,768 m	1,768 m²
18	Drainage	0,540 m	0,540 m²
19	Drainage 2	0,540 m	0,540 m²

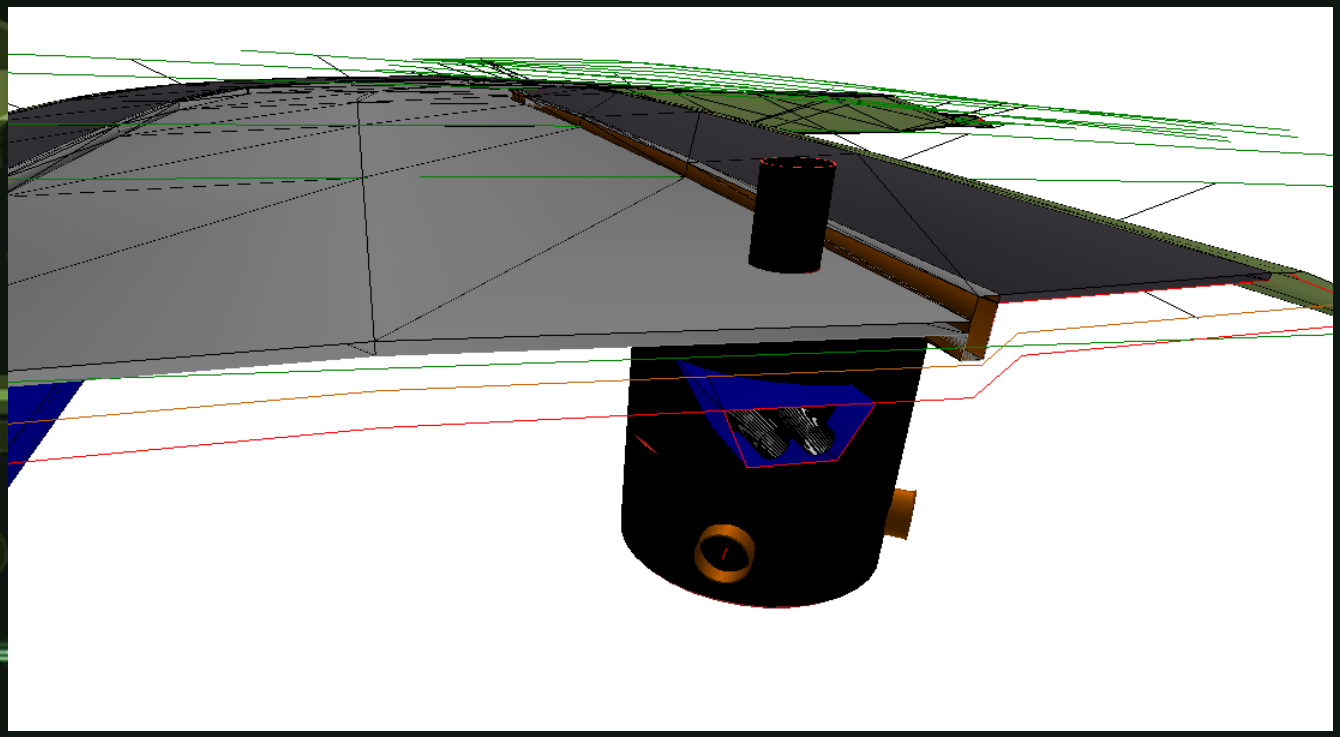
- Cross sections calculation – result ends up as machine guidance and solids for export to BIM systems.

Volumes = solids



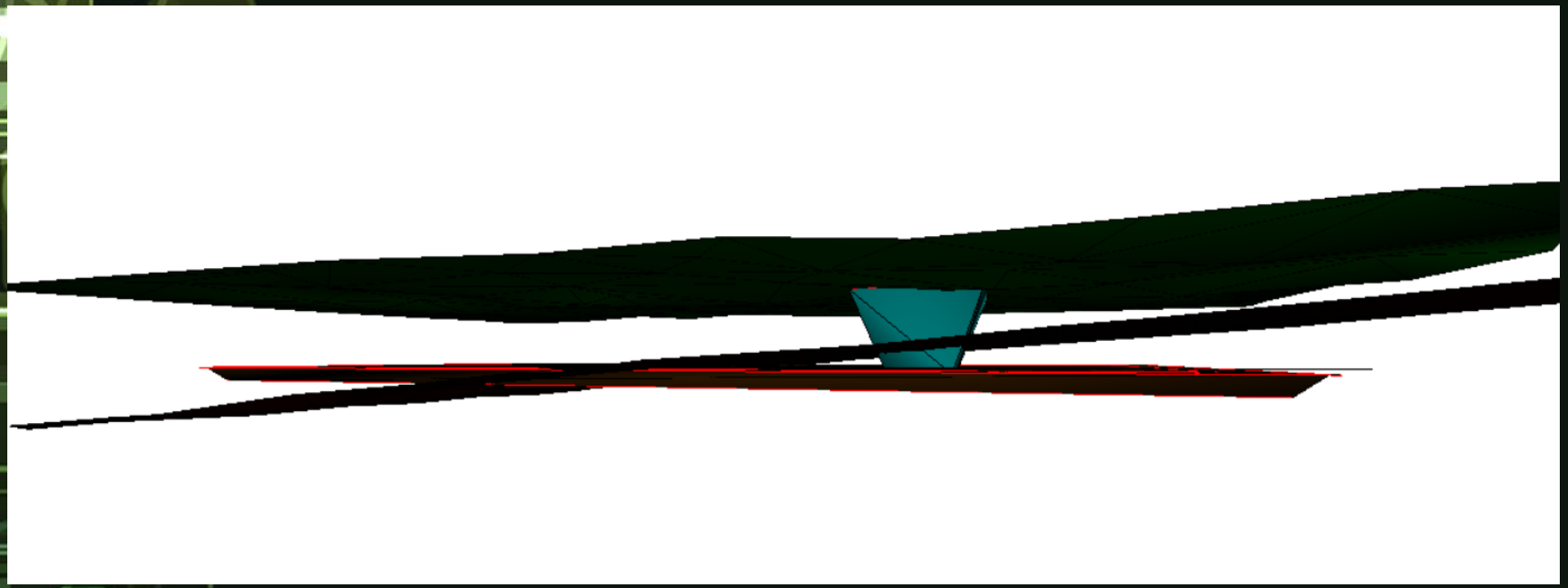
- Cross sections calculation – result ends up as machine guidance and solids for export to BIM systems.

Volumes = solids



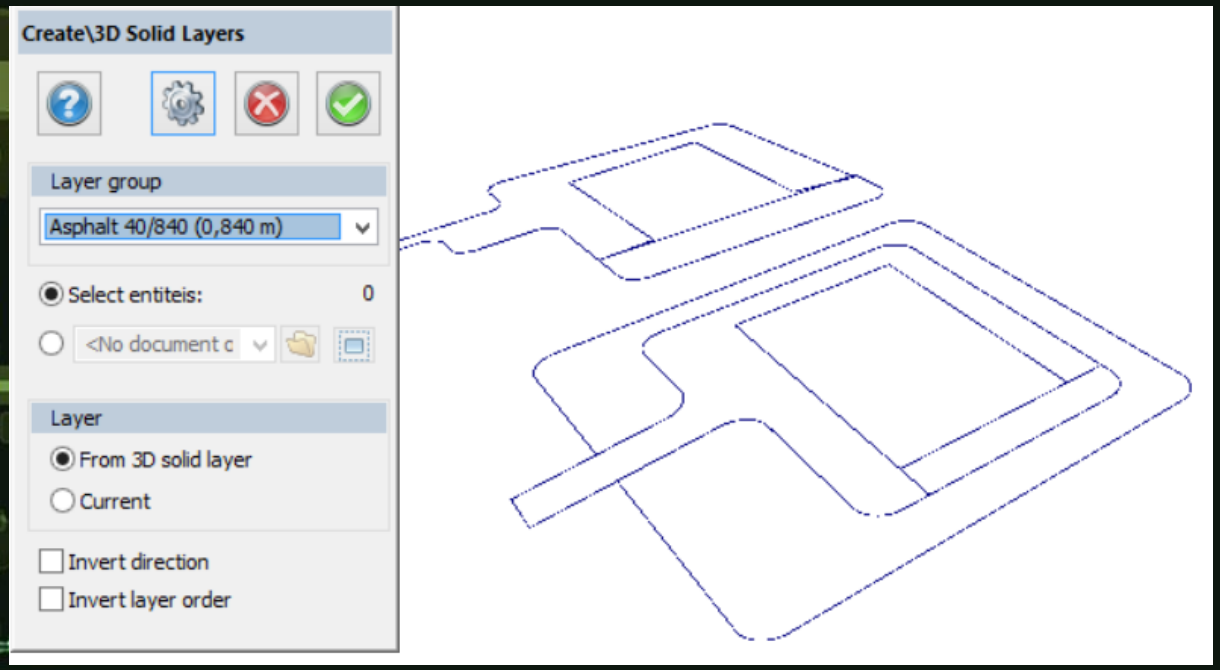
- Cross sections calculation – result ends up as machine guidance and solids for export to BIM systems and for volumes.

Volumes = solids



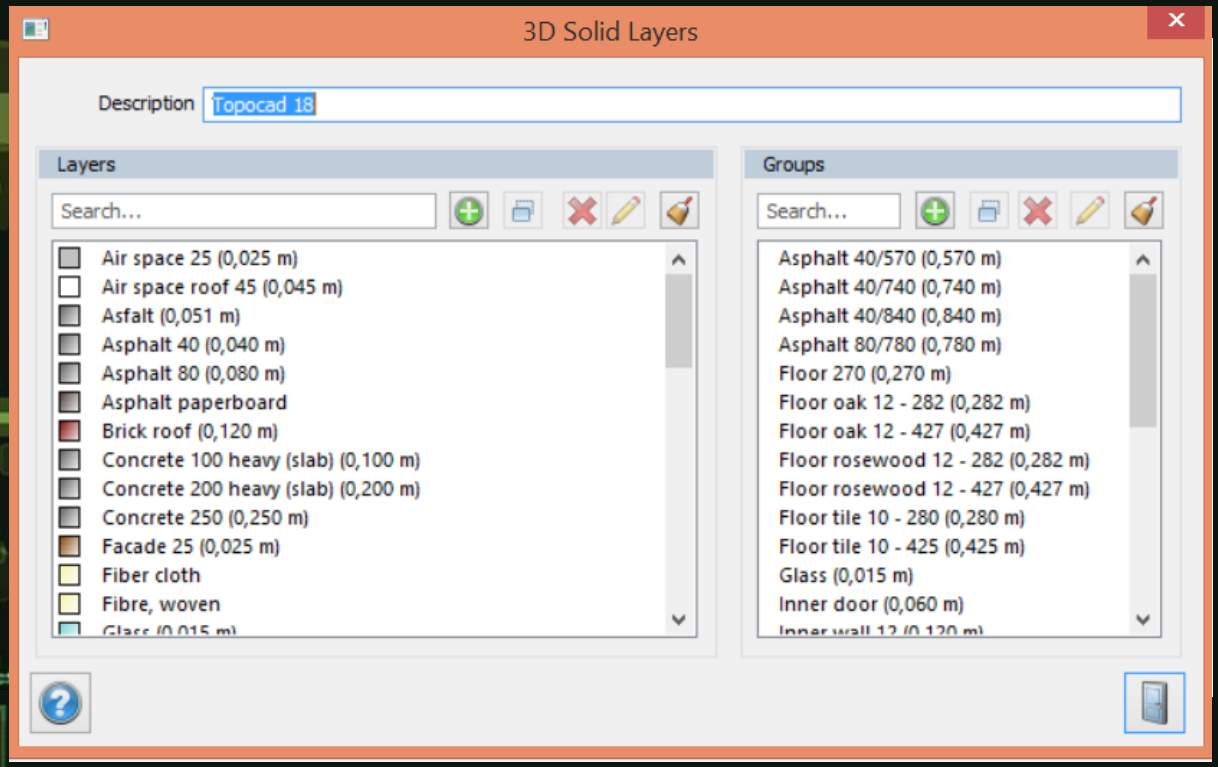
- Volume from terrain models, any number of models. Result ends up as solids.

Volumes = solids



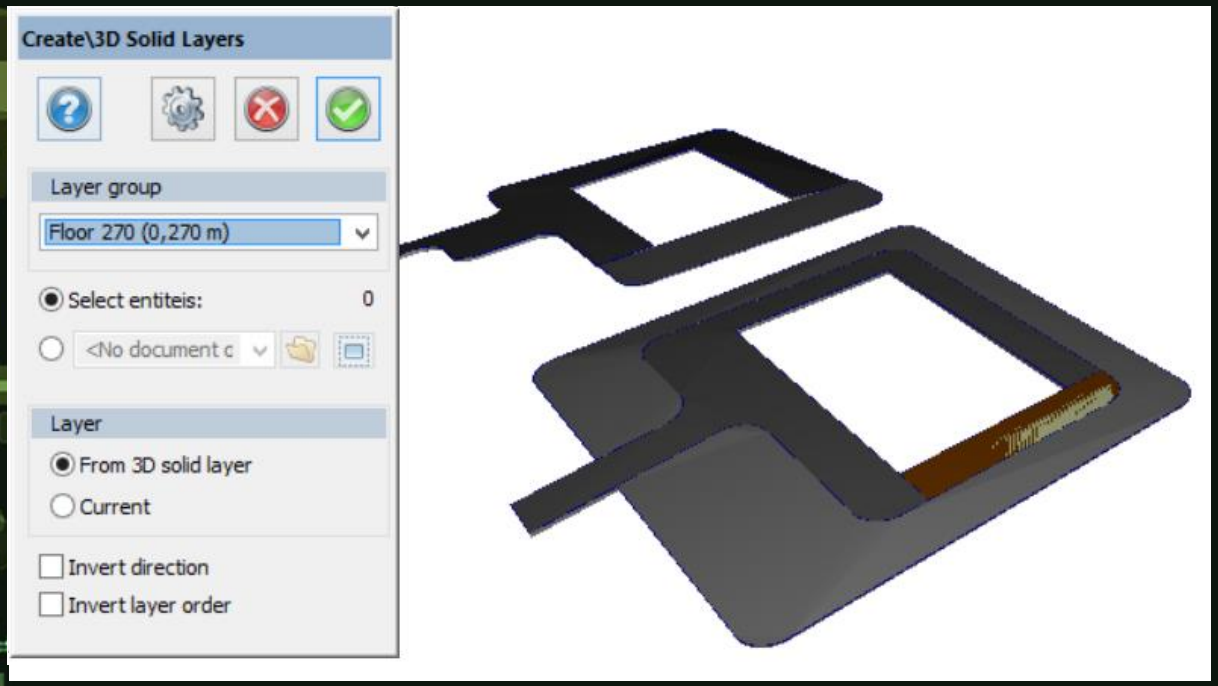
Solid receipts -> create solids of any surfaces

Volumes = solids



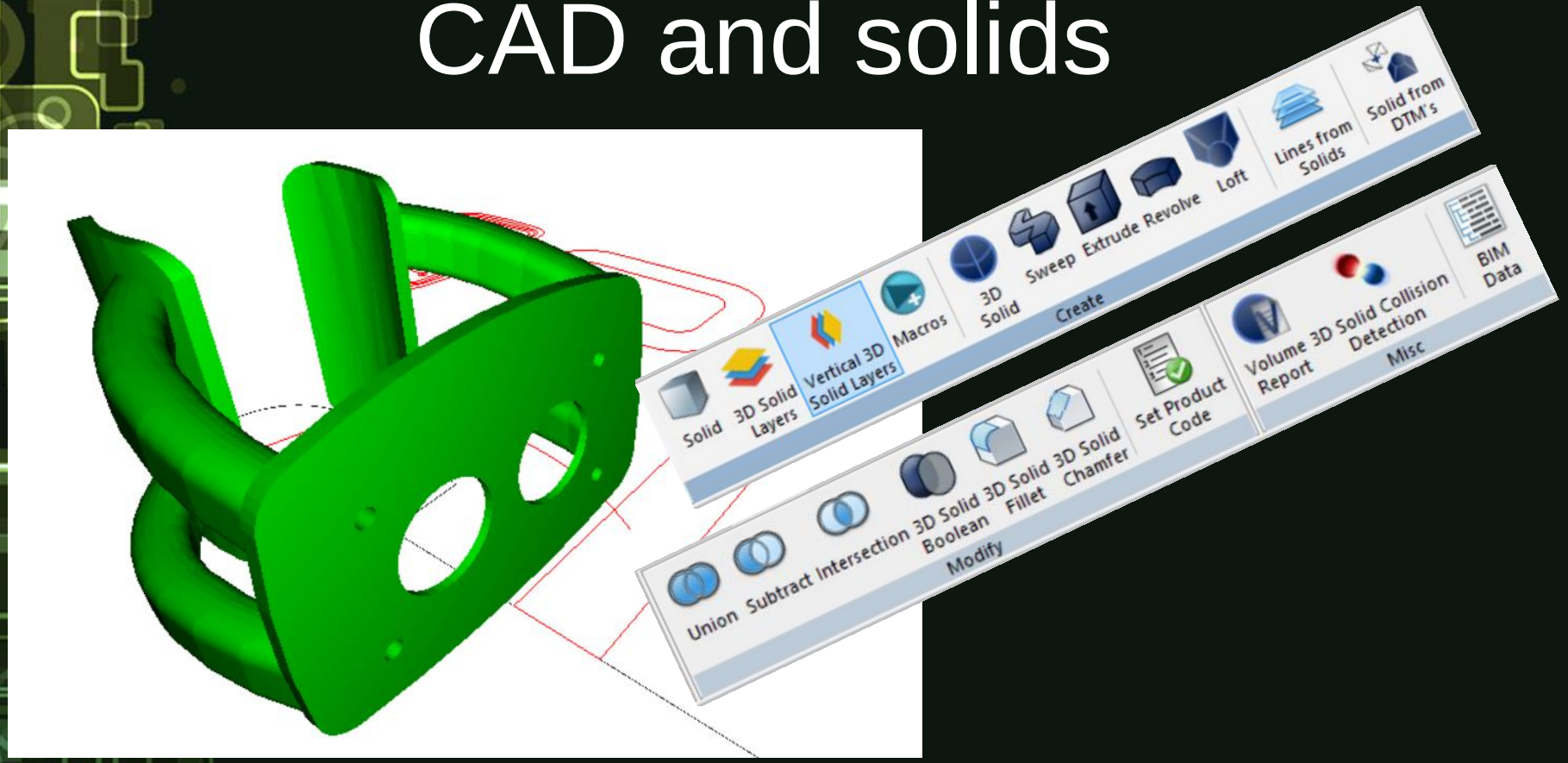
Solid recipies -> create your own receipt

Volumes = solids



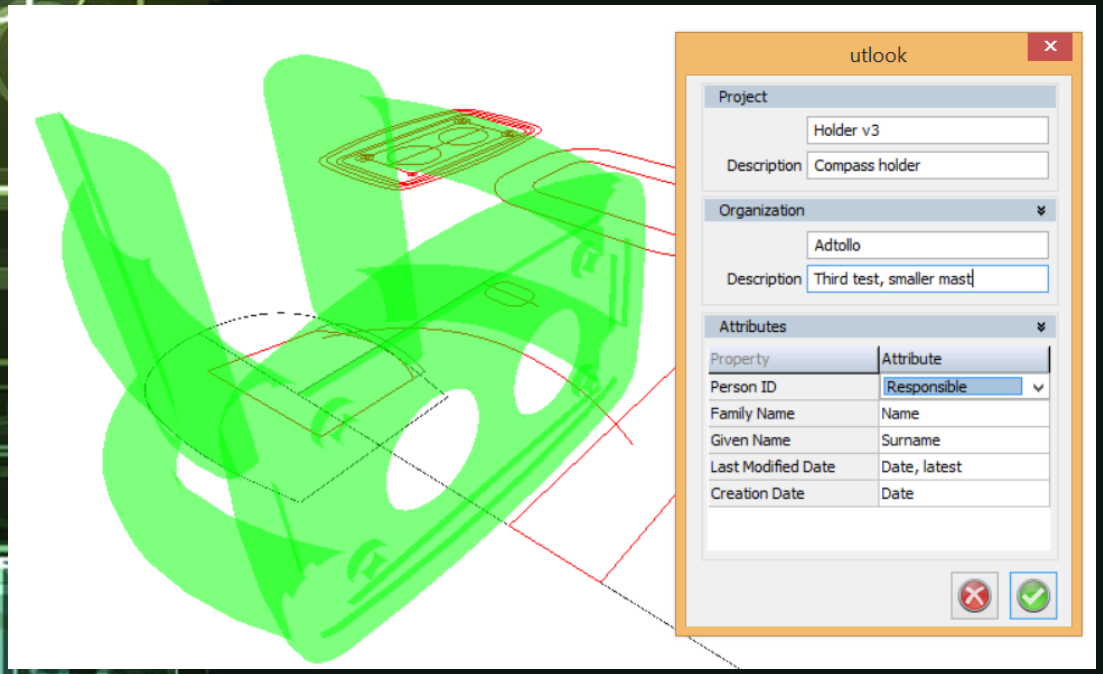
Solid recipies -> create your own receipt

CAD and solids



All commands to create and modify solids, including sweep, loft, revolve, extrude, Boolean operations and others.

BIM in Topocad



Import and export functions for IFC and CityGML, with an automatic connection between metadata and attributes

BIM

- BIM – a good system for buildings!
- BIM – transfer data in ifc, CityGML file formats, waiting for InfraGML…
- IFC -> Solids and surfaces
  - Requires ”Type”
- LOD – Level of Details
- Solids -> Volumes
- I in BIM = Information