Description and usage – Building height

This document describes the use of scripts calculating building height in the GitHub repository *Testbed_BIM_GIS*. The scripts are developed in the software FME (Feature Manipulation Engine) version 2017.1 (Build 17539).

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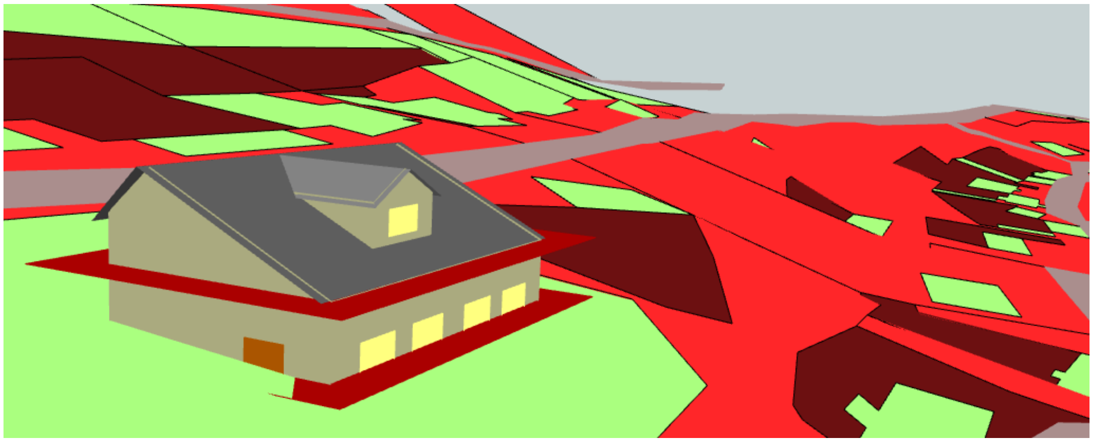


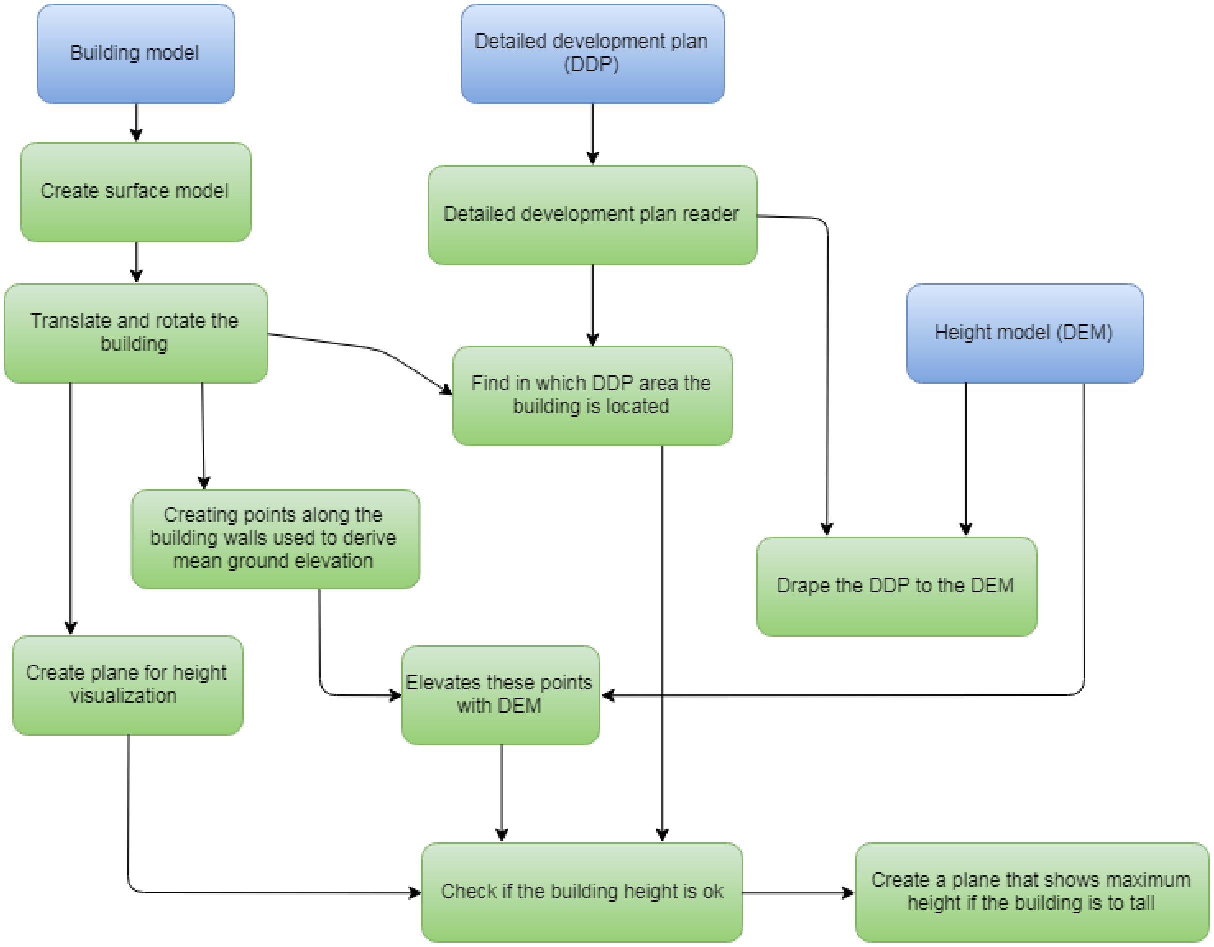
History

Version	Date	Comments	Person
1.0	2018-06-27	First version of this document that describes the script	Josefine Axelsson

Calculation of building height

Description

This script imports a detailed development plan, DEM (digital elevation model) over the planned area and a building model (IFC model). With the DEM and building model the height of the building is calculated. The development plan (draped to the DEM) and building are then visualizes along with a surface illustrating the maximum height.


Building model
Detailed development plan (DDP)
Create surface model
Detailed development plan reader
Translate and rotate the building
Height model (DEM)
Find in which DDP area the building is located
Creating points along the building walls used to derive mean ground elevation
Drape the DDP to the DEM
Create plane for height visualization
Elevates these points with DEM
Check if the building height is ok
Create a plane that shows maximum height if the building is to tall

detaljPlanReader

Imports a detailed development plan in XML format and create polygons with attributes of the regulated area.

Ifc2surfacesParts

Creating a LOD 3 surface model of an IFC model. For more information see *Description and Usage – LOD 3 Surface model*.

IFC2CityGML_Geometryconverter_parts

Checks if the geometry of the object is a solid (Geometry Name = Body). Coerce the geometry types *IFMEExtrusion* and *IFMEBRepSolid* to *fme_composite_surface.* The composite surfaces are then split into individual surfaces. Should be included in *Ifc2SurfceParts* but due to FME error this custom transformer is placed outside.

NormalVectorFinder

Calculates normal vectors of surface objects. In FME version 2018.0 some transformers (CoordinateExtractor) behaves differently than in version 2017.1 and an error message is printed in the log. Should be included in *Ifc2SurfceParts* but due to FME error this custom transformer is placed outside.

mainWallFinder

Find the *main wall* according to current regulations, which is the wall with the greatest visual impact to the public. It is identified as the wall closets to a public street (car, bike, pedestrian).

BuildingHeightCheckerNew

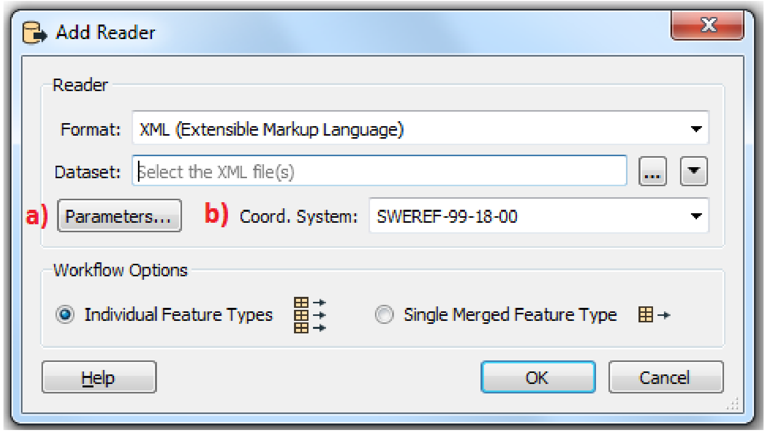
Uses all outer walls. Creating a horizontal plane representing mean ground elevation by creating 16 points along the building walls and with these derive the mean ground elevation. Checks the building height against the development plan and if building height is allowed the attribute *heightOK* is set with the value True or False. If the building is too high, a horizontal plane representing max allowed building height is visualized.

BuildingHeightCheckerCurrent

Uses the main wall calculated with *mainWallFinder*. Creating a horizontal plane representing mean ground elevation by creating 16 points along the building walls and with these derive the mean ground elevation. Checks the building height against the development plan and if building height is allowed the attribute *heightOK* is set with the value True or False. If the building is too high, a horizontal plane representing max allowed building height is visualized.

Usage

1. The XML file is read into the workspace two times with the readers *XML (Extensible Markup Language)* and *GML (Geography Markup Language)*
2. XML:



Add Reader

Reader

Format: XML (Extensible Markup Language)

Dataset: Select the XML file(s)

Coord. System: SWEREF-99-18-00

Workflow Options

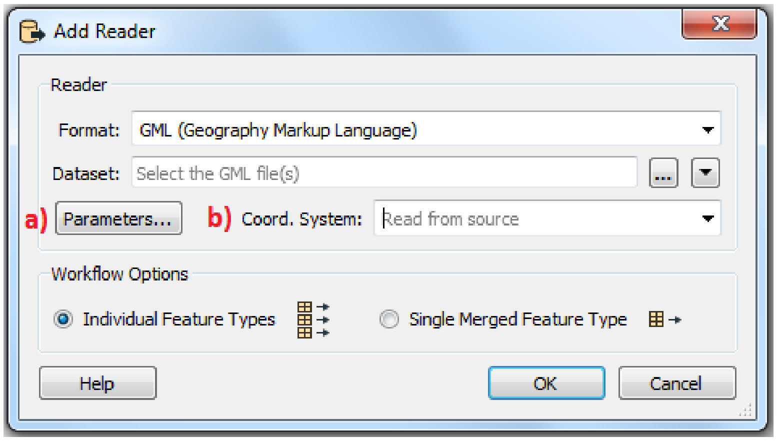
● Individual Feature Types ○ Single Merged Feature Type

   a. Parameter *Elements to match* is set to: *DP_Data/omrade/DP_Omrade DP_Data/omrade/DP_Omrade/minus DP_Data/omrade/DP_Omrade/plus*

   b. *Coord. System* is set to the coordinate system the detailed development plan is created in / Read from Source

