

# FME Form: Reading and writing CityGML 2.0 data



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# Foreword

- This **tutorial** is meant to guide your step-by-step with the basics of reading/writing (XML-based) **CityGML 2.0 data** with FME Form
- Besides FME Form, you are heartily suggested to:
  - Install and have the [KIT ModelViewer](#) and a decent **text editor** at hand (e.g. Notepad++)
  - Have the CityGML 2.0 [UML diagrams](#) at hand for reference
  - Have the CityGML 2.0 [Specifications](#) at hand for reference
- Further suggestions
  - Before jumping to FME Form, familiarize yourself with the KIT ModelViewer, too!
  - If you are totally new to FME Form, you should *really* first check the [FME tutorial for beginners](#)
  - Follow this tutorial AND try to repeat it on your PC what you see in the slides
  - Pay attention to the details that are highlighted in the screenshots

# Foreword

- The following slides are based on the CityGML sample dataset **Alderaan**. The dataset consists of a fantasy city consisting of buildings, trees, and a DTM. The zipped file contains XML-based CityGML 2.0 data grouped into different files.
  - A quick introduction to the Alderaan dataset can be downloaded [here](#)
  - The zipped file containing the data can be downloaded [here](#).



- The dataset is intended to be used as reference, to test and to learn. Therefore... do not worry! If you make mistakes, neither you nor your computer will be destroyed by an evil green super laser during this tutorial 😊



## WARNING

Just to be clear:

- No chance you can “survive” this tutorial without being familiar with the CityGML data model
- Hence: always have a copy of the UML diagrams at hand, and – possibly – a copy of the CityGML specifications!
- **Nota bene:** these slides are based on FME Form 2023 (or earlier). Since FME Form 2024, some GUI elements have been redesigned. The overall structure and functionalities, however, remain the same!



# CityGML in FME

- A CityGML file is read and written by means of **MULTIPLE readers/writers**.
- Simply put, each reader/writer corresponds to a **GML Feature**
  - i.e. all CityObjects (Building, BuildingPart, RoofSurface, ...)
  - But also: Address, Appearance, etc.
- **Attributes** of a Feature are included inside the corresponding reader/writer
- **Generic attributes** are (by default) attached to the corresponding Feature
  - Optionally, they can be dealt with by means of a specific reader/writer
- **Nested data** (which are not a Feature) are accessible via attributes (XML path is flattened to a long attribute name)
  - Lists are used with properties that have a cardinality of 0..\*
  - Example: citygml\_function{}, citygml\_usage{}

Sample dataset  
**Introduction**  
Good habits  
Reading CityGML  
Writing CityGML  
Good habits 2  
Appearances  
Implicit Geometries  
ADEs

# CityGML in FME

Sample dataset

**Introduction**

Good habits

Reading CityGML

Writing CityGML

Good habits 2

Appearances

Implicit Geometries

ADEs

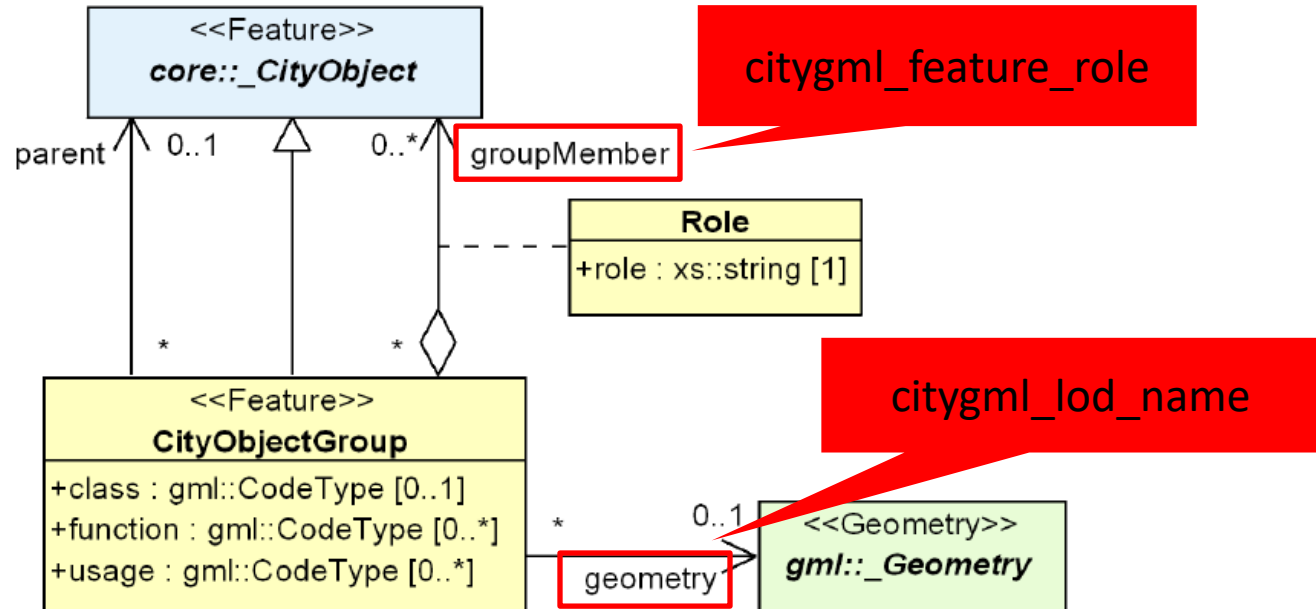
- Geometries are mapped to/from the **FME geometry model**
  - *Geometry traits/properties* are fundamental to work with CityGML in FME
- Geometries referenced by **Xlinks** are instantiated within the workbench upon reading, and (optionally) written again as Xlinks by the writer
- **Implicit geometries** are supported, and mapped to FME Geometry Instances
- **Appearances** are also supported
  - User friendly approach: only **one** appearance per CityGML file
  - Advanced mode: many appearances per CityGML file
  - **Please note:** FME can read and write multiple appearances, but the Data inspector only shows one (the first written in the xml file)

# CityGML in FME

- Particular attributes play a major role when working with CityGML
  - The spelling of the attributes is important: they must be *exactly* as shown here!
- For non-spatial data:
  - `gml_id`
  - `gml_parent_id`
  - `citygml_feature_role` (see next slide)
  - `attribute_name_xlink_href`
- For geometries (via **geometry properties**, previously known as **geometry traits**)
  - `gml_id`
  - `citygml_lod_name` (see next slide)
  - `xlink_href`
  - `gml_geometry_reversed` (Boolean: true or false)

# CityGML in FME: good habits

- As already said: ALWAYS have the UML diagrams of CityGML at hand!
- A **citygml\_feature\_role** attribute contains the name of the roles between two features classes
- A **gml\_lod\_name** attribute contains the name of the role between a geometry and a feature class



# CityGML in FME: good habits

- Use the **validation** option for reading and, above all, writing CityGML. It gives hints at what you may be doing wrong
  - As it slows down the ETL process, you may disable it when you are sure you are generating valid CityGML files
- Always **test** (and learn) **using few data** before going full scale
  - CityGML files *can* become very large!
- **Check the generated file** in a text/code editor
  - At least while testing at the beginning
  - Using Windows Notepad is a bad option. Go for something better (e.g. Notepad++)
- If you can, **use a multi-monitor** configuration
  - More real estate where to place the application windows
  - Your eyes will be thankful! 😊

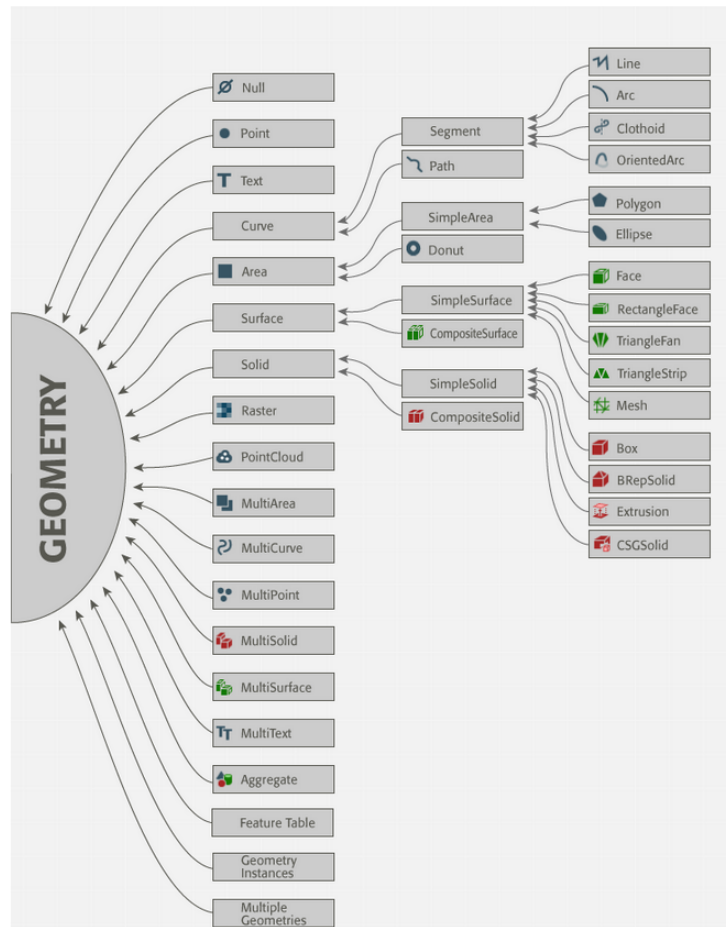
# FME geometry model to/from (City)GML

- For **spatial data**, FME has its own internal geometry model. All geometries are mapped to/from it
  - [https://docs.safe.com/fme/html/FME\\_Desktop\\_Documentation/FME\\_Desktop/!FME\\_Geometry/FME\\_Geometry\\_Model.htm](https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Desktop/!FME_Geometry/FME_Geometry_Model.htm)
- It is rather intuitive, however with some peculiar semantics
  - **Area**: a 2D polygon with or without holes is called a “Donut” or a “SimpleArea”
  - **Surface**: a 3D geometry (simple or composite) that is made of 3D entities (Face, RectangleFace, ... Mesh) and generally has a surface normal
- Examples of series of geometrical transformations could be:
  - donut -> face -> multisurface
  - polygon -> face -> composite surface -> Brep-solid
- **WATCH OUT:** A “classical” 3D polygon can be many things in FME!
- Geometries can have “internal” attributes called *geometry traits*

## FME Geometry Model

FME provides a comprehensive geometry model that includes everything from the simplest geometry to the most complex.

*Click on a geometry class for more information.*

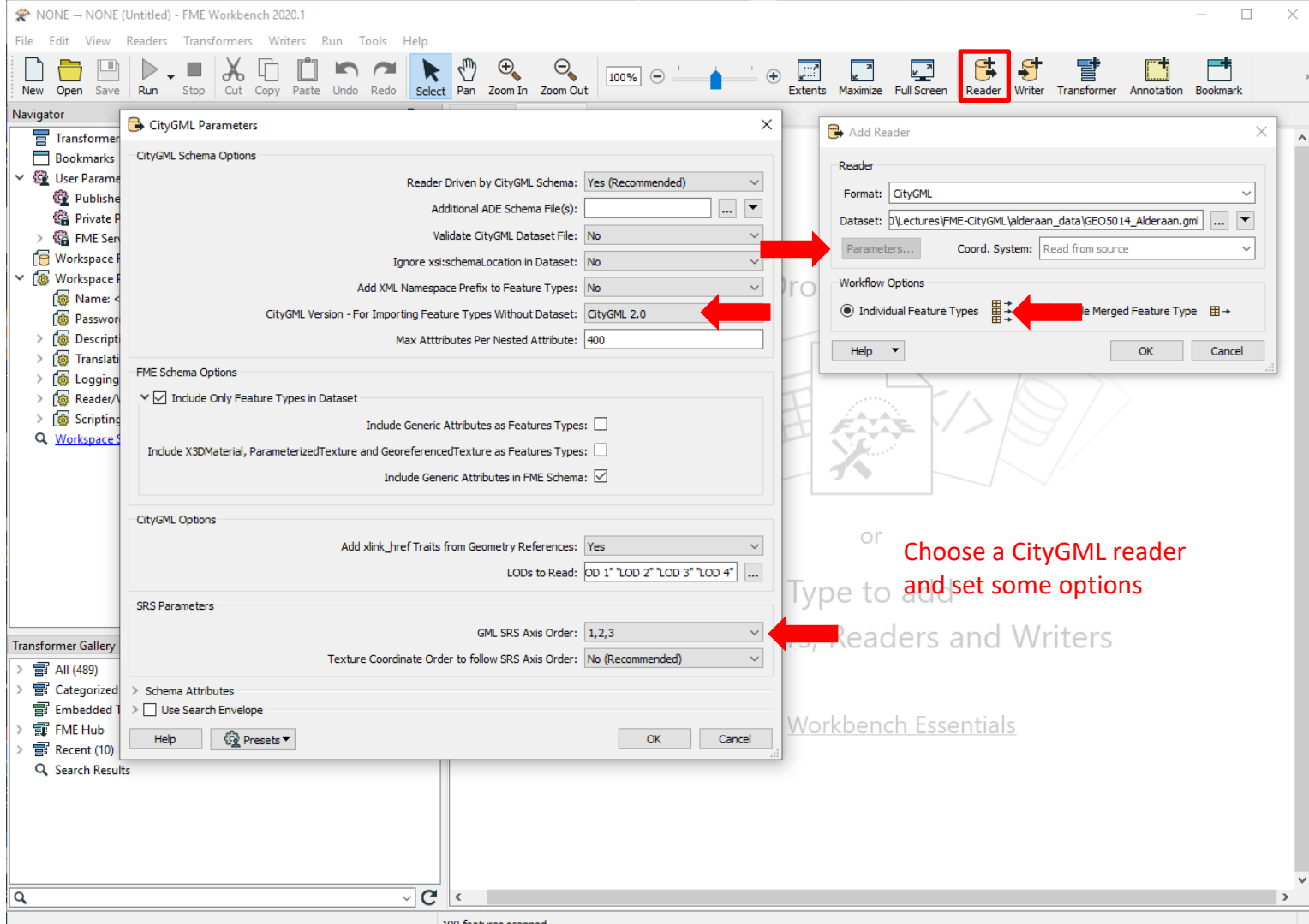


## Understanding FME Geometry

Geometry Concepts
<b>FME Geometry Model</b>
Nulls (IFMENull)
Points (IFMEPoint)
Text (IFMEText)
Curves (IFMECurve)
Segments (IFMESegment)
Paths (IFMEPath)
Areas (IFMEArea)
Simple Areas (IFMESimpleArea)
Donuts (IFMEDonut)
Surfaces (IFMESurface)
Simple Surfaces (IFMESimpleSurface)
Composite Surfaces (IFMECompositeSurface)
Solids (IFMESolid)
Simple Solids (IFMESimpleSolid)
Composite Solids (IFMECompositeSolid)
Rasters (IFMERaster)
Point Clouds (IFMEPointCloud)
Multis
Aggregates (IFMEAggregate)
Feature Tables (IFMEFeatureTable)
Geometry Definitions and Instances
Multiple Geometries

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Implicit Geometries  
ADEs

# Reading CityGML in FME



The screenshot shows the FME Workbench 2020.1 interface. The top toolbar has a 'Reader' button highlighted with a red box. Below it, two dialog boxes are open:

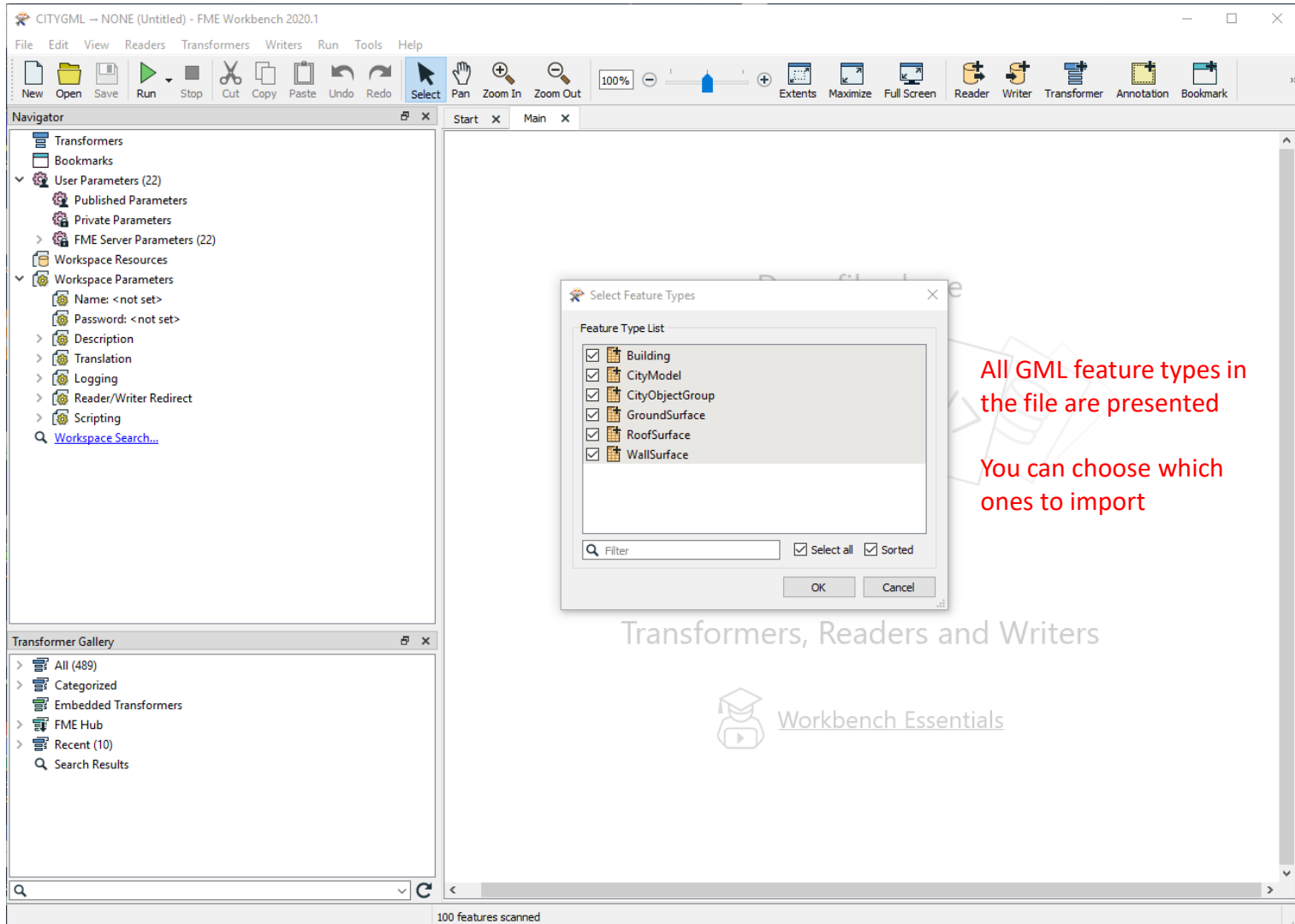
- CityGML Parameters**: This dialog has several sections:
  - CityGML Schema Options**: Includes 'Reader Driven by CityGML Schema' (set to 'Yes (Recommended)'), 'Additional ADE Schema File(s)', 'Validate CityGML Dataset File' (set to 'No'), 'Ignore xsi:schemaLocation in Dataset' (set to 'No'), 'Add XML Namespace Prefix to Feature Types' (set to 'No'), 'CityGML Version - For Importing Feature Types Without Dataset' (set to 'CityGML 2.0'), and 'Max Attributes Per Nested Attribute' (set to '400').
  - FME Schema Options**: Includes 'Include Only Feature Types in Dataset' (checked), 'Include Generic Attributes as Features Types' (unchecked), 'Include X3DMaterial, ParameterizedTexture and GeoreferencedTexture as Features Types' (unchecked), and 'Include Generic Attributes in FME Schema' (checked).
  - CityGML Options**: Includes 'Add xlink\_href Traits from Geometry References' (set to 'Yes') and 'LODs to Read' (set to 'LOD 1" LOD 2" LOD 3" LOD 4"').
  - SRS Parameters**: Includes 'GML SRS Axis Order' (set to '1,2,3') and 'Texture Coordinate Order to follow SRS Axis Order' (set to 'No (Recommended)').
- Add Reader**: This dialog has:
  - Reader**: 'Format' is set to 'CityGML' and 'Dataset' is set to 'D:\Lectures\FME-CityGML\alderaan\_data\GEO5014\_Alderaan.gml'.
  - Workflow Options**: 'Individual Feature Types' is selected, and 'Merged Feature Type' is disabled.

Red arrows indicate the following actions:

- Clicking the 'Reader' button in the top toolbar.
- Selecting 'CityGML 2.0' in the 'CityGML Schema Options' dialog.
- Selecting 'Individual Feature Types' in the 'Workflow Options' section of the 'Add Reader' dialog.

or  
Type to add  
Readers and Writers  
Workbench Essentials

Choose a CityGML reader  
and set some options



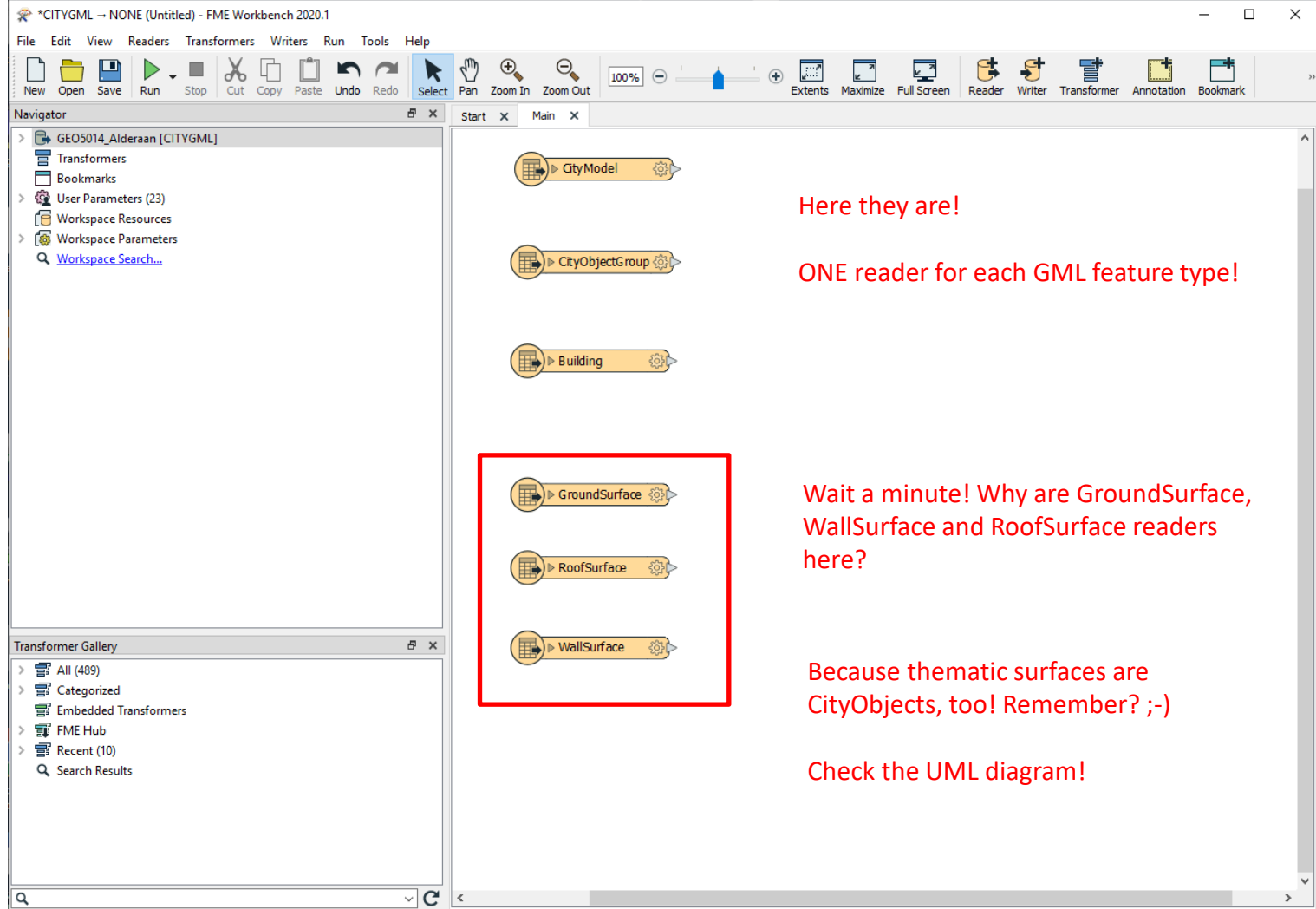
All GML feature types in the file are presented

You can choose which ones to import

Transformers, Readers and Writers



Workbench Essentials



File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 100%

Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

Navigator

- GEO5014\_Alderaan [CITYGML]
  - Transformers
  - Bookmarks
  - User Parameters (23)
  - Workspace Resources
  - Workspace Parameters
  - [Workspace Search...](#)

Start Main

CityModel

CityObjectGroup

Building

GroundSurface

RoofSurface

WallSurface

Transformer Gallery

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

Here they are!

ONE reader for each GML feature type!

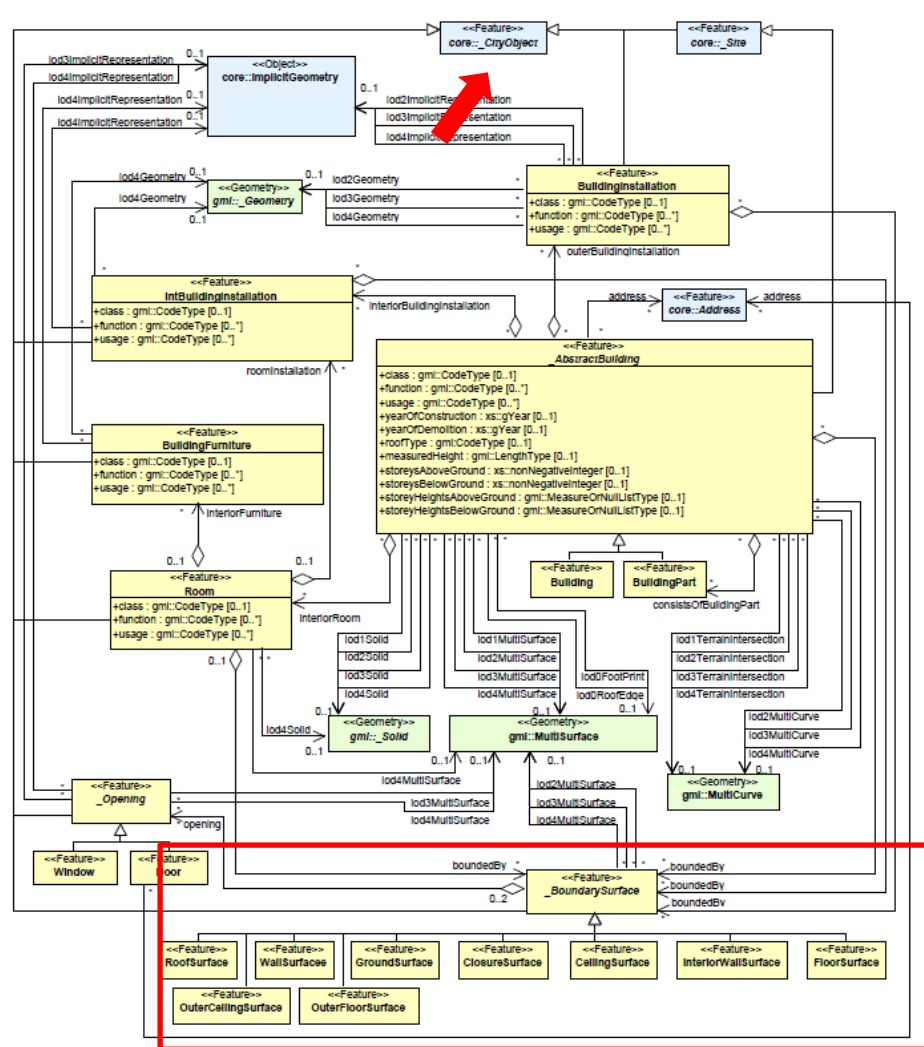
Wait a minute! Why are GroundSurface, WallSurface and RoofSurface readers here?

Because thematic surfaces are CityObjects, too! Remember? ;-)

Check the UML diagram!

## A RoofSurface:

- is a `_BoundarySurface`,
- which itself is a `_CityObject`!





\*CITYGML -> NONE (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 84%

Events Maximize Full Screen Reader Writer Transformer Annotation Bookmark

**Navigator**

- GEO5014\_Alderaan [CITYGML]
  - Transformers (2)
  - Bookmarks
  - User Parameters (23)
  - Workspace Resources
  - Workspace Parameters
    - Workspace Search...

**Start** **Main**

**Building**

- citygml\_target\_uri
- citygml\_feature\_role
- citygml\_feature\_role\_attr\_name
- citygml\_feature\_role\_attr\_val
- gml\_description
- gml\_name
- citygml\_creationDate
- citygml\_terminationDate
- externalReference().externalObject.name
- externalReference().externalObject.uri
- externalReference().informationSystem
- citygml\_generalizes\_to().xlink\_href
- citygml\_relative\_to\_terrain
- citygml\_relative\_to\_water
- citygml\_appearance().xlink\_href
- citygml\_class
- citygml\_class\_codeSpace
- citygml\_function()
- citygml\_function().codeSpace
- citygml\_usage()
- citygml\_usage().codeSpace
- citygml\_year\_of\_construction
- citygml\_year\_of\_demolition
- citygml\_roof\_type
- citygml\_roof\_type\_codeSpace
- citygml\_measured\_height
- citygml\_measured\_height\_units
- citygml\_storeys\_above\_ground
- citygml\_storeys\_below\_ground
- citygml\_storey\_heights\_above\_ground
- citygml\_storey\_heights\_above\_ground\_units
- citygml\_storey\_heights\_below\_ground
- citygml\_storey\_heights\_below\_ground\_units
- citygml\_outer\_building\_installation().xlink\_href
- citygml\_interior\_building\_installation().xlink\_href
- citygml\_bounded\_by().xlink\_href
- citygml\_level\_of\_detail()
- citygml\_interior\_room().xlink\_href
- citygml\_consists\_of\_building\_part().xlink\_href
- citygml\_address().xlink\_href
- test\_date\_att
- test\_integer\_att
- test\_measure\_att
- test\_measure\_att\_units
- test\_real\_att
- test\_string\_att
- test\_uri\_att
- gml\_id
- gml\_parent\_id

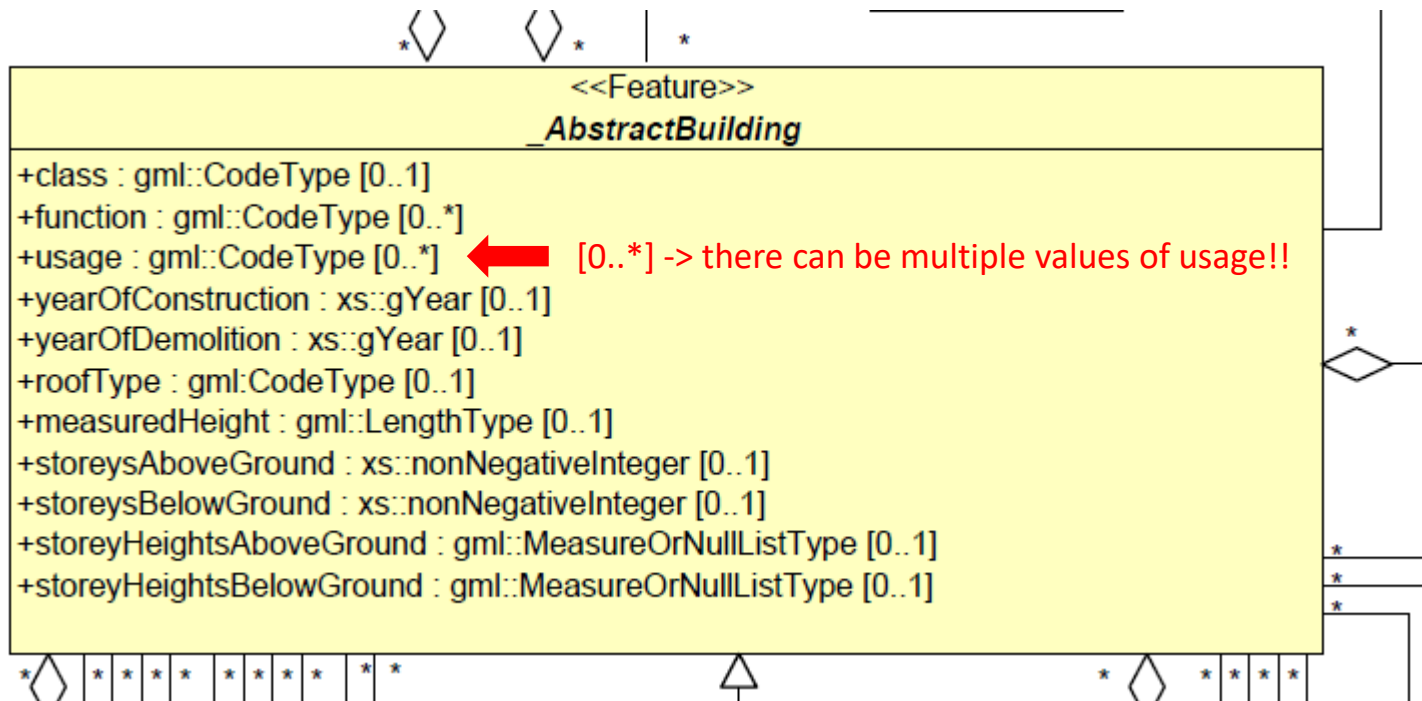
**Attributes of a Feature are included in the corresponding reader**

**Attributes with a {} are actually *lists*. I.e. They can contain multiple values, accessible via indices. E.g. citygml\_usage{0}, citygml\_usage{1}, etc.**

**Check the UML diagrams! 😊**

Expos...	Name	Type	Wid...	Precisi...
<input checked="" type="checkbox"/>	citygml_storey_heights_above_ground_units	xml_buffer		
<input checked="" type="checkbox"/>	citygml_storey_heights_below_ground	xml_buffer		
<input checked="" type="checkbox"/>	citygml_storey_heights_below_ground_units	xml_buffer		
<input checked="" type="checkbox"/>	citygml_storeys_above_ground	xml_uint64		
<input checked="" type="checkbox"/>	citygml_storeys_below_ground	xml_uint64		
<input checked="" type="checkbox"/>	citygml_target_uri	xml_buffer		
<input checked="" type="checkbox"/>	citygml_terminationDate	xml_date		
<input checked="" type="checkbox"/>	citygml_usage{}	xml_buffer		
<input checked="" type="checkbox"/>	citygml_usage{}.codeSpace	xml_buffer		
<input checked="" type="checkbox"/>	citygml_year_of_construction	xml_buffer		
<input checked="" type="checkbox"/>	citygml_year_of_demolition	xml_buffer		
<input checked="" type="checkbox"/>	externalReference().externalObject.name	xml_xml		
<input checked="" type="checkbox"/>	externalReference().externalObject.uri	xml_xml		
<input checked="" type="checkbox"/>	externalReference().informationSystem	xml_xml		
<input checked="" type="checkbox"/>	gml_description	xml_buffer		
<input checked="" type="checkbox"/>	gml_name	xml_buffer		
<input checked="" type="checkbox"/>	test_date_att	xml_buffer		
<input checked="" type="checkbox"/>	test_integer_att	xml_buffer		
<input checked="" type="checkbox"/>	test_measure_att	xml_buffer		
<input checked="" type="checkbox"/>	test_measure_att_units	xml_buffer		
<input checked="" type="checkbox"/>	test_real_att	xml_buffer		
<input checked="" type="checkbox"/>	test_string_att	xml_buffer		
<input checked="" type="checkbox"/>	test_uri_att	xml_buffer		

Help Apply to... OK Cancel



\*CITYGML - NONE (untitled) - FME Workbench 2020.1  
 File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 84% Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

Navigator  
 GEO5014\_Alderaan [CITYGML]  
 Transformers (2)  
 Bookmarks  
 User Parameters (23)  
 Workspace Resources  
 Workspace Parameters  
 Workspace Search...

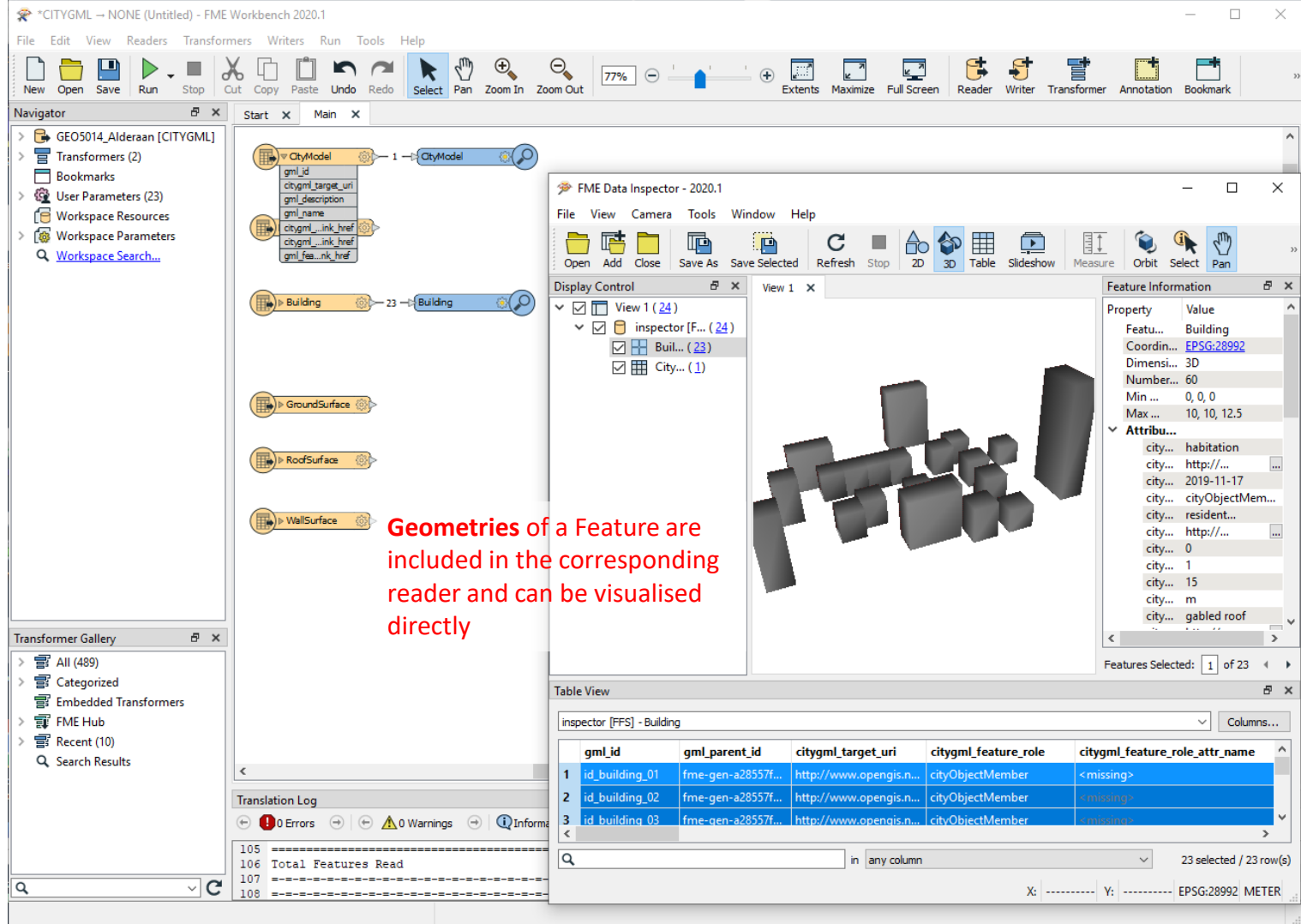
Start Main  
 Building  
 citygml\_target\_uri  
 citygml\_feature\_role  
 citygml\_feature\_role\_attr\_name  
 citygml\_feature\_role\_attr\_val  
 gml\_description  
 gml\_name  
 citygml\_creationDate  
 citygml\_terminationDate  
 externalReference().externalObject.name  
 externalReference().externalObject.uri  
 externalReference().informationSystem  
 citygml\_generalizes\_to().xlink\_href  
 citygml\_relative\_to\_terrain  
 citygml\_relative\_to\_vaster  
 citygml\_appearance().xlink\_href  
 citygml\_class  
 citygml\_class\_codeSpace  
 citygml\_function()  
 citygml\_function().codeSpace  
 citygml\_usage()  
 citygml\_usage().codeSpace  
 citygml\_year\_of\_construction  
 citygml\_year\_of\_demolition  
 citygml\_roof\_type  
 citygml\_roof\_type\_codeSpace  
 citygml\_measured\_height  
 citygml\_measured\_height\_units  
 citygml\_storeys\_above\_ground  
 citygml\_storeys\_below\_ground  
 citygml\_storeys\_heights\_above\_ground  
 citygml\_storeys\_heights\_above\_ground\_units  
 citygml\_storeys\_heights\_below\_ground  
 citygml\_storeys\_heights\_below\_ground\_units  
 citygml\_outer\_building\_installation().xlink\_href  
 citygml\_interior\_building\_installation().xlink\_href  
 citygml\_bounded\_by().xlink\_href  
 citygml\_level\_of\_detail()  
 citygml\_interior\_room().xlink\_href  
 citygml\_consists\_of\_building\_part().xlink\_href  
 citygml\_address().xlink\_href  
 test\_date\_att  
 test\_integer\_att  
 test\_measure\_att  
 test\_measure\_att\_units  
 test\_real\_att  
 test\_string\_att  
 test\_uri\_att  
 gml\_id  
 gml\_parent\_id

Attributes of a Feature are included in the corresponding reader  
 Generic attributes are added, too (here: all test\_\* attributes are CityGML generic attributes)

Attribute Definition

Expos...	Name	Type	Wid...	Precis...
<input checked="" type="checkbox"/>	citygml_storeys_heights_above_ground_units	xml_buffer		
<input checked="" type="checkbox"/>	citygml_storeys_heights_below_ground	xml_buffer		
<input checked="" type="checkbox"/>	citygml_storeys_heights_below_ground_units	xml_buffer		
<input checked="" type="checkbox"/>	citygml_storeys_above_ground	xml_uint64		
<input checked="" type="checkbox"/>	citygml_storeys_below_ground	xml_uint64		
<input checked="" type="checkbox"/>	citygml_target_uri	xml_buffer		
<input checked="" type="checkbox"/>	citygml_terminationDate	xml_date		
<input checked="" type="checkbox"/>	citygml_usage()	xml_buffer		
<input checked="" type="checkbox"/>	citygml_usage().codeSpace	xml_buffer		
<input checked="" type="checkbox"/>	citygml_year_of_construction	xml_buffer		
<input checked="" type="checkbox"/>	citygml_year_of_demolition	xml_buffer		
<input checked="" type="checkbox"/>	externalReference().externalObject.name	xml_xml		
<input checked="" type="checkbox"/>	externalReference().externalObject.uri	xml_xml		
<input checked="" type="checkbox"/>	externalReference().informationSystem	xml_xml		
<input checked="" type="checkbox"/>	gml_description	xml_buffer		
<input checked="" type="checkbox"/>	gml_name	xml_buffer		
<input checked="" type="checkbox"/>	test_date_att	xml_buffer		
<input checked="" type="checkbox"/>	test_integer_att	xml_buffer		
<input checked="" type="checkbox"/>	test_measure_att	xml_buffer		
<input checked="" type="checkbox"/>	test_measure_att_units	xml_buffer		
<input checked="" type="checkbox"/>	test_real_att	xml_buffer		
<input checked="" type="checkbox"/>	test_string_att	xml_buffer		
<input checked="" type="checkbox"/>	test_uri_att	xml buffer		

+ - < > \* % & # \$ % & # \$ % & # \$ %  
 Filter Select All  
 Help Apply to... OK Cancel



The screenshot displays the FME Workbench 2020.1 interface. The main workspace shows a workflow starting with 'CityModel' (1) connected to 'CityModel' (1), followed by 'Building' (23) connected to 'Building' (23). The 'Building' feature type is expanded, showing attributes: gml\_id, citygml\_target\_uri, gml\_description, gml\_name, citygml\_link\_href, citygml\_link\_href, and gml\_feature\_href. Below the workspace, the 'Transformer Gallery' lists various transformers, and the 'Translation Log' shows 0 errors and 0 warnings.

The 'FME Data Inspector - 2020.1' window is open, showing a 3D visualization of building geometries. The 'Display Control' panel shows 'View 1 (24)' with 'inspector [F... (24)', 'Buil... (23)', and 'City... (1)'. The 'Feature Information' panel shows the 'Building' feature type with attributes: citygml\_habitation, citygml\_http://..., citygml\_2019-11-17, citygml\_cityObjectMem..., citygml\_resident..., citygml\_http://..., citygml\_0, citygml\_1, citygml\_15, citygml\_m, and citygml\_gabled roof.

The 'Table View' panel shows the 'inspector [FFS] - Building' table with the following data:

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name
1	id_building_01	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>
2	id_building_02	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>
3	id_building_03	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>

The 'Features Selected' panel shows 1 of 23 features selected. The 'Table View' panel also shows 23 selected / 23 row(s).

**Geometries of a Feature are included in the corresponding reader and can be visualised directly**

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 (24)

- Inspector [FFS] (24)
  - Building (23)
  - CityModel (1)

View 1 X

Feature Information

Property	Value
Feature Type	Building
Coordinate System	EPSG:28992
Dimension	3D
Number of Vertices	60
Min Extents	20, -50, 5
Max Extents	40, -40, 25
Attributes (16)	
citygml_feature_role (encoded: UTF-16LE)	groupMember
citygml_level_of_detail[0] (encoded: UTF-16LE)	0
citygml_level_of_detail[1] (encoded: UTF-16LE)	1
citygml_target_uri (encoded: UTF-16LE)	http://www.opengis.net/citygml/building/2...
fme_feature_type (string)	Building
fme_geometry (string)	fme_aggregate
fme_type (string)	fme_collection
gml_description (encoded: UTF-16LE)	This is a simple, primastic building meant .....
gml_id (encoded: UTF-16LE)	id_box_building_29
gml_name (encoded: UTF-16LE)	Box building 29
gml_parent_id (encoded: UTF-16LE)	id_group_1
multi_reader_full_id (32 bit integer)	0
multi_reader_id (32 bit integer)	0
multi_reader_keyword (string)	CITYGML_1
multi_reader_type (string)	CITYGML
xml_type (string)	xml_aggregate
IFMEAggregate (Multiple Geometry: 2 Geometries)	

Attributes of a Feature

The arrows show the "particularly relevant" feature attributes

Table View

Inspector [FFS] - Building

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	cit
1	id_building_01	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 1	Snoke's Palace	2019-11-17	<n
2	id_building_02	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 2	Rey's Hut	2019-11-17	<n
3	id_building_03	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 3	Poe's Hanqar	2019-11-17	<n

Save selected data to a new dataset

23 row(s)

X: ..... Y: ..... EPSG:28992 METER

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 x

View 1 (24)  
 inspector [FFS] (24)  
 Building (23)  
 CityModel (1)

Feature Information

Property	Value
Feature Type	Building
Coordinate System	EPSG:28992
Dimension	3D
Number of Vertices	60
Min Extents	20, -50, 5
Max Extents	40, -40, 25
Attributes (16)	
IFMEAggregate (Multiple Geometry: 2 Geometries)	
Front Appearance Reference	<inherited_or_default_appearance>
Back Appearance Reference	<inherited_or_default_appearance>
Part 0: IFMEMultiSurface (1 Part)	
Part 1: IFMEBRepSolid	0 Inner Surfaces

Geometry/(ies) of a Feature

Here we have an aggregation of geometries:  
LoD0 and LoD1

The same feature has multiple geometries!

Table View

Inspector [FFS] - Building

gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	cit
1 id_building_01	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 1	Snoke's Palace	2019-11-17	<n
2 id_building_02	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 2	Rey's Hut	2019-11-17	<n
3 id_building_03	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 3	Poe's Hanqar	2019-11-17	<n

Features Selected: 1 of 1

Columns...

Q in any column

23 row(s)

X: ----- Y: ----- EPSG:28992 METER

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 (24)

- View 1 (24)
  - inspector [FFS] (24)
    - Building (23)
      - CityModel (1)

For the LoD0, you can see the hierarchy:  
MultiSurface -> Face(s) -> Polygon

Feature Information

Property	Value
<b>IFMEAggregate (Multiple Geometry: 2 Geometries)</b>	
Front Appearance Reference	<inherited_or_default_appearance>
Back Appearance Reference	<inherited_or_default_appearance>
<b>Part 0: IFMEMultiSurface (1 Part)</b>	
Name (encoded: UTF-16LE)	lod0FootPrint
Geometry Traits (4)	
citygml_level_of_detail (encoded: UTF-16LE)	0
citygml_lod_name (encoded: UTF-16LE)	lod0FootPrint
gml_geometry (encoded: UTF-16LE)	MultiSurface
gml_id (encoded: UTF-16LE)	id_lod0_MultiSurf_29
Front Appearance Reference	<inherited_or_default_appearance>
Back Appearance Reference	<inherited_or_default_appearance>
<b>Part 0: IFMEFace</b>	
Name (encoded: UTF-16LE)	surfaceMember
Geometry Traits (3)	
citygml_lod_name (encoded: UTF-16LE)	surfaceMember
gml_geometry (encoded: UTF-16LE)	Polygon
gml_id (encoded: UTF-16LE)	id_lod0_Polygon_29
Sidedness	1-sided (front)
Front Appearance Reference	<inherited_or_default_appearance>
<b>Area: IFMEPolygon</b>	
Name (encoded: UTF-16LE)	exterior
Geometry Traits (2)	
citygml_lod_name (encoded: UTF-16LE)	exterior
gml_geometry (encoded: UTF-16LE)	LinearRing
Linear Boundary	Yes
Convex	Yes
Orientation	Left Hand Rule
<b>Boundary: IFMELine (5 Coordinates)</b>	
	(20. -50. 5) ... (20. -50. 5)

By the way: do not be fooled by the visualisation! You see a triangulated mesh, but the polygons have 4(+1) vertices!

Table View

inspector [FFS] - Building

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	cit
1	id_building_01	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 1	Snoke's Palace	2019-11-17	<n
2	id_building_02	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 2	Rey's Hut	2019-11-17	<n
3	id_building_03	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 3	Poe's Hanqar	2019-11-17	<n

23 row(s)

X: ----- Y: ----- EPSG:28992 METER

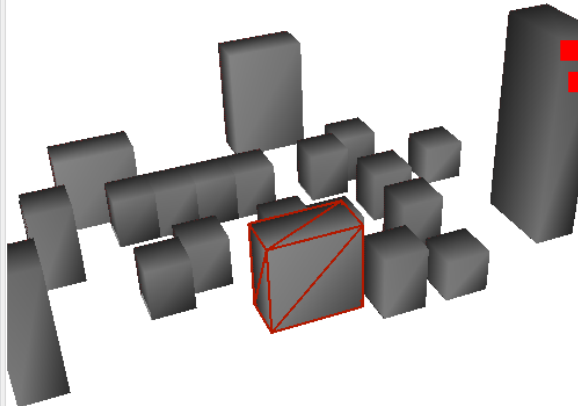
FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 (24)

- View 1 (24)
  - Inspector [FFS] (24)
    - Building (23)
      - CityModel (1)



Feature Information

Property	Value
IFMEAggregate (Multiple Geometry: 2 Geometries)	
Front Appearance Reference	<inherited_or_default_appearance>
Back Appearance Reference	<inherited_or_default_appearance>
Part 0: IFMEMultiSurface (1 Part)	
Name (encoded: UTF-16LE)	lod0FootPrint
Geometry Traits (4)	
citygml_level_of_detail (encoded: UTF-16LE)	0
citygml_lod_name (encoded: UTF-16LE)	lod0FootPrint
gml_geometry (encoded: UTF-16LE)	MultiSurface
gml_id (encoded: UTF-16LE)	id_lod0_MultiSurf_29
Front Appearance Reference	<inherited_or_default_appearance>
Back Appearance Reference	<inherited_or_default_appearance>
Part 0: IFMEFace	
Name (encoded: UTF-16LE)	surfaceMember
Geometry Traits (3)	
citygml_lod_name (encoded: UTF-16LE)	surfaceMember
gml_geometry (encoded: UTF-16LE)	Polygon
gml_id (encoded: UTF-16LE)	id_lod0_Polygon_29
Sidedness	1-sided (front)
Front Appearance Reference	<inherited_or_default_appearance>
Area: IFMEPolygon	
Name (encoded: UTF-16LE)	exterior
Geometry Traits (2)	
citygml_lod_name (encoded: UTF-16LE)	exterior
gml_geometry (encoded: UTF-16LE)	LinearRing
Linear Boundary	Yes
Convex	Yes
Orientation	Left Hand Rule
Boundary: IFMELINE (5 Coordinates)	(20. -50. 5) ... (20. -50. 5)

Attributes of a Geometry  
 The arrows show the "particularly relevant" geometry attributes  
 In FME, they are called *geometry traits (or properties)*.

Table View

Inspector [FFS] - Building

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	cit
1	id_building_01	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 1	Snoke's Palace	2019-11-17	<n
2	id_building_02	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 2	Rey's Hut	2019-11-17	<n
3	id_building_03	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 3	Poe's Hanqar	2019-11-17	<n

23 row(s)

X: ----- Y: ----- EPSG:28992. METER

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 x

View 1 (24)  
 inspector [FFS] (24)  
 Building (23)  
 CityModel (1)

Property

Part 1: IFMEBRepSolid  
 Name (encoded: UTF-16LE) 0 Inner Surfaces  
 lod1Solid  
 Geometry Traits (4)  
 citygml\_level\_of\_detail (encoded: UTF-16LE) 1  
 citygml\_lod\_name (encoded: UTF-16LE) lod1Solid  
 gml\_geometry (encoded: UTF-16LE) Solid  
 gml\_id (encoded: UTF-16LE) id\_lod1\_Solid\_29  
 Front Appearance Reference <inherited\_or\_default\_appearance>  
 Back Appearance Reference <inherited\_or\_default\_appearance>

Outer Surface: IFMECompositeSurface (6 Parts)  
 Name (encoded: UTF-16LE) exterior  
 Geometry Traits (3)  
 citygml\_lod\_name (encoded: UTF-16LE) exterior  
 gml\_geometry (encoded: UTF-16LE) CompositeSurface  
 gml\_id (encoded: UTF-16LE) id\_lod1\_CompSurf\_29  
 Sidedness 1-sided (front)  
 Front Appearance Reference <inherited\_or\_default\_appearance>

Part 0: IFMEFace  
 Part 1: IFMEFace  
 Part 2: IFMEFace  
 Part 3: IFMEFace  
 Part 4: IFMEFace  
 Part 5: IFMEFace  
 Name (encoded: UTF-16LE) surfaceMember  
 Geometry Traits (3)  
 citygml\_lod\_name (encoded: UTF-16LE) surfaceMember  
 gml\_geometry (encoded: UTF-16LE) Polygon  
 gml\_id (encoded: UTF-16LE) id\_lod1\_Polygon\_60  
 Sidedness 1-sided (front)  
 Front Appearance Reference <inherited\_or\_default\_appearance>

Area: IFMEPolygon  
 Name (encoded: UTF-16LE) exterior  
 Geometry Traits (2)  
 citygml\_lod\_name (encoded: UTF-16LE) exterior  
 gml\_geometry (encoded: UTF-16LE) LinearRing

Also for the LoD1, you can see the geometry hierarchy:  
 BRepSolid -> CompositeSurface -> Face(s) -> Polygon

And the geometry traits (or properties).

Table View inspector [FFS] - Building

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	cit
1	id_building_01	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 1	Smoke's Palace	2019-11-17	<n
2	id_building_02	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 2	Rey's Hut	2019-11-17	<n
3	id_building_03	fme-gen-a28557f...	http://www.opengis.n...	cityObjectMember	<missing>	<missing>	This is Building 3	Poe's Hanqar	2019-11-17	<n

Columns...

Features Selected: 1 of 1

23 row(s)

\*CITYGML - NONE (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 84%

Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

**Navigator**

- > GEO5014\_Alderaan [CITYGML]
  - > Transformers (7)
    - > Disabled Transformers (2)
      - > Building [Inspector]
      - > CityModel [Inspector]
    - > Bookmarks
    - > User Parameters (23)
      - > Published Parameters (1)
      - > Private Parameters
      - > FME Server Parameters (22)
    - > Workspace Resources
    - > Workspace Parameters
    - > [Workspace Search...](#)

**Transformer Gallery**

- > All (489)
- > Categorized
- > Embedded Transformers
- > FME Hub
- > Recent (10)
- > Search Results

**Start Main**

CityModel 1 CityModel

CityObjectGroup

Building 23 Building

GroundSurface 12 GroundSurface

RooSurface 24 RooSurface

WallSurface 48 WallSurface

AppearanceSetter 12

Appearance

Geometry

Holder

Output

Holder

Unmatched

<Rejected>

AppearanceSetter 24

Appearance

Geometry

Holder

Output

Holder

Unmatched

<Rejected>

AppearanceSetter 48

Appearance

Geometry

Holder

Output

Holder

Unmatched

<Rejected>

**Translation Log**

0 Errors 0 Warnings Information

146 END - ProcessID: 16892, peak process memory usage: 118152 kB, current process memory usage: 104184 kB

147 Translation was SUCCESSFUL

Copy the selection and put it on the Clipboard

To visualise the LoD2 thematic surfaces, you need to connect inspectors to the respective readers

(The appearance setters are added here only to simplify the visualisation in the next slides!)

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 View 2 View 3

View 3 (84)

- Inspector [FFS] (84)
  - GroundSurf... (12)
  - RoofSurf... (24)
  - WallSurf... (48)

For the LoD2 WallSurfaces, you can see the attributes and the geometry hierarchy: MultiSurface -> Face(s) -> Polygon

And the geometry traits

Feature Information

Property Value

Attributes (15)

- citygml\_feature\_role (encoded: UTF-16LE) boundedBy
- citygml\_level\_of\_detail(0) (encoded: UTF-16LE) 2
- citygml\_target\_uri (encoded: UTF-16LE) http://www.opengis.net/citygml/building/2.0
- fme\_feature\_type (string) WallSurface
- fme\_geometry (string) fme\_aggregate
- fme\_type (string) fme\_surface
- gml\_description (encoded: UTF-16LE) This is WallSurface 1 (South) (Building 9)
- gml\_id (encoded: UTF-16LE) id\_building\_9\_wallsurface\_3
- gml\_name (encoded: UTF-16LE) WallSurface 3 (Building 9)
- gml\_parent\_id (encoded: UTF-16LE) id\_building\_09
- multi\_reader\_full\_id (32 bit integer) 0
- multi\_reader\_id (32 bit integer) 0
- multi\_reader\_keyword (string) CITYGML\_1
- multi\_reader\_type (string) CITYGML
- xml\_type (string) xml\_surface

IFMEMultiSurface (1 Part)

Name (encoded: UTF-16LE) lod2MultiSurface

Geometry Traits (4)

- citygml\_level\_of\_detail (encoded: UTF-16LE) 2
- citygml\_lod\_name (encoded: UTF-16LE) lod2MultiSurface
- gml\_geometry (encoded: UTF-16LE) MultiSurface
- gml\_id (encoded: UTF-16LE) id\_building\_9\_wallsurface\_3\_lod2\_geom
- Front Appearance Reference '118' to an unnamed appearance 0
- Back Appearance Reference '118' to an unnamed appearance 0

Part 0: IFMEFace

Name (encoded: UTF-16LE) surfaceMember

Geometry Traits (3)

- citygml\_lod\_name (encoded: UTF-16LE) surfaceMember
- gml\_geometry (encoded: UTF-16LE) Polygon
- gml\_id (encoded: UTF-16LE) id\_building\_9\_polygon\_7
- Sidedness 1-sided (front)
- Front Appearance Reference <inherited\_or\_default\_appearance>

Area: IFMEPolygon

Name (encoded: UTF-16LE) exterior

Table View

Inspector [FFS] - GroundSurface

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	citygml_creationTime
1	id_building_1_g...	id_building_01	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n
2	id_building_2_g...	id_building_02	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n
3	id_building_3_a...	id_building_03	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n

12 row(s)

Scale: X: Y: EPSG:28992 METR

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 x View 2 x View 3 x

View 3 (84)

- Inspector [FFS] (84)
  - GroundSurf... (12)
  - RoofSurf... (24)
  - WallSurf... (48)

Feature Information

Property Value

Attributes (15)

- citygml\_feature\_role (encoded: UTF-16LE) **boundedBy**
- citygml\_level\_of\_detail(0) (encoded: UTF-16LE) 2
- citygml\_target\_uri (encoded: UTF-16LE) http://www.opengis.net/citygml/building/2.0
- fme\_feature\_type (string) WallSurface
- fme\_geometry (string) fme\_aggregate
- fme\_type (string) fme\_surface
- gml\_description (encoded: UTF-16LE) This is WallSurface 1 (South) (Building 9)
- gml\_id (encoded: UTF-16LE) id\_building\_9\_wallsurface\_3
- gml\_name (encoded: UTF-16LE) WallSurface 3 (Building 9)
- gml\_parent\_id (encoded: UTF-16LE) id\_building\_09
- multi\_reader\_full\_id (32 bit integer) 0
- multi\_reader\_id (32 bit integer) 0
- multi\_reader\_keyword (string) CITYGML\_1
- multi\_reader\_type (string) CITYGML
- xml\_type (string) xml\_surface

IFMEMultiSurface (1 Part)

- Name (encoded: UTF-16LE) lod2MultiSurface

Geometry Traits (4)

- citygml\_level\_of\_detail (encoded: UTF-16LE) 2
- citygml\_lod\_name (encoded: UTF-16LE) **lod2MultiSurface**
- gml\_geometry (encoded: UTF-16LE) MultiSurface
- gml\_id (encoded: UTF-16LE) id\_building\_9\_wallsurface\_3\_lod2\_geom

Front Appearance Reference '118' to an unnamed appearance 0

Back Appearance Reference '118' to an unnamed appearance 0

Part 0: IFMEFace

- Name (encoded: UTF-16LE) surfaceMember

Geometry Traits (3)

- citygml\_lod\_name (encoded: UTF-16LE) surfaceMember
- gml\_geometry (encoded: UTF-16LE) Polygon
- gml\_id (encoded: UTF-16LE) id\_building\_9\_polygon\_7

Sidedness 1-sided (front)

Front Appearance Reference <inherited\_or\_default\_appearance>

Area: IFMEPolygon

- Name (encoded: UTF-16LE) exterior

Features Selected: 1 of 1

Table View

Inspector [FFS] - GroundSurface

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	cit
1	id_building_1_g...	id_building_01	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n
2	id_building_2_g...	id_building_02	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n
3	id_building_3_a...	id_building_03	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n

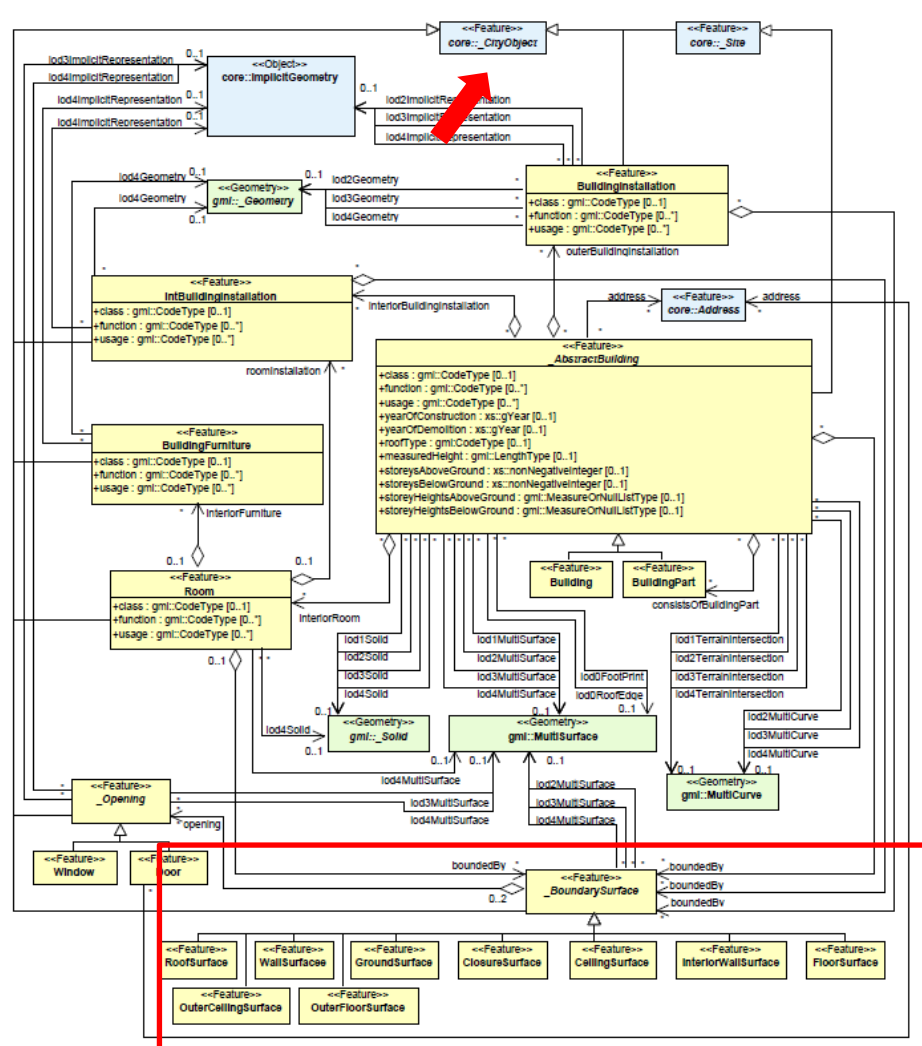
Q in any column

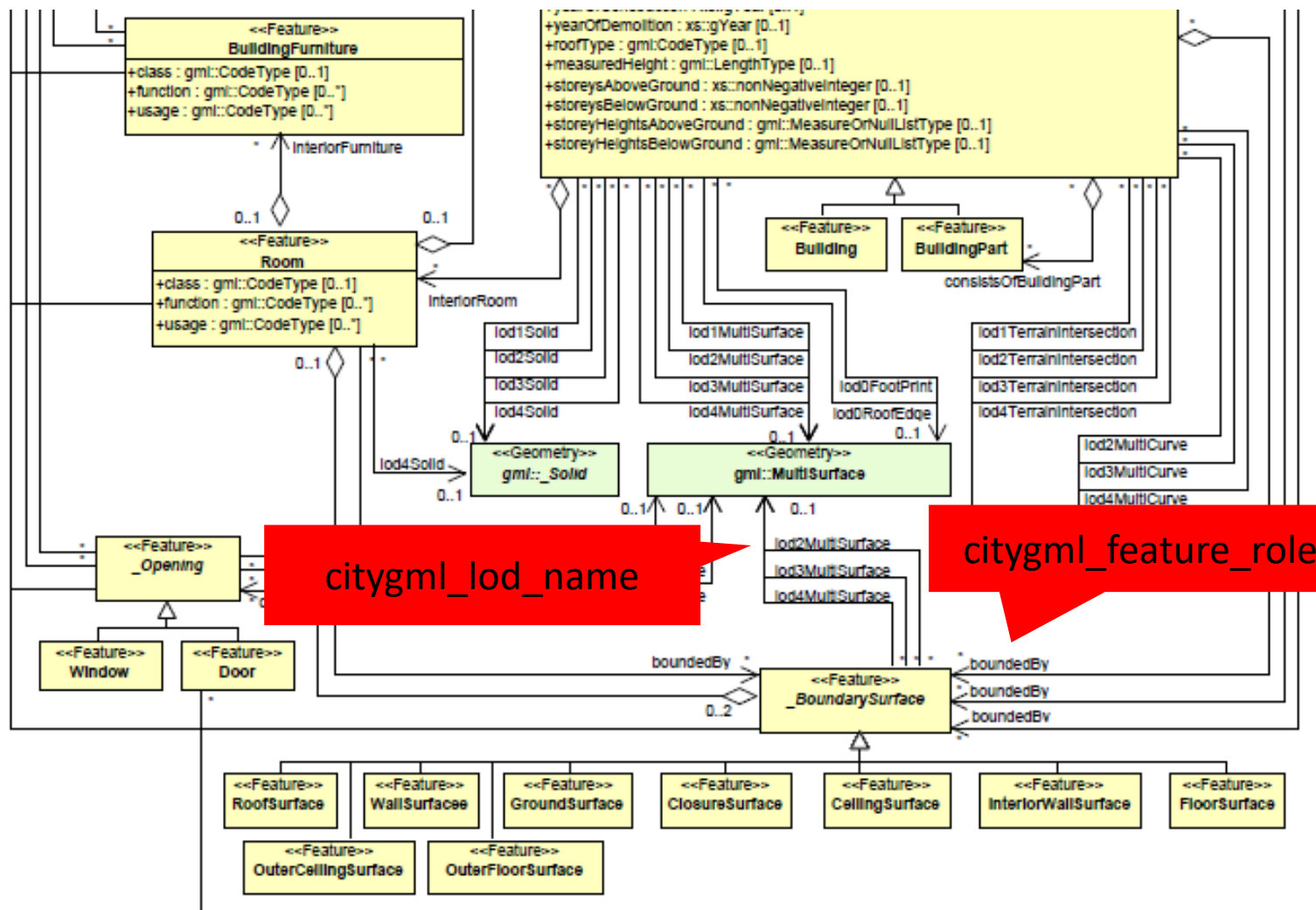
12 row(s)

X: ----- Y: ----- EPSG:28992 METR

For the LoD2 WallSurfaces, you can see the  
 attributes and the geometry hierarchy:  
 MultiSurface -> Face(s) -> Polygon

And the geometry traits





FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control View 1 View 2 View 3

- View 3 (84)
  - Inspector [FFS] (84)
    - GroundSurf... (12)
    - RoofSurf... (24)
    - WallSurf... (48)

This is analogous for the the LoD2 RoofSurfaces. You can see the attributes and the geometry hierarchy: MultiSurface -> Face(s) -> Polygon

And the geometry traits

Feature Information

Property	Value
<b>Attributes (15)</b>	
citygml_feature_role (encoded: UTF-16LE)	boundedBy
citygml_level_of_detail(0) (encoded: UTF-16LE)	2
citygml_target_uri (encoded: UTF-16LE)	http://www.opengis.net/citygml/building/2.0
fme_feature_type (string)	RoofSurface
fme_geometry (string)	fme_aggregate
fme_type (string)	fme_surface
gml_description (encoded: UTF-16LE)	This is Roofsurface 1 (South) (Building 9)
gml_id (encoded: UTF-16LE)	id_building_9_roofsurface_1
gml_name (encoded: UTF-16LE)	RoofSurface 1 (Building 9)
gml_parent_id (encoded: UTF-16LE)	id_building_09
multi_reader_full_id (32 bit integer)	0
multi_reader_id (32 bit integer)	0
multi_reader_keyword (string)	CITYGML_1
multi_reader_type (string)	CITYGML
xml_type (string)	xml_surface
<b>IFMEMultiSurface (1 Part)</b>	
Name (encoded: UTF-16LE)	lod2MultiSurface
<b>Geometry Traits (4)</b>	
citygml_level_of_detail (encoded: UTF-16LE)	2
citygml_lod_name (encoded: UTF-16LE)	lod2MultiSurface
gml_geometry (encoded: UTF-16LE)	MultiSurface
gml_id (encoded: UTF-16LE)	id_building_9_roofsurface_1_lod2_geom
Front Appearance Reference	'115' to an unnamed appearance 0
Back Appearance Reference	'115' to an unnamed appearance 0
<b>Part 0: IFMEFace</b>	
Name (encoded: UTF-16LE)	surfaceMember
<b>Geometry Traits (3)</b>	
citygml_lod_name (encoded: UTF-16LE)	surfaceMember
gml_geometry (encoded: UTF-16LE)	Polygon
gml_id (encoded: UTF-16LE)	id_building_9_polygon_1
Sidedness	1-sided (front)
Front Appearance Reference	<inherited_or_default_appearance>
<b>Area: IFMEPolygon</b>	
Name (encoded: UTF-16LE)	exterior

Features Selected: 1 of 1

Table View

Inspector [FFS] - GroundSurface

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	citygml_creationDate
1	id_building_1_g...	id_building_01	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n
2	id_building_2_g...	id_building_02	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n
3	id_building_3_a...	id_building_03	http://www.opengis.n...	boundedBy	<missing>	<missing>	This is GroundSurfa...	GroundSurface ...	<missing>	<n

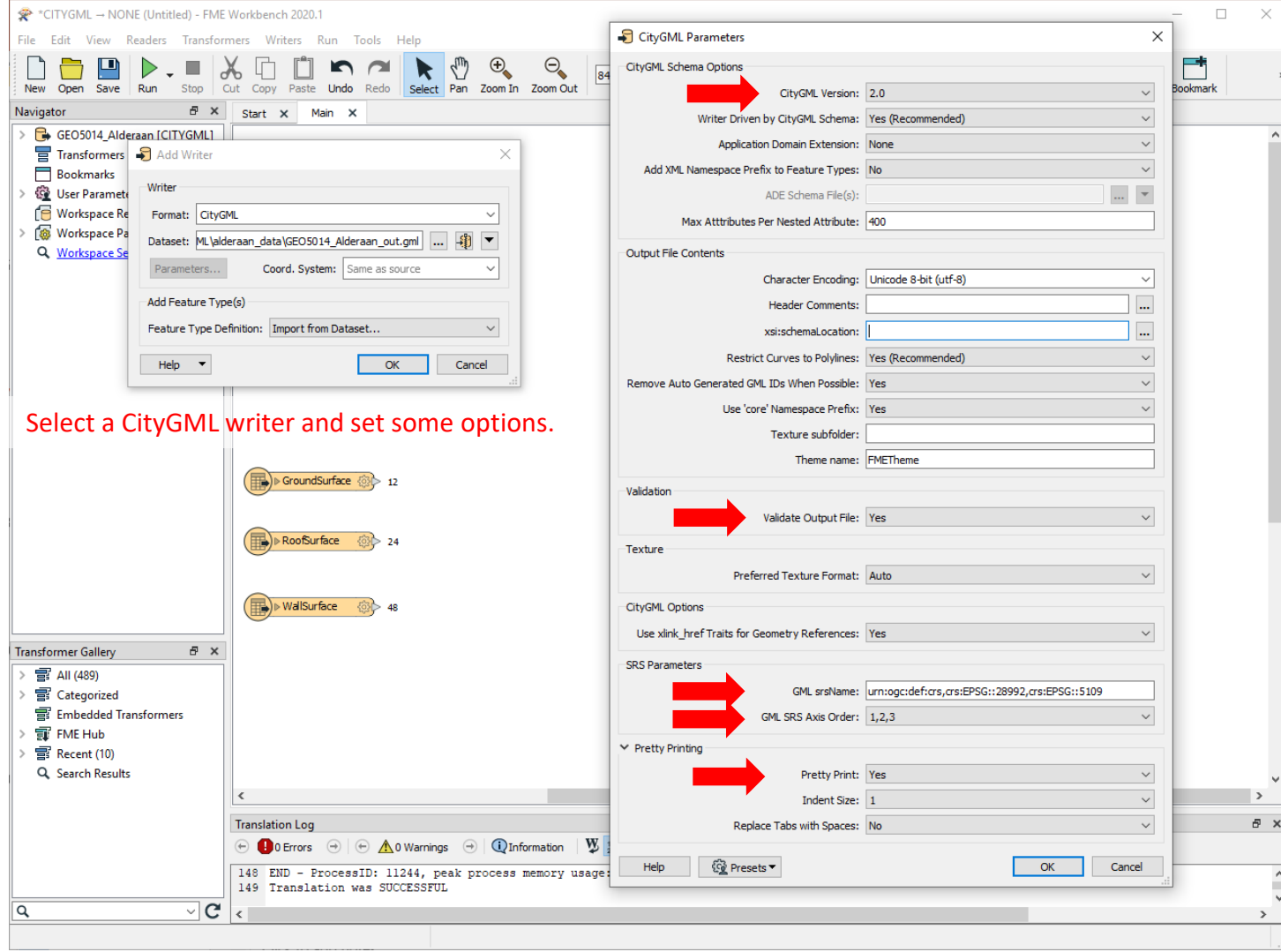
12 row(s)

Add a dataset to the current view

X: Y: EPSG:28992 METER

Sample dataset  
Introduction  
Good habits  
Reading CityGML  
**Writing CityGML**  
Good habits 2  
Appearances  
Implicit Geometries  
ADEs

# Writing CityGML in FME




\*CITYGML - NONE (Untitled) - FME Workbench 2020.1  
 File Edit View Readers Transformers Writers Run Tools Help  
 New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out  
 Navigator  
 GEO5014\_Alderaan [CITYGML]  
 Add Writer  
 Writer  
 Format: CityGML  
 Dataset: ML\alderaan\_data\GEO5014\_Alderaan\_out.gml  
 Parameters... Coord. System: Same as source  
 Add Feature Type(s)  
 Feature Type Definition: Import from Dataset...  
 Help OK Cancel  
 Select a CityGML writer and set some options.  
 GroundSurface 12  
 RooSurface 24  
 WallSurface 48  
 Transformer Gallery  
 All (489)  
 Categorized  
 Embedded Transformers  
 FME Hub  
 Recent (10)  
 Search Results  
 Translation Log  
 0 Errors 0 Warnings Information  
 148 END - ProcessID: 11244, peak process memory usage:  
 149 Translation was SUCCESSFUL  
 CityGML Parameters  
 CityGML Schema Options  
 CityGML Version: 2.0  
 Writer Driven by CityGML Schema: Yes (Recommended)  
 Application Domain Extension: None  
 Add XML Namespace Prefix to Feature Types: No  
 ADE Schema File(s):  
 Max Attributes Per Nested Attribute: 400  
 Output File Contents  
 Character Encoding: Unicode 8-bit (utf-8)  
 Header Comments:  
 xsi:schemaLocation:  
 Restrict Curves to Polylines: Yes (Recommended)  
 Remove Auto Generated GML IDs When Possible: Yes  
 Use 'core' Namespace Prefix: Yes  
 Texture subfolder:  
 Theme name: FMETheme  
 Validation  
 Validate Output File: Yes  
 Texture  
 Preferred Texture Format: Auto  
 CityGML Options  
 Use xlink\_href Traits for Geometry References: Yes  
 SRS Parameters  
 GML srsName: urn:ogc:def:crs:crs:EPSG::28992,crs:EPSG::5109  
 GML SRS Axis Order: 1,2,3  
 Pretty Printing  
 Pretty Print: Yes  
 Indent Size: 1  
 Replace Tabs with Spaces: No  
 Help Presets OK Cancel

# CityGML writer

- **Suggestion:** turn output validation ON (at least at the beginning!)
- **GML srsName** is composed of information regarding the horizontal AND the vertical datum (we are dealing with 3D data)

– urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109

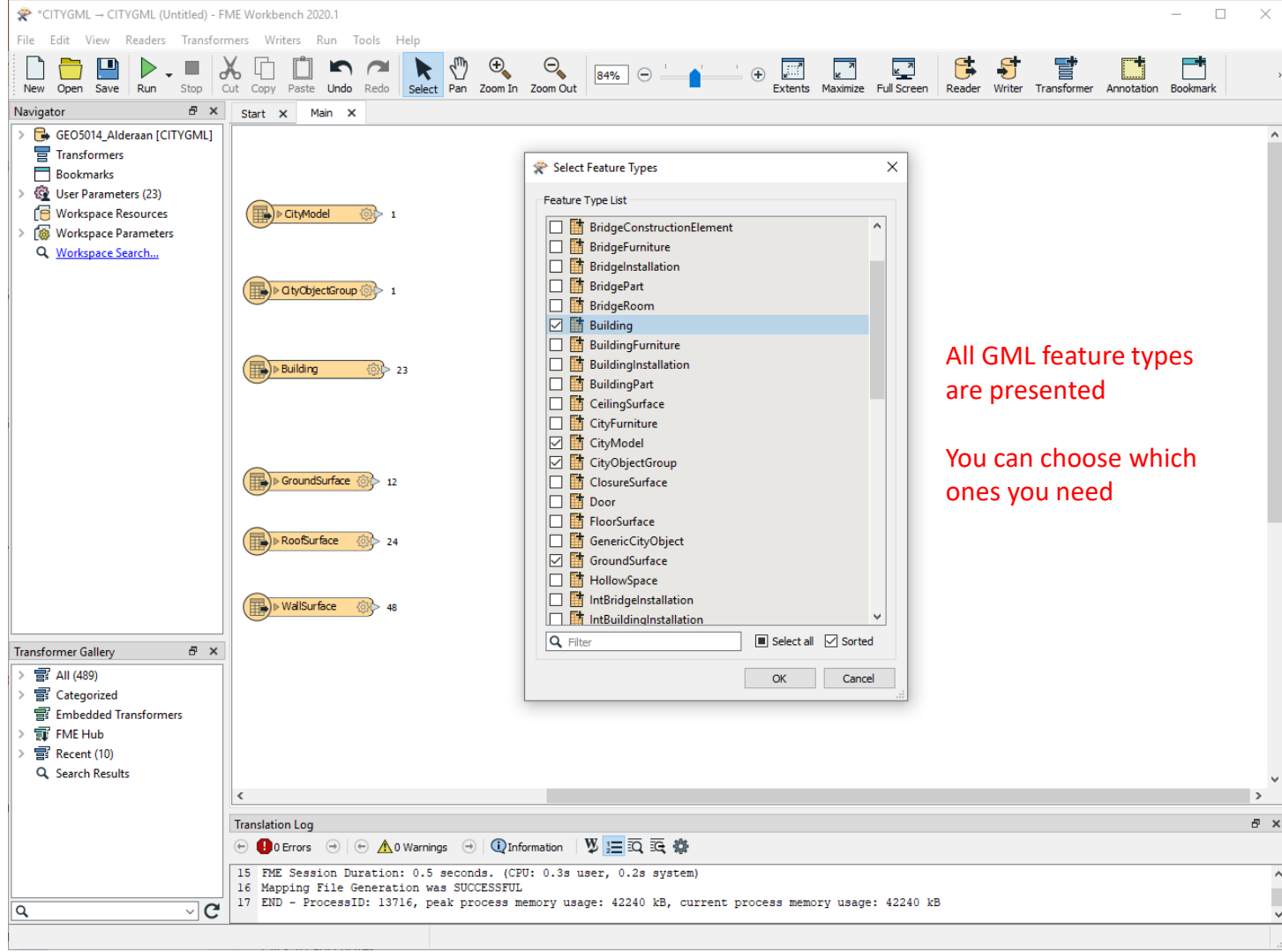


Horizontal datum  
Amersfort / RD New  
<https://epsg.io/28992>



Vertical datum  
Normaal Amsterdams Peil  
<https://epsg.io/5109-datum>

- **Pretty print** allows you to write nicely indented XML using tab spaces
  - **Suggestion:** turn it on!



\*CITYGML -> CITYGML (Untitled) - FME Workbench 2020.1  
 File Edit View Readers Transformers Writers Run Tools Help  
 New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 84% Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

Navigator  
 GEO5014\_Alderaan [CITYGML]  
 Transformers  
 Bookmarks  
 User Parameters (23)  
 Workspace Resources  
 Workspace Parameters  
 Workspace Search...

Start Main  
 CityModel 1  
 CityObjectGroup 1  
 Building 23  
 GroundSurface 12  
 RoofSurface 24  
 WallSurface 48

Select Feature Types  
 Feature Type List  
☐ BridgeConstructionElement  
☐ BridgeFurniture  
☐ BridgeInstallation  
☐ BridgePart  
☐ BridgeRoom  
☒ Building  
☐ BuildingFurniture  
☐ BuildingInstallation  
☐ BuildingPart  
☐ CeilingSurface  
☐ CityFurniture  
☒ CityModel  
☒ CityObjectGroup  
☐ ClosureSurface  
☐ Door  
☐ FloorSurface  
☐ GenericCityObject  
☒ GroundSurface  
☐ HollowSpace  
☐ IntBridgeInstallation  
☐ IntBuildingInstallation  
 Filter Select all Sorted OK Cancel

Transformer Gallery  
 All (489)  
 Categorized  
 Embedded Transformers  
 FME Hub  
 Recent (10)  
 Search Results

Translation Log  
 0 Errors 0 Warnings Information  
 15 FME Session Duration: 0.5 seconds. (CPU: 0.3s user, 0.2s system)  
 16 Mapping File Generation was SUCCESSFUL  
 17 END - ProcessID: 13716, peak process memory usage: 42240 kB, current process memory usage: 42240 kB

All GML feature types are presented

You can choose which ones you need

\*CITYGML -> CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

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Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

Navigators

- GEO5014\_Alderaan [CITYGML]
- GEO5014\_Alderaan\_out [CITYGML]
- Transformers
- Bookmarks
- User Parameters (24)
  - Published Parameters (2)
  - Private Parameters
  - FME Server Parameters (22)
- Workspace Resources
- Workspace Parameters
- Workspace Search...

Transformer Gallery

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

Start Main

CityModel 1

CityObjectGroup 1

Building 23

GroundSurface 12

RoofSurface 24

WallSurface 48

Connect...

run...

...et voilà!

Translation Log

0 Errors 0 Warnings Information

```

145 The uri-map document 'C:\Program Files\FME\xml\urimap\gml_citygml.xml' is being used to map from URI to URI
146 A <schemaLocation> in the uri-map is overriding the namespace 'http://www.w3.org/1999/xlink' xsd location from '../xlink/xlinks.xsd' to 'xlink.xsd'
147 XML Validation: '0' warning(s) found.
148 XML Validation: '0' fatal error(s) and '0' error(s) in 'D:\gagugiaro\Documents\Teaching\GEO5014-2020\Lectures\FME-CityGML\alderaan_data\GEO5014_A1
149 -----
150 Feature output statistics for 'CITYGML' writer using keyword 'CITYGML_2':
151 -----
152 Features Written
153 -----
154 Building 23
155 CityModel 1
156 CityObjectGroup 1
157 GroundSurface 12
158 RoofSurface 24
159 WallSurface 48
160 -----
161 Total Features Written 109
162 -----
163 Features Read Summary
164 -----
165 -----
166 Building 23
167 CityModel 1
168 CityObjectGroup 1
169 GroundSurface 12
170 RoofSurface 24
  
```

The validation was carried out successfully

D:\gagugiario\Documents\Teaching\GEO5014-2020\Lectures\FME-CityGML\alderaan\_data\GEO5014\_Alderaan\_out.gml - Notepad++

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

GEO5014\_Alderaan\_out.gml x GEO5014\_Alderaan.gml x

```

11 <core:cityObjectMember>
12   <bldg:Building gml:id="id_building_01">
13     <gml:description>This is Building 1</gml:description>
14     <gml:name>Snoke's Palace</gml:name>
15     <core:creationDate>2019-11-17</core:creationDate>
16     <bldg:class codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_class.xml">habitation</bldg:class>
17     <bldg:function codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_function.xml">residential building</bldg:function>
18     <bldg:yearOfConstruction>1955</bldg:yearOfConstruction>
19     <bldg:roofType codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/_AbstractBuilding_roofType.xml">gabled roof</bldg:roofType>
20     <bldg:measuredHeight uom="m">15</bldg:measuredHeight>
21     <bldg:storeysAboveGround>3</bldg:storeysAboveGround>
22     <bldg:storeysBelowGround>0</bldg:storeysBelowGround>
23     <bldg:storeyHeightsAboveGround uom="m">3</bldg:storeyHeightsAboveGround>
24     <bldg:lod0FootPrint>
25       <gml:MultiSurface gml:id="id_building_1_footprint_multisurf_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109" srsDimension="3">
26         <gml:surfaceMember>
27           <gml:OrientableSurface orientation="-">
28             <gml:baseSurface xlink:href="#id_building_1_polygon_3"/>
29           </gml:OrientableSurface>
30         </gml:surfaceMember>
31       </gml:MultiSurface>
32     </bldg:lod0FootPrint>
33     <bldg:lod1Solid>
34       <gml:Solid gml:id="id_building_01_lod1_Solid_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109" srsDimension="3">
35         <gml:exterior>
36           <gml:CompositeSurface gml:id="id_building_01_lod1_CompSurf_1">
37             <gml:surfaceMember>
38               <gml:Polygon gml:id="id_building_01_lod1_Polygon_1">
39                 <gml:exterior>
40                   <gml:LinearRing>
41                     <gml:posList>0 0 0 0 10 0 10 0 10 0 10 0 0 0 0</gml:posList>
42                   </gml:LinearRing>
43                 </gml:exterior>
44               </gml:Polygon>
45             </gml:surfaceMember>
46             <gml:surfaceMember>
47               <gml:Polygon gml:id="id_building_01_lod1_Polygon_2">
48                 <gml:exterior>
49                   <gml:LinearRing>
50                     <gml:posList>0 0 0 10 0 0 10 0 12.5 0 0 12.5 0 0 0</gml:posList>
51                   </gml:LinearRing>
52                 </gml:exterior>
53               </gml:Polygon>
54             </gml:surfaceMember>
55             <gml:surfaceMember>
56               <gml:Polygon gml:id="id_building_01_lod1_Polygon_3">
57                 <gml:exterior>
  
```

Extensible Markup Language file      length: 150,843    lines: 3,576    Ln: 1    Col: 1    Sel: 0 | 0      Unix (LF)      UTF-8      INS

INPUT

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

GE05014\_Alderaan\_out.gml GE05014\_Alderaan.gml

```

66 <core:cityObjectMember>
67   <bldg:Building gml:id="id_building_01">
68     <gml:description>This is Building 1</gml:description>
69     <gml:name>Snoke's Palace</gml:name>
70     <core:creationDate>2019-11-17</core:creationDate>
71     <!-- This is an exemplary set of generic attributes attached to a Building BEGIN -->
72     <gen:measureAttribute name="test_measure_att">
73       <gen:value uom="m^2">134.45</gen:value>
74     </gen:measureAttribute>
75     <gen:uriAttribute name="test_uri_att">
76       <gen:value>https://www.brickset.com</gen:value>
77     </gen:uriAttribute>
78     <gen:intAttribute name="test_integer_att">
79       <gen:value>12</gen:value>
80     </gen:intAttribute>
81     <gen:doubleAttribute name="test_real_att">
82       <gen:value>12.34</gen:value>
83     </gen:doubleAttribute>
84     <gen:dateAttribute name="test_date_att">
85       <gen:value>2020-08-06</gen:value>
86     </gen:dateAttribute>
87     <gen:stringAttribute name="test_string_att">
88       <gen:value>This is a test string</gen:value>
89     </gen:stringAttribute>
90     <!-- This is an exemplary set of generic attributes attached to a Building END -->
91     <bldg:class codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/ AbstractBuilding_class.xml">habitation</bldg:class>
92     <bldg:function codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/ AbstractBuilding_function.xml">residential building</bldg:function>
93     <bldg:yearOfConstruction>1955</bldg:yearOfConstruction>
94     <bldg:roofType codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/ AbstractBuilding_roofType.xml">gabled roof</bldg:roofType>
95     <bldg:measuredHeight uom="m">15</bldg:measuredHeight>
96     <bldg:storeysAboveGround>3</bldg:storeysAboveGround>
97     <bldg:storeysBelowGround>0</bldg:storeysBelowGround>
98     <bldg:storeyHeightsAboveGround uom="m">3</bldg:storeyHeightsAboveGround>
99     <bldg:lod0FootPrint>
100       <gml:MultiSurface gml:id="id_building_1_footprint_multisurf_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109" srsDimension="3">
101         <gml:surfaceMember>
102           <!-- Please not that the geometry is referenced by means of an Xlink and its orientation is reversed
103             It is referencing the polygon contained in the LoD2 GroundSurface -->
104           <gml:OrientableSurface orientation="-">
105             <gml:baseSurface xlink:href="#id_building_1_polygon_3"/>
106           </gml:OrientableSurface>
107         </gml:surfaceMember>
108       </gml:MultiSurface>
109     </bldg:lod0FootPrint>
110     <bldg:lod1Solid>
111       <gml:Solid gml:id="id_building_01_lod1_Solid_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109" srsDimension="3">
112         <gml:exterior>

```

length: 182,113 lines: 4,102 Ln: 116 Col: 37 Sel: 0 | 0 Windows (CR LF) UTF-8 INS

D:\gagugiaro\Documents\Teaching\GEO5014-2020\Lectures\FME-CityGML\data\GEO5014\_Alderaan.gml - Notepad++

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

GEO5014\_Alderaan\_out.gml GEO5014\_Alderaan.gml

```

66 <core:cityObjectMember>
67   <bldg:Building gml:id="id_building_01">
68     <gml:description>This is Building 1</gml:description>
69     <gml:name>Snoke's Palace</gml:name>
70     <!-- This is an exemplary set of generic attributes attached to a Building BEGIN -->
71     <gen:measureAttribute name="test_measure_att">
72       <gen:value uom="m^2">134.45</gen:value>
73     </gen:measureAttribute>
74     <gen:uriAttribute name="test_uri_att">
75       <gen:value>https://www.brickset.com</gen:value>
76     </gen:uriAttribute>
77     <gen:intAttribute name="test_integer_att">
78       <gen:value>12</gen:value>
79     </gen:intAttribute>
80     <gen:doubleAttribute name="test_real_att">
81       <gen:value>12.34</gen:value>
82     </gen:doubleAttribute>
83     <gen:dateAttribute name="test_date_att">
84       <gen:value>2020-08-06</gen:value>
85     </gen:dateAttribute>
86     <gen:stringAttribute name="test_string_att">
87       <gen:value>This is a test string</gen:value>
88     </gen:stringAttribute>
89     <!-- This is an exemplary set of generic attributes attached to a Building END -->
90     <bldg:class codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/AbstractBuilding_class.xml">habitation</bldg:class>
91     <bldg:function codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/AbstractBuilding_function.xml">residential building</bldg:function>
92     <bldg:yearOfConstruction>1955</bldg:yearOfConstruction>
93     <bldg:roofType codeSpace="http://www.sig3d.org/codelists/standard/building/2.0/AbstractBuilding_roofType.xml">gabled roof</bldg:roofType>
94     <bldg:measuredHeight uom="m">15</bldg:measuredHeight>
95     <bldg:storeysAboveGround>3</bldg:storeysAboveGround>
96     <bldg:storeysBelowGround>0</bldg:storeysBelowGround>
97     <bldg:storeyHeightsAboveGround uom="m">3</bldg:storeyHeightsAboveGround>
98     <bldg:lod0FootPrint>
99       <gml:MultiSurface gml:id="id_building_1_footprint_multisurf_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109" srsDimension="3">
100         <gml:surfaceMember>
101           <!-- Please not that the geometry is referenced by means of an Xlink and its orientation is reversed
102             It is referencing the polygon contained in the LoD2 GroundSurface -->
103           <gml:OrientableSurface orientation="-">
104             <gml:baseSurface xlink:href="#id_building_1_polygon_3"/>
105           </gml:OrientableSurface>
106         </gml:surfaceMember>
107       </gml:MultiSurface>
108     </bldg:lod0FootPrint>
109     <bldg:lod1Solid>
110       <gml:Solid gml:id="id_building_01_lod1_Solid_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109" srsDimension="3">
111       <gml:exterior>
  
```

Literally... *lost in translation!*

The generic attributes have not been written to the new file

extensible Markup Language file

length: 182,113 lines: 4,102 Ln: 116 Col: 37 Sel: 0 | 0 Windows (CR LF) UTF-8 INS

\*CITYGML -- CITYGML (untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 79%

Extents Maximize Full Screen Reader Writer

Navigators

- GEOS014\_Alderaan [CI...
- GEOS014\_Alderaan\_out...
- Transformers
- Bookmarks
- User Parameters (24)
  - Published Parameter...
  - Private Parameters
  - FME Server Paramet...
  - Workspace Resources
  - Workspace Parameters
  - [Workspace Search...](#)

Transformer Gallery

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

CityObjectGroup

Building

Feature Type

Parameters User Attributes Format Attributes

Attribute Definition

☐ Automatic ☒ Manual ☐ Dynamic

Name	Type	Wid...	Precisi...	Val...
citygml_stores_above_ground	xml_uint64			
citygml_stores_below_ground	xml_uint64			
citygml_storey_heights_above_g...	xml_buffer			
citygml_storey_heights_above_g...	xml_buffer			
citygml_storey_heights_below_g...	xml_buffer			
citygml_storey_heights_below_g...	xml_buffer			
citygml_outer_building_installati...	xml_buffer			
citygml_interior_building_install...	xml_buffer			
citygml_bounded_by(){xlink_href	xml_buffer			
citygml_level_of_detail()	xml_buffer			
citygml_interior_room(){xlink_href	xml_buffer			
citygml_consists_of_building.pa...	xml_buffer			
citygml_address(){xlink_href	xml_buffer			
test_date_att	citygml_date			
test_integer_att	xml_int32			
test_measure_att	xml_real32			
test_measure_att_units	xml_buffer			
test_real_att	xml_real32			
test_string_att	xml_buffer			
test_uri_att	citygml_uri			

You have to add them to the writer manually, and define the proper data type

Help Apply to... OK Cancel

CityObjectGroup

Building

citygml\_target\_uri  
citygml\_ure\_role  
citygml\_tr\_name  
citygml\_attr\_val  
gml\_description  
gml\_name  
citygml\_tionDate  
citygml\_tionDate  
external\_ct\_name  
external\_jact.uri  
external\_rSystem  
citygml\_xlink\_href  
citygml\_xlink\_href  
citygml\_xlink\_href  
citygml\_class  
citygml\_deSpace  
citygml\_function()  
citygml\_usage()  
citygml\_deSpace  
citygml\_truction  
citygml\_molition  
citygml\_roof\_type  
citygml\_deSpace  
citygml\_height  
citygml\_ht\_units  
citygml\_ground  
citygml\_ground  
citygml\_d\_units  
citygml\_ground  
citygml\_d\_units  
citygml\_d\_units  
citygml\_xlink\_href  
citygml\_xlink\_href  
citygml\_detail()  
citygml\_xlink\_href  
citygml\_xlink\_href  
citygml\_xlink\_href  
test\_date\_att  
test\_integer\_att  
test\_measure\_att  
test\_measure\_att\_units  
test\_real\_att  
test\_string\_att  
test\_uri\_att  
gml\_id  
gml\_parent\_id

D:\gugugiara\Documents\Lectures\FME-CityGML\alderaan\_data\GEO5014\_Alderaan\_out.gml - Notepad++

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

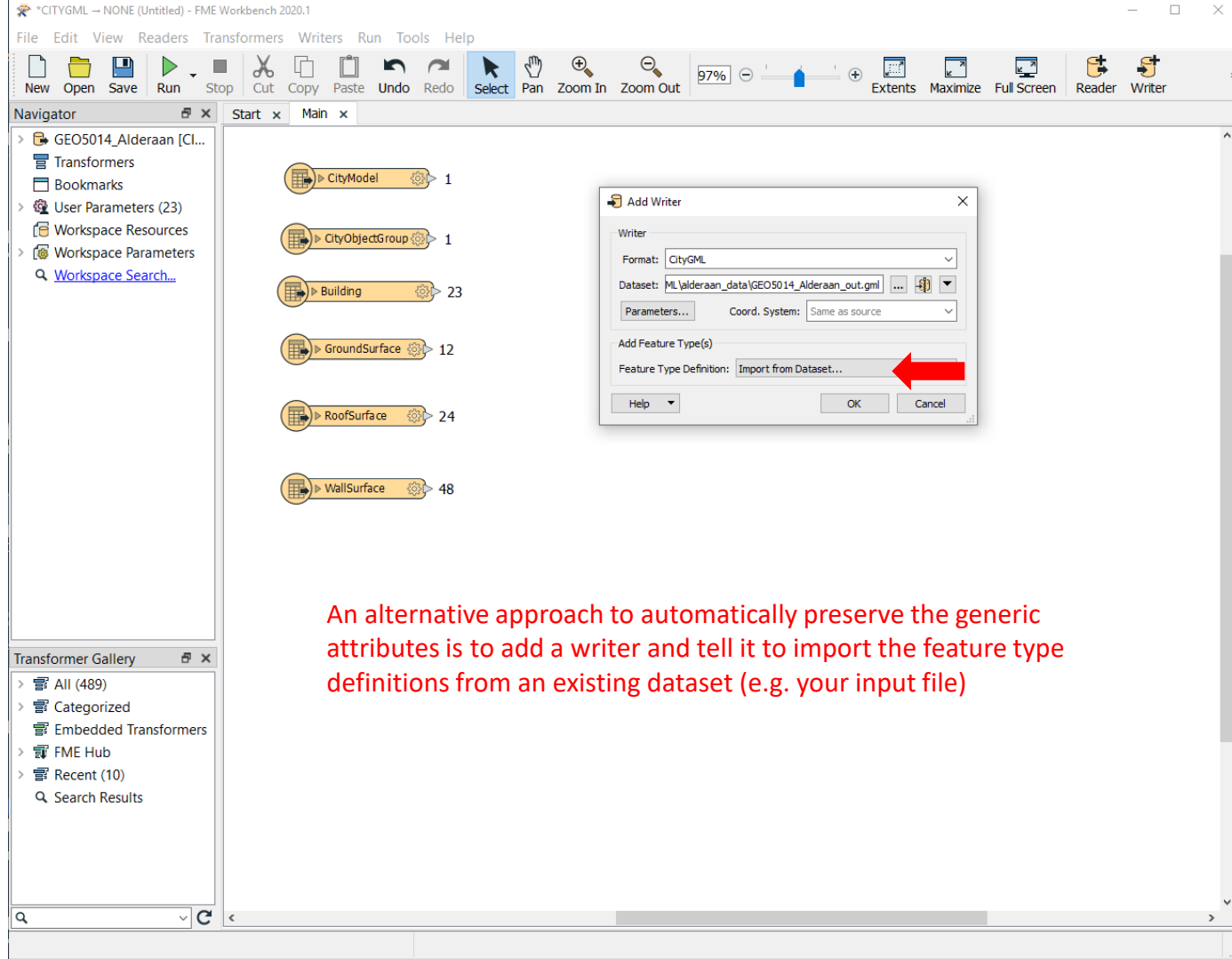
GEO5014\_Alderaan\_out.gml GEO5014\_Alderaan.gml

```

11 <core:cityObjectMember>
12 <bldg:Building gml:id="id_building_01">
13 <gml:description>This is Building 1</gml:description>
14 <gml:name>Snoke's Palace</gml:name>
15 <core:creationDate>2019-11-17</core:creationDate>
16 <gen:dateAttribute name="test_date_att">
17 <gen:value>2020-08-06</gen:value>
18 </gen:dateAttribute>
19 <gen:intAttribute name="test_integer_att">
20 <gen:value>12</gen:value>
21 </gen:intAttribute>
22 <gen:measureAttribute name="test_measure_att">
23 <gen:value uom="m^2">134.45</gen:value>
24 </gen:measureAttribute>
25 <gen:doubleAttribute name="test_real_att">
26 <gen:value>12.34</gen:value>
27 </gen:doubleAttribute>
28 <gen:stringAttribute name="test_string_att">
29 <gen:value>This is a test string</gen:value>
30 </gen:stringAttribute>
31 <gen:uriAttribute name="test_uri_att">
32 <gen:value>https://www.brickset.com</gen:value>
33 </gen:uriAttribute>
34 <bldg:class codeSpace="http://www.sig3d.org/codelist/standard/building/2.0/_AbstractBuilding_class.xml">habitation</bldg:class>
35 <bldg:function codeSpace="http://www.sig3d.org/codelist/standard/building/2.0/_AbstractBuilding_function.xml">residential
    building</bldg:function>
36 <bldg:yearOfConstruction>1955</bldg:yearOfConstruction>
37 <bldg:roofType codeSpace="http://www.sig3d.org/codelist/standard/building/2.0/_AbstractBuilding_roofType.xml">gabled roof
    </bldg:roofType>
38 <bldg:measuredHeight uom="m">15</bldg:measuredHeight>
39 <bldg:storeysAboveGround>3</bldg:storeysAboveGround>
40 <bldg:storeysBelowGround>0</bldg:storeysBelowGround>
41 <bldg:storeyHeightsAboveGround uom="m">3</bldg:storeyHeightsAboveGround>
42 <bldg:lod0FootPrint>
43 <gml:MultiSurface gml:id="id_building_1_footprint_multisurf_1" srsName="urn:ogc:def:crs,crs:EPSG::28992,crs:EPSG::5109"
    srsDimension="3">
44 <gml:surfaceMember>
45 <gml:OrientableSurface orientation="-">
46 <gml:baseSurface xlink:href="#id_building_1_polygon_3"/>
47 </gml:OrientableSurface>
48 </gml:surfaceMember>
49 </gml:MultiSurface>
50 </bldg:lod0FootPrint>
  
```

The generic attributes are back!

Extensible Markup Language file | length: 151,514 | lines: 3,594 | Ln: 57 | Col: 46 | Sel: 0 | 0 | Unix (LF) | UTF-8 | INS



\*CITYGML -> NONE (Untitled) - FME Workbench 2020.1  
 File Edit View Readers Transformers Writers Run Tools Help  
 New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 97% Extents Maximize Full Screen Reader Writer  
 Navigator  
 Start x Main x  
 > GEO5014\_Alderaan [CI...  
 Transformers  
 Bookmarks  
 > User Parameters (23)  
 Workspace Resources  
 > Workspace Parameters  
 > [Workspace Search...](#)  
 CityModel 1  
 CityObjectGroup 1  
 Building 23  
 GroundSurface 12  
 RoofSurface 24  
 WallSurface 48  
 Transformer Gallery  
 > All (489)  
 > Categorized  
 Embedded Transformers  
 > FME Hub  
 > Recent (10)  
 Search Results  
 Add Writer  
 Writer  
 Format: CityGML  
 Dataset: ML\alderaan\_data\GEO5014\_Alderaan\_out.gml  
 Parameters... Coord. System: Same as source  
 Add Feature Type(s)  
 Feature Type Definition: Import from Dataset...  
 Help OK Cancel

An alternative approach to automatically preserve the generic attributes is to add a writer and tell it to import the feature type definitions from an existing dataset (e.g. your input file)

\*CITYGML -> CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 97% Extents Maximize Full Screen Reader Writer

**Navigator**

- > GEO5014\_Alderaan (Cl...
- Transformers
- Bookmarks
- > User Parameters (23)
- Workspace Resources
- > Workspace Parameters
- Workspace Search...

CityModel 1

CityObjectGroup 1

Building 23

GroundSurface 12

RoofSurface 24

WallSurface 48

**Transformer Gallery**

- > All (489)
- > Categorized
- Embedded Transformers
- > FME Hub
- > Recent (10)
- Search Results

**Import Writer Feature Types**

Reader

Format: CityGML

Dataset: CityGML\alderaan\_data\GEO5014\_Alderaan\_out.gml

Parameters...

Coord. System: Read from source

Help OK Cancel

**Select File**

< > << >> FME-CityGML > alderaan\_data Search alderaan\_data

Organize New folder

Name	Date modified	Type
GEO5014_Alderaan.gml	07/08/2020 08:58	GML File
GEO5014_Alderaan_out.gml	18/08/2020 21:24	GML File
GEO5014_PowerAlderaan_20200805.gml	05/08/2020 15:39	GML File

File name: GEO5014\_Alderaan.gml CityGML Files (\*.gml \*.xml \*.gz)

Open Cancel

\*CITYGML - CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 97%

Extents Maximize Full Screen Reader Writer

Navigators

- Start x Main x
- CityModel
- CityObjectGroup
- Building
- GroundSurface
- RoofSurface
- WallSurface

Transformer Gallery

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

Feature Type

Parameters User Attributes Format Attributes

Attribute Definition

☐ Automatic ☒ Manual ☐ Dynamic

Name	Type	Wid...	Preci...	Val...
citygml_storeys_below_ground	xml_uint64			
citygml_storey_heights_above_g...	xml_buffer			
citygml_storey_heights_above_g...	xml_buffer			
citygml_storey_heights_below_g...	xml_buffer			
citygml_storey_heights_below_g...	xml_buffer			
citygml_outer_building_installati...	xml_buffer			
citygml_interior_building_install...	xml_buffer			
citygml_bounded_by{}.xlink_href	xml_buffer			
citygml_level_of_detail{}	xml_buffer			
citygml_interior_room{}.xlink_href	xml_buffer			
citygml_consists_of_building_pa...	xml_buffer			
citygml_address{}.xlink_href	xml_buffer			
test_date_att	xml_buffer			
test_integer_att	xml_buffer			
test_measure_att	xml_buffer			
test_measure_att_units	xml_buffer			
test_real_att	xml_buffer			
test_string_att	xml_buffer			
test_uri_att	xml_buffer			

CityModel

CityObjectGroup

Building

- gml\_id
- gml\_parent\_id
- citygml\_target\_uri
- citygml\_ure\_role
- citygml\_tr\_name
- citygml\_atr\_val
- gml\_description
- gml\_name
- citygml\_tionDate
- citygml\_tionDate
- external\_name
- external\_jecturi
- external\_nSystem
- citygml\_ink\_href
- citygml\_terrain
- citygml\_o\_water
- citygml\_ink\_href
- citygml\_class
- citygml\_despace
- citygml\_function{}
- citygml\_despace
- citygml\_usage{}
- citygml\_despace
- citygml\_truction
- citygml\_molition
- citygml\_roof\_type
- citygml\_despace
- citygml\_height
- citygml\_ht\_units
- citygml\_ground
- citygml\_ground
- citygml\_ground
- citygml\_d\_units
- citygml\_ground
- citygml\_d\_units
- citygml\_ink\_href

The generic attributes are added automatically to the writer, BUT THE DATA TYPES still need to be adjusted manually

BEWARE: The default value (xml\_buffer) will generate only STRINGS

# CityGML in FME: good habits 2

Sample dataset

Introduction

Good habits

Reading CityGML

Writing CityGML

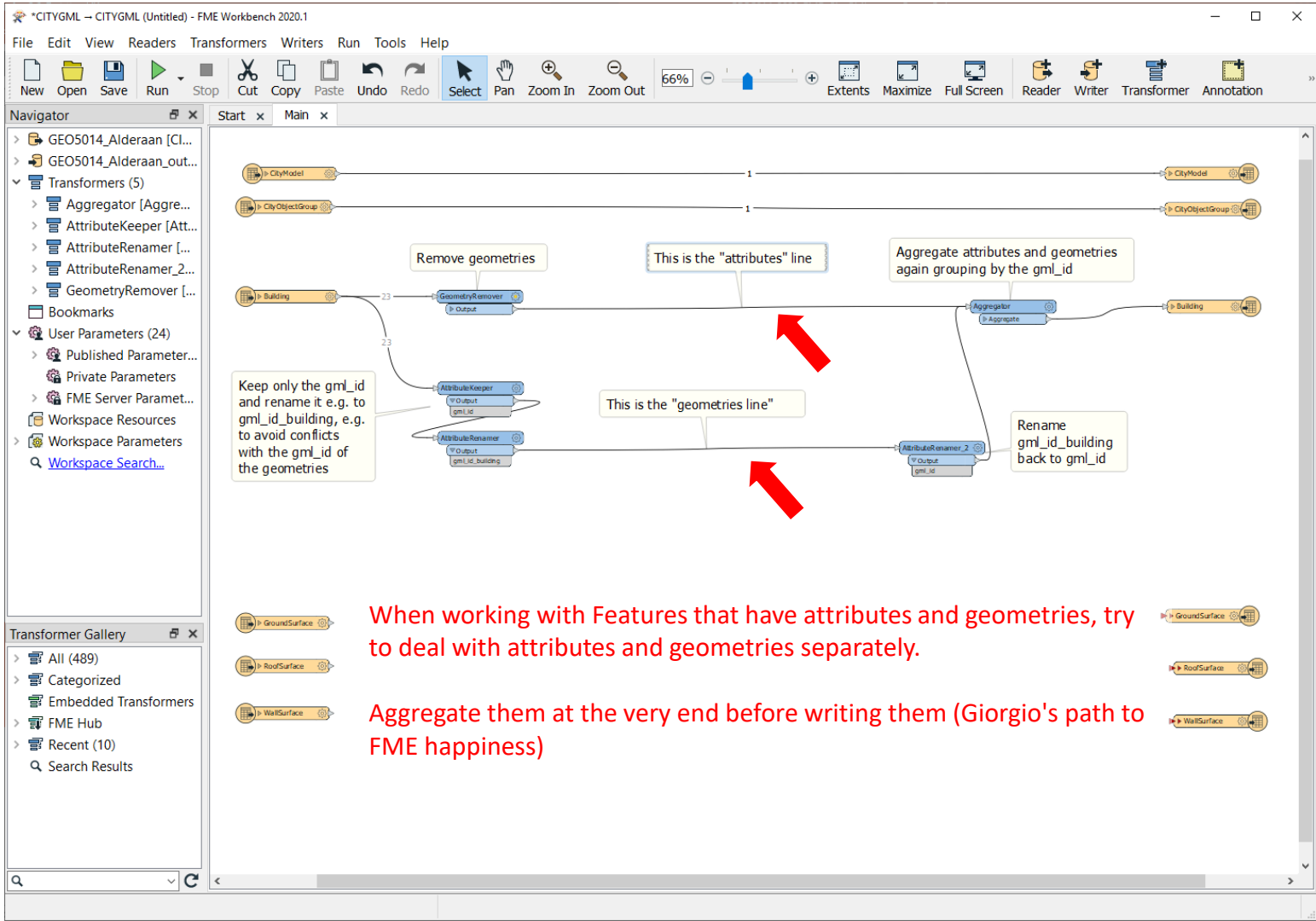
**Good habits 2**

Appearances

Implicit Geometries

ADEs

- When working with Features that have attributes and geometries, try to deal with attributes and geometries separately, and aggregate them at the very end before writing them
  - Not an official approach, just Giorgio's path to (FME) happiness 😊
- In order to separate different geometries associated to the same feature (e.g. a building), you can disaggregate and filter them, and afterwards aggregate them again
- You can extract geometry properties/traits with a **GeometryPropertyExtractor**. They will be added as normal attributes
- You can set geometry properties/traits with a **GeometryPropertySetter**. Refer to the UML diagrams to find out the exact value of the *citygml\_lod\_name* attribute.
- You can group transformers in order to reduce chaos in the workbench
- Do not be stingy on **GeometryValidators**! They help "cleaning up" and correcting issues in geometries



\*CITYGML -- CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 81% Extents Maximize Full Screen Reader Writer Transformer Annotation

**Navigator**

- GEOS014\_Alderaan [CI...]
- GEOS014\_Alderaan\_out...
- Transformers (9)
  - Aggregator [Aggre...]
  - AreaCalculator [Are...]
  - AttributeFilter [Attri...]
  - AttributeKeeper [Att...]
  - AttributeRenamer [...]
  - AttributeRenamer\_2...
  - Deagggregator [Dea...]
  - Deagggregator\_Dea...
  - GeometryRemover [...]
- Bookmarks
- User Parameters (24)
  - Published Parameter...
  - Private Parameters
  - FME Server Paramet...
  - Workspace Resources
  - Workspace Parameters
  - [Workspace Search...](#)

**Transformer Gallery**

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- [Search Results](#)

**Workflow Diagram:**

- Remove geometries:** Building (23) → GeometryRemover (23) → Output (23)
- Deaggregate geometries:** GeometryRemover (23) → AttributeKeeper (23) → AttributeRenamer (23) → Deagggregator (23) → Deagggregator\_Deagggregated (46)
- Filter them:** Deagggregator\_Deagggregated (46) → AttributeFilter (23) → AreaCalculator (23) → AttributeRenamer\_2 (23) → Output (23)
- Aggregate attributes and geometries again grouping by the gml\_id:** AttributeRenamer\_2 (23) → Aggregator (46) → Output (1)
- Rename gml\_id\_building back to gml\_id:** AttributeRenamer\_2 (23) → Output (23)

**Deagggregator Parameters:**

Transformer: Deagggregator

Parameters:

- Mode: Flatten One Level
- Split Composites: No
- Explode Instances: No

**Flatten:**

- Part Number Attribute: [Empty]
- Attribute Accumulation:
  - List Attribute to Explode: No List Attributes Available
  - Accumulation Mode: Merge List Attributes
  - Conflict Resolution: Use List Attribute Values
  - Prefix: [Empty]
- Geometry Name Attribute: \_geometry\_name

**Annotations:**

- Keep only the gml\_id and rename it e.g. to gml\_id\_building, e.g. to avoid conflicts with the gml\_id of the geometries
- This is the "attributes" line
- Aggregate attributes and geometries again grouping by the gml\_id
- Rename gml\_id\_building back to gml\_id

**Red Text:**

In order to separate different geometries associated to the same feature (e.g. a building), you can deaggregate and filter them using the **\_geometry\_name** attribute generated by the **Deagggregator**

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control

- View 1 (46)
  - Inspector [FFS] (46)
    - Deaggregator\_Deaggregated (46)

View 1 X

Feature Information

Property	Value
fme_geometry (string)	fme_aggregate
fme_type (string)	fme_solid
gml_id_building (encoded: UTF-16LE)	id_building_01
IFMEBRepSolid	0 Inner Surfaces
Name (encoded: UTF-16LE)	lod1Solid
Geometry Traits (4)	
citygml_level_of_detail (encode...	1
citygml_lod_name (encoded: UTF-16LE)	lod1Solid
gml_geometry (encoded: UTF-16LE)	Solid
gml_id (encoded: UTF-16LE)	id_building_01_lod1_Solid_1
Front Appearance Reference	<inherited_or_default_appearance>
Back Appearance Reference	<inherited_or_default_appearance>
Outer Surface: IFMECompositeSurfa...	
Name (encoded: UTF-16LE)	exterior
Geometry Traits (3)	
citygml_lod_name (encode...	exterior
gml_geometry (encoded: UTF-16LE)	CompositeSurface
gml_id (encoded: UTF-16LE)	id_building_01_lod1_CompSurf_1

Features Selected: 2 of 2

Table View

Inspector [FFS] - Deaggregator\_Deaggregated Columns...

	gml_id_building	_geometry_name
1	id_building_01	lod0FootPrint
2	id_building_01	lod1Solid
3	id_building_02	lod0FootPrint
4	id_building_02	lod1Solid
5	id_building_03	lod0FootPrint
6	id_building_03	lod1Solid
7	id_building_04	lod0FootPrint
8	id_building_04	lod1Solid
9	id_building_05	lod0FootPrint
10	id_building_05	lod1Solid
11	id_building_06	lod0FootPrint
12	id_building_06	lod1Solid
13	id_building_07	lod0FootPrint
14	id_building_07	lod1Solid
15	id_building_08	lod0FootPrint
16	id_building_08	lod1Solid

Example:  
For each building, two geometries have been extracted, corresponding to the lod0Footprint and the lod1Solid

2 selected / 46 row(s)

X: Y: EPSG:28992 METER

\*CITYGML -- CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 81% Extents Maximize Full Screen Reader Writer Transformer Annotation

**Navigator**

- > GEO5014\_Alderaan [CI...
- > GEO5014\_Alderaan\_out...
- > Transformers (10)
  - > Aggregator [Aggre...
  - > AreaCalculator [Are...
  - > AttributeFilter [Attri...
  - > AttributeKeeper [Att...
  - > AttributeRenamer [...]
  - > AttributeRenamer\_2...
  - > Deaggregator [Dea...
  - > GeometryPropertyE...
  - > GeometryPropertyE...
  - > GeometryRemover [...]
- > Bookmarks
- > User Parameters (24)
  - > Published Parameter...
  - > Private Parameters
  - > FME Server Paramet...
  - > Workspace Resources
  - > Workspace Parameters
  - > [Workspace Search...](#)

**Transformer Gallery**

- > All (489)
- > Categorized
- > Embedded Transformers
- > FME Hub
- > Recent (10)
- > Search Results

**Start Main**

**Remove geometries**

**Deaggregate geometries**

**Filter them**

**Aggregate attributes and geometries again grouping by the gml\_id**

**Rename gml\_id\_building back to gml\_id**

**Extract geometry traits**

**Keep only the gml\_id and rename it e.g. to gml\_id\_building, e.g. to avoid conflicts with the gml\_id of the geometries**

**This is the "attributes" line**

**GeometryPropertyExtractor Parameters**

Transformer: **GeometryPropertyExtractor**

Geometry Part Selection: <All parts>

Parameters:

Property to Extract: Traits

Geometry Name Attribute:

Prefix Extracted Trait with Geometry Name: No

Trait to Extract	<input type="checkbox"/> Extract Traits as List
<input checked="" type="checkbox"/> gml_id	<input type="checkbox"/>
<input type="checkbox"/> citygml_lod_name	<input type="checkbox"/>

Help Presets OK Cancel

**You can extract geometry traits with a GeometryPropertyExtractor.**

**They will be added as normal attributes**

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background

Display Control

- View 2 (46)
- inspector [FFS] (46)
  - GeometryPropertyExtractor... (46)

View 1 View 2

Feature Information

Property	Value
Feature Type	GeometryPropertyExtractor_Extracted
Coordinate System	EPSG:28992
Dimension	3D
Number of Vertices	52
Min Extents	0, 0, 0
Max Extents	10, 10, 12.5
Attributes (7)	
_geometry_name (string)	lod1Solid
citygml_lod_name (encode...	lod1Solid
fme_feature_type (string)	Building
fme_geometry (string)	fme_aggregate
fme_type (string)	fme_solid
gml_id (encoded: UTF-16LE)	id_building_01_lod1_Solid_1
gml_id_building (encode...	id_building_01
IFMEBRepSolid	0 Inner Surfaces
Name (encoded: UTF-16LE)	lod1Solid
Geometry Traits (4)	
citygml level of det...	1

Features Selected: 2 of 2

Table View

inspector [FFS] - GeometryPropertyExtractor\_Extracted

	gml_id_building	_geometry_name	gml_id	citygml_lod_name
1	id_building_01	lod0FootPrint	id_building_1_footprint_multisurf_1	lod0FootPrint
2	id_building_01	lod1Solid	id_building_01_lod1_Solid_1	lod1Solid
3	id_building_02	lod0FootPrint	id_building_2_footprint_multisurf_1	lod0FootPrint
4	id_building_02	lod1Solid	id_building_02_lod1_Solid_2	lod1Solid
5	id_building_03	lod0FootPrint	id_building_3_footprint_multisurf_1	lod0FootPrint
6	id_building_03	lod1Solid	id_building_03_lod1_Solid_3	lod1Solid
7	id_building_04	lod0FootPrint	id_building_4_footprint_multisurf_1	lod0FootPrint
8	id_building_04	lod1Solid	id_building_04_lod1_Solid_4	lod1Solid
9	id_building_05	lod0FootPrint	id_building_5_footprint_multisurf_1	lod0FootPrint
10	id_building_05	lod1Solid	id_building_05_lod1_Solid_5	lod1Solid
11	id_building_06	lod0FootPrint	id_building_6_footprint_multisurf_1	lod0FootPrint
12	id_building_06	lod1Solid	id_building_06_lod1_Solid_6	lod1Solid
13	id_building_07	lod0FootPrint	id_building_7_footprint_multisurf_1	lod0FootPrint
14	id_building_07	lod1Solid	id_building_07_lod1_Solid_7	lod1Solid
15	id_building_08	lod0FootPrint	id_building_8_footprint_multