National Cartographic Center of Iran

BIM & 3D Web Services

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GIS expert at the GIS office of NCC

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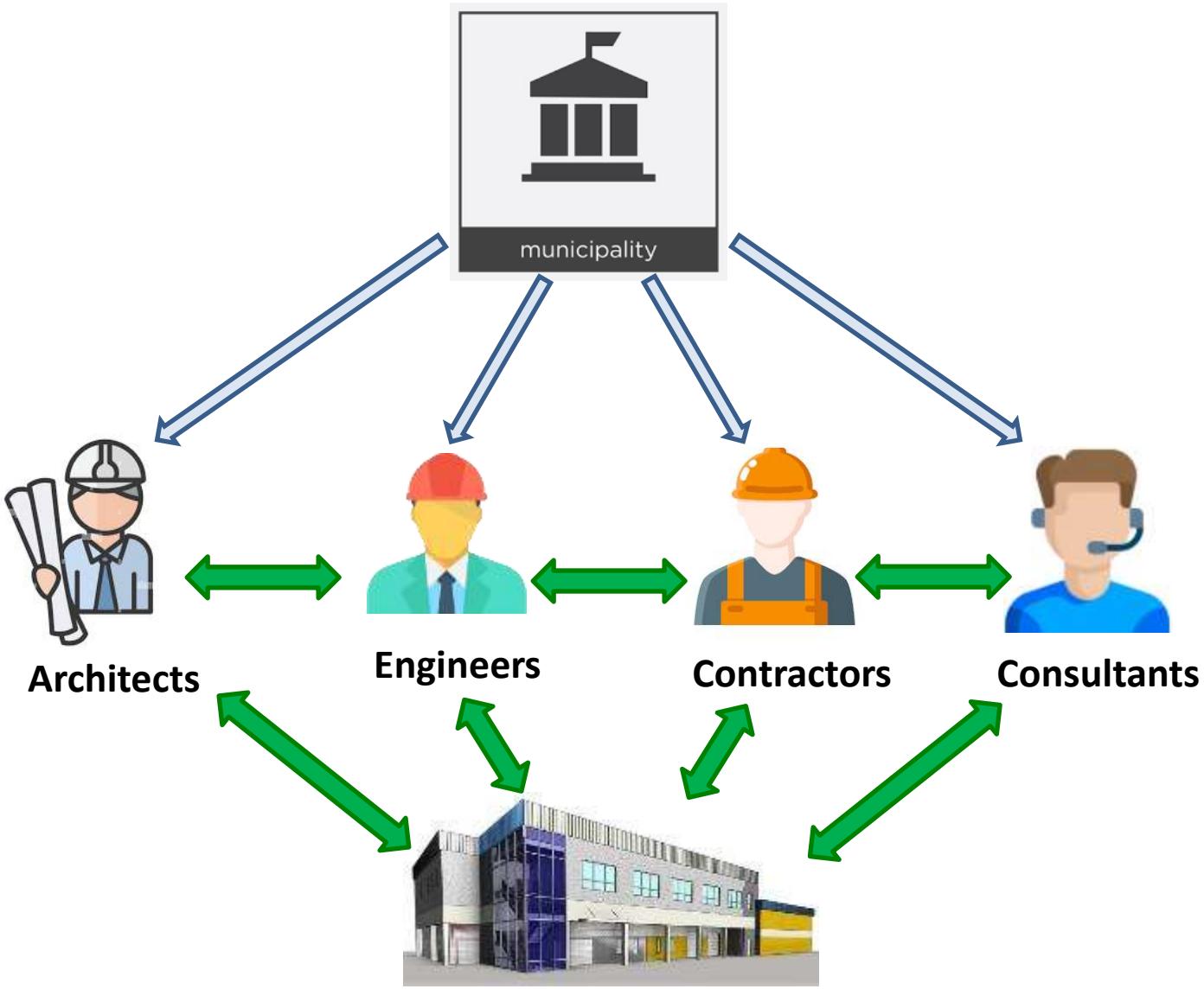
- **BIM**
- **Some Spatial formats**
- **Practical Examples**

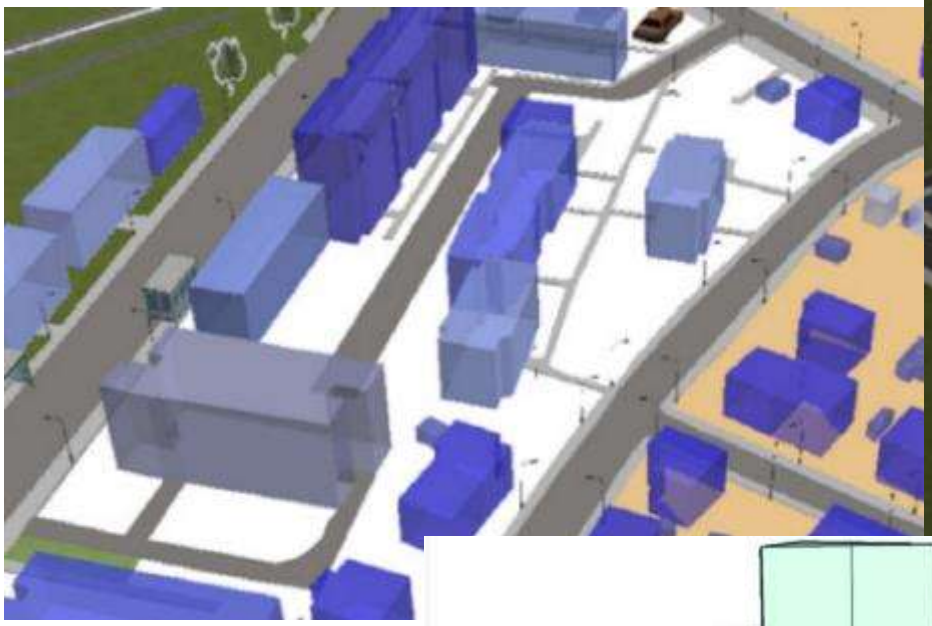
Benefits of BIM

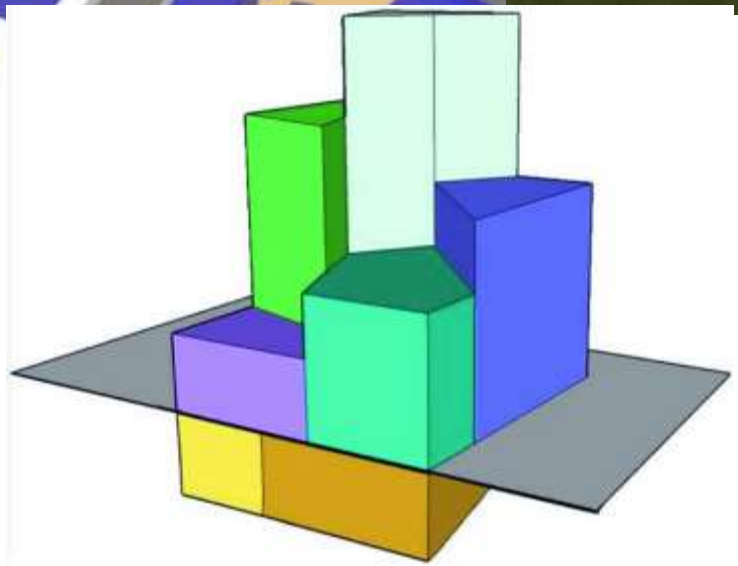
Easier Management

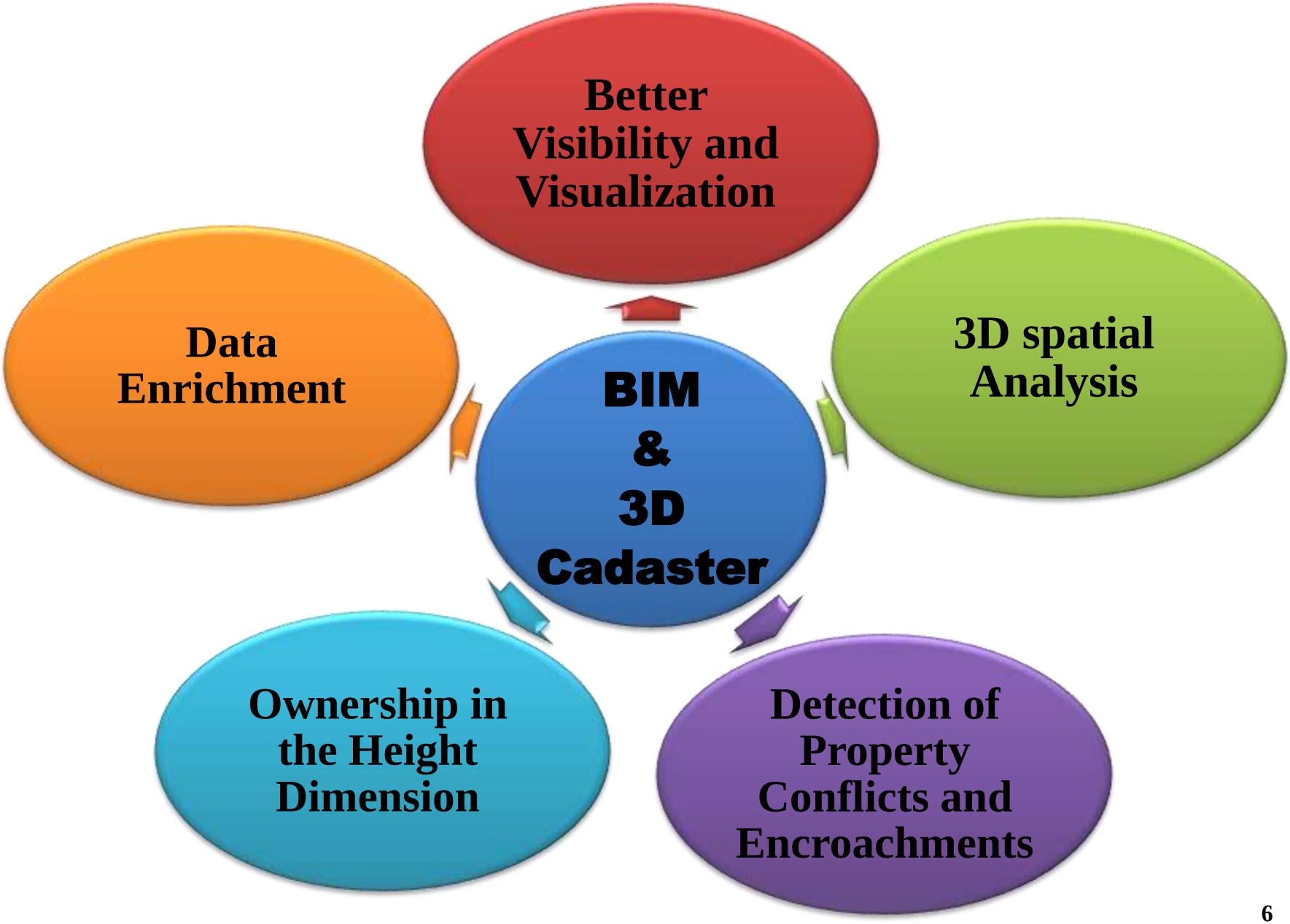
How municipalities manage cities?



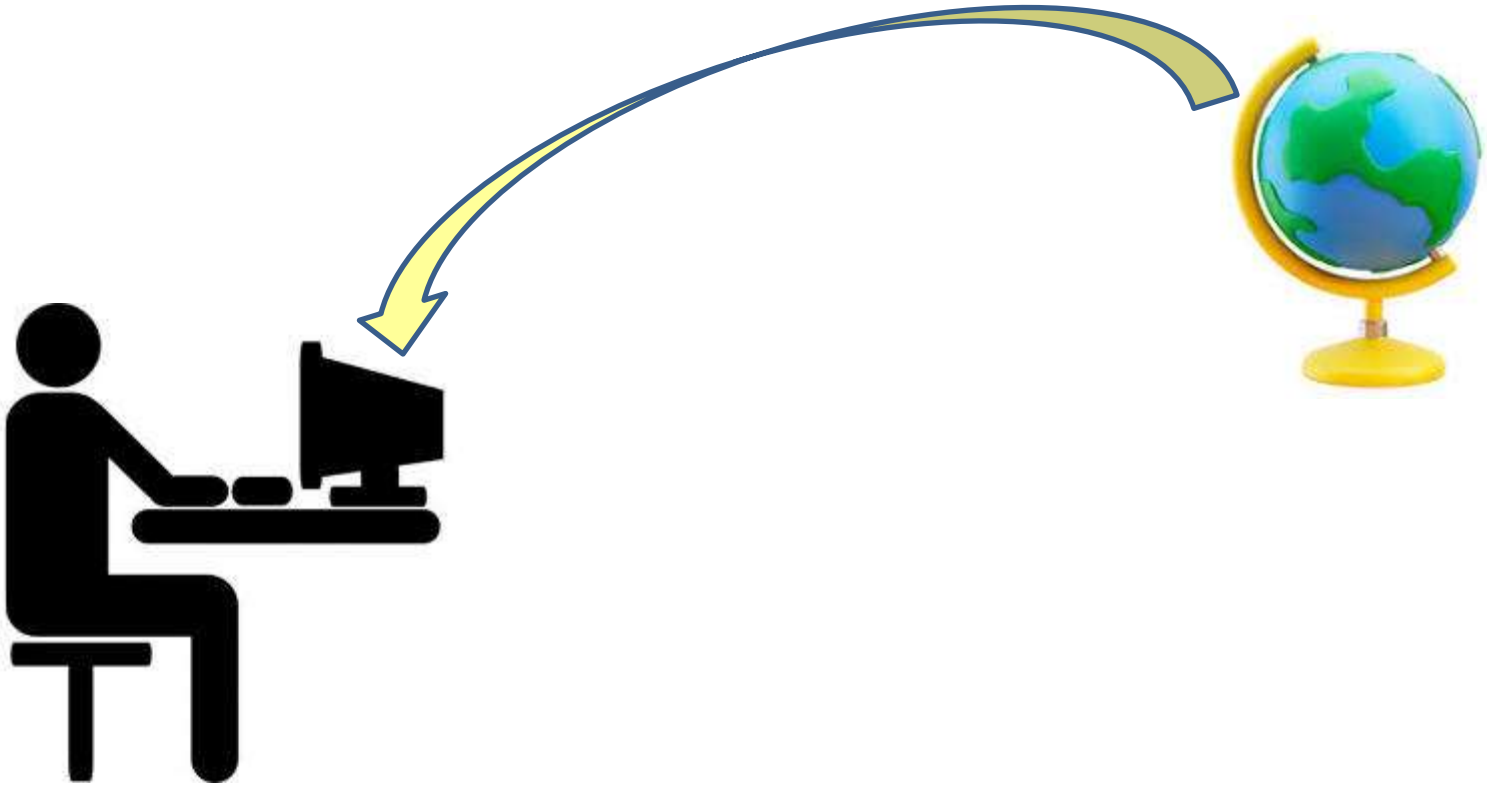
BIM & 3D Cadaster






Better Visibility and Visualization
Data Enrichment
BIM & 3D Cadaster
3D spatial Analysis
Ownership in the Height Dimension
Detection of Property Conflicts and Encroachments

3D Spatial Web Service



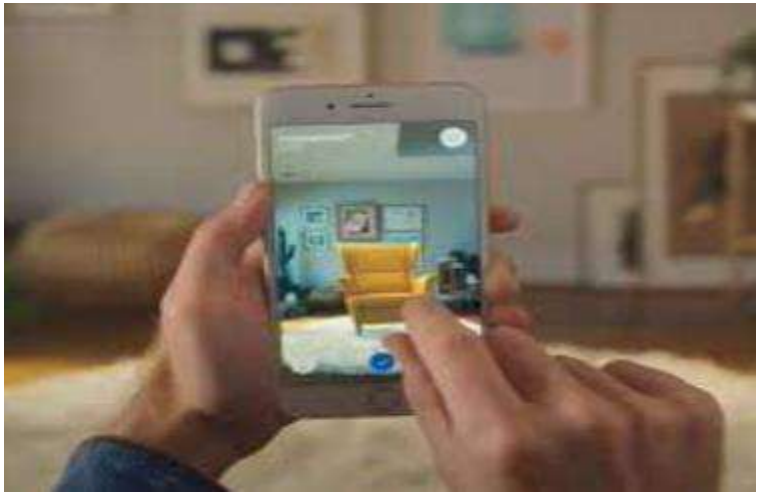
3D Spatial Web Service Characteristics

1- Online Access

2- 3D Visualization

3D Spatial Web Service Characteristics

3- Interactivity



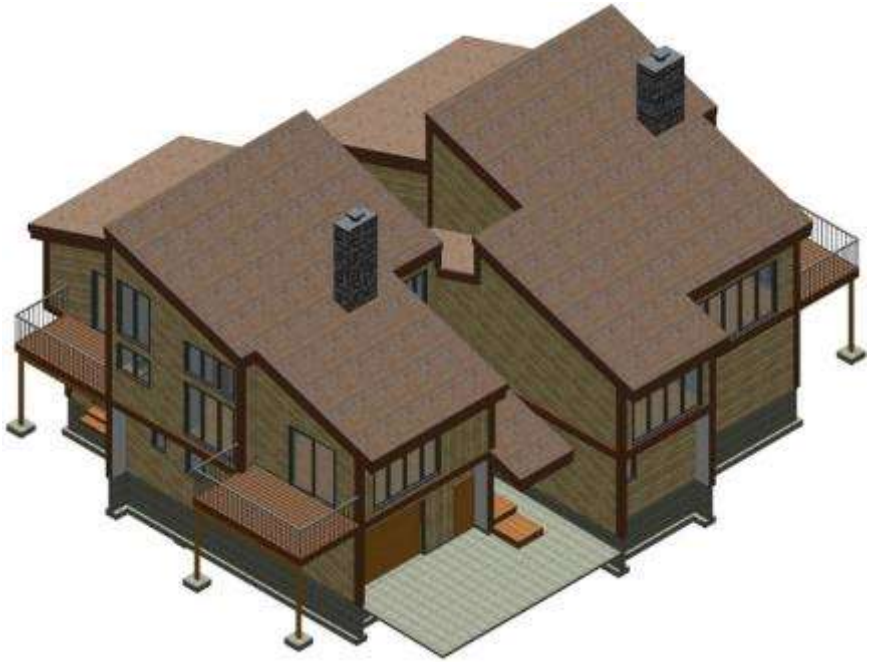
4- Data Integration

3D Spatial Web Service Characteristics

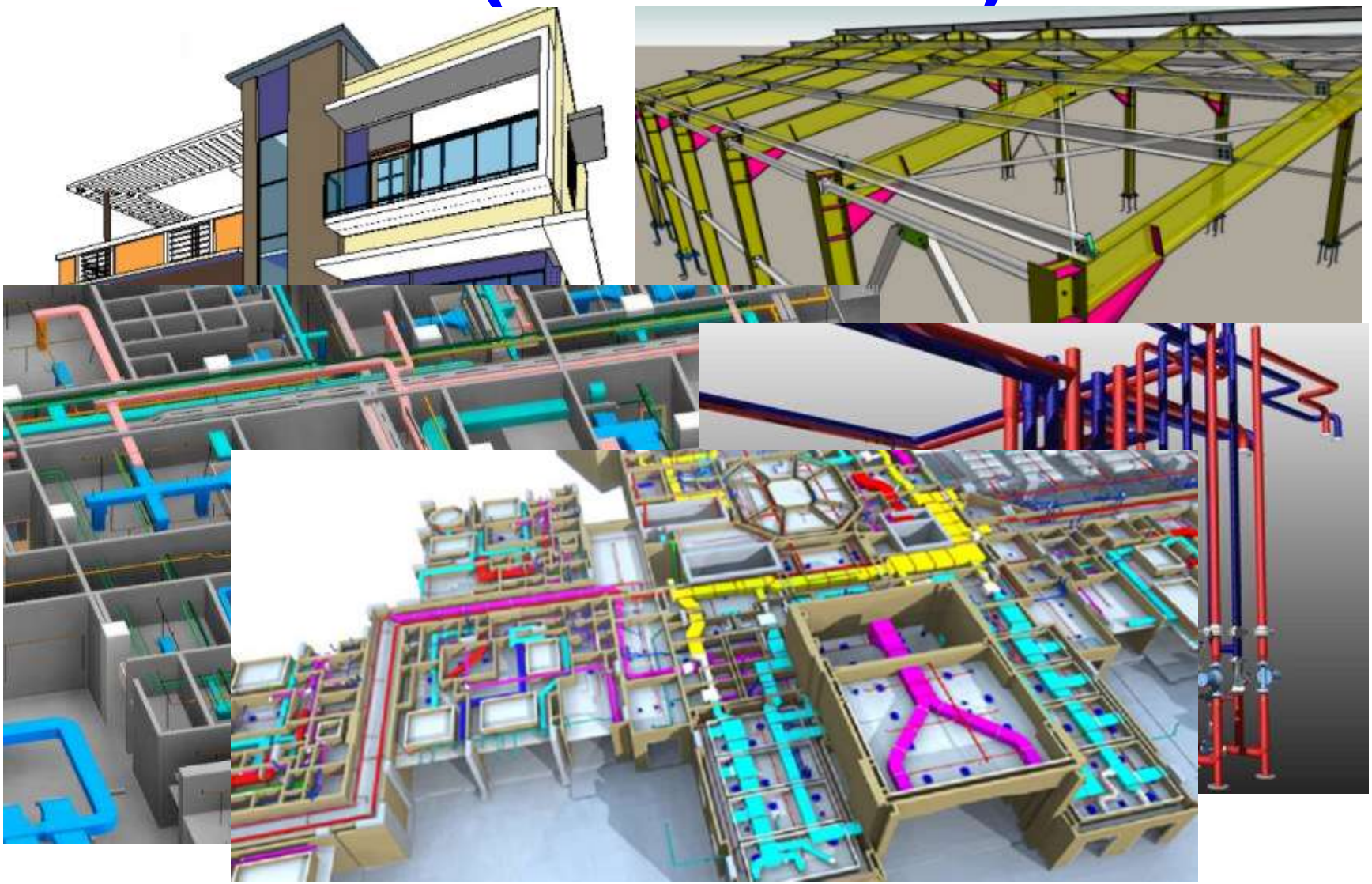
5- Collaboration and Sharing

Getting to Know Some Spatial Formats

Some standard formats (RVT format)



Some standard formats (RVT format)



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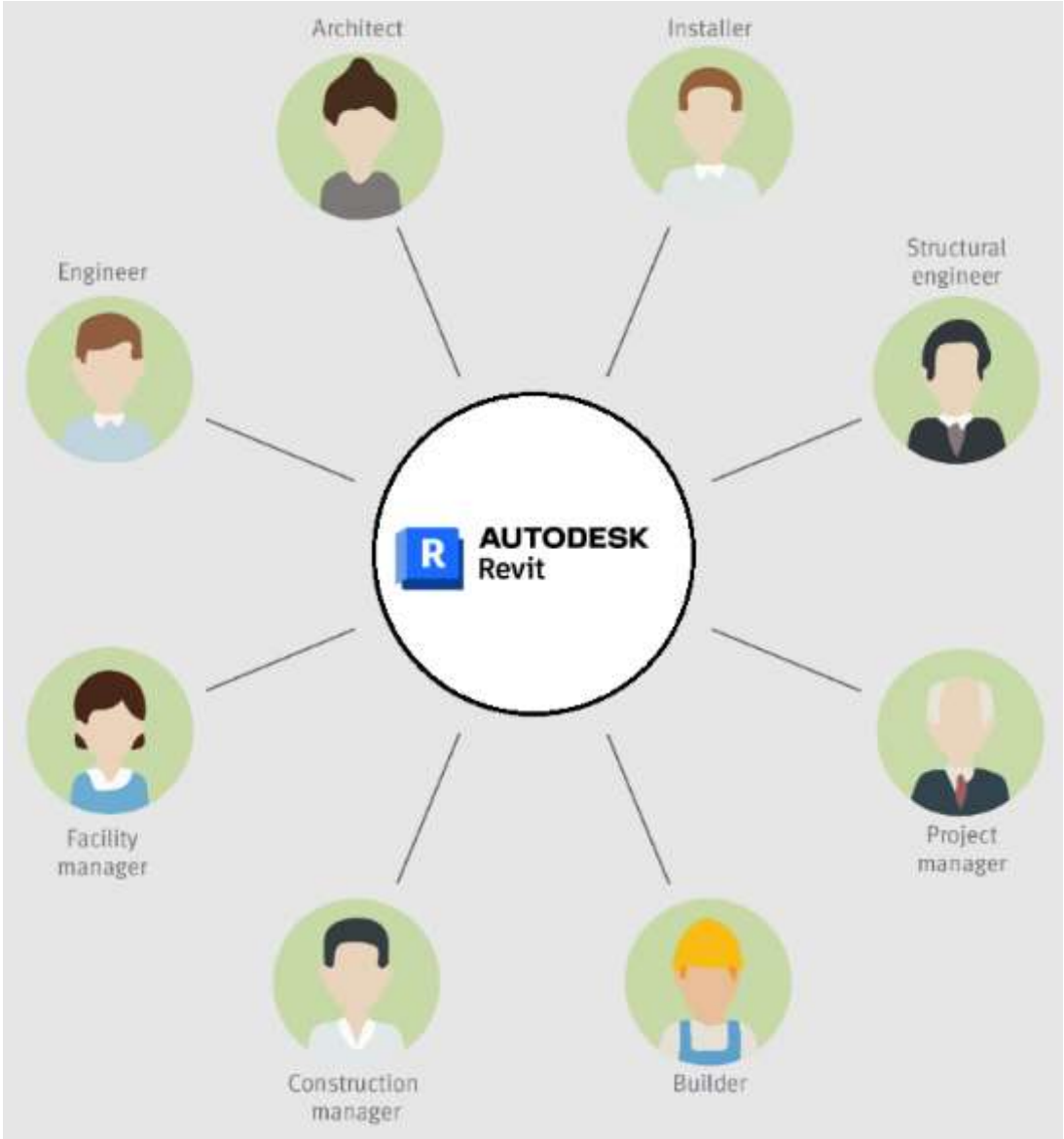

Some standard formats (RVT format)

1- File Size

2- Performance Issue

3- Data Extraction and Data Editing

4- Higher Learning Curve

Sharing RVT format

IFC format

Industry Foundation Classes

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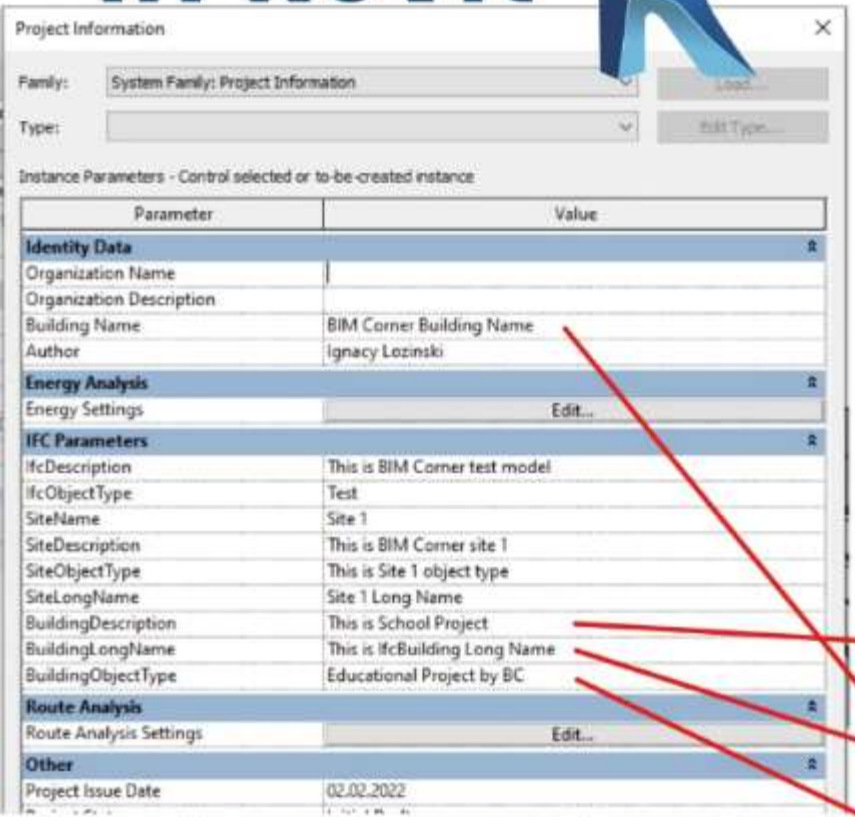
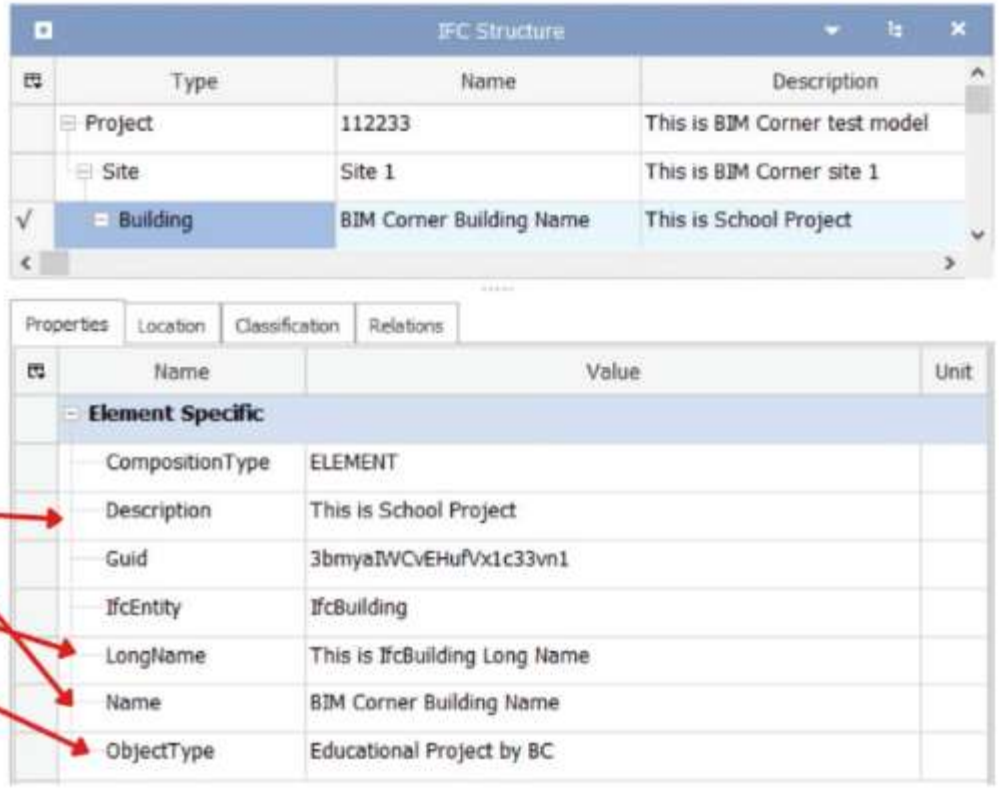
IFC format

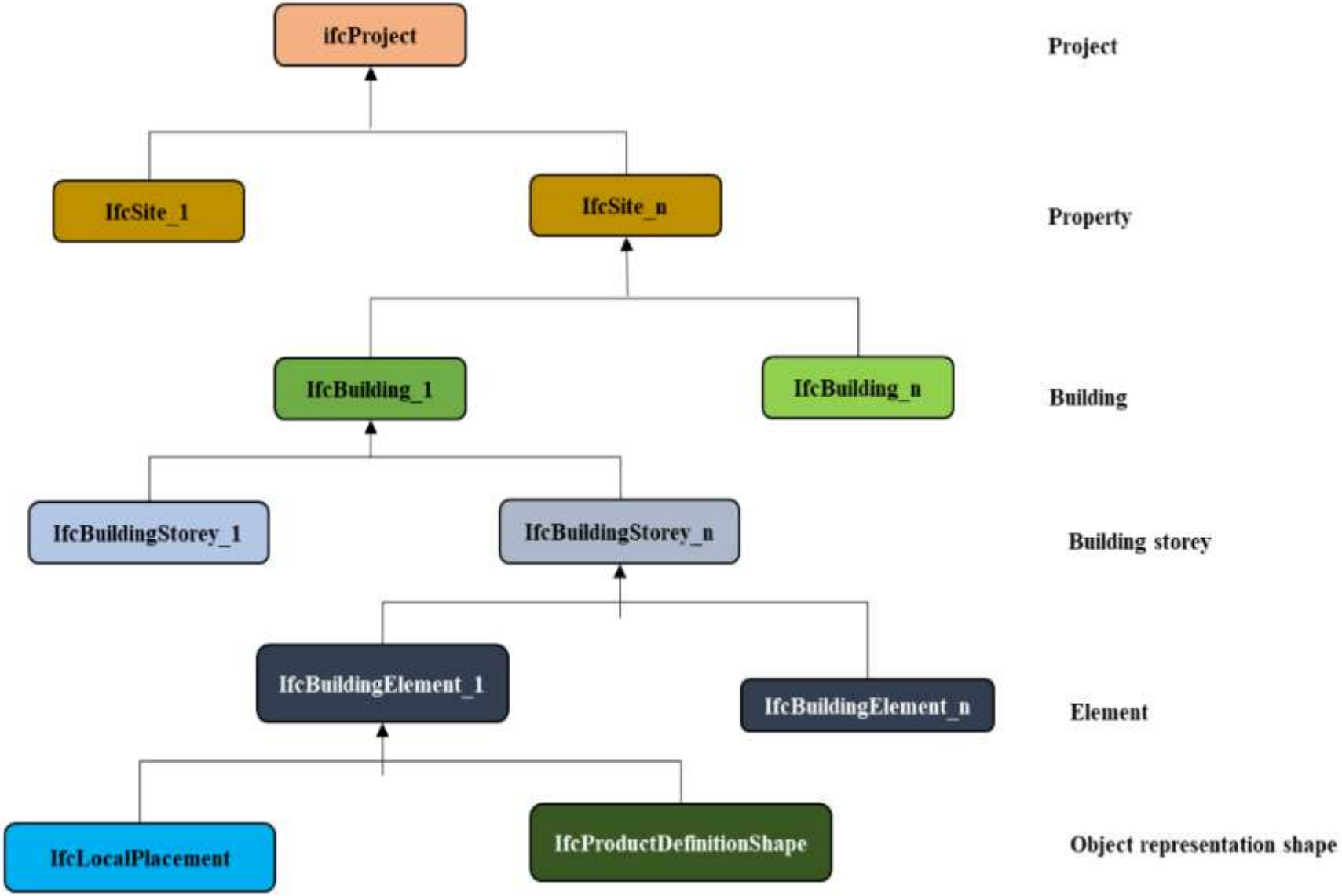
In Revit



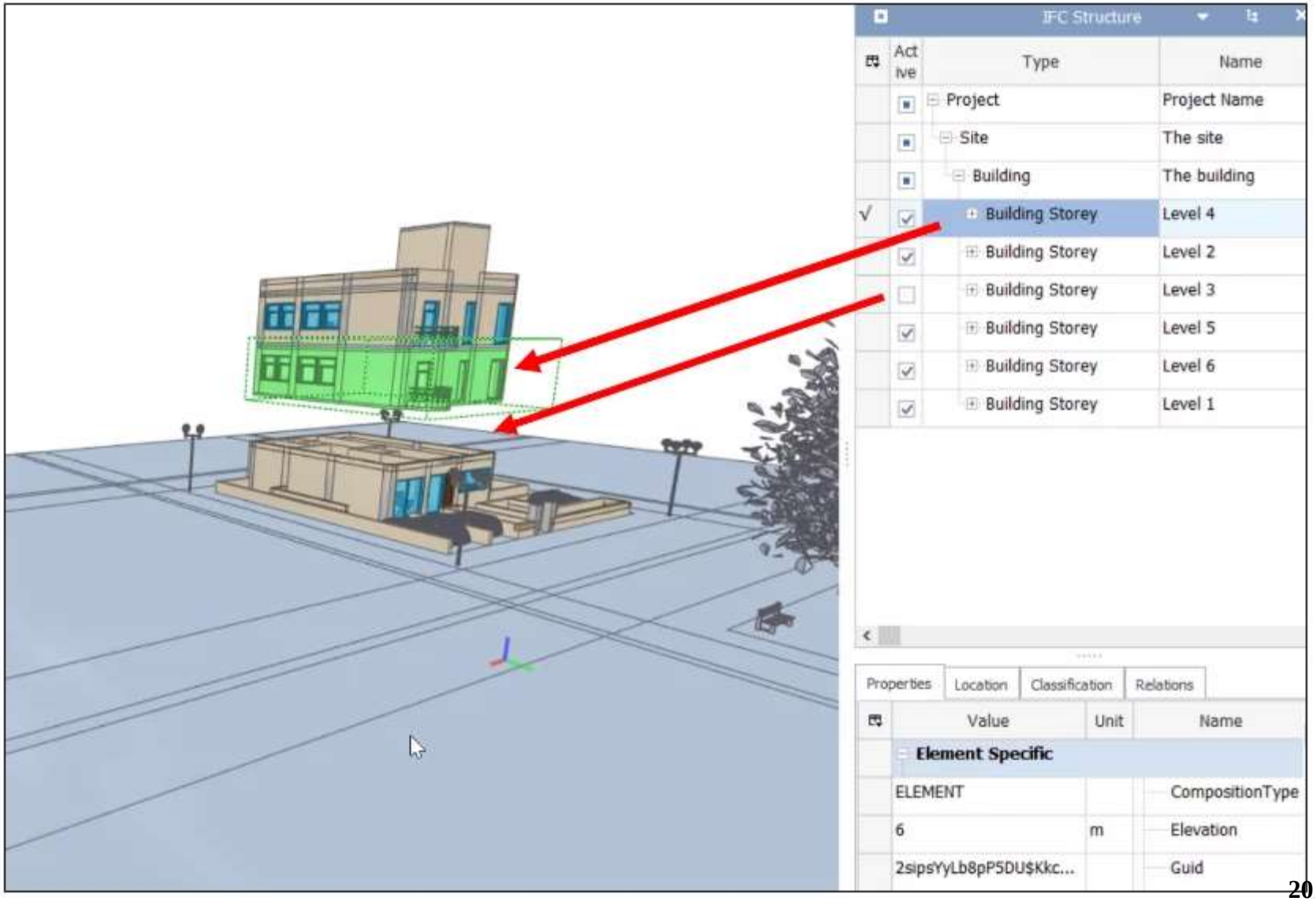
In IFC



IFC format


ifcProject
Project
IfcSite_1
IfcSite_n
Property
IfcBuilding_1
IfcBuilding_n
Building
IfcBuildingStorey_1
IfcBuildingStorey_n
Building storey
IfcBuildingElement_1
IfcBuildingElement_n
Element
IfcLocalPlacement
IfcProductDefinitionShape
Object representation shape

IFC format


IFC Structure
Active
Type
Name
Project
Project Name
Site
The site
Building
The building
Building Storey
Level 4
Building Storey
Level 2
Building Storey
Level 3
Building Storey
Level 5
Building Storey
Level 6
Building Storey
Level 1
Properties
Location
Classification
Relations
Value
Unit
Name
Element Specific
ELEMENT
CompositionType
6
m
Elevation
2sipsYyLb8pP5DU$Kkc...
Guid

CityGML OGC format

CityGML OGC format

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</cityObjectMember>
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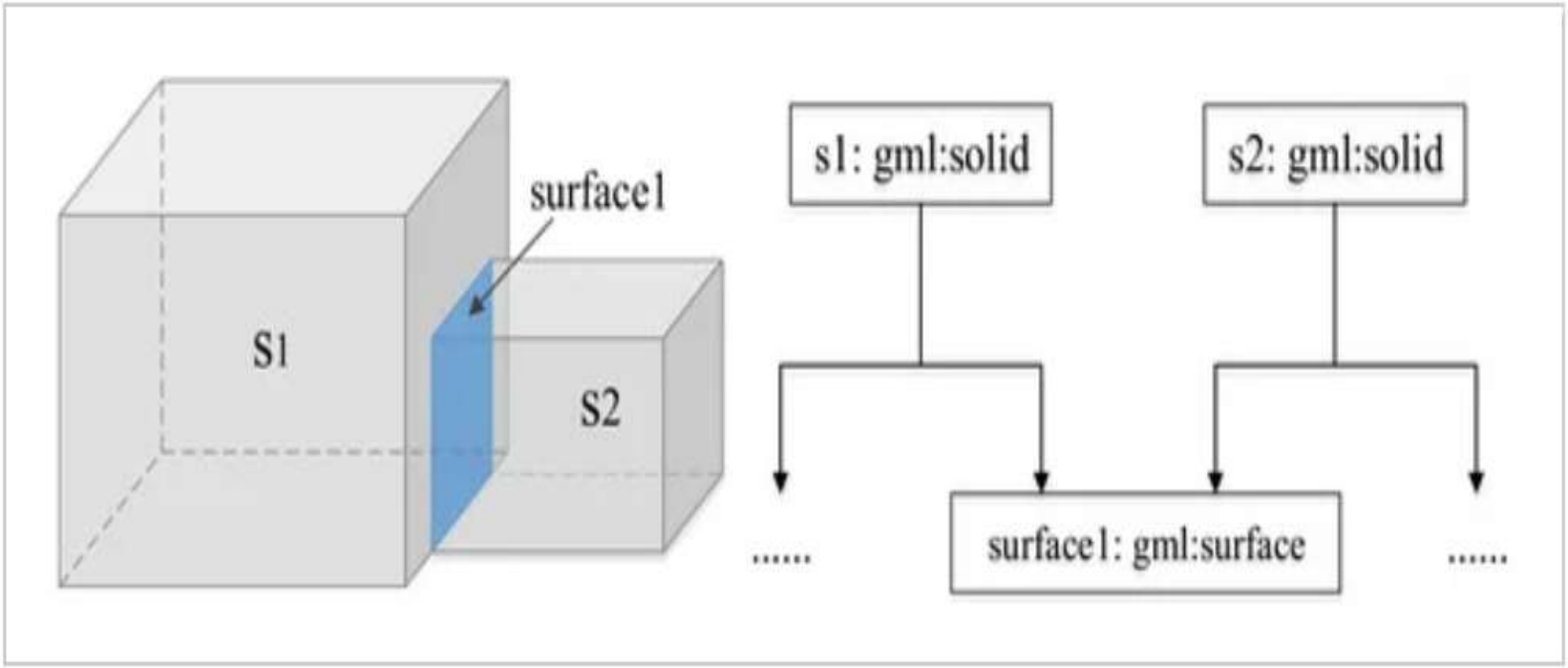
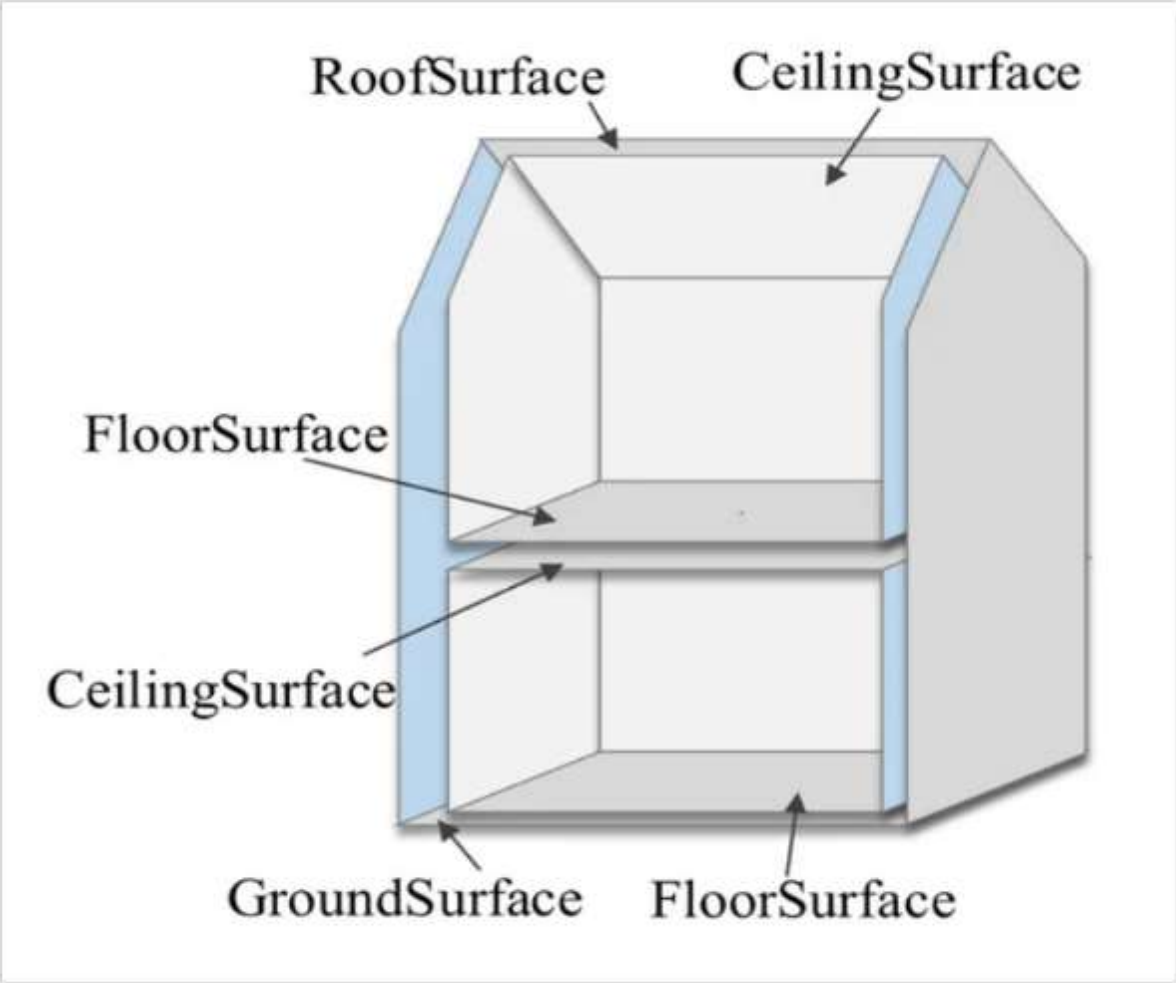
IFC format

IFC	CityGML
IfcBuilding	AbstractBuilding
IfcOpeningElement	Opening
IfcDoor	Door
IfcWindow	Window
IfcBeam	BuildingInstallation
IfcColumn	BuildingInstallation
IfcRailing	BuildingInstallation
IfcRamp	BuildingInstallation
IfcStair	BuildingInstallation
IfcStairCase	BuildingInstallation
IfcWall	WalSurface
	InteriorWallSurface
	ExteriorWallSurface
IfcRoof	RoofSurface
IfcSlab	GroundSurfcae
IfcFloor	FloorSurface

Topology in CityGML



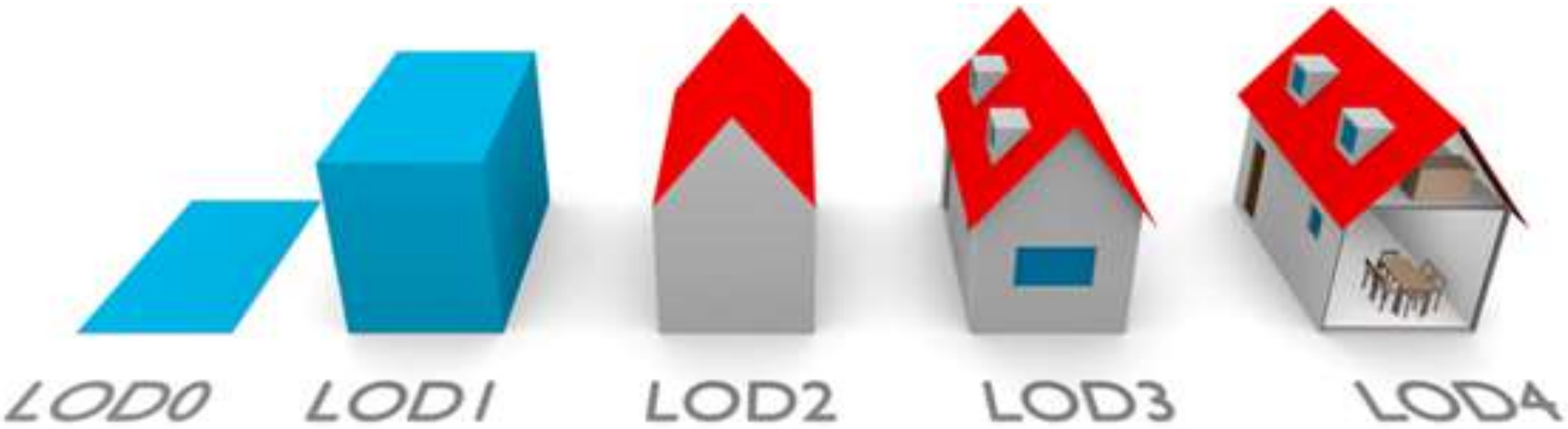
Representation of Building Elements in CityGML



Categories of Features in CityGML

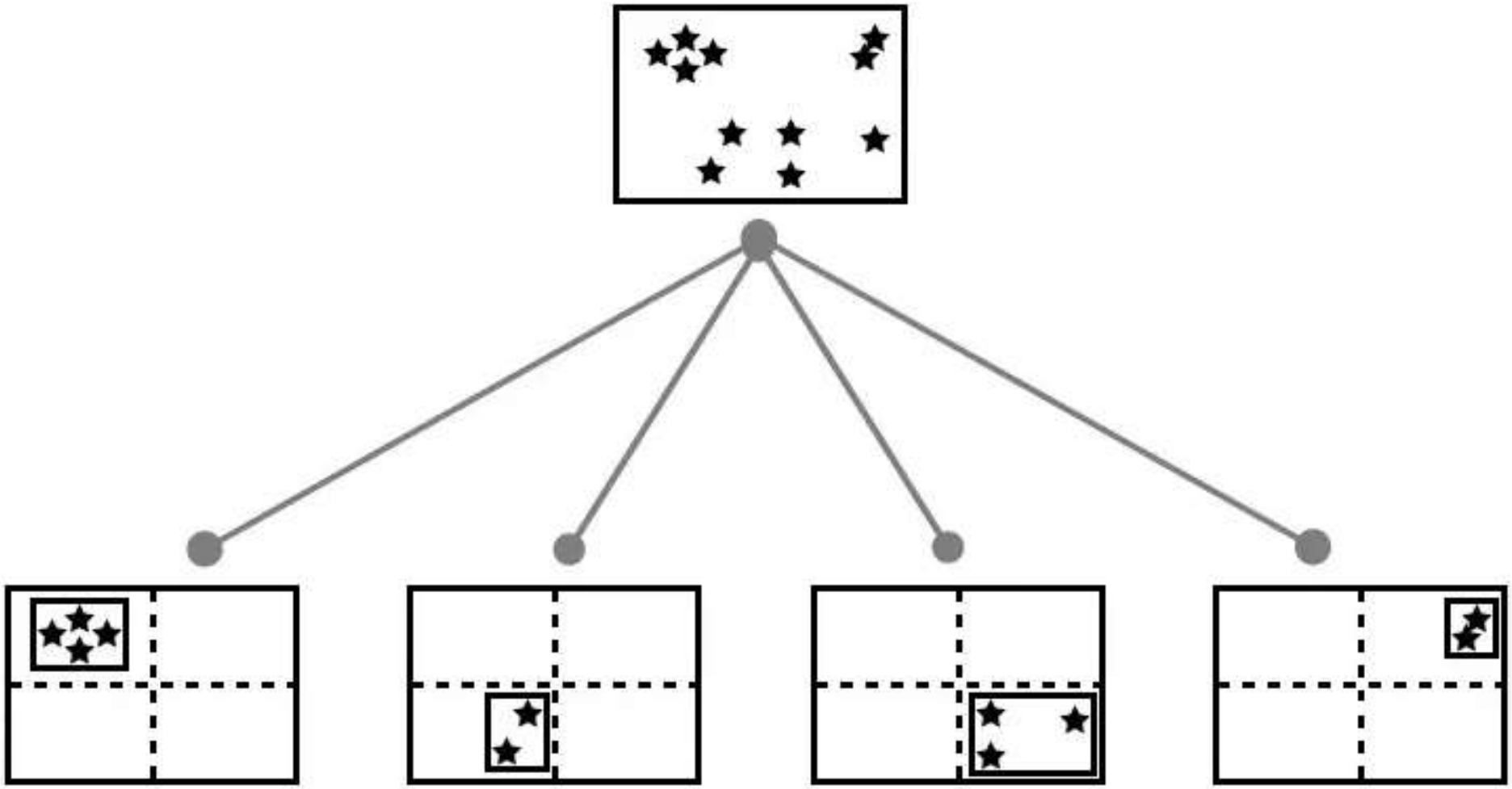
- Digital Terrain Models
- Sites (buildings, bridges, and tunnels)
- Vegetation
- Water bodies
- Transportation facilities
- Land use
- City furniture

The Five Levels of Detail (LOD) Defined by CityGML

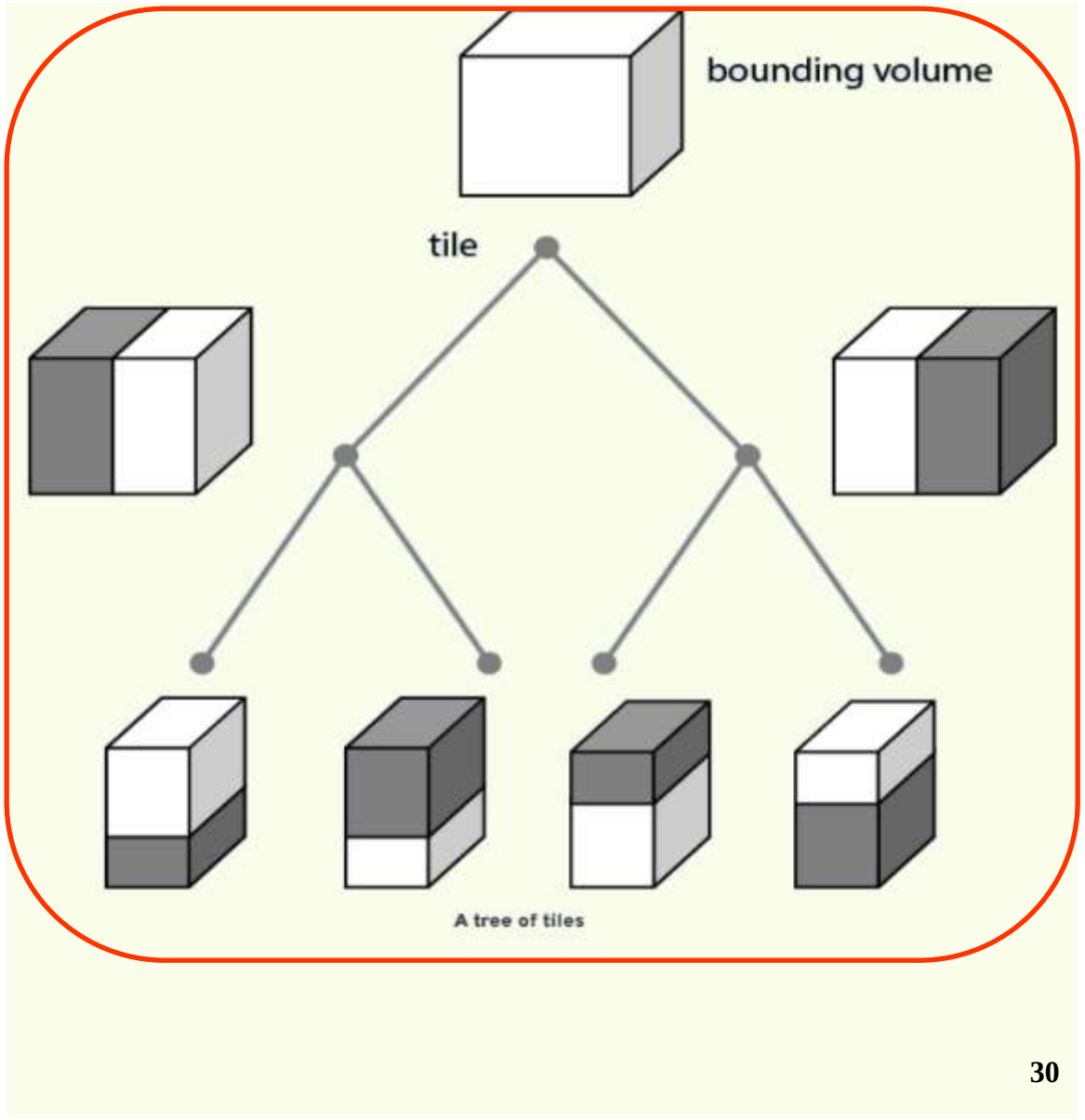


3D Tiles OGC format

3D Tiles OGC format



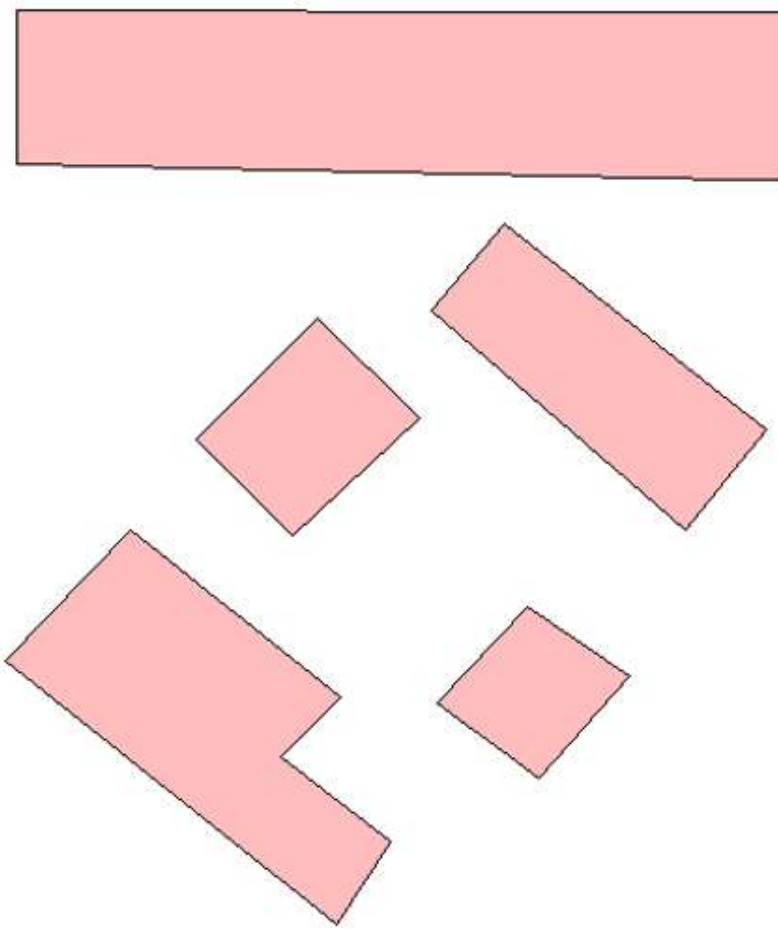
3D Tiles OGC format



Implementation & Practical Examples

3D Web Service CityGML (LOD1)

A Sample Shapefile



Table

Building_2D

FID	Shape *	Storey	id
0	Polygon	10	1
1	Polygon	15	2
2	Polygon	20	3
3	Polygon	30	4
4	Polygon	10	5

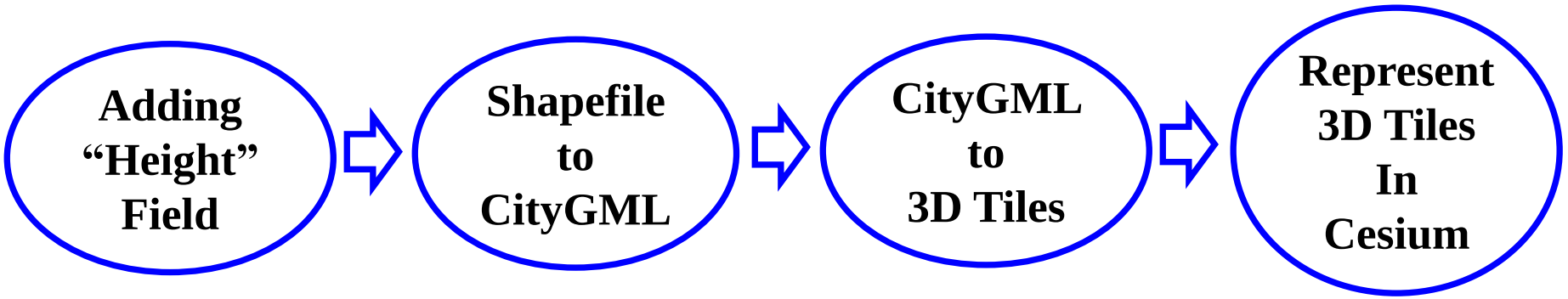
1

(0 out of 5 Selected)

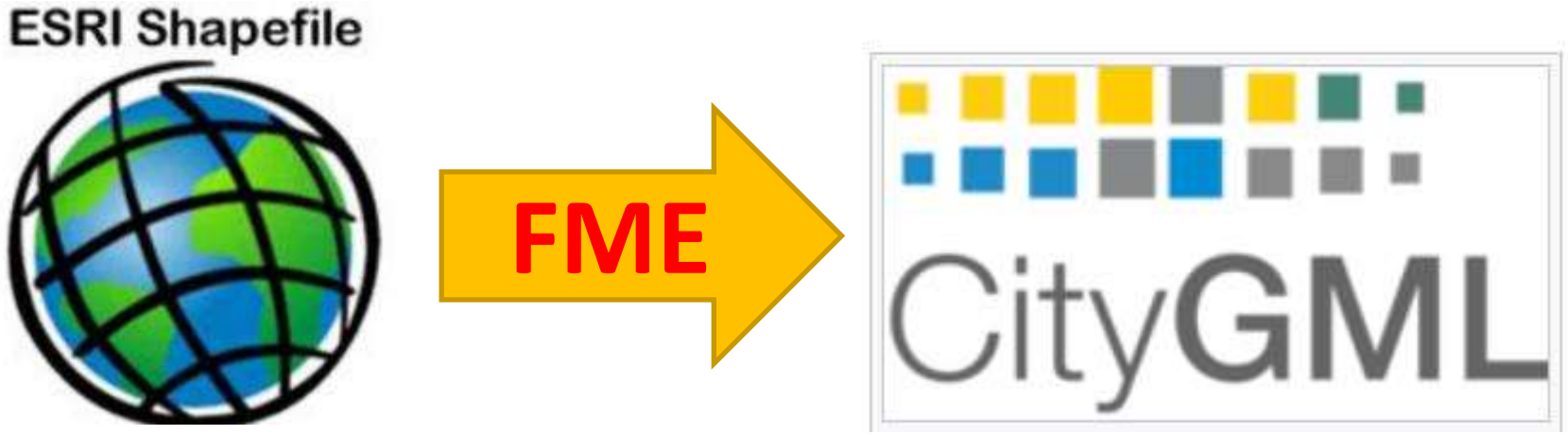
Building_2D

Preparing Data

- Adding a Field to Shapefile as Height of Building
- Converting Shapefile to CityGML (LOD1)
- Converting CityGML (LOD1) to 3D Tiles
- Representing 3D Tiles in Cesium



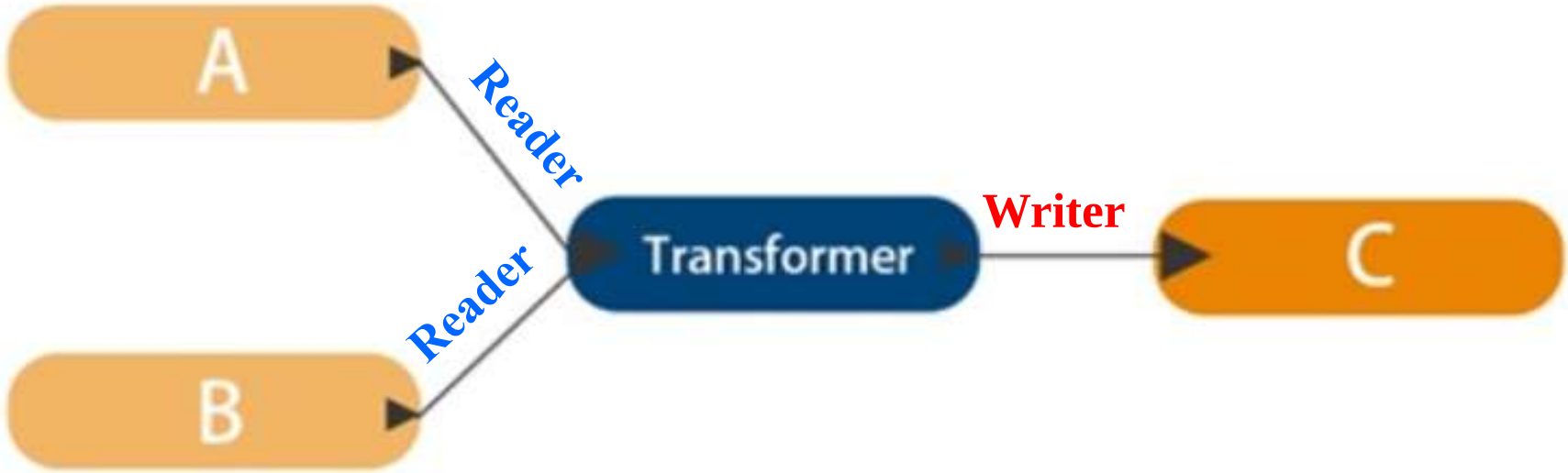
Shapefile to CityGML Conversion



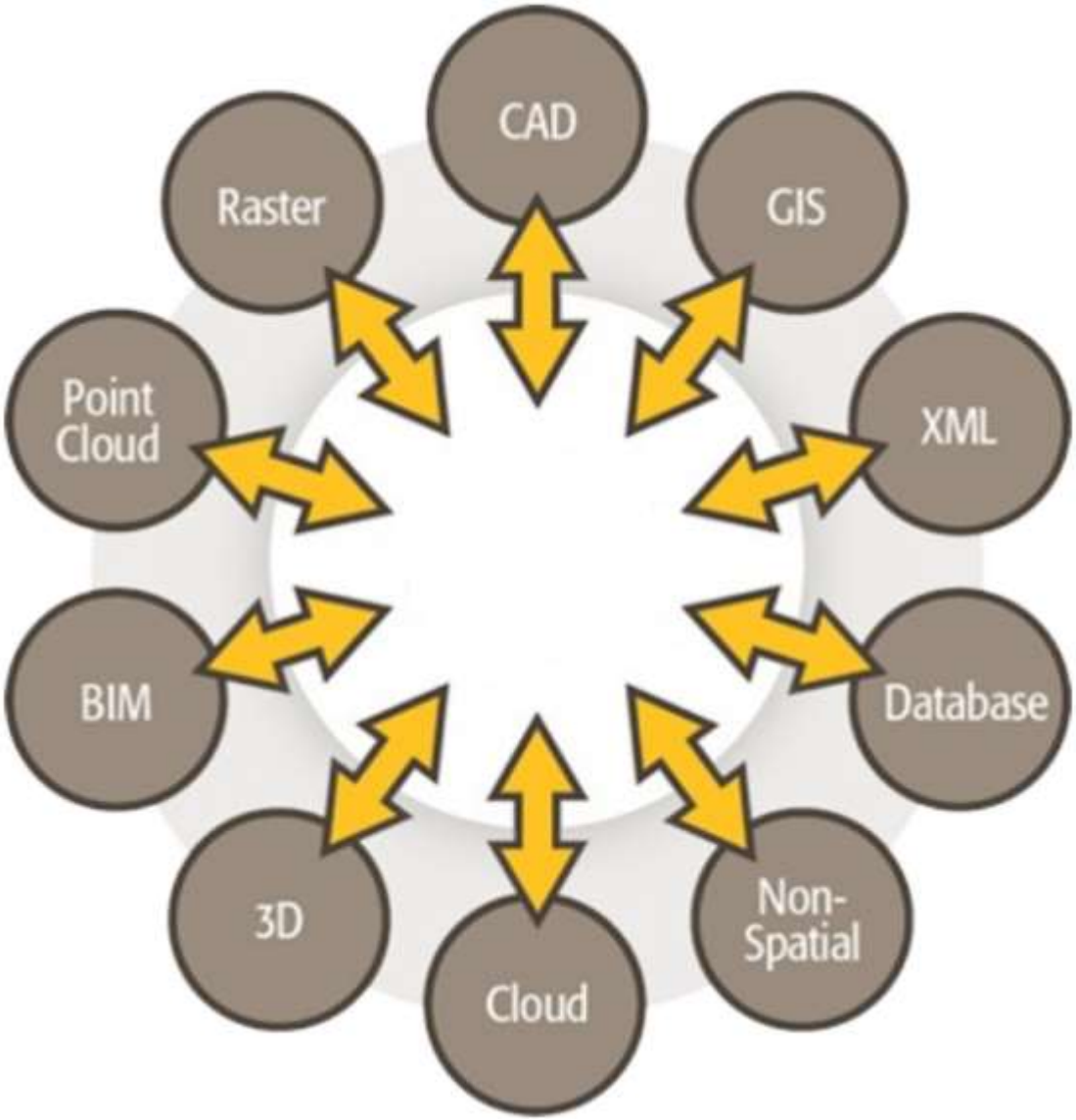
Conversion by FME

Feature Manipulation Engine

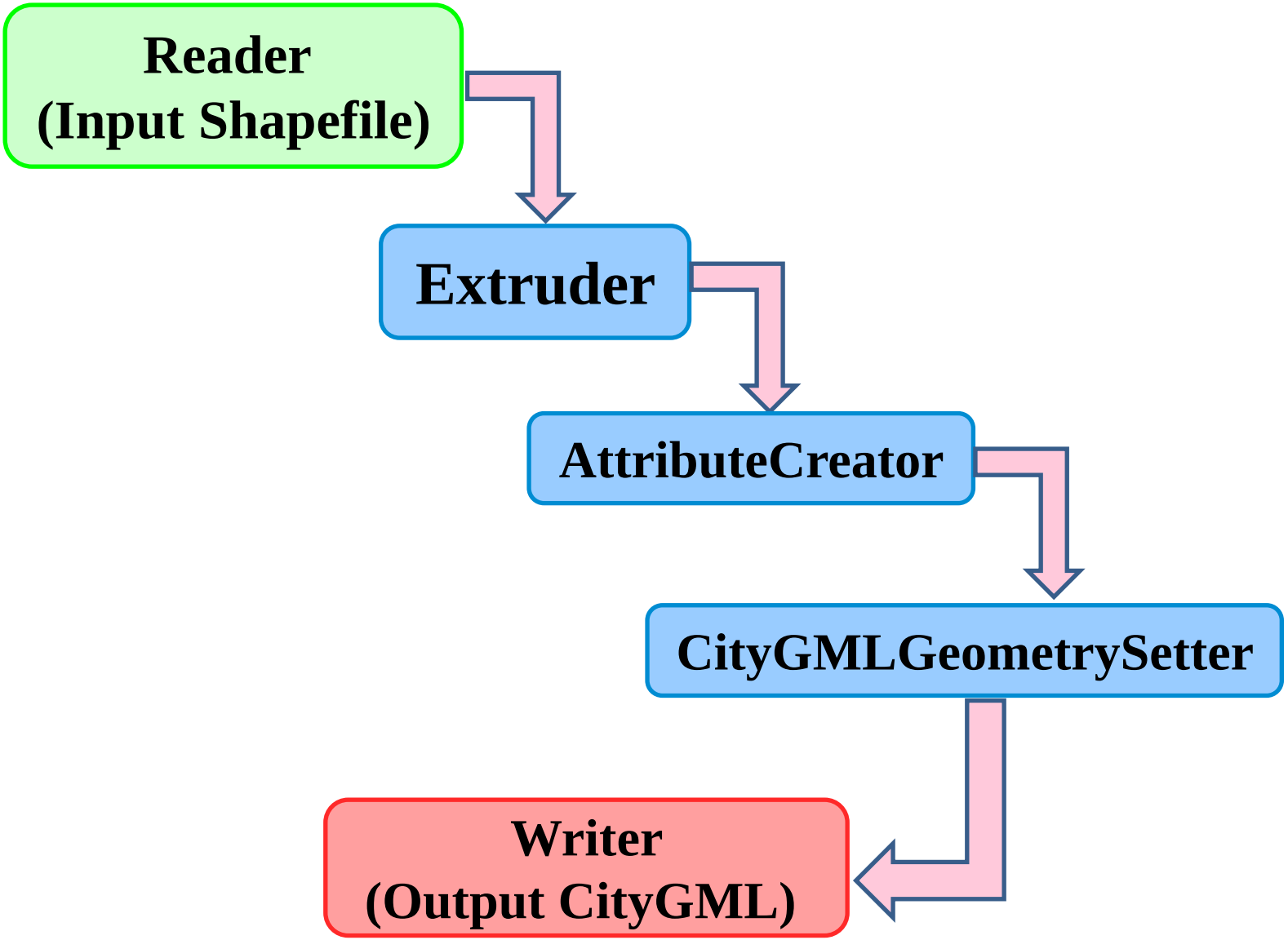
FME



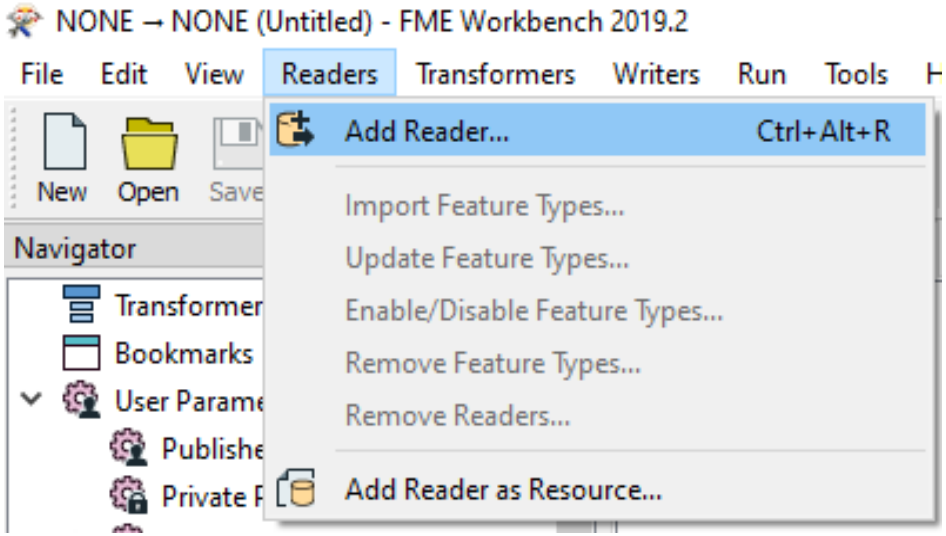
FME

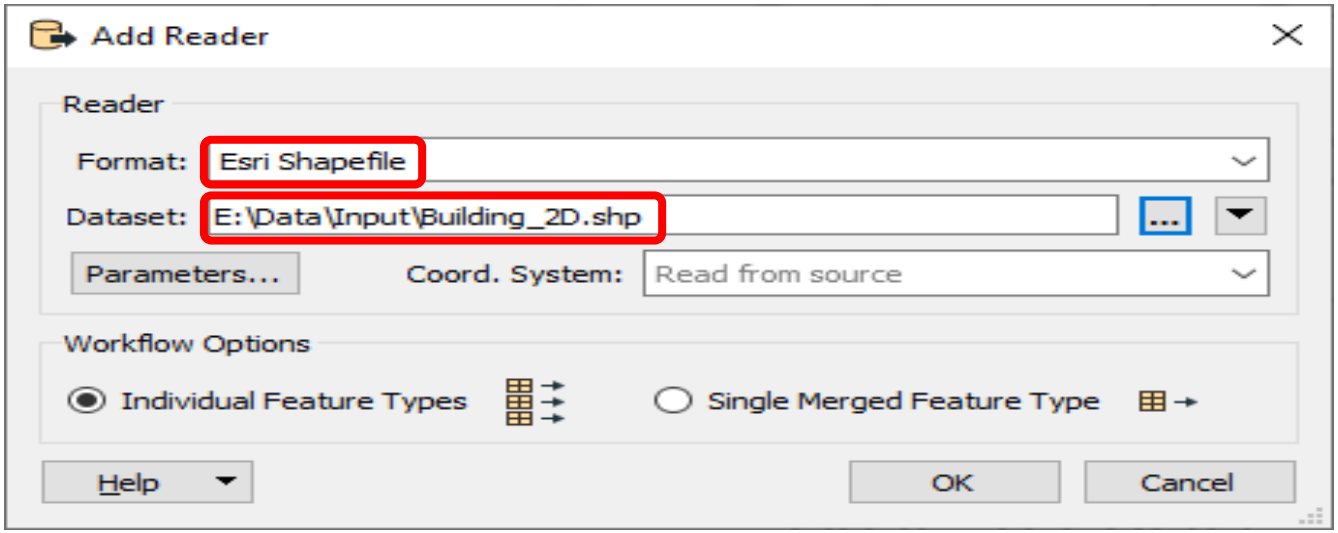

CAD
Raster
GIS
Point Cloud
XML
BIM
Database
3D
Non-Spatial
Cloud

Minimum Transformers in FME to Convert Shp to CityGML

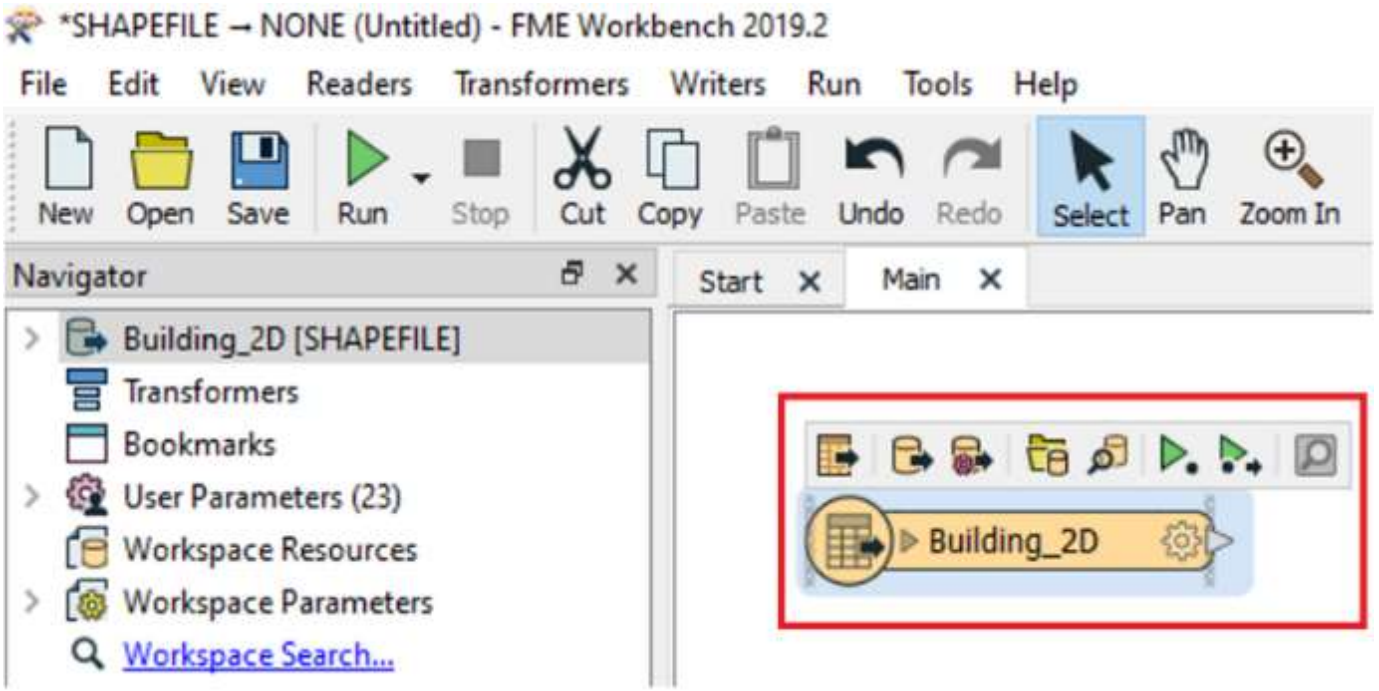


Minimum Transformers in FME to Convert Shp to CityGML





Minimum Transformers in FME to Convert Shp to CityGML



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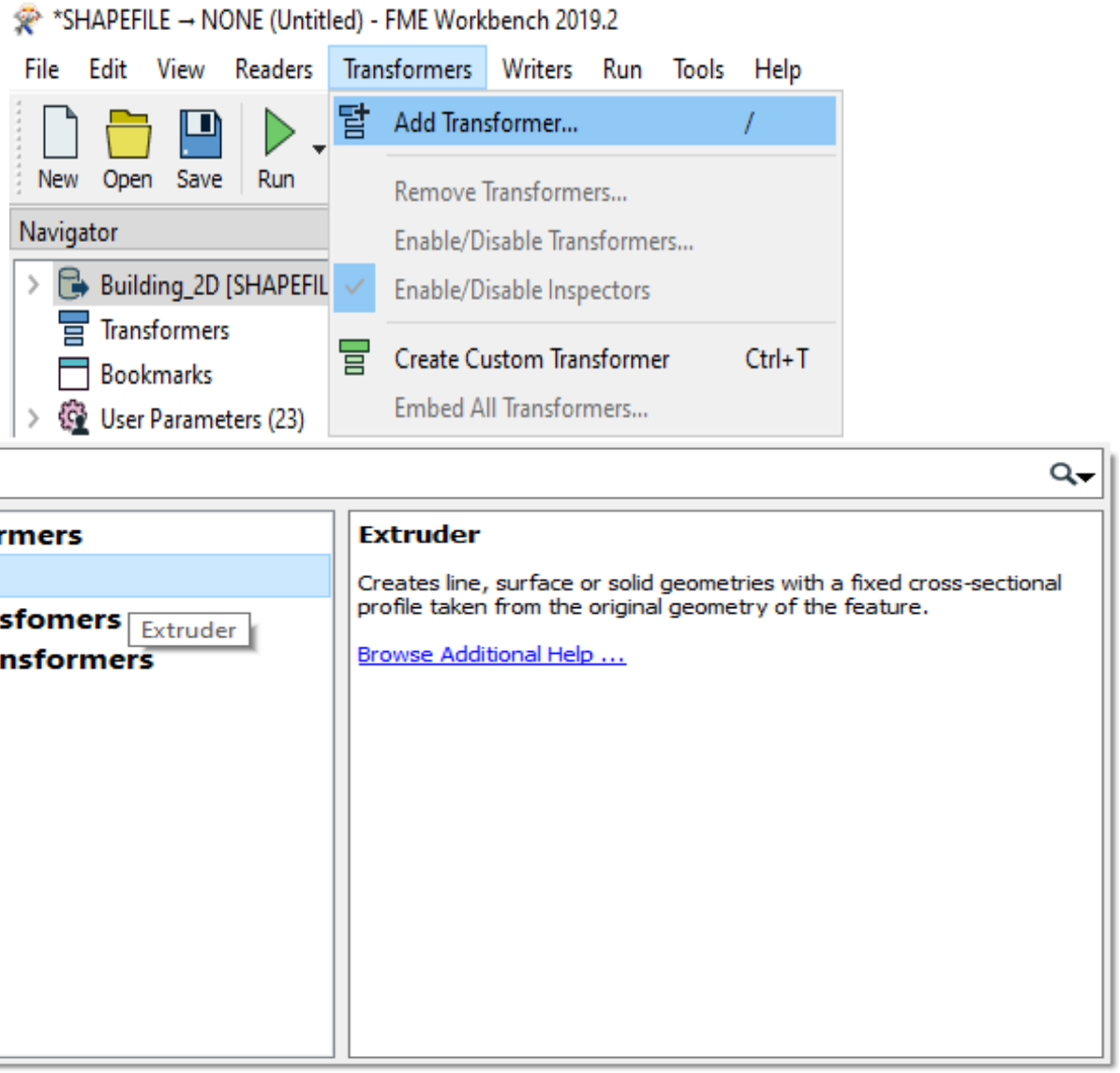

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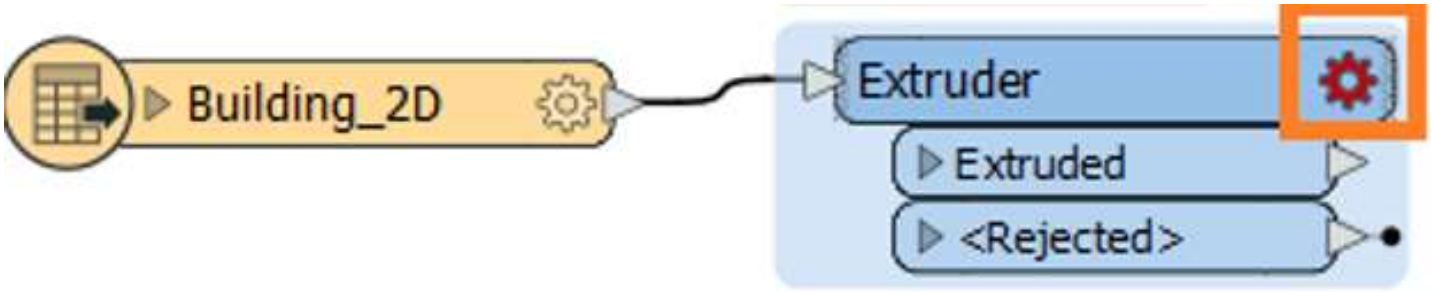
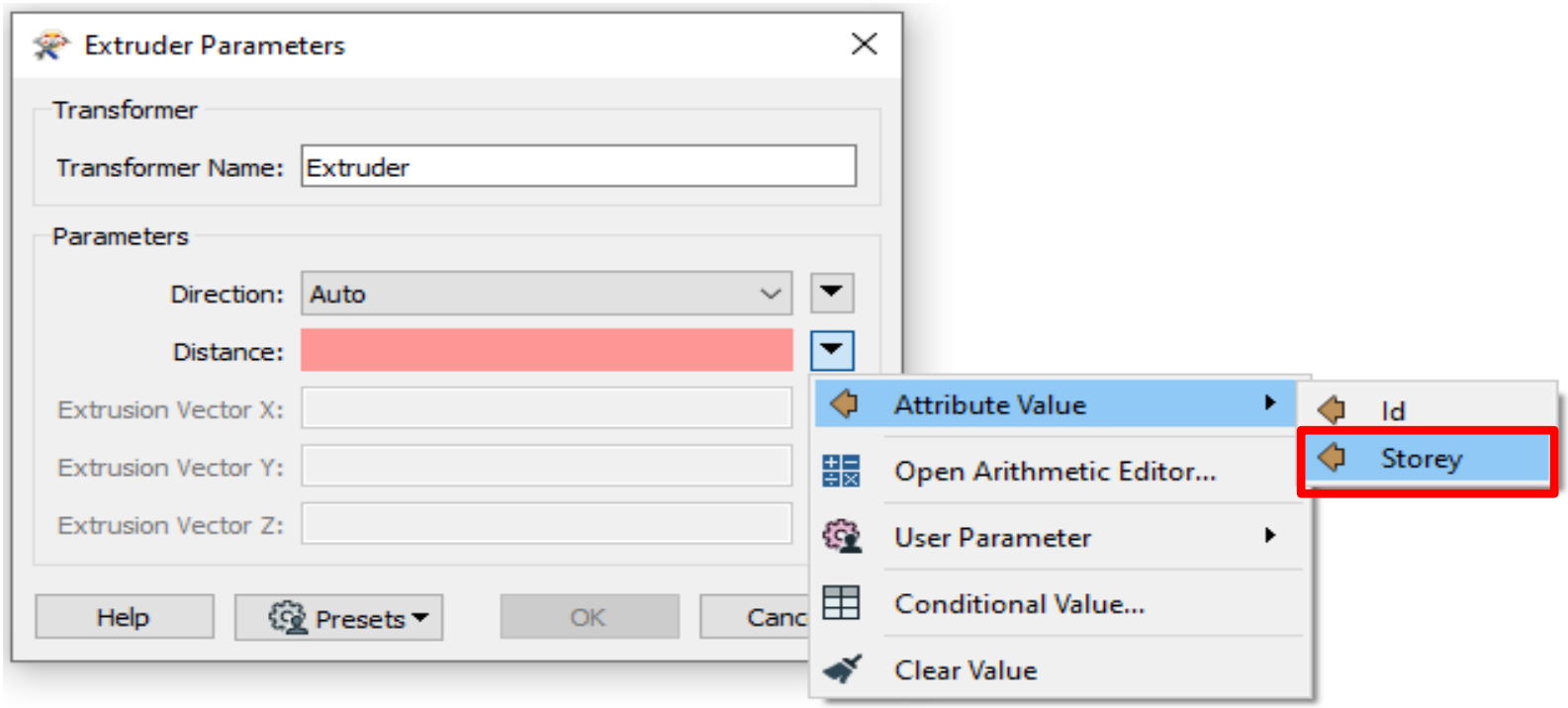
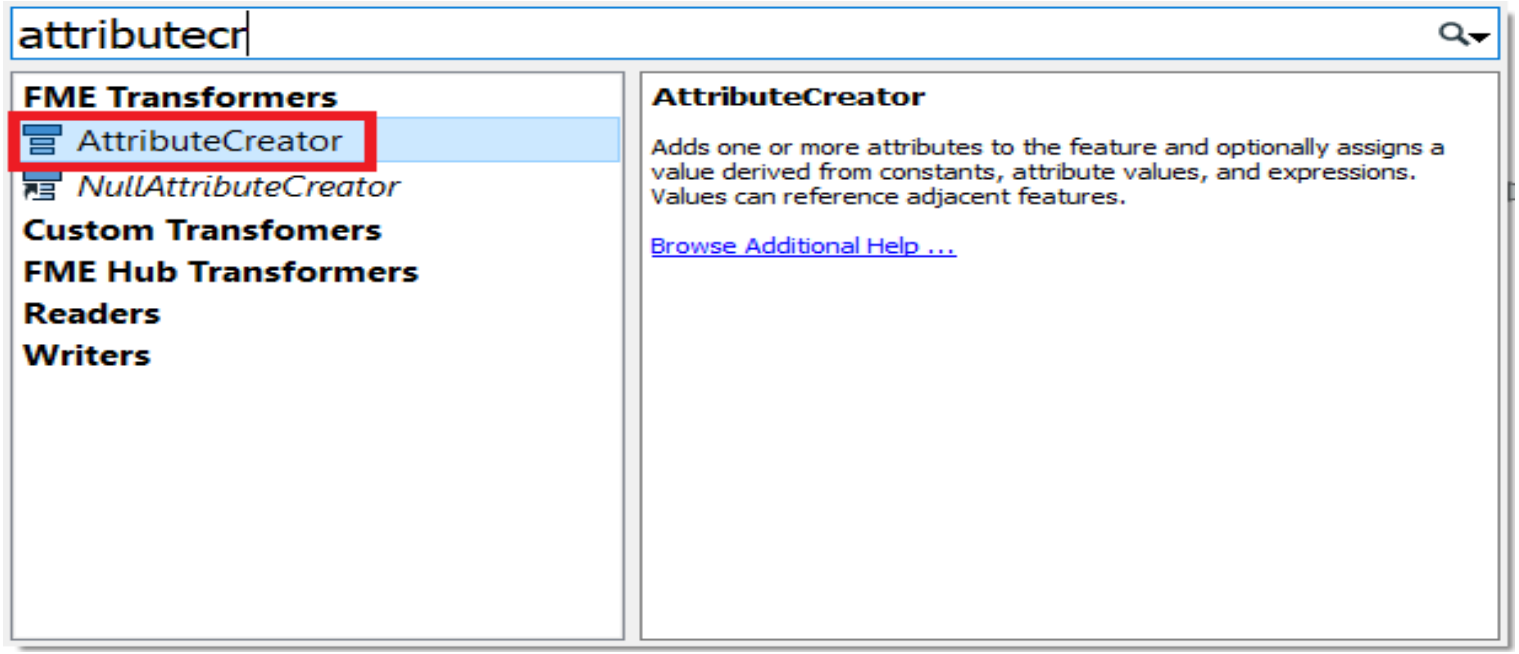
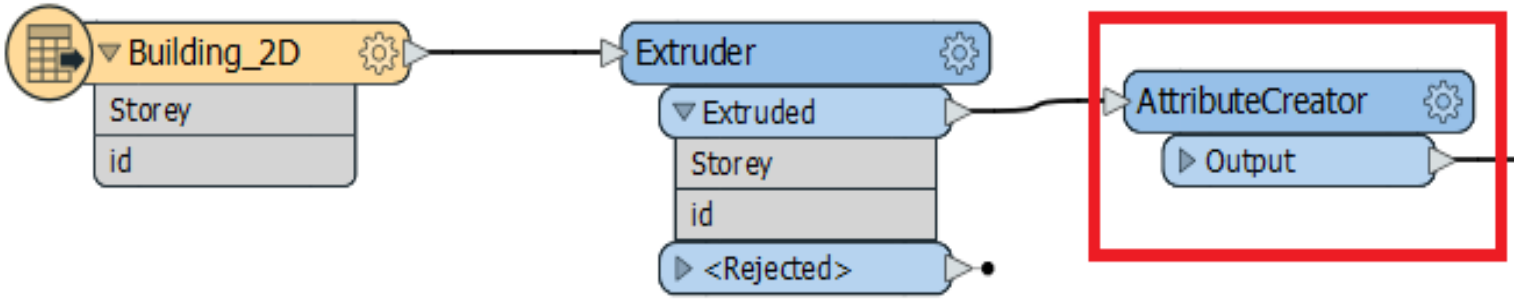


Minimum Transformers in FME to Convert Shp to CityGML

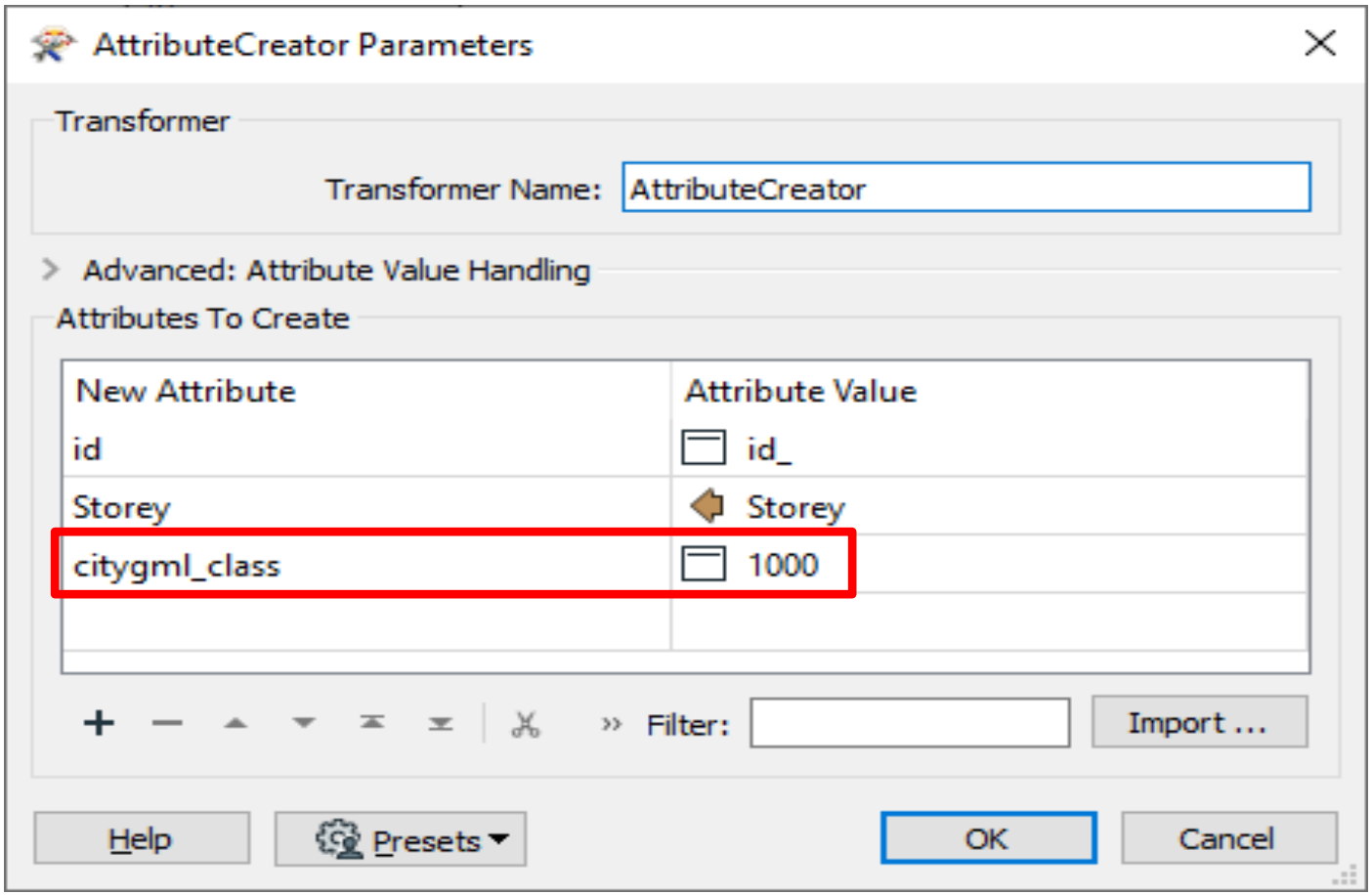


Minimum Transformers in FME to Convert Shp to CityGML





Minimum Transformers in FME to Convert Shp to CityGML

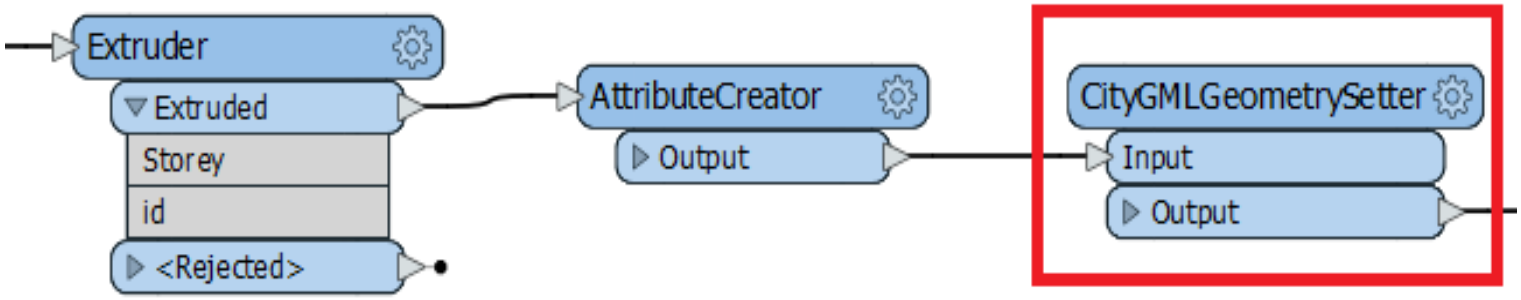


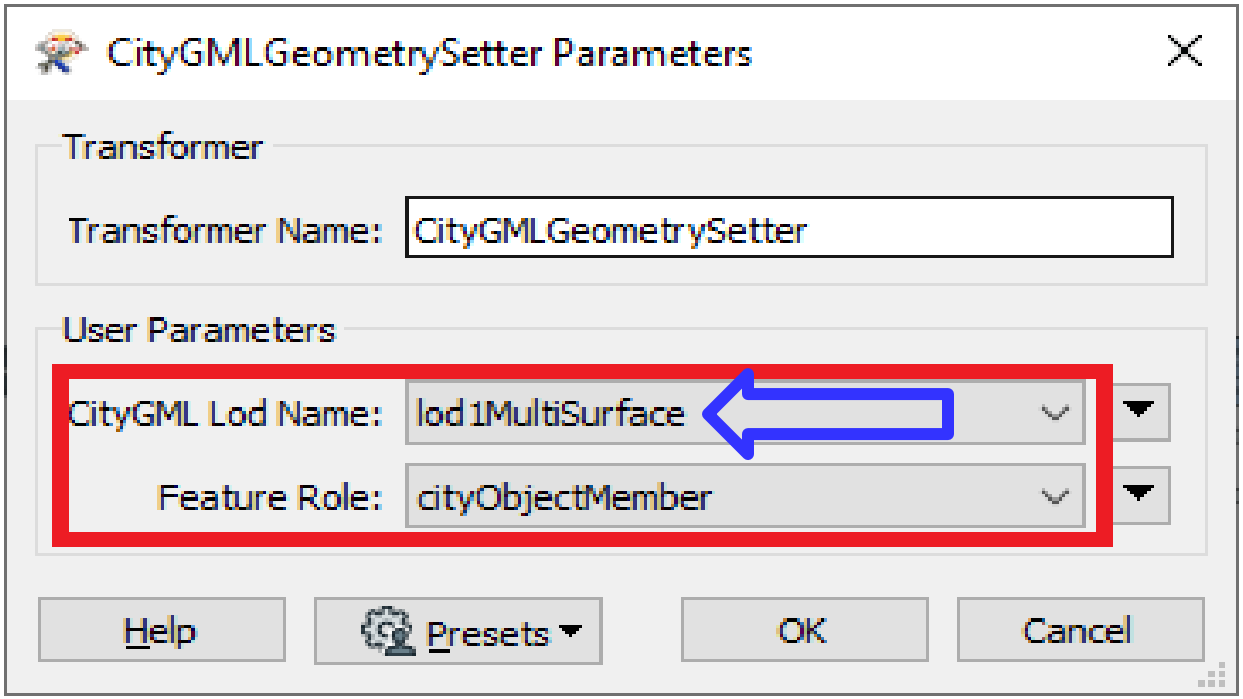
Minimum Transformers in FME to Convert Shp to CityGML

C.1 Building module

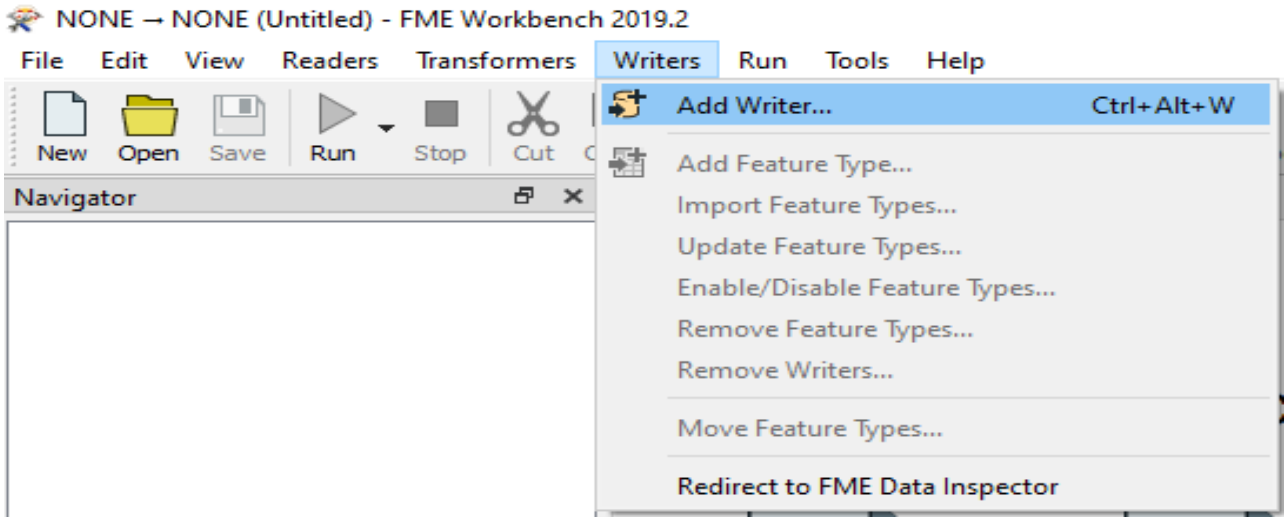
Code list of the *_AbstractBuilding* attribute *class*			
http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_class.xml			
1000	habitation	1100	schools, education, research
1010	sanitation	1110	maintainence and waste management
1020	administration	1120	healthcare
1030	business, trade	1130	communicating
1040	catering	1140	security
1050	recreation	1150	storage
1060	sport	1160	industry
1070	culture	1170	traffic
1080	church institution	1180	function
1090	agriculture, forestry		

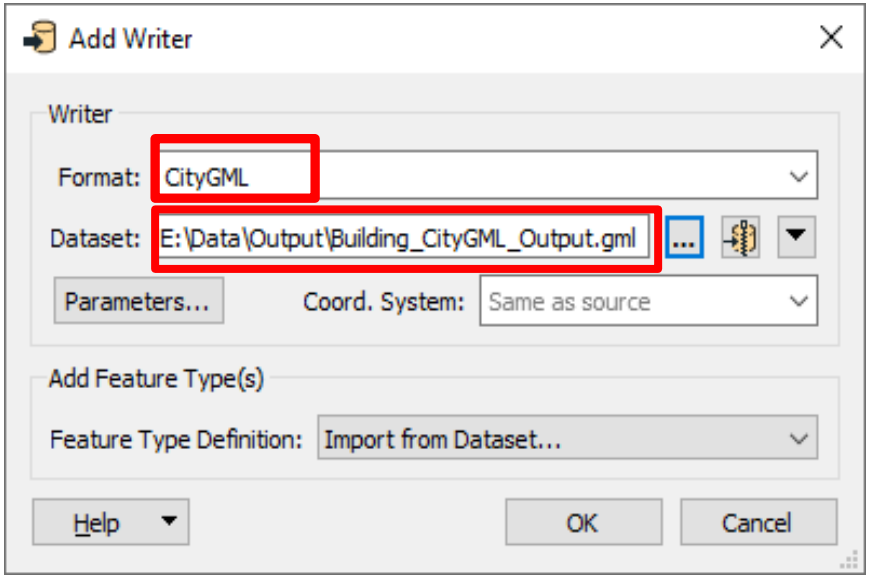
Minimum Transformers in FME to Convert Shp to CityGML



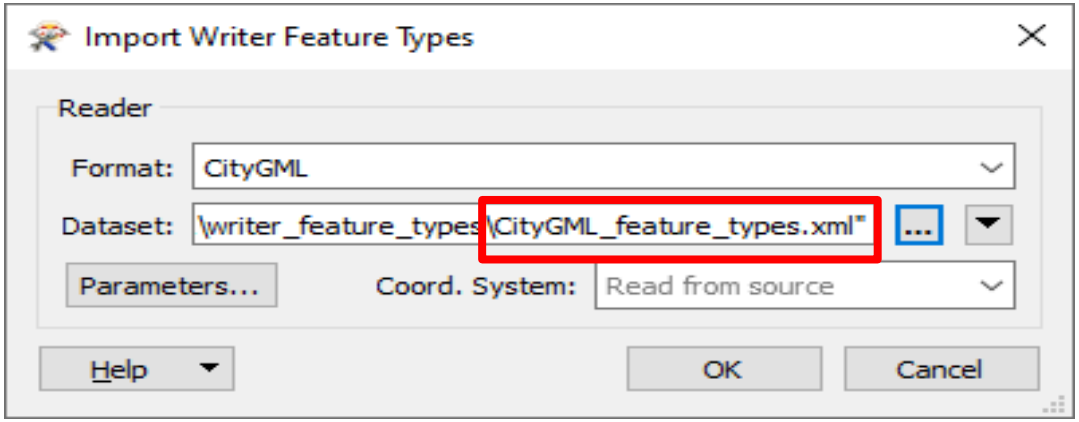


Minimum Transformers in FME to Convert Shp to CityGML





Minimum Transformers in FME to Convert Shp to CityGML



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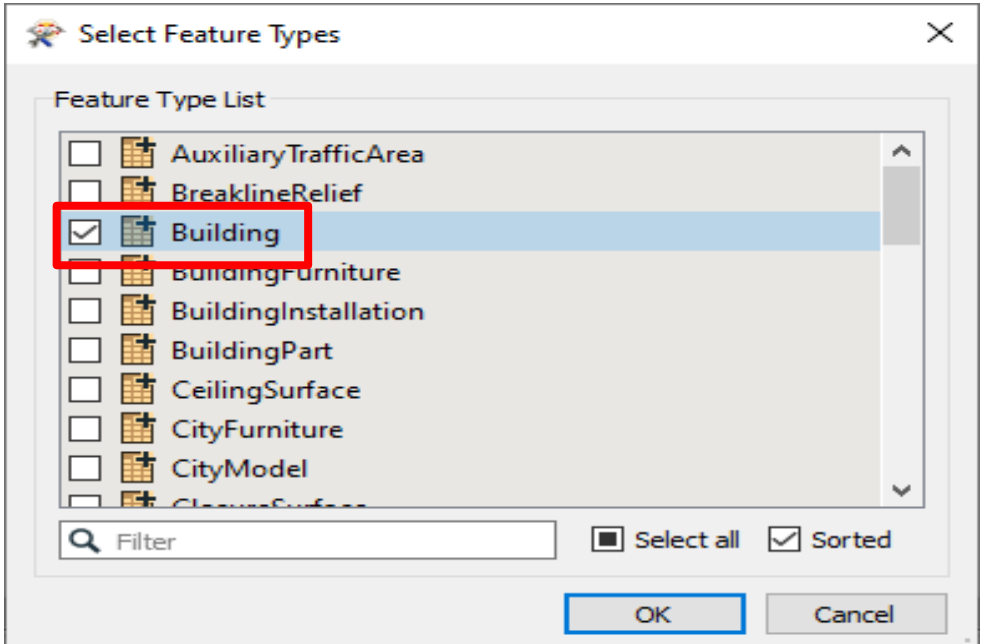
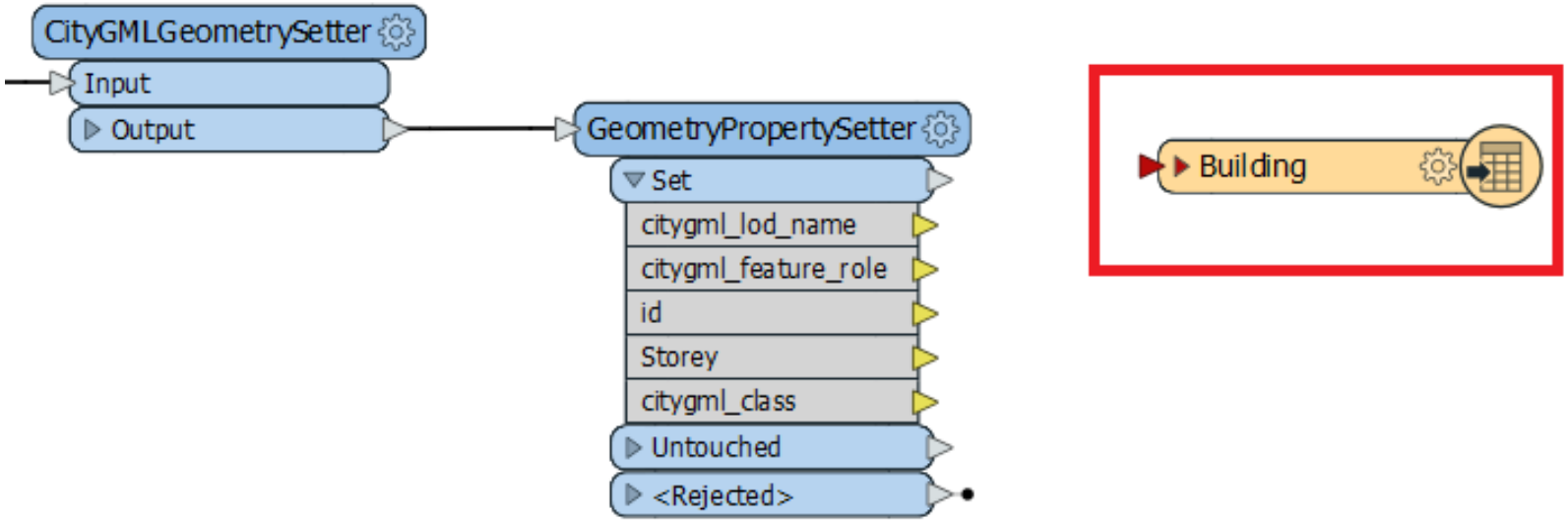
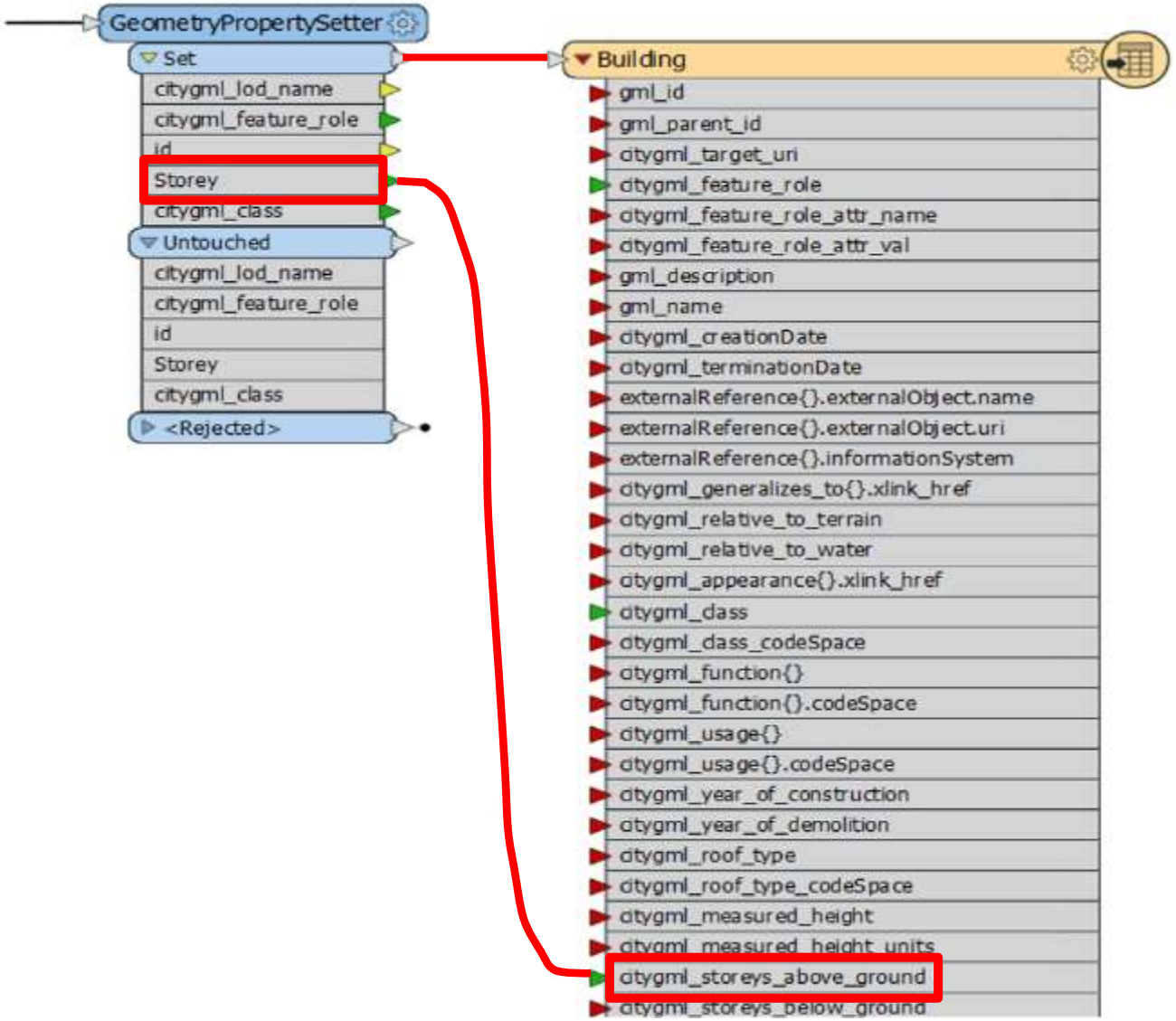


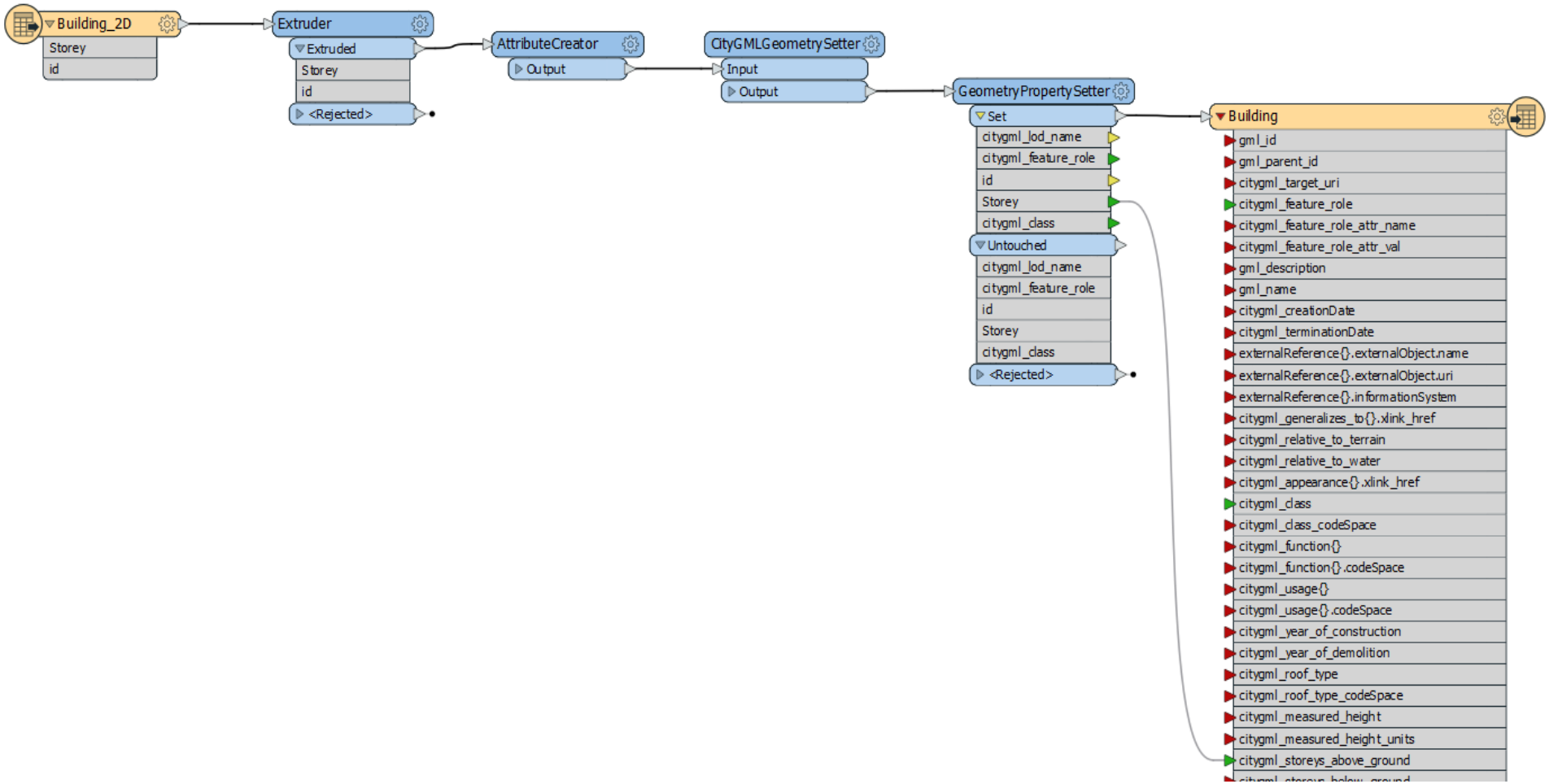
Minimum Transformers in FME to Convert Shp to CityGML



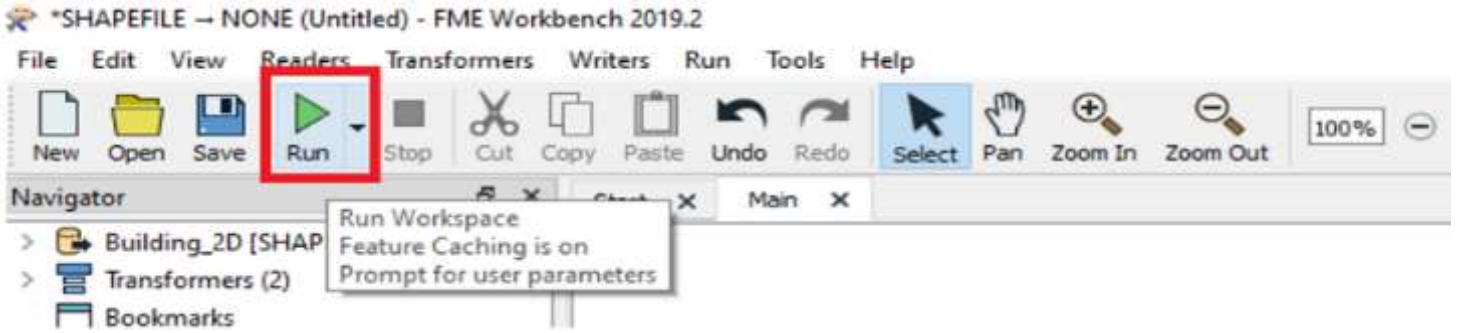
Minimum Transformers in FME to Convert Shp to CityGML

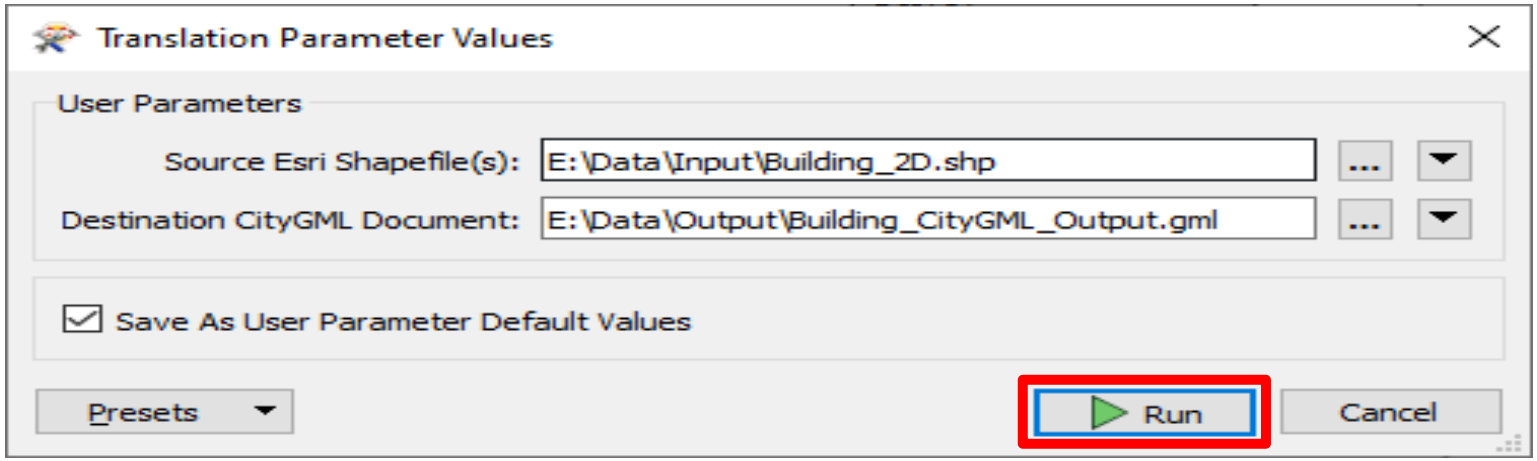


The Whole Model to Convert Shp to CityGML in FME

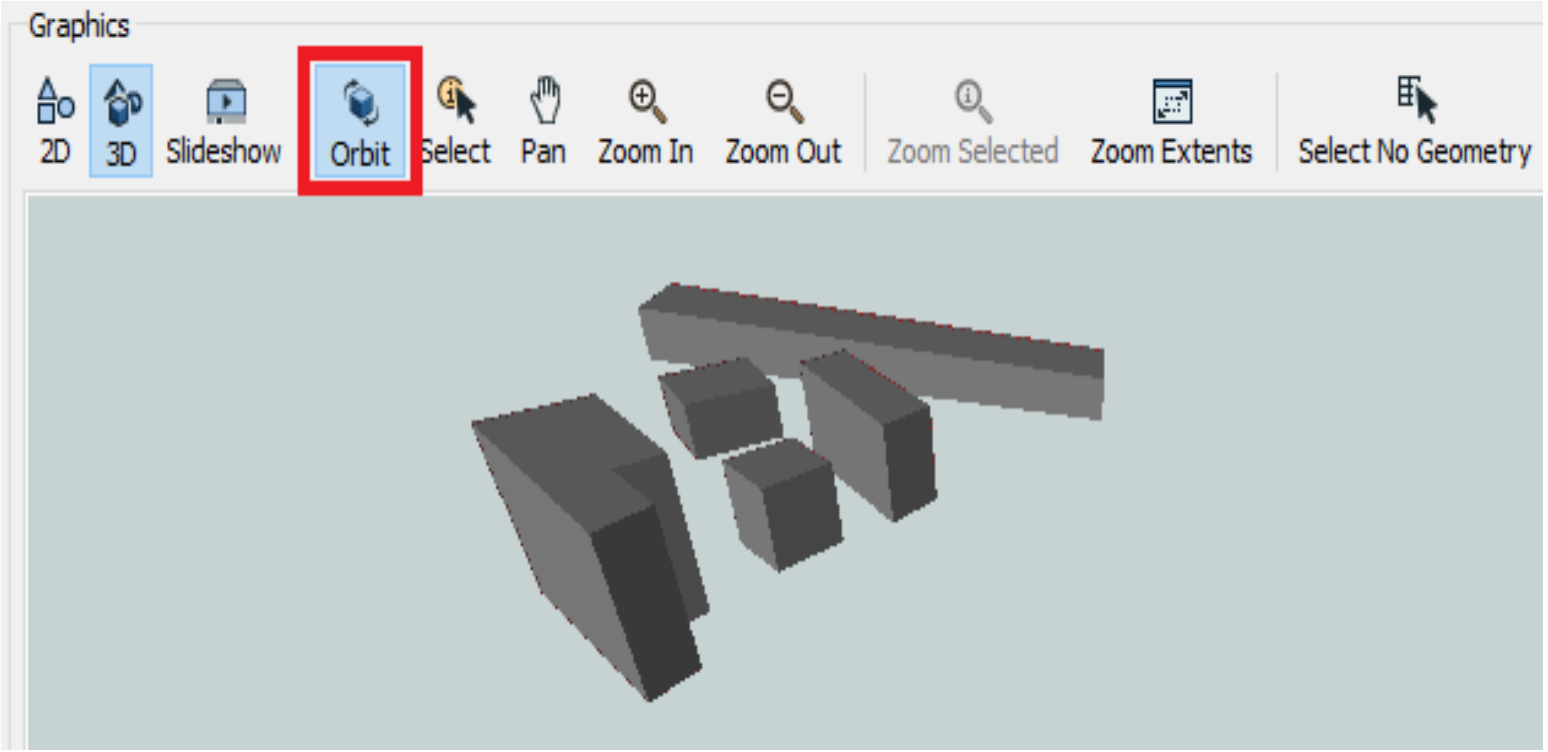


Minimum Transformers in FME to Convert Shp to CityGML





Preview of Created CityGML in FME



Preview of Created CityGML in FME

```
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<core:CityModel xmlns:brid="http://www.opengis.net/citygml/bridge/2.0" xmlns:tran="ht
<gml:boundedBy>
<gml:Envelope srsName="EPSG:32639" srsDimension="3">
<gml:lowerCorner>528027.2483553989 3953291.0040660817 0</gml:lowerCorner>
<gml:upperCorner>528124.5262990175 3953366.3009359 30</gml:upperCorner>
</gml:Envelope>
</gml:boundedBy>
<core:cityObjectMember>
<bldg:Building>
<bldg:class>1000</bldg:class>
<bldg:storeysAboveGround>10</bldg:storeysAboveGround>
<bldg:lod1MultiSurface>
<gml:MultiSurface srsName="EPSG:32639" srsDimension="3">
<gml:surfaceMember>
<gml:CompositeSurface>
<gml:surfaceMember>
<gml:Polygon>
<gml:exterior>
<gml:LinearRing>
<gml:posList>528042.9999999991 3953331.0000000037 0 528053 3953341.0000000037 0 52806
</gml:LinearRing>
</gml:exterior>
</gml:Polygon>
</gml:surfaceMember>
<gml:surfaceMember>
<gml:Polygon>
<gml:exterior>
<gml:LinearRing>
<gml:posList>528042.9999999991 3953331.0000000037 0 528050.8663176708 3953323.0403119
</gml:LinearRing>
```
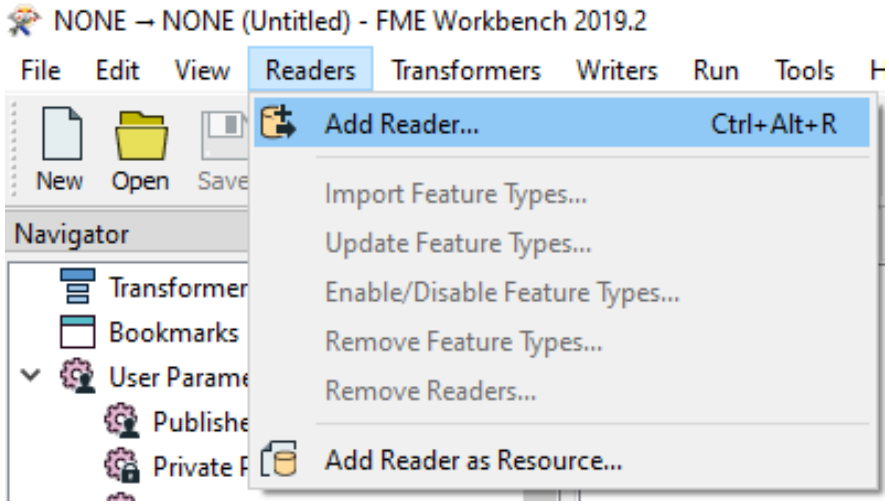
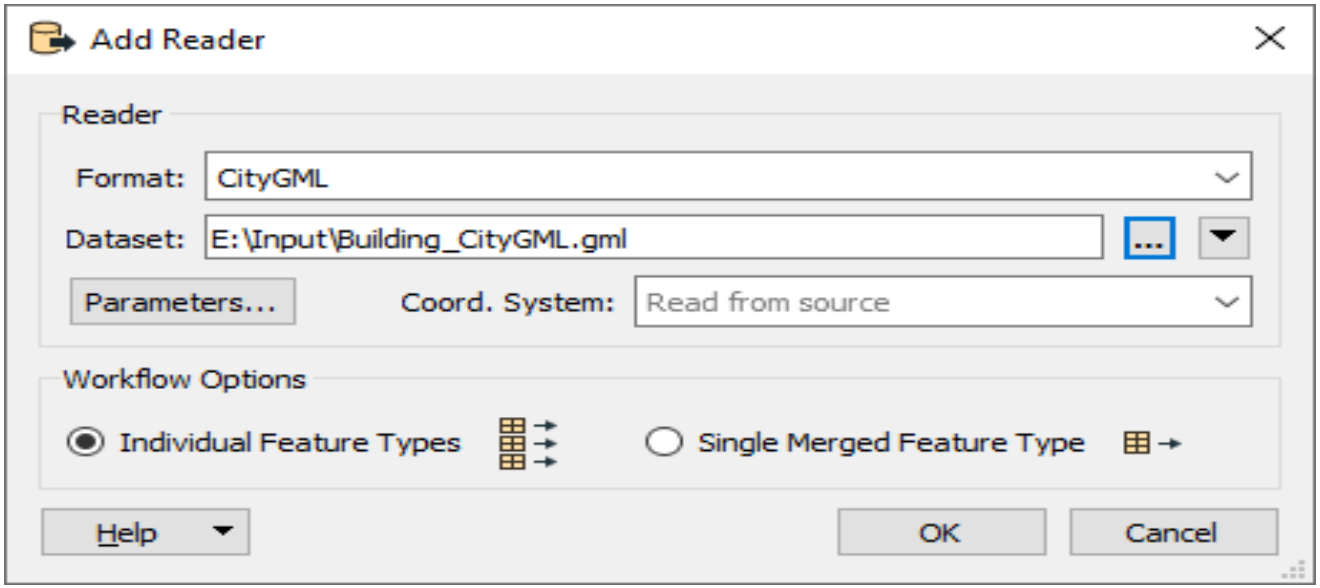
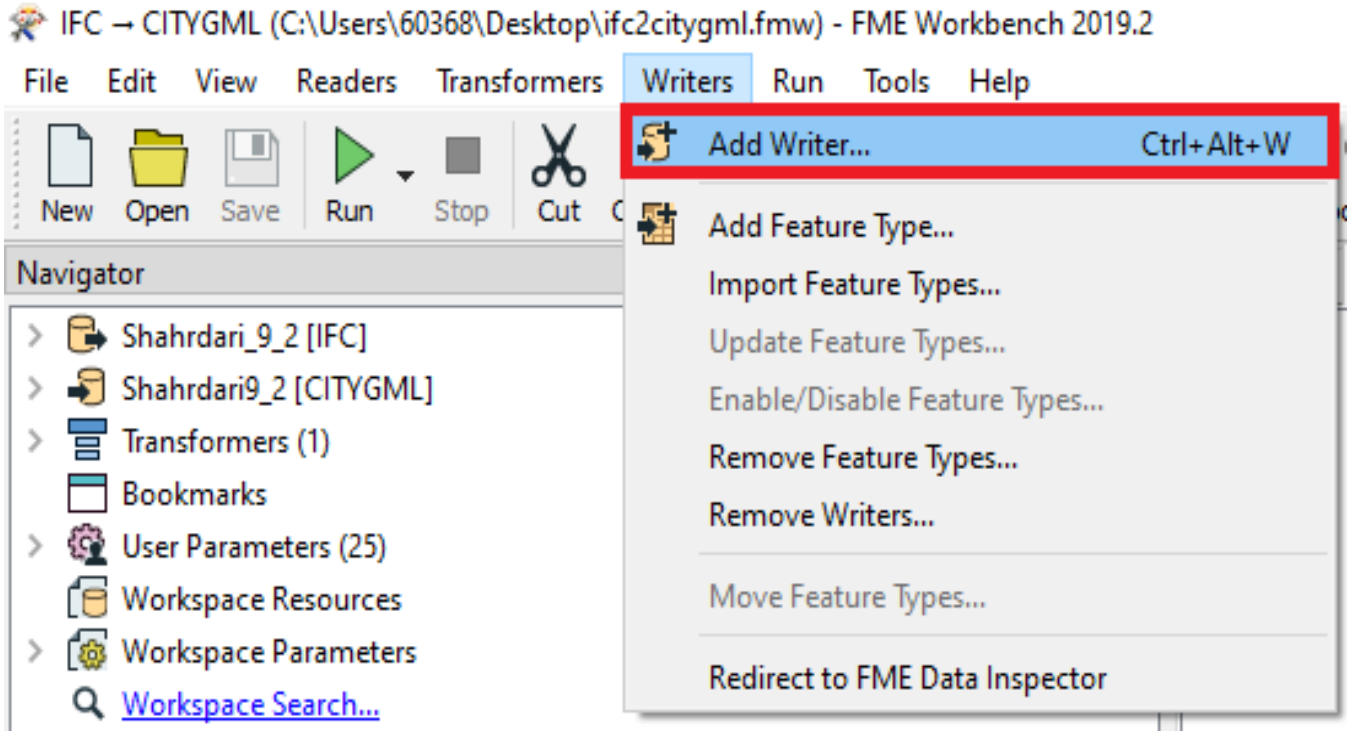

Converting CityGML to 3D Tiles in FME

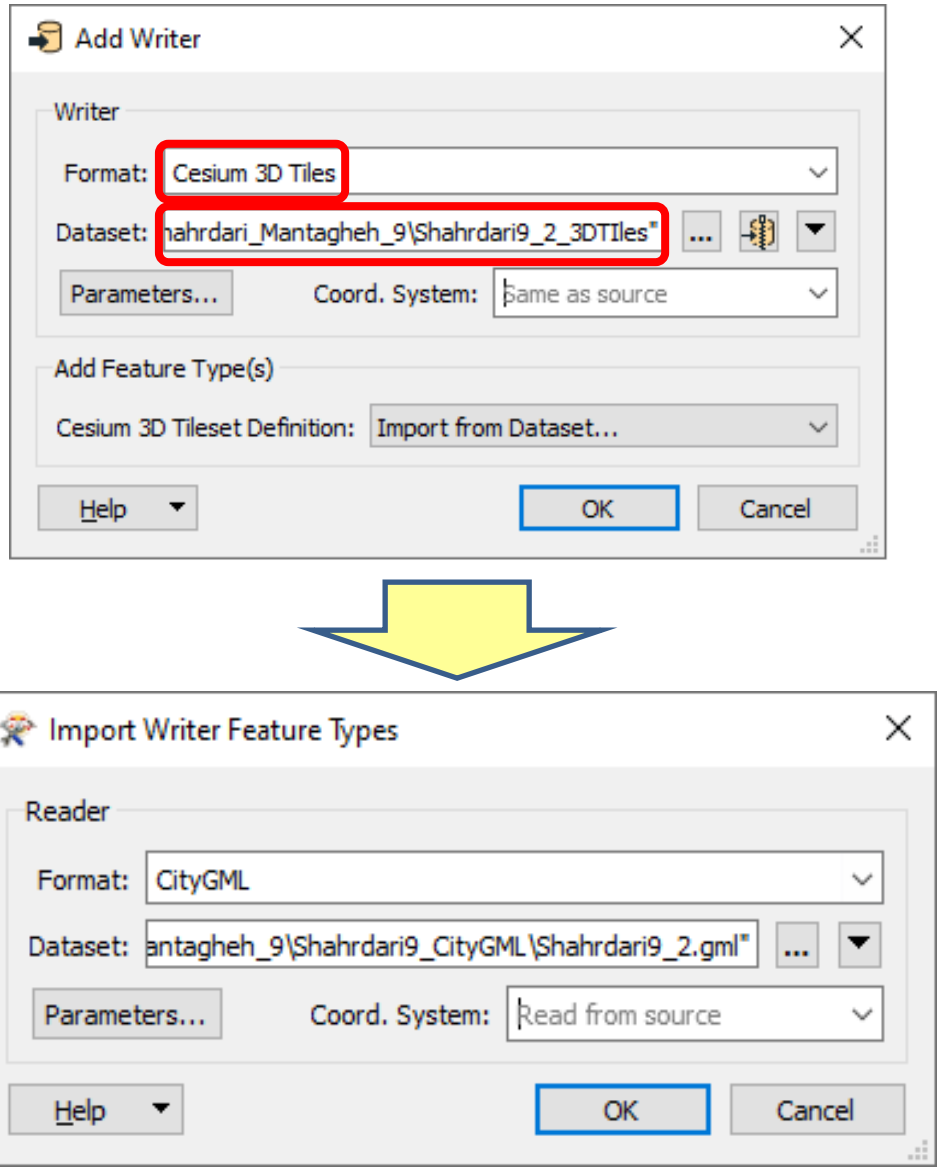




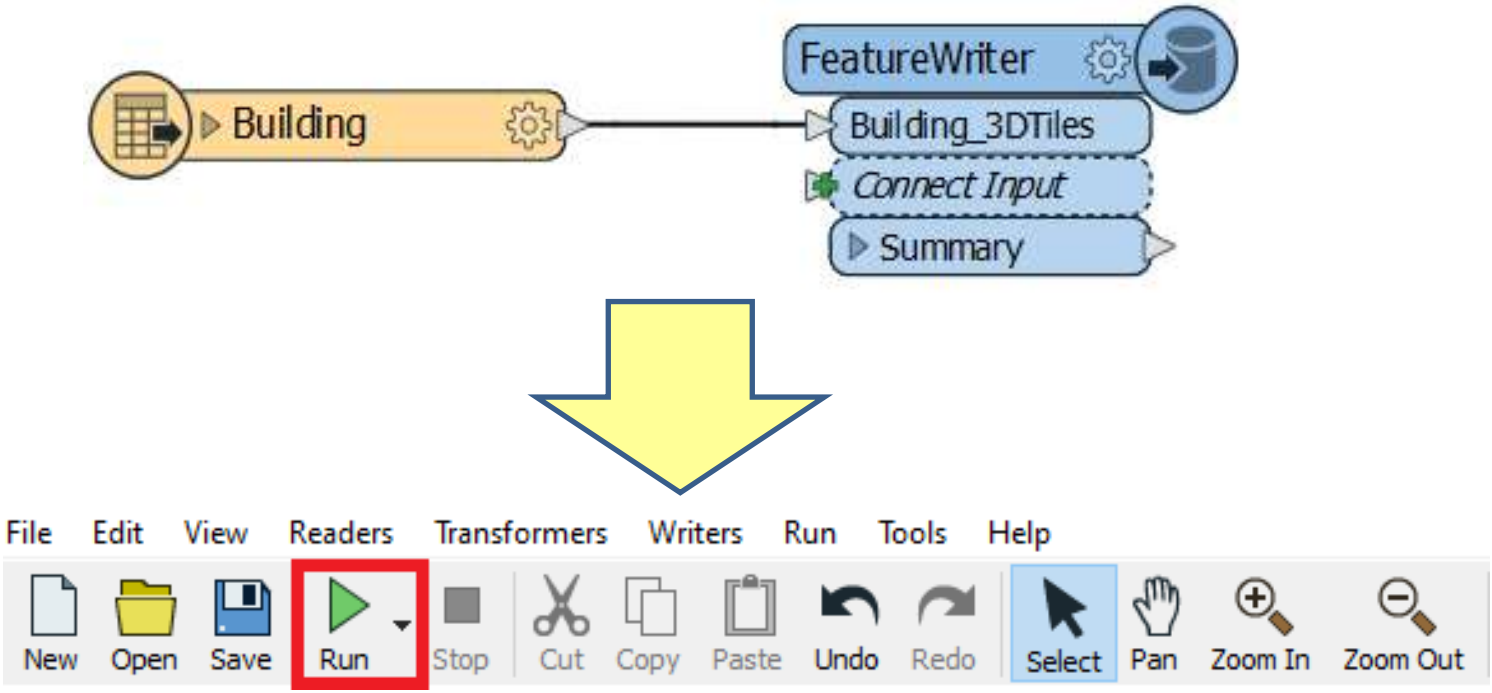
Converting CityGML to 3D Tiles in FME



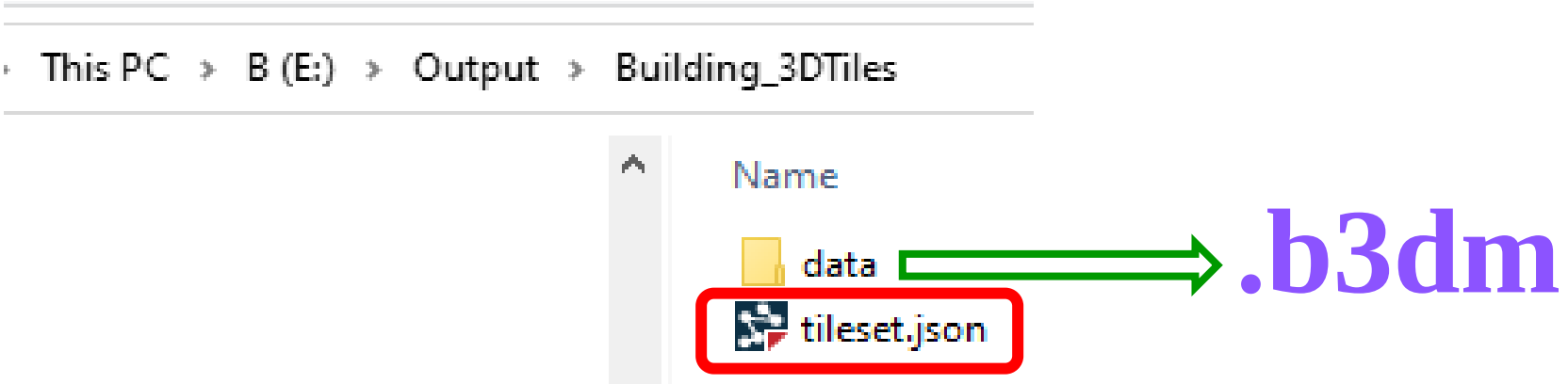
Converting CityGML to 3D Tiles in FME



Converting CityGML to 3D Tiles in FME



Converting CityGML to 3D Tiles in FME



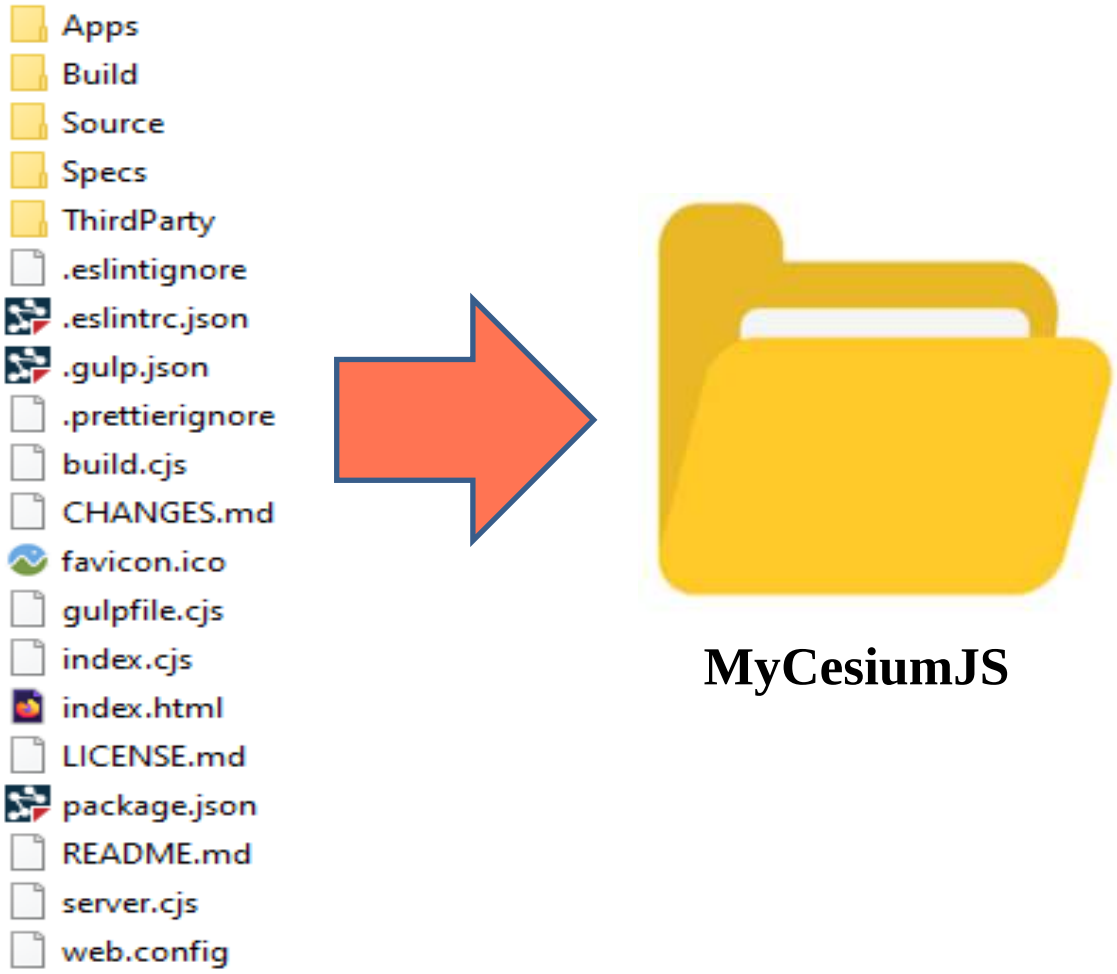
Representing 3D Tiles in CesiumJS

Installing CesiumJS

https://cesium.com/downloads/

Representing 3D Tiles in CesiumJS

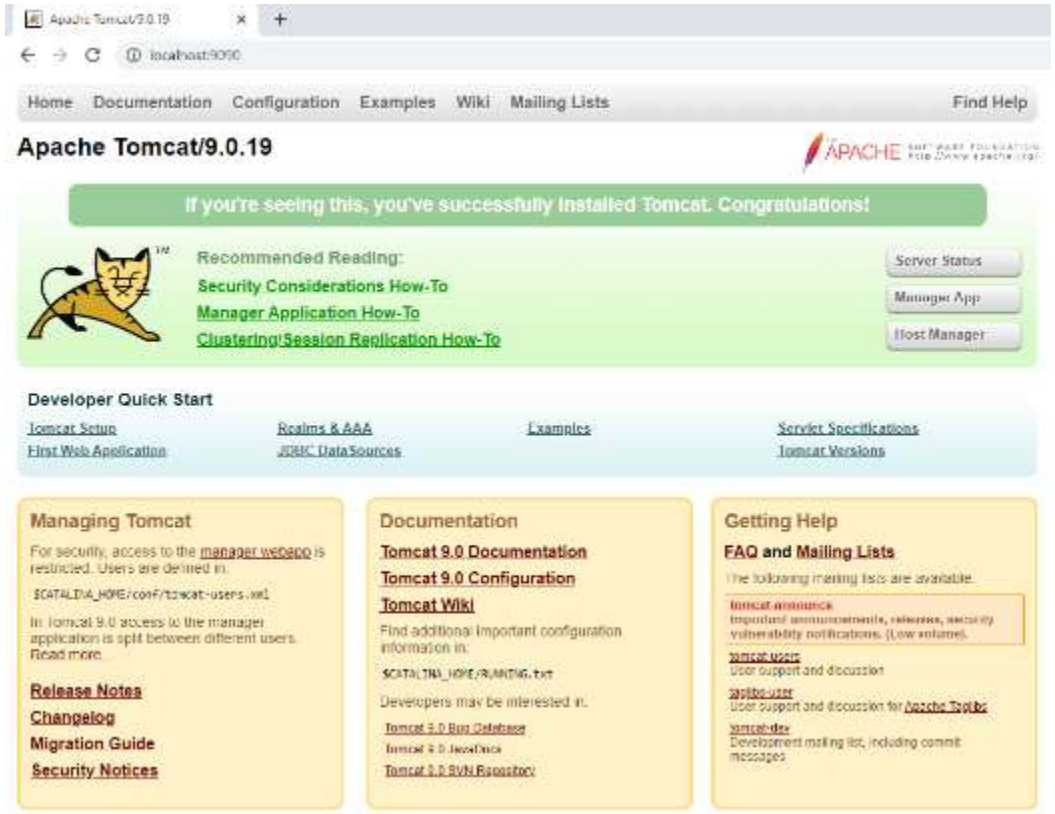
Installing CesiumJS



Representing 3D Tiles in CesiumJS

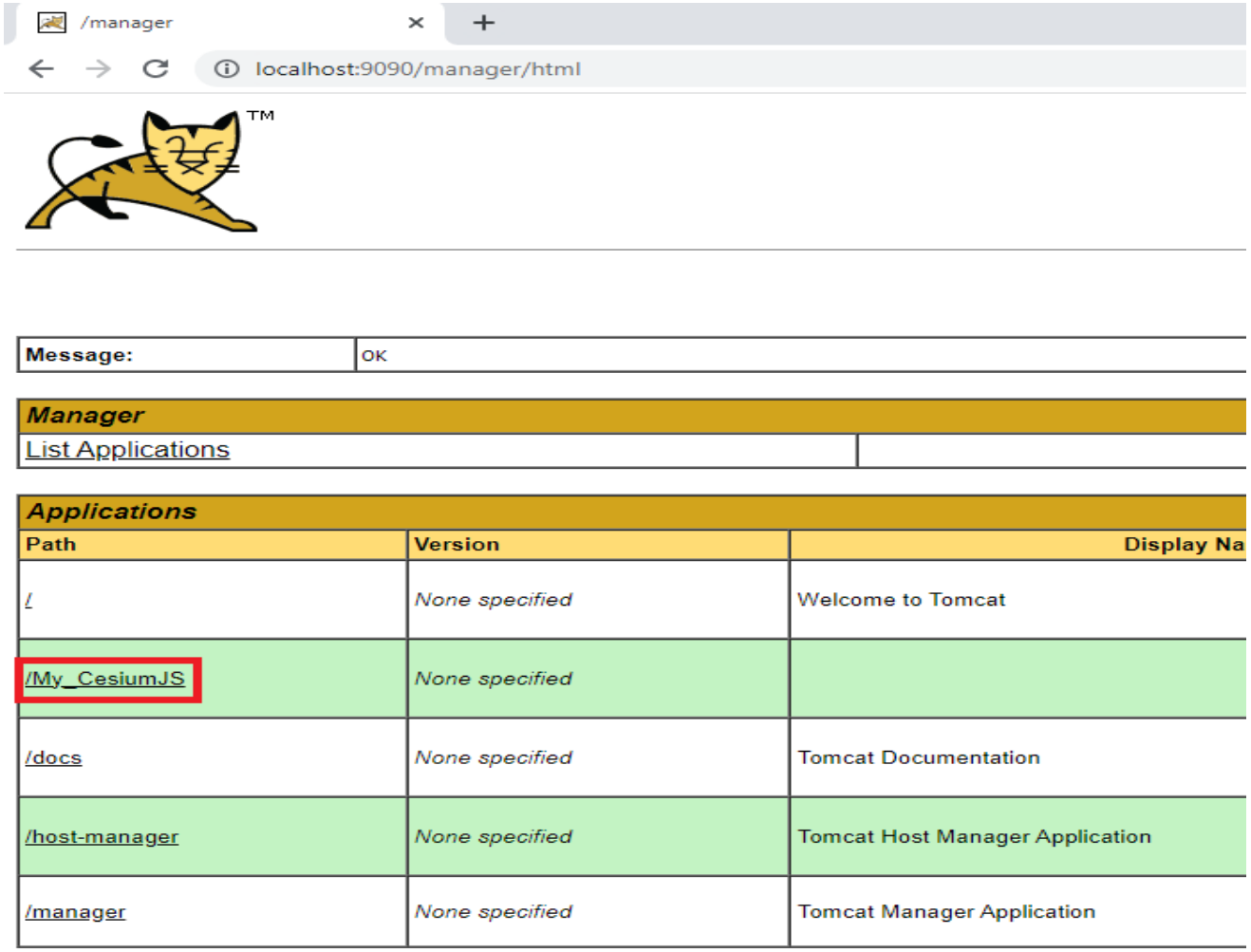
Installing CesiumJS

MyCesiumJS



Representing 3D Tiles in CesiumJS

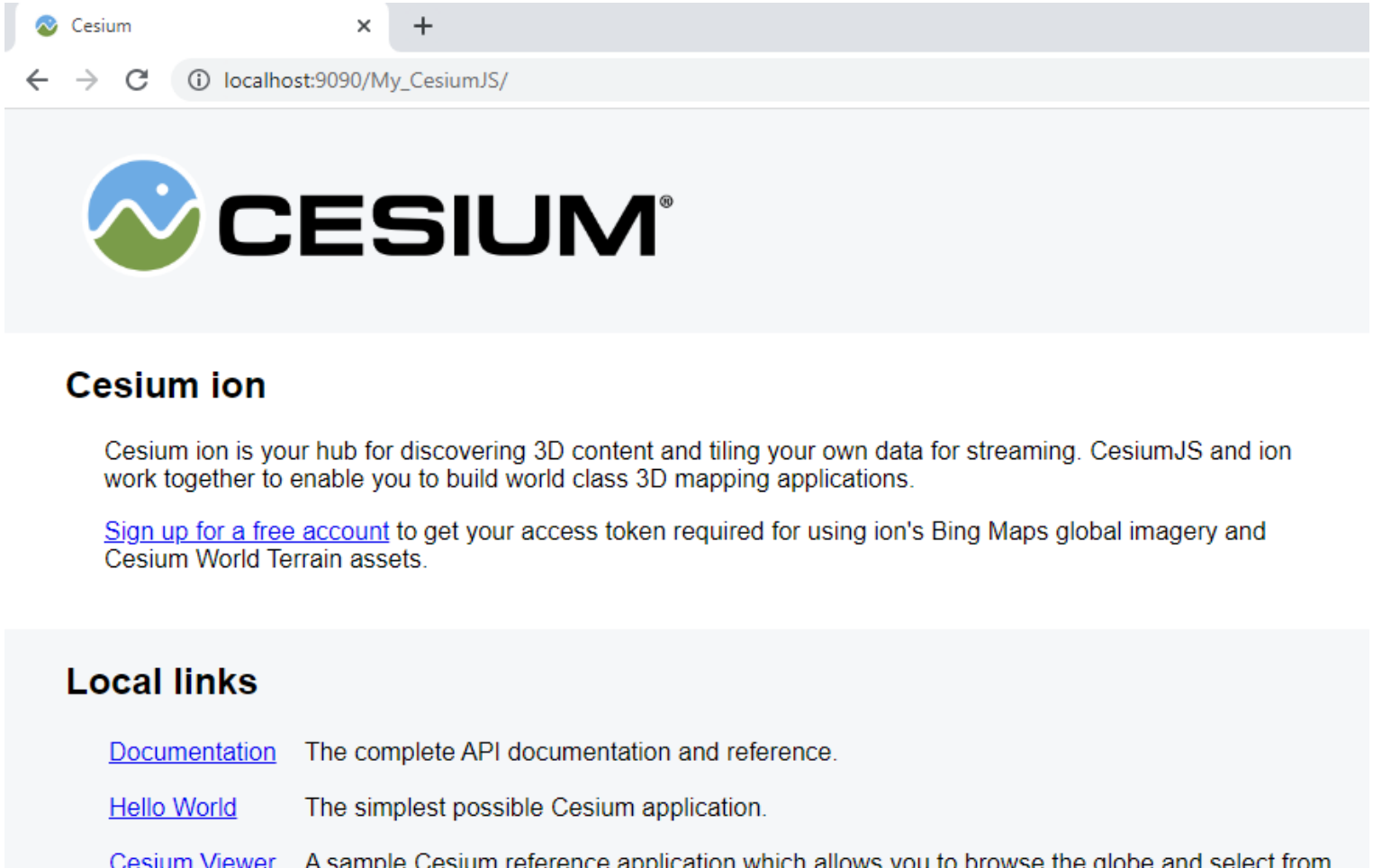
Verifying CeisumJS Installation



Representing 3D Tiles in CesiumJS

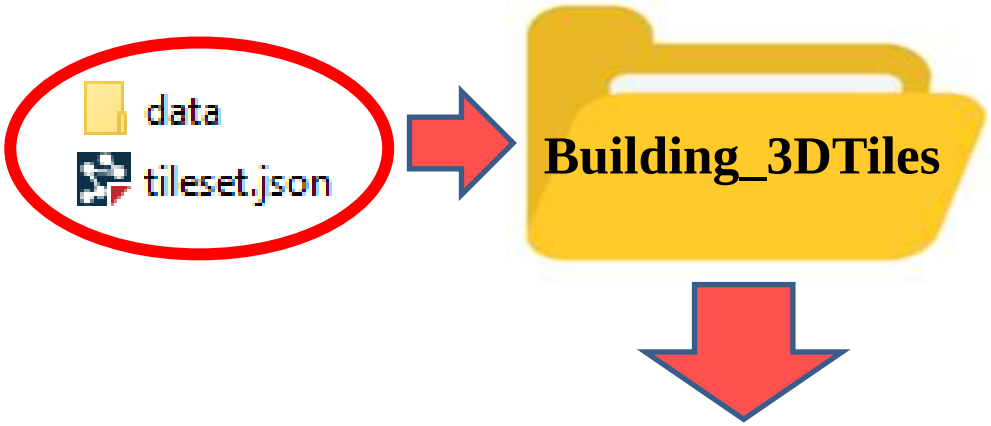
Verifying CeisumJS Installation

https://localhost:9090/My_CesiumJS



Representing 3D Tiles in CesiumJS

Inserting 3D Tiles data into CesiumJS



…\webapps\My_CesiumJS\Specs\Data\Cesium3DTiles

Representing 3D Tiles in CesiumJS

Inserting 3D Tiles data into CesiumJS

Create an HTML file

…\webapps\My_CesiumJS\Apps

Representing 3D Tiles in CesiumJS

Create an HTML file

Building_from_CityGML.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <!-- Use correct character set. -->
    <meta charset="utf-8" />
    <!-- Tell IE to use the latest, best version. -->
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <!-- Make the application on mobile take up the full browser screen
-->
    <meta
      name="viewport"
      content="width=device-width, initial-scale=1, maximum-scale=1
scalable=no"
    />
    <title>Hello World!</title>
    <script src="../Build/CesiumUnminified/Cesium.js"></script>
    <style>
      @import url(../Build/CesiumUnminified//Widgets/widgets.css);
      html,
      body,
      #cesiumContainer {
        width: 100%;
        height: 100%;
        margin: 0;
        padding: 0;
        overflow: hidden;
      }
    </style>
  </head>
  <body>
    <div id="cesiumContainer"></div>
    <script>
      const viewer = new Cesium.Viewer("cesiumContainer");
    </script>
  </body>
</html>
```

Replaced by Piece of Code

Representing 3D Tiles in CesiumJS

Create an HTML file

Building_from_CityGML.html

```
    }
  </style>
</head>
<body>
  <div id="cesiumContainer"></div>
  <script>
    const viewer = new Cesium.Viewer("cesiumContainer");
  </script>
</body>
</html>
```

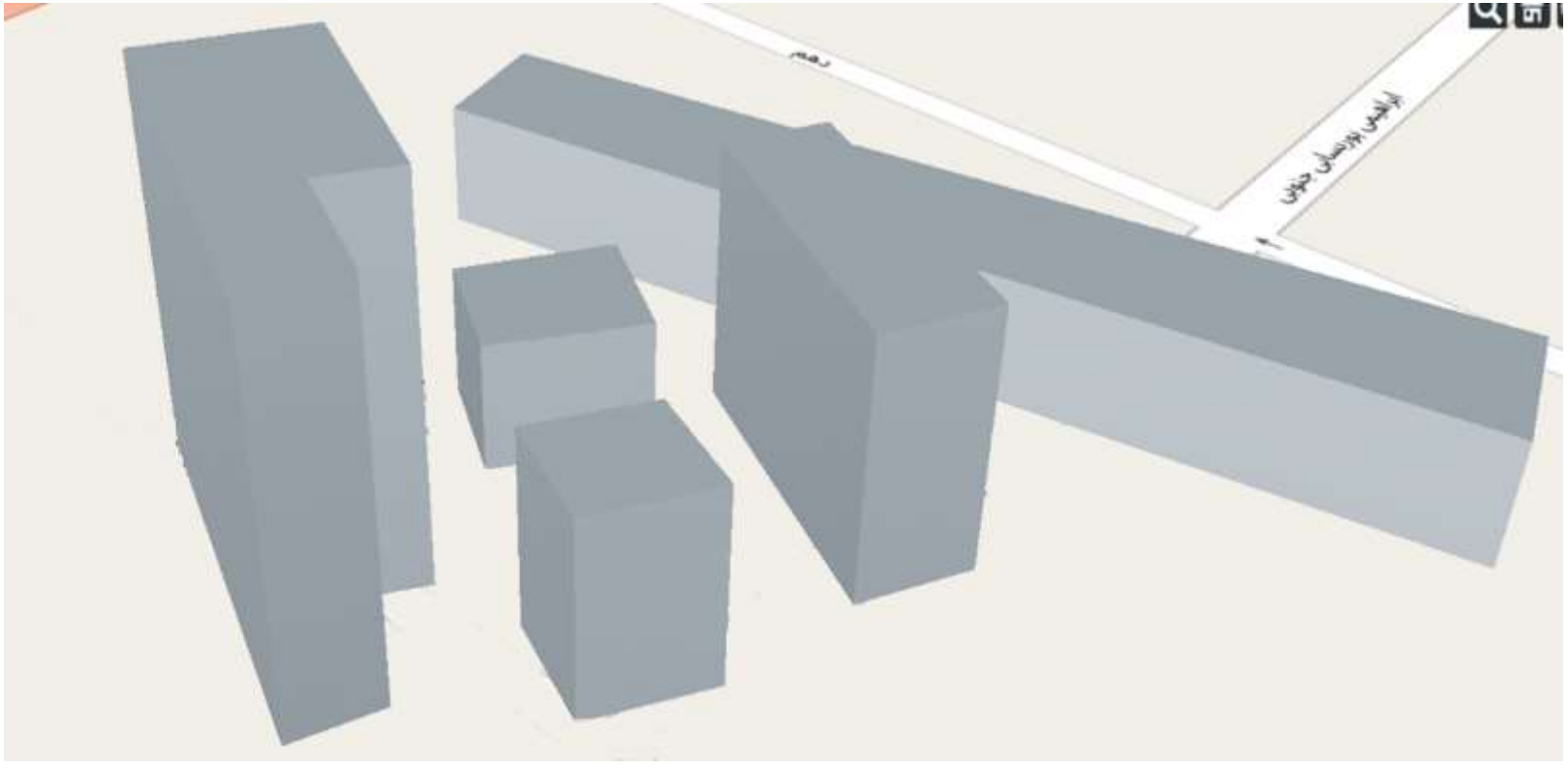
Replace

```
>div id="cesiumContainer"></div<
>    script<
        var viewer = new Cesium.Viewer('cesiumContainer');
        var tileset = viewer.scene.primitives.add(new Cesium.Cesium3DTileset({
            url : "../Specs/Data/Cesium3DTiles/Building_3DTiles/tileset.json", // URL from
`Starting the Server  section.
        }));
        viewer.zoomTo(tileset);
/>    script<
```

Representing 3D Tiles in CesiumJS

Representing the HTML file in a Web Browser

http://localhost:9090/My_CesiumJS/Apps/Building_from_CityGML.html

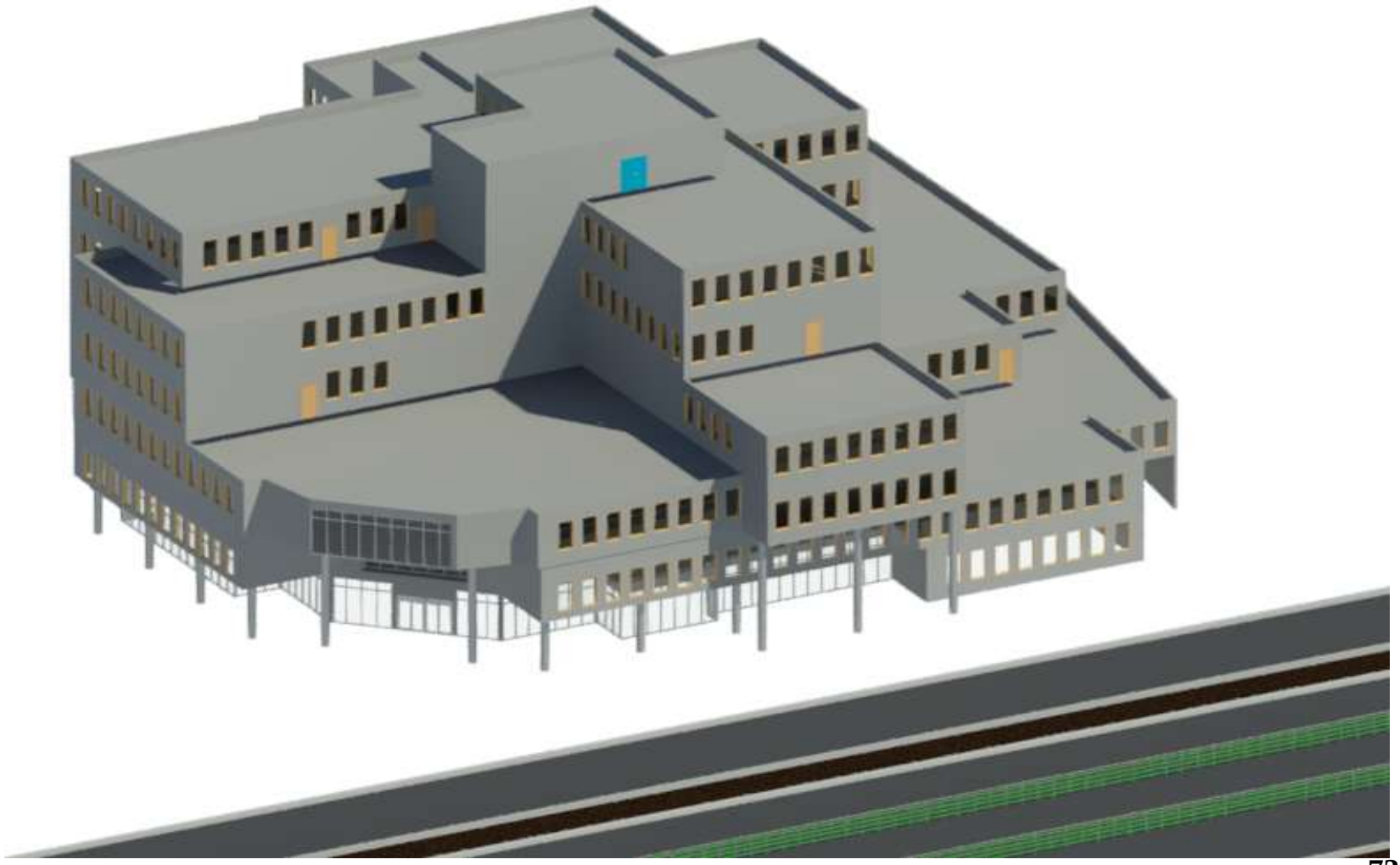


Representing 3D Tiles in CesiumJS (LOD1)

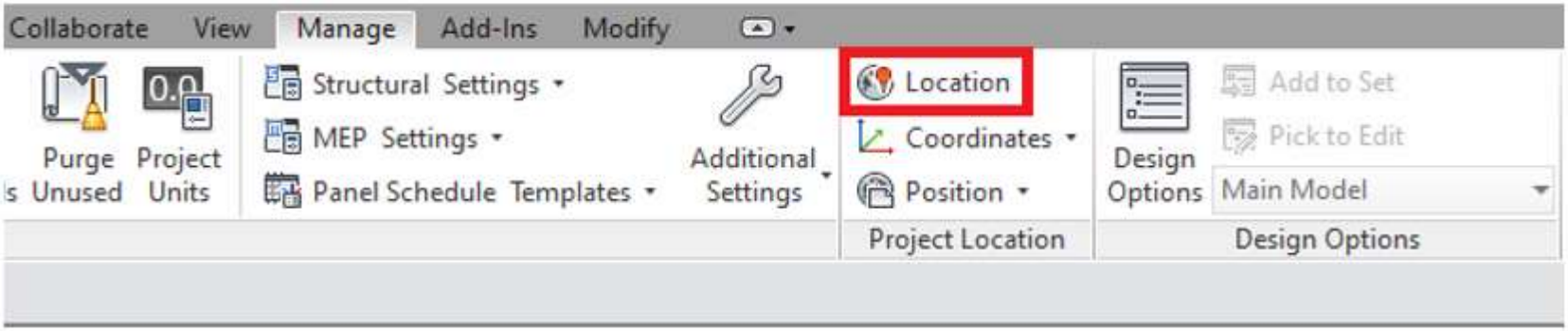
Implementation & Practical Examples

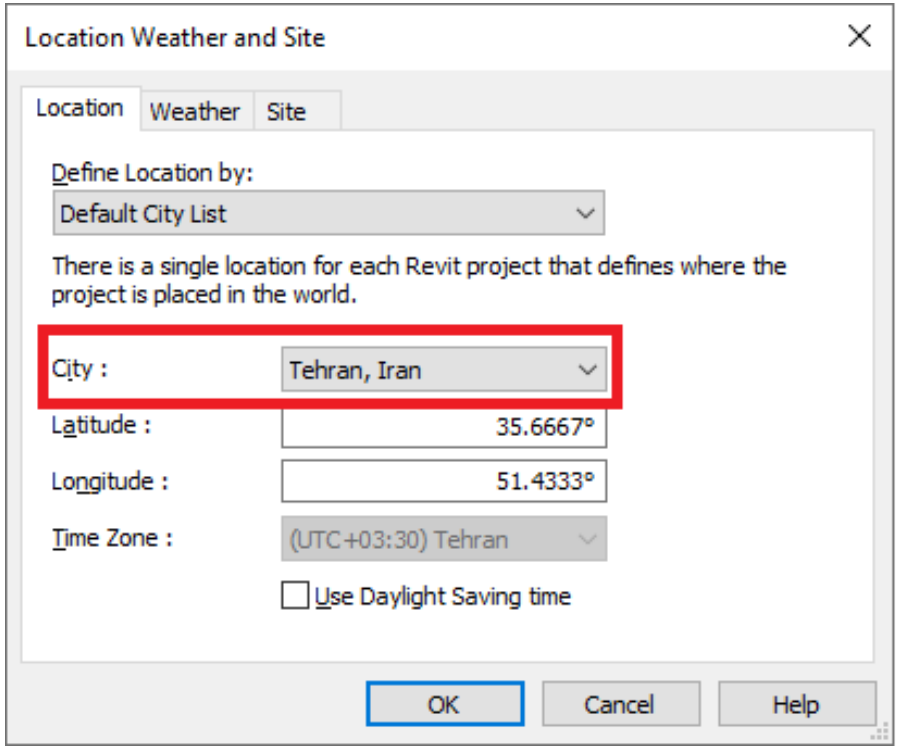
3D Web Service CityGML (LOD3)

Municipal Building of District 9 In Tehran Drawn By Revit

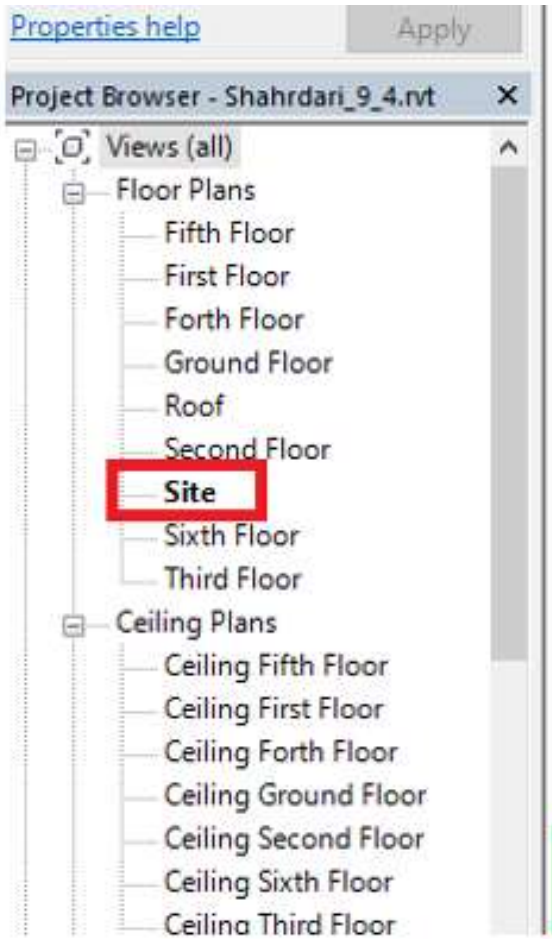


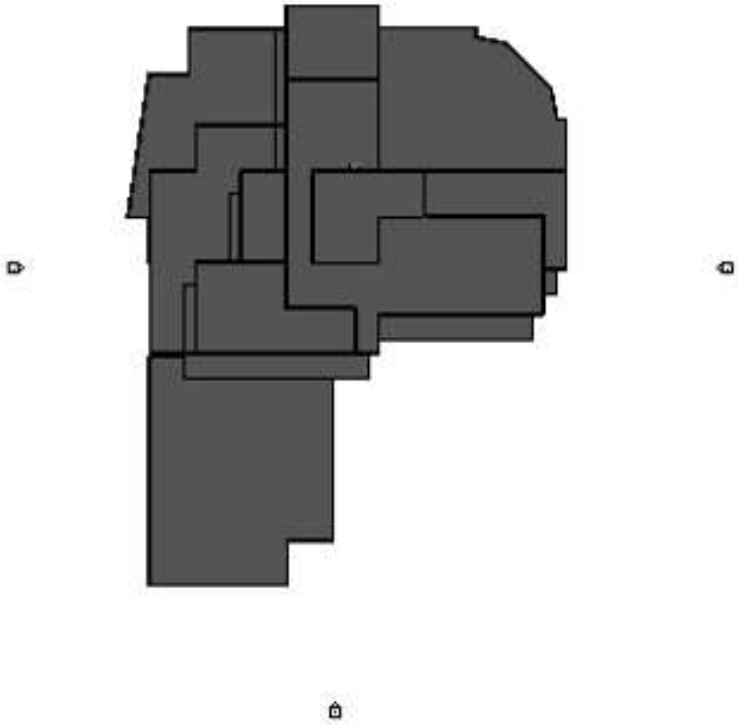
Introducing the Location

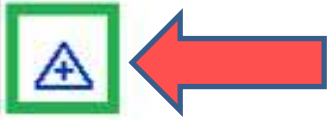




Georeferencing the Building in Revit

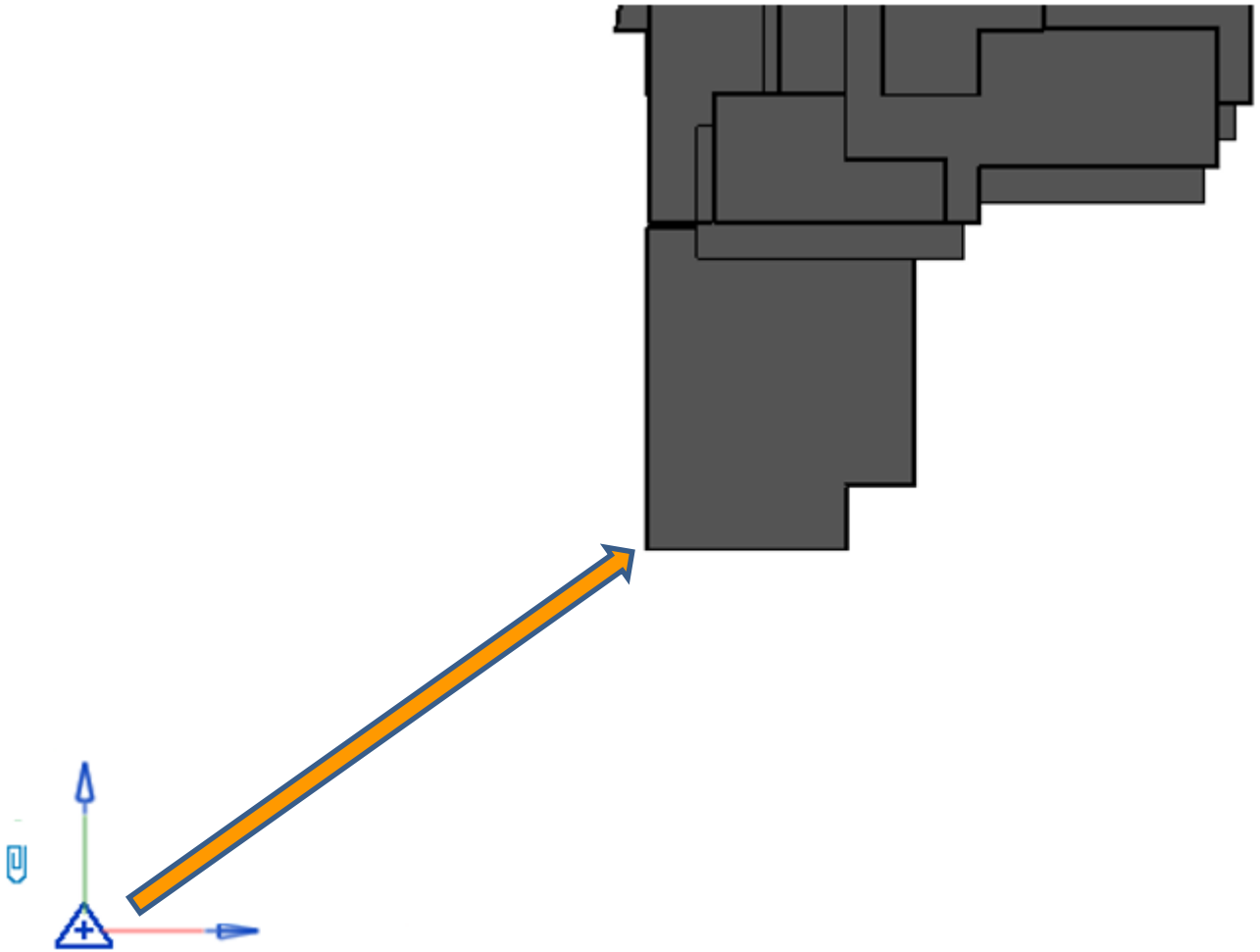




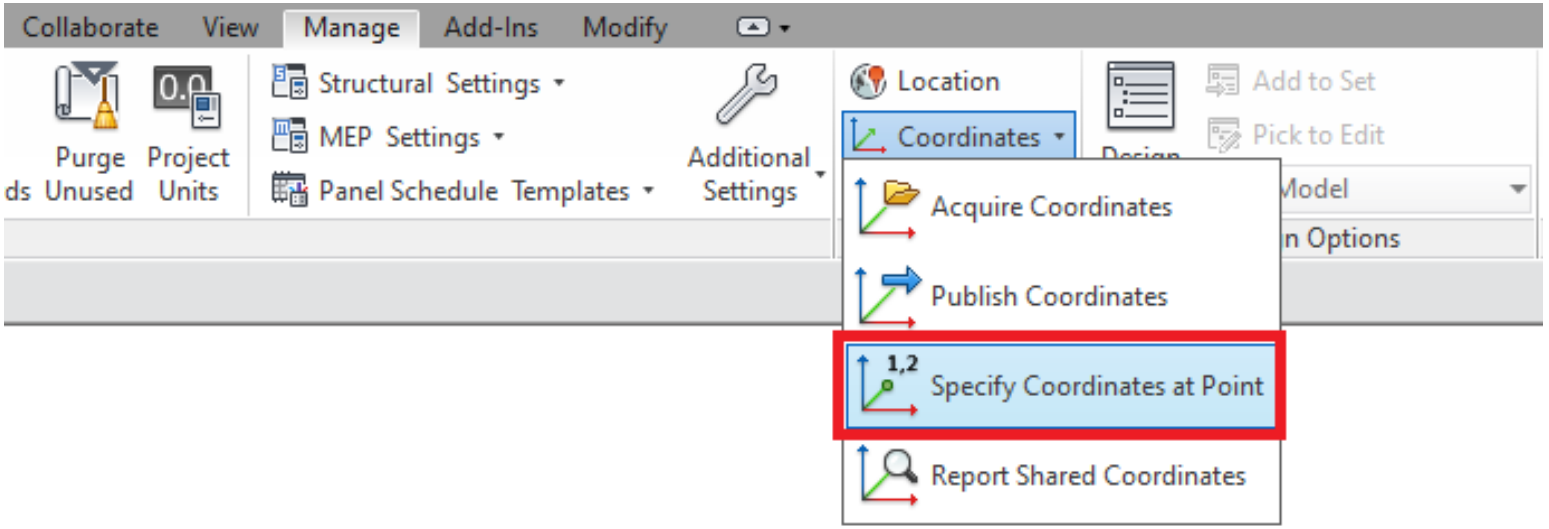


Survey Point

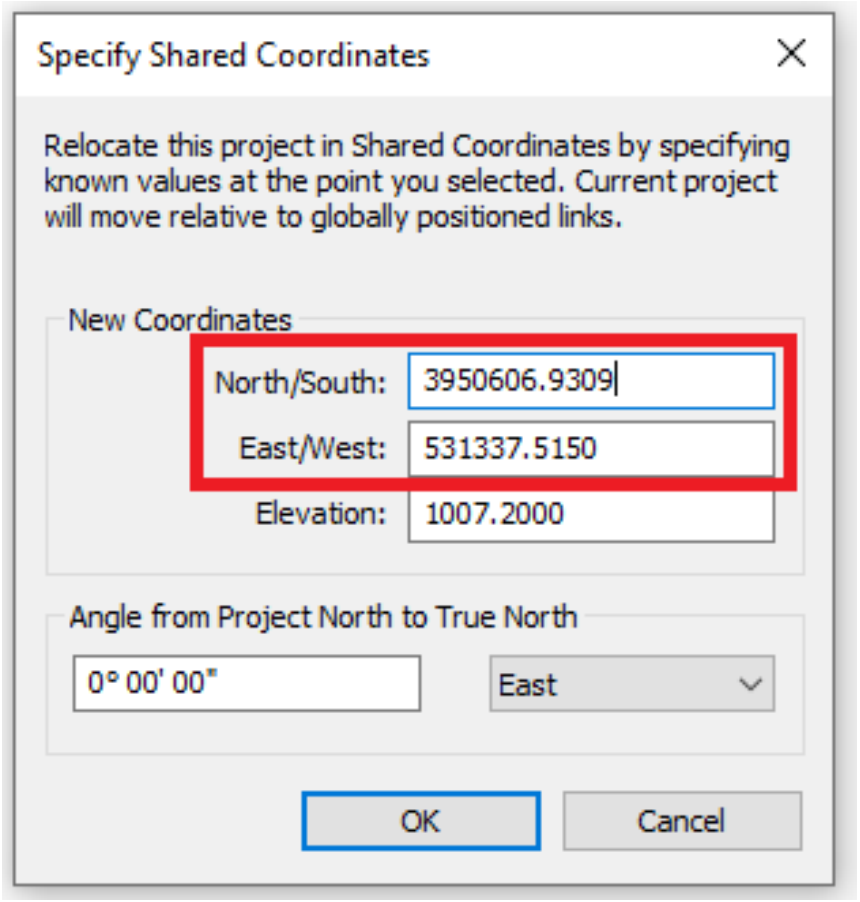
Transfer Survey Point to the Correct Position



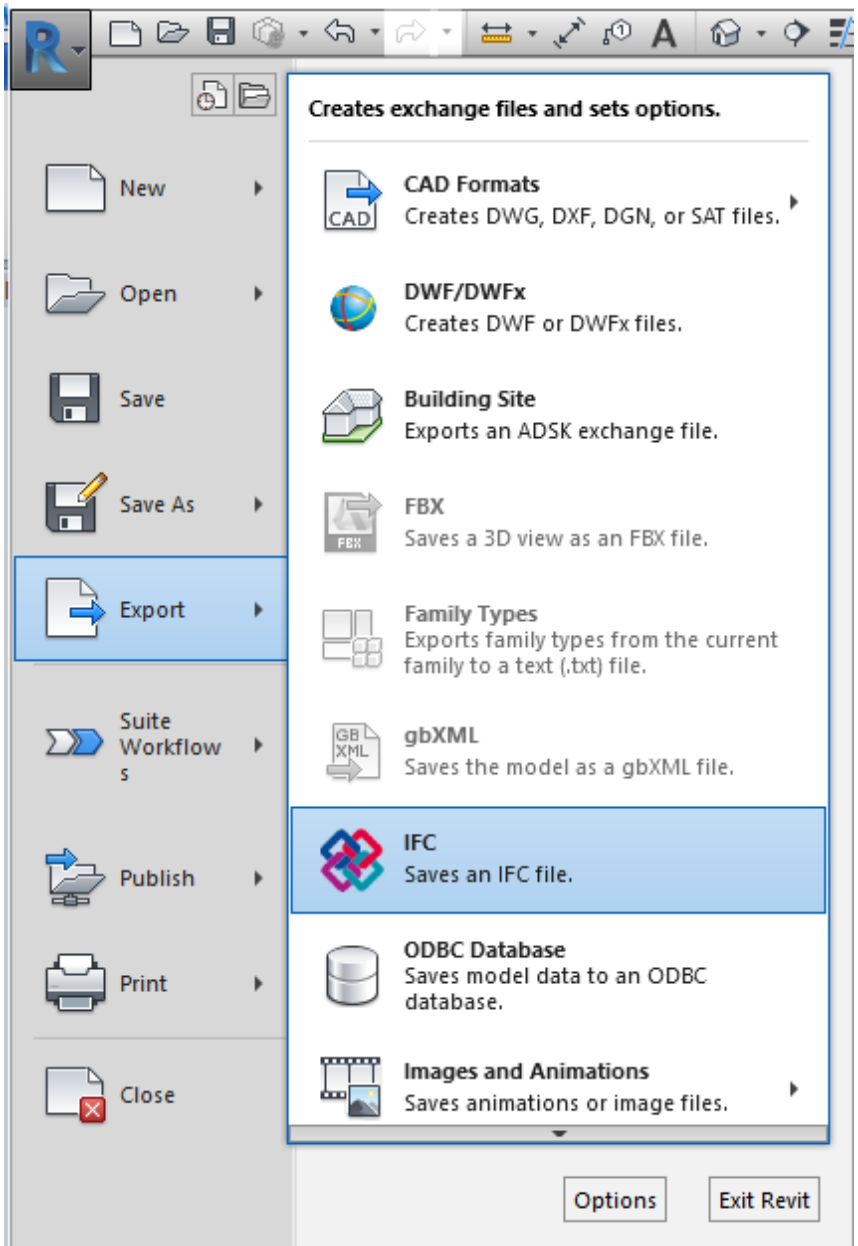
Transfer the Building to the Correct Position



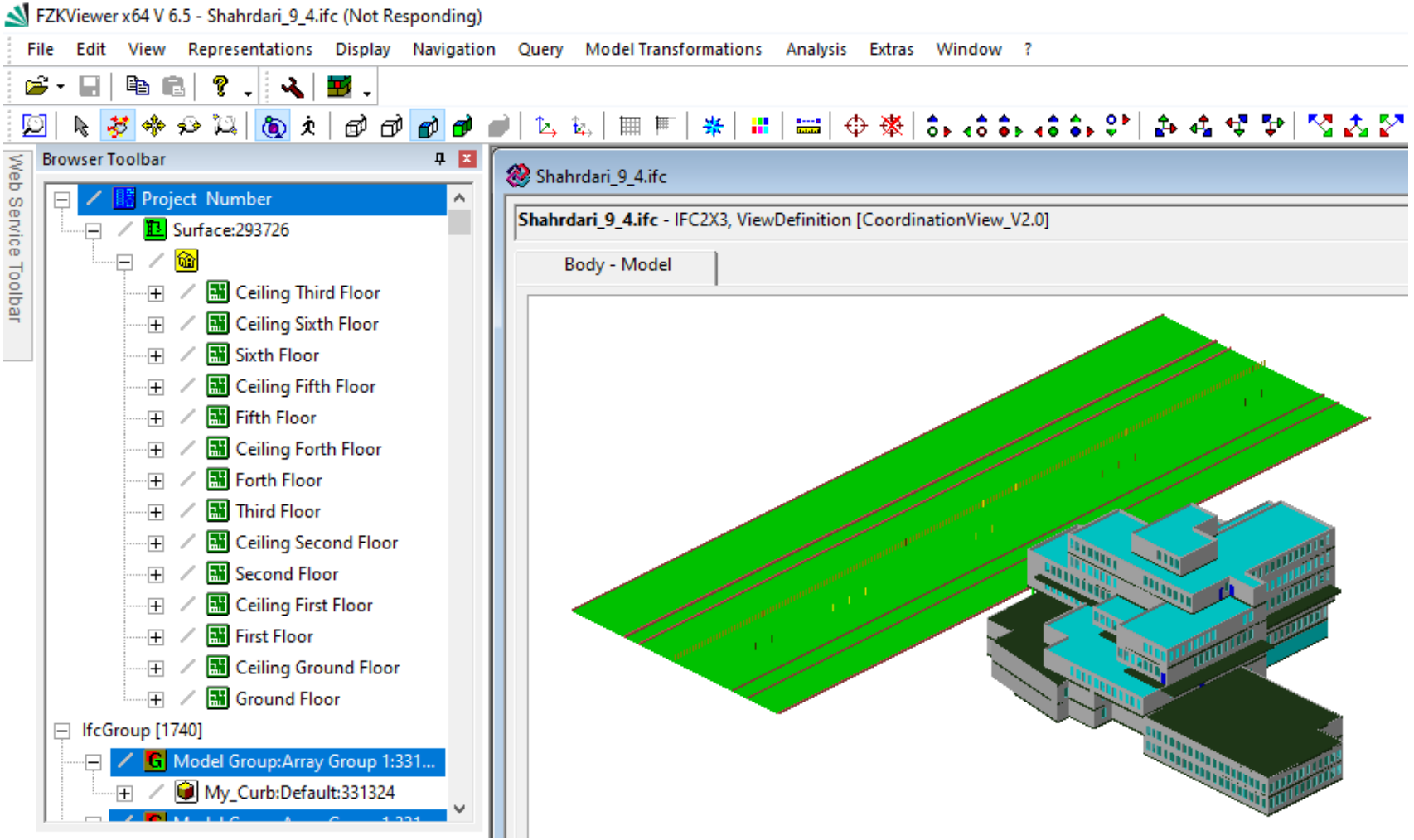
Insert the Correct Coordinates of Corner of Building



Export the RVT format to IFC format



Verifying the Conversion of RVT to IFC

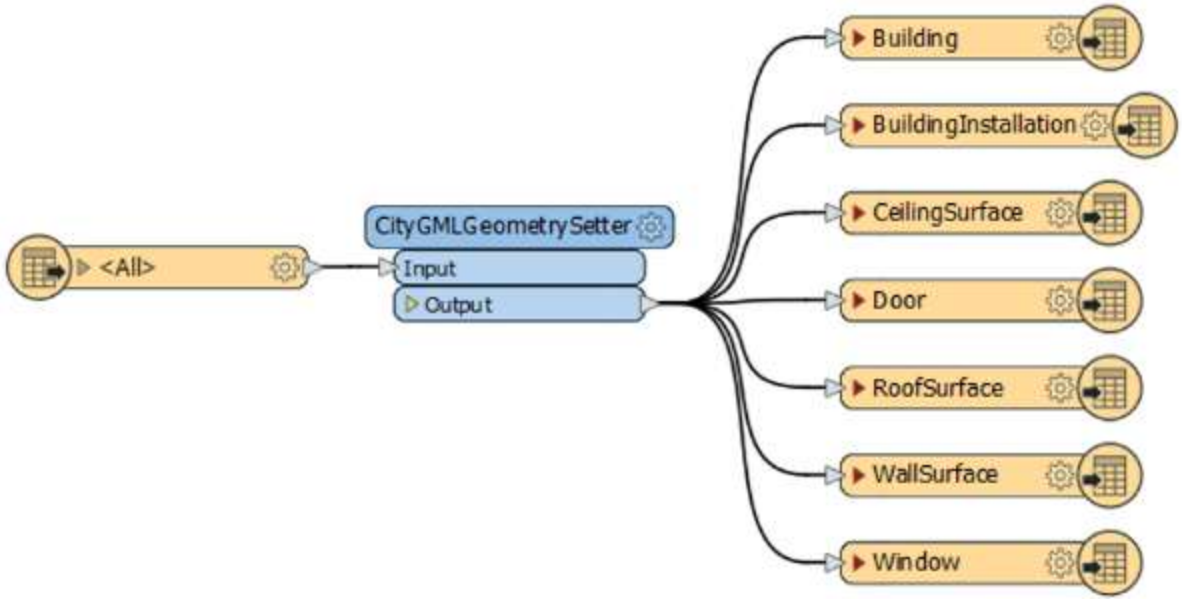


Convert IFC to CityGML

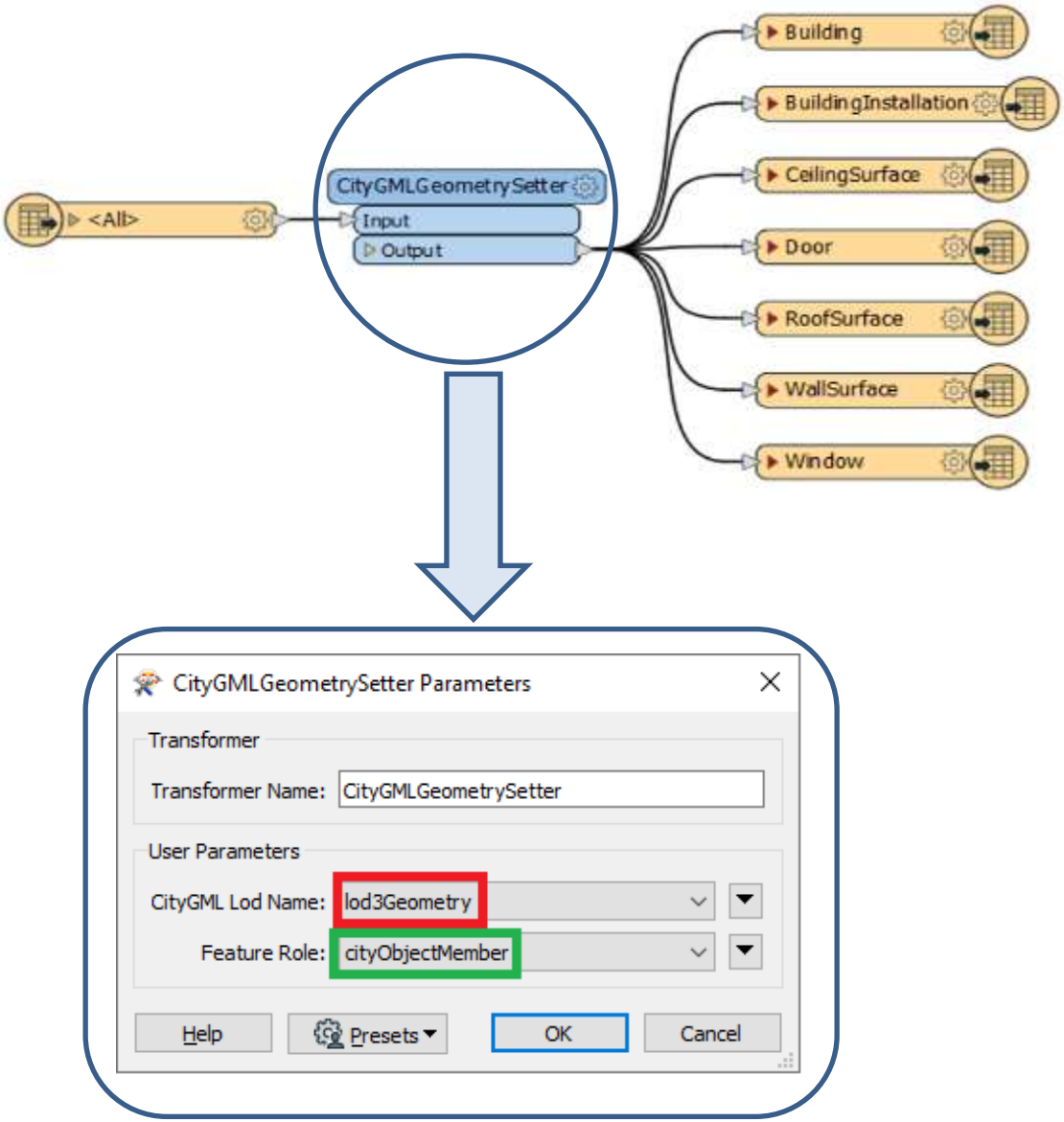
IFC

conversion

CityGML

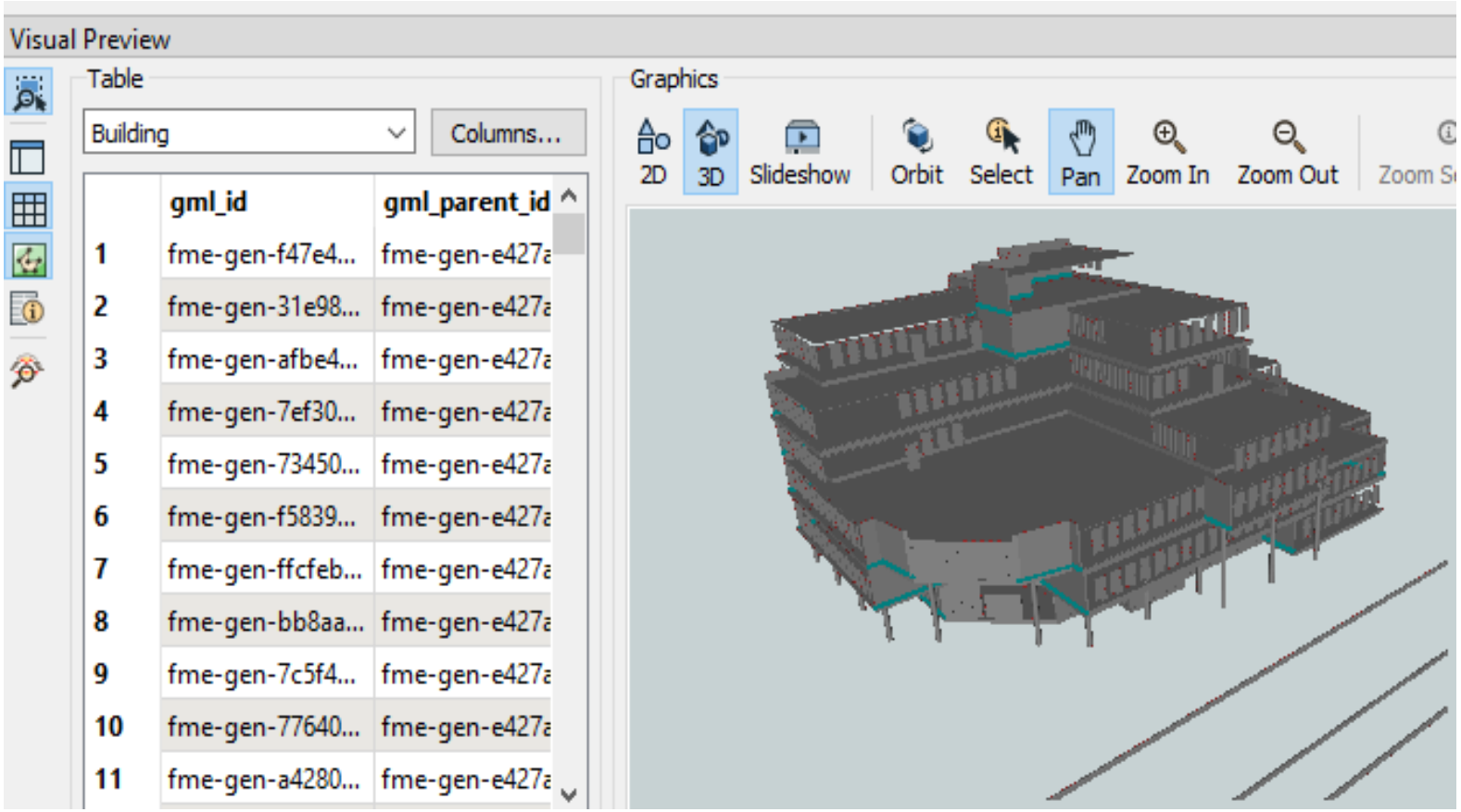


Convert IFC to CityGML

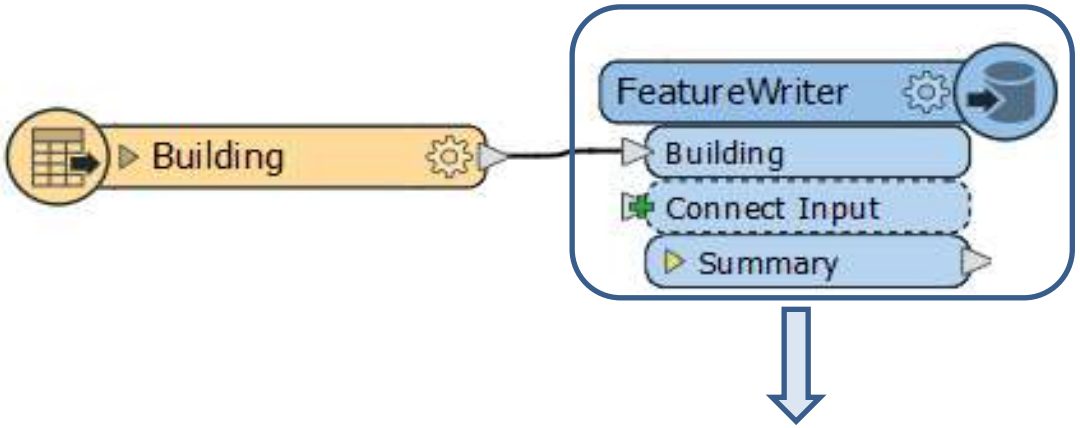


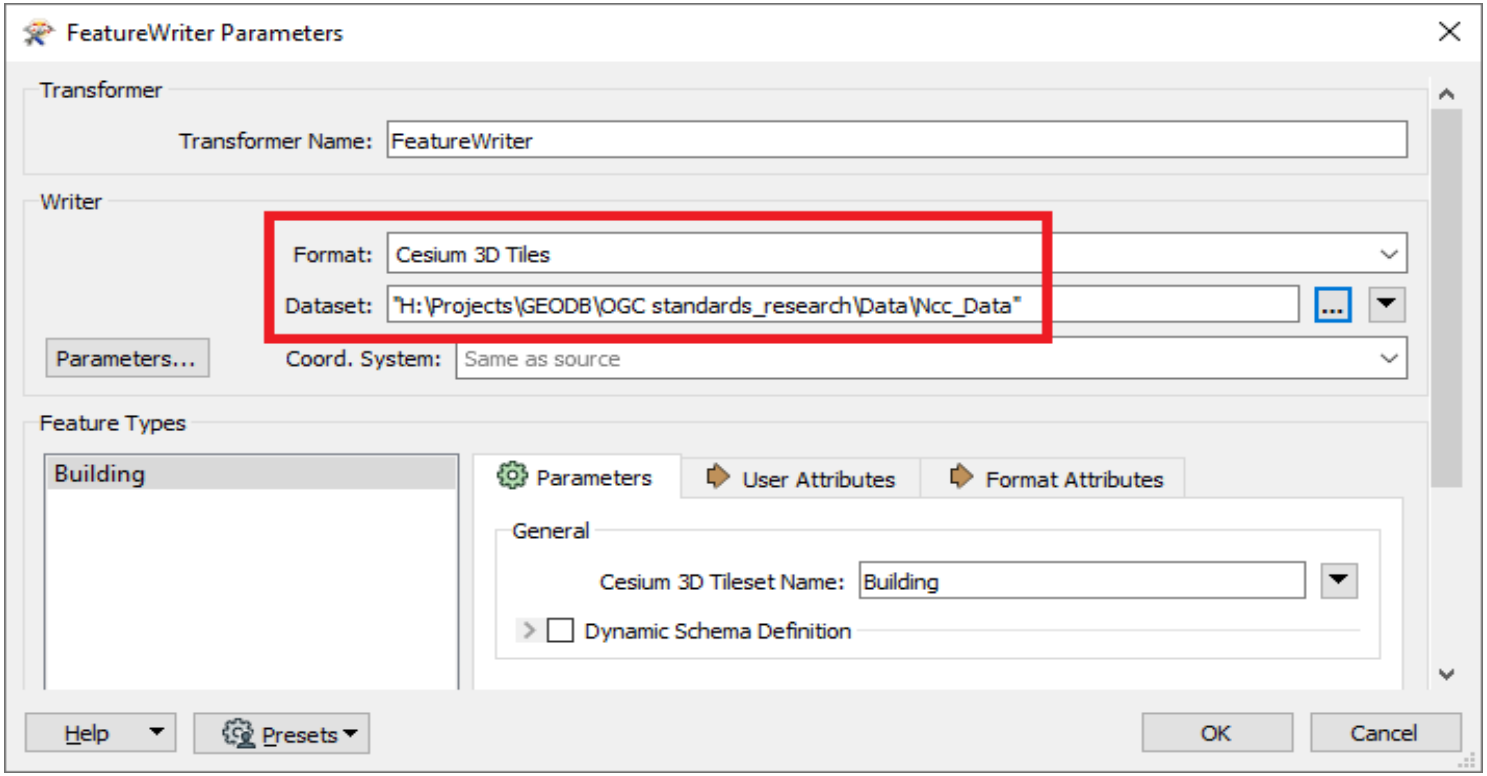
Preview CityGML in FME

View Menu>Windows>Visual Preview

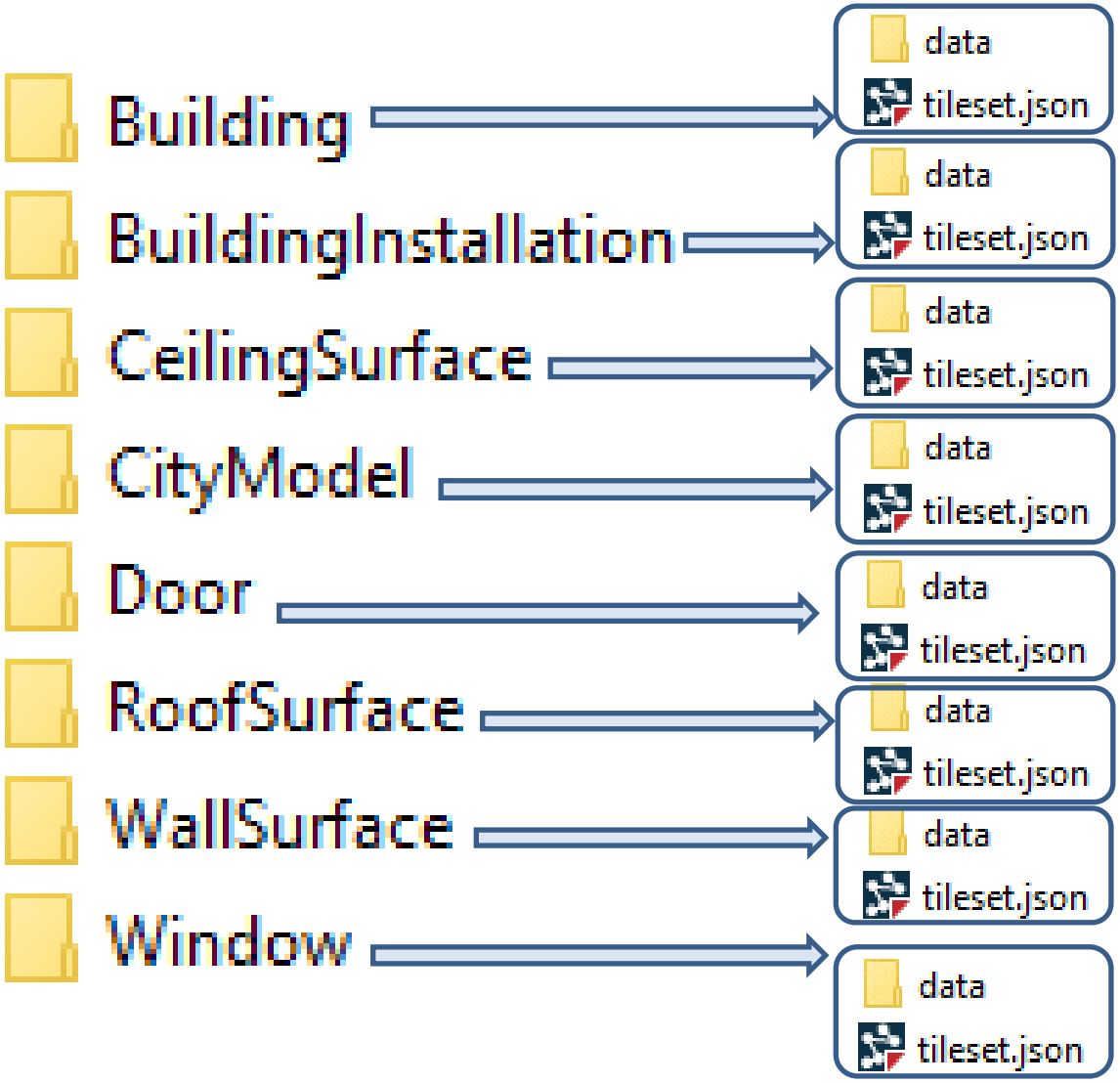


Convert CityGML to 3D Tiles

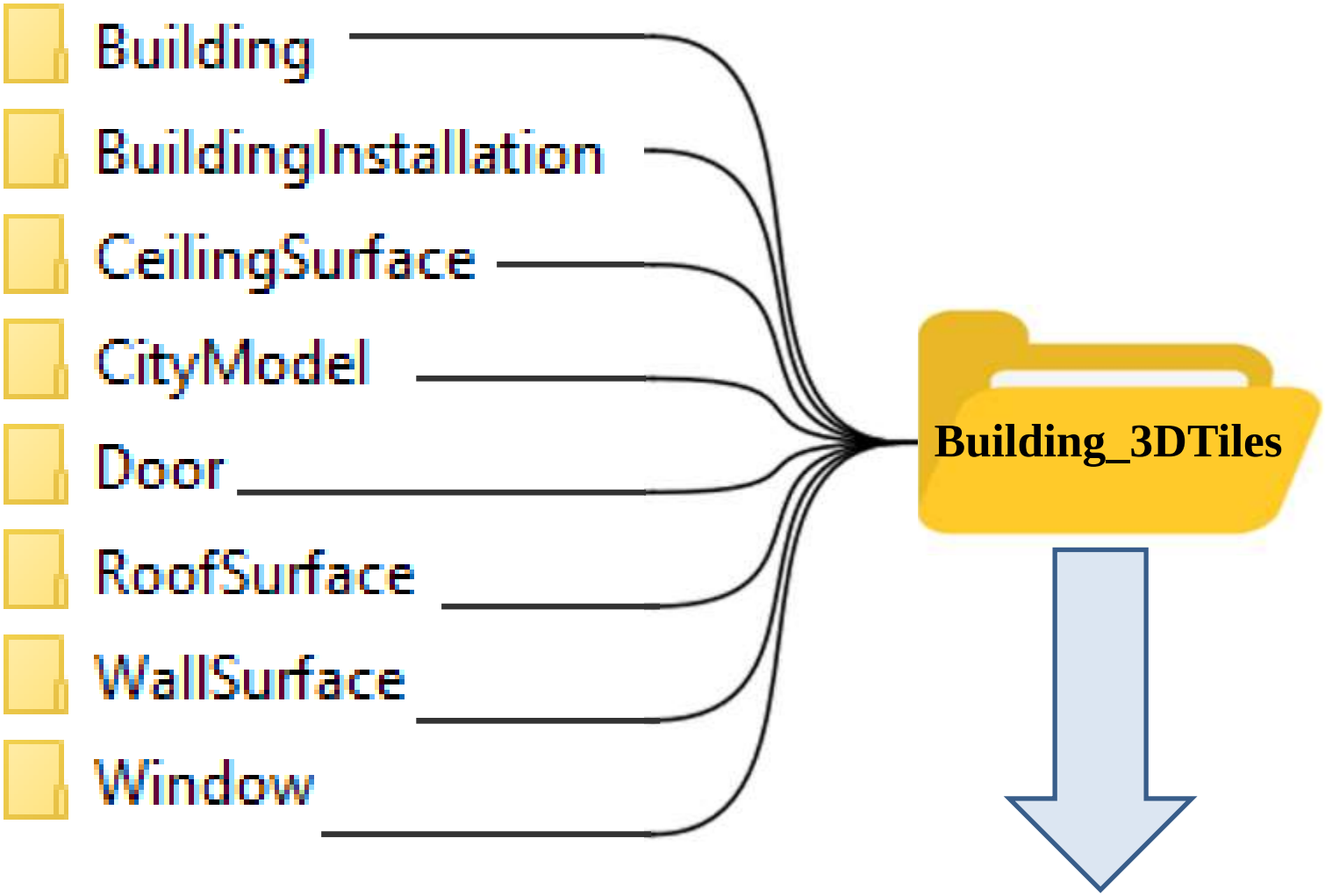




Convert CityGML to 3D Tiles

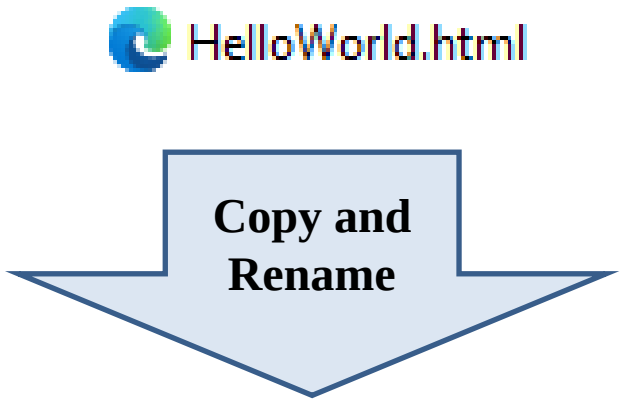


Representing 3D Tiles in CesiumJS



…\Tomcat 9.0_Tomcat9_9090\webapps\My_CesiumJS\Specs\Data\Cesium3DTiles

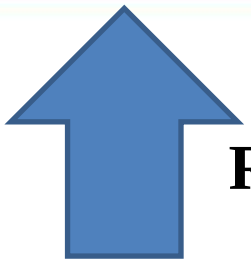
Representing 3D Tiles in CesiumJS



...\Tomcat 9.0_Tomcat9_9090\webapps\My_CesiumJS\Apps

Representing 3D Tiles in CesiumJS

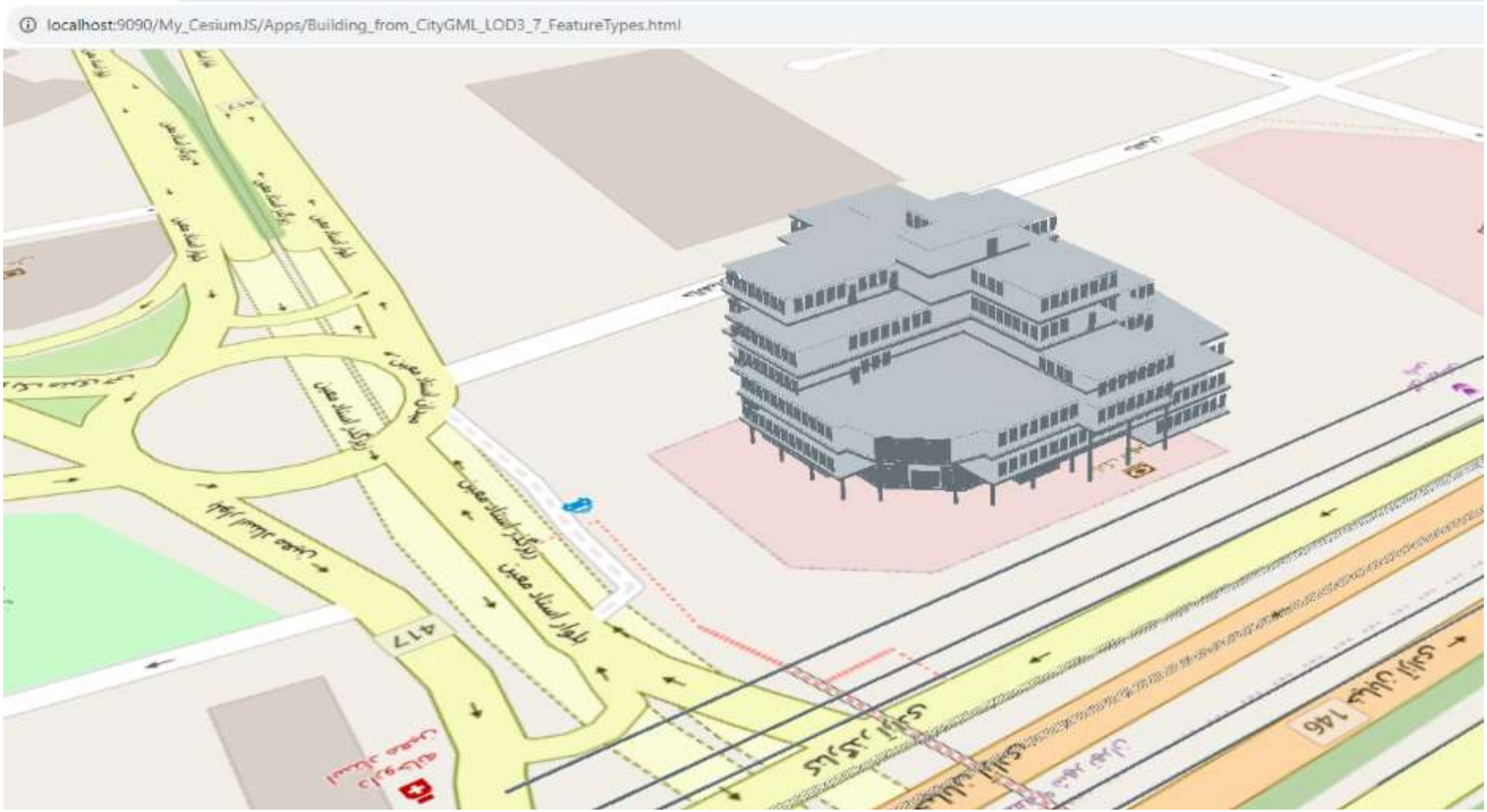
```
    }
  </style>
</head>
<body>
  <div id="cesiumContainer"></div>
  <script>
    const viewer = new Cesium.Viewer("cesiumContainer");
  </script>
</body>
</html>
```



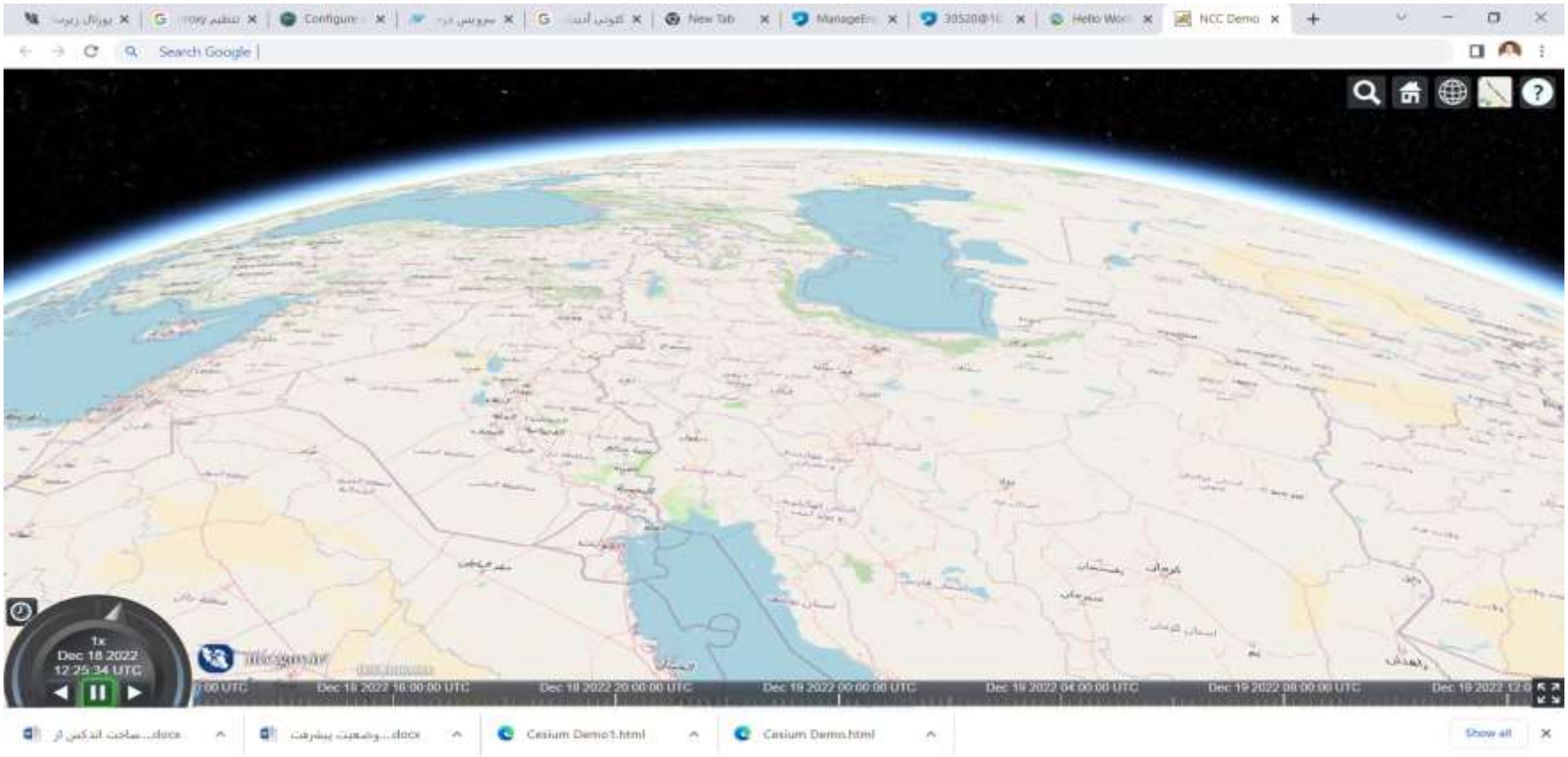
Replace

```
>div id="cesiumContainer"></div<
>    script<
        var viewer = new Cesium.Viewer('cesiumContainer');
        var tileset = viewer.scene.primitives.add(new Cesium.Cesium3DTileset({
            url : "../Specs/Data/Cesium3DTiles/Building/tileset.json", // URL from `Starting
the Server` section.
        }));
        viewer.zoomTo(tileset);
/>    script<
```

Representing 3D Tiles in CesiumJS



Representing 3D Tiles in CesiumJS (LOD3) (Main Building of NCC)




Thanks
for
your
attention