3. Chosen/used features are: *DP_Omrade, minus and plus.*

4. GML:



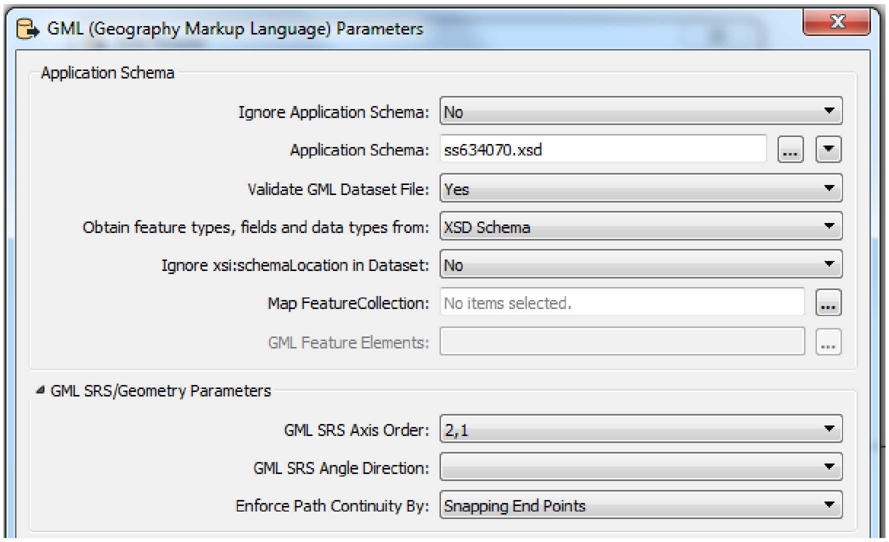
Format: GML (Geography Markup Language)

Dataset: Select the GML file(s)

Coord. System: Read from source

● Individual Feature Types ○ Single Merged Feature Type

a. Set the path to the Application Schema *ss634070.xsd* and change Validate GML Datatset File to *Yes.* Change *GML SRS Axis Order* to *(2,1).*


GML (Geography Markup Language) Parameters
Application Schema
GML SRS/Geometry Parameters

Ignore Application Schema: No

Application Schema: ss634070.xsd

Validate GML Dataset File: Yes

Obtain feature types, fields and data types from: XSD Schema

Ignore xsi:schemaLocation in Dataset: No

Map FeatureCollection: No items selected.

GML Feature Elements:

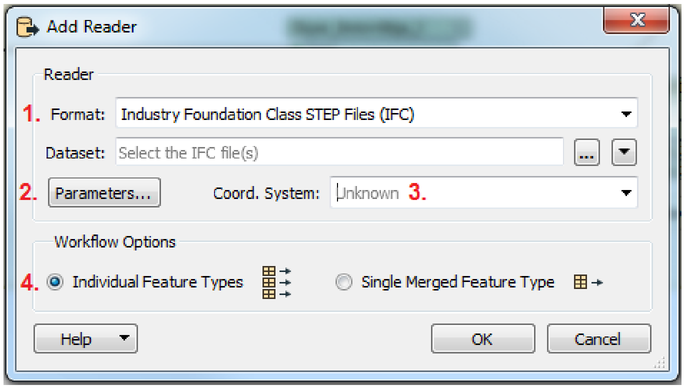
GML SRS Axis Order: 2,1

GML SRS Angle Direction:

Enforce Path Continuity By: Snapping End Points

b. *Coord. System* is set to the coordinate system the detailed development plan is created in / Read from Source

5. Chosen/used features are: *DP_Grans, DP_Egenskapsbestammelse, DP_Omrade and DP_Anvandningsbestämmelse.*



Format: Industry Foundation Class STEP Files (IFC)

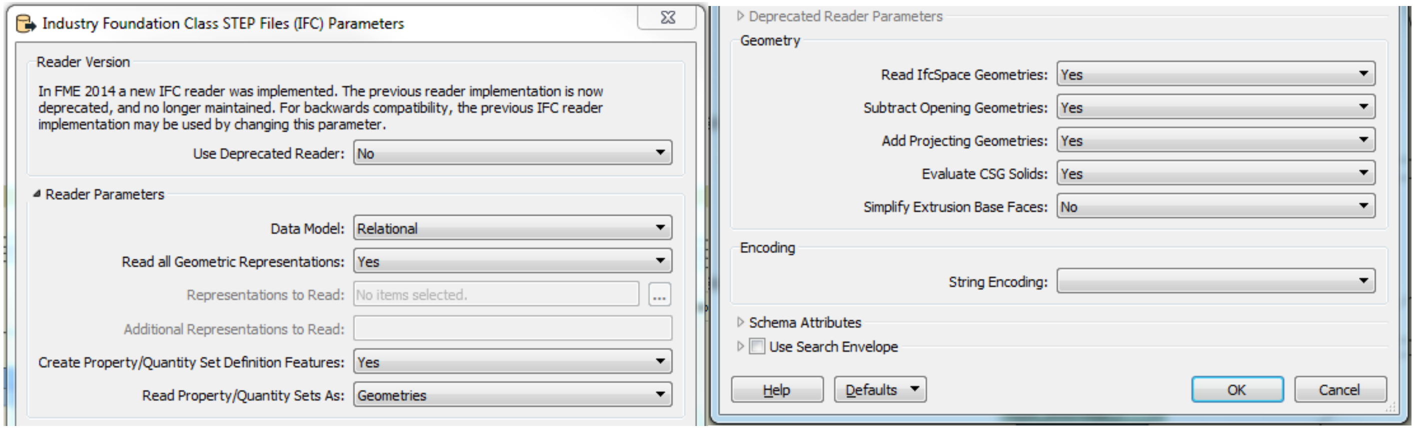
Dataset: Select the IFC file(s)

Coord. System: Unknown

● Individual Feature Types ○ Single Merged Feature Type

6. (1.) The IFC model is read to the program with a *Reader* choosing the file format *Industry Foundation Class STEP Files (IFC)*.

7. (2.) Reader parameters are chosen as the shown in figure below.



Industry Foundation Class STEP Files (IFC) Parameters

Reader Version

In FME 2014 a new IFC reader was implemented. The previous reader implementation is now deprecated, and no longer maintained. For backwards compatibility, the previous IFC reader implementation may be used by changing this parameter.

Use Deprecated Reader: No

Reader Parameters

Data Model: Relational

Read all Geometric Representations: Yes

Representations to Read: No items selected.

Additional Representations to Read:

Create Property/Quantity Set Definition Features: Yes

Read Property/Quantity Sets As: Geometries

Deprecated Reader Parameters

Geometry

Read IfcSpace Geometries: Yes

Subtract Opening Geometries: Yes

Add Projecting Geometries: Yes

Evaluate CSG Solids: Yes

Simplify Extrusion Base Faces: No

Encoding

String Encoding:

Schema Attributes

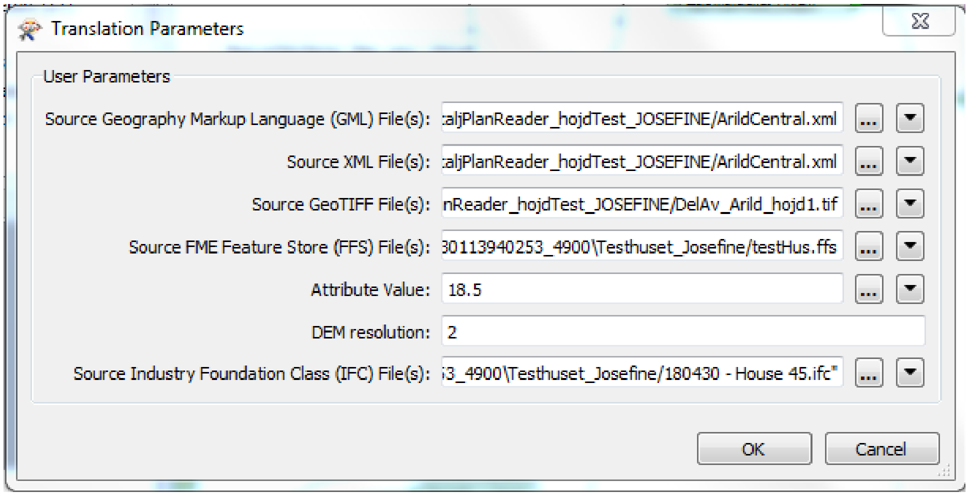
□ Use Search Envelope

8. (3.) Coordinate system is not needed to be set.

9. (4.) To be able to handle different element *Individual Feature Types* is chosen.

10. The DEM is read with a GEOTIFF reader.

When the script is run the translation parameters *Attribute Value* and *DEM Resolution* are set. *Attribute Value* is a parameter that gives the offset in z-direction when placing the building in the detailed development plan.



Translation Parameters

User Parameters

Source Geography Markup Language (GML) File(s): :aljPlanReader_hojdTest_JOSEFINE/ArildCentral.xml

Source XML File(s): :aljPlanReader_hojdTest_JOSEFINE/ArildCentral.xml

Source GeoTIFF File(s): nReader_hojdTest_JOSEFINE/DelAv_Arild_hojd1.tif

Source FME Feature Store (FFS) File(s): 30113940253_4900\Testhuset_Josefine/testHus.ffs

Attribute Value: 18.5

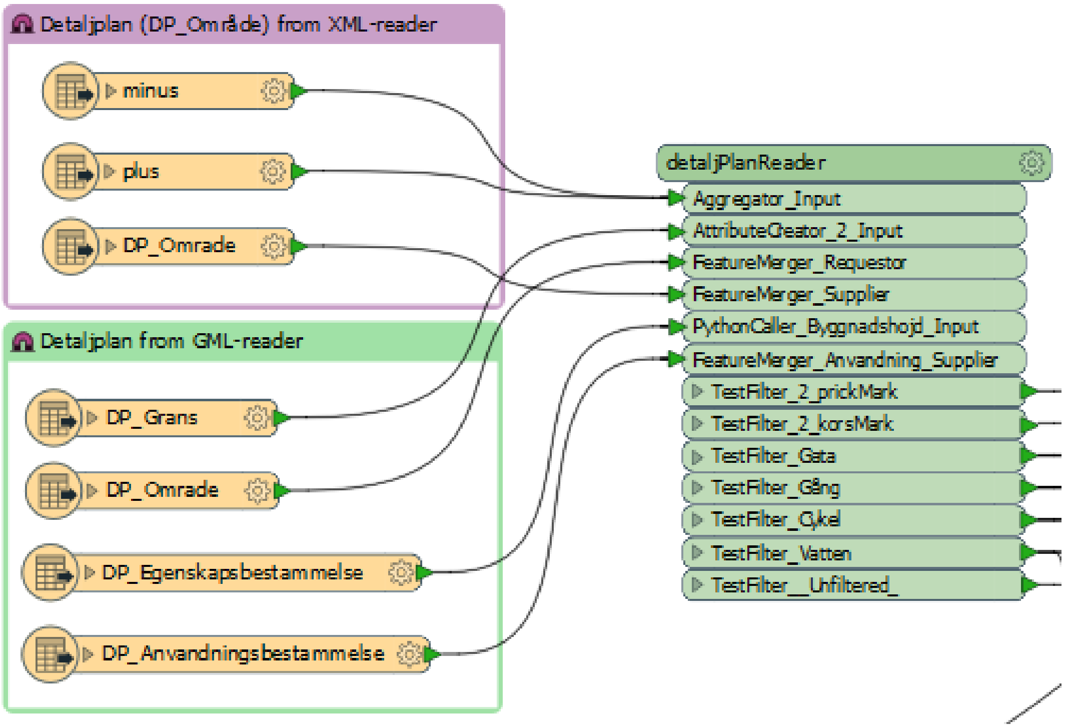
DEM resolution: 2

Source Industry Foundation Class (IFC) File(s): i3_4900\Testhuset_Josefine/180430 - House 45.ifc"

Connecting features and transformers

Detailed development plan reader

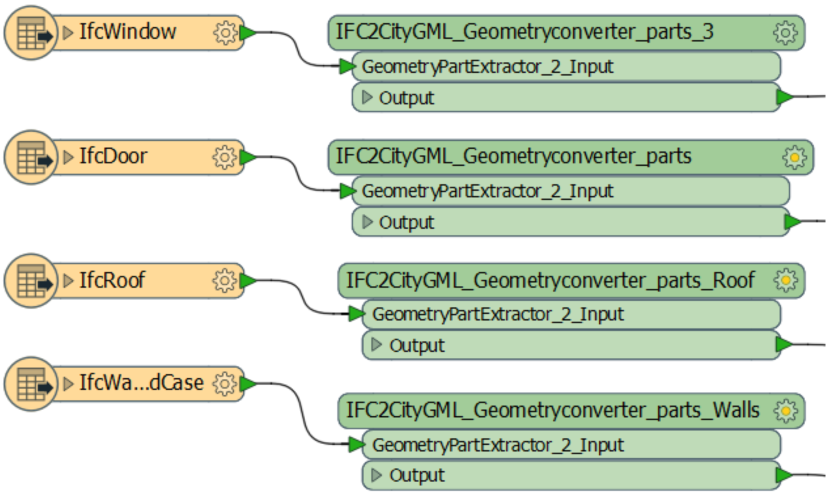
XML-features *minus, plus* and *DP_Omrade* are connected to the custom transformer *detaljPlanReader* as shown in the figure below. Features from a GML-reader are also connected to the custom transformer.



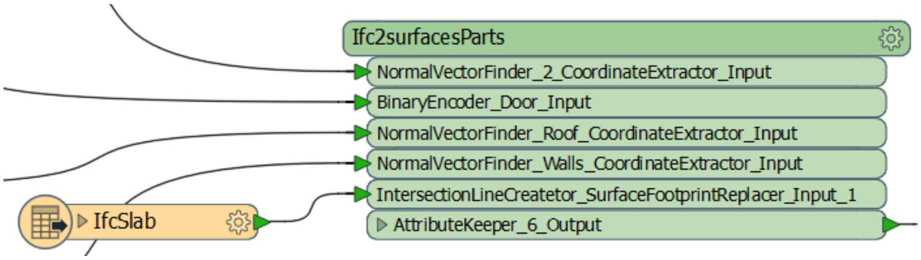
The output from *detaljPlanReader* is then connected to *FreatureColorSetters* to modify coloring for visualization. For more information about *detaljPlanReader* see *Description and usage - Detailed development plan reader*.

Building model

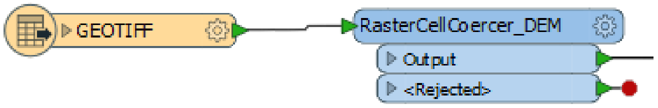
The elements *IfcWindow*, *IfcDoor*, *IfcRoof* and *IfcStandardWallCase* are connected to *IFC2CityGML_Geometryconverter_parts* transformers


IfcWindow
IFC2CityGML_Geometryconverter_parts_3
GeometryPartExtractor_2_Input
Output
IfcDoor
IFC2CityGML_Geometryconverter_parts
GeometryPartExtractor_2_Input
Output
IfcRoof
IFC2CityGML_Geometryconverter_parts_Roof
GeometryPartExtractor_2_Input
Output
IfcWa...dCase
IFC2CityGML_Geometryconverter_parts_Walls
GeometryPartExtractor_2_Input
Output

IFC2CityGML_Geometryconverter_parts are connected to *NormalVectorFinder* and then *Ifc2SurfaceParts. IfcSlab* is connected directly to *Ifc2SurfaceParts.*


Ifc2surfacesParts
NormalVectorFinder_2_CoordinateExtractor_Input
BinaryEncoder_Door_Input
NormalVectorFinder_Roof_CoordinateExtractor_Input
NormalVectorFinder_Walls_CoordinateExtractor_Input
IntersectionLineCreatetor_SurfaceFootprintReplacer_Input_1
AttributeKeeper_6_Output
IfcSlab

Height model (DEM)


GEOTIFF
RasterCellCoercer_DEM
Output
<Rejected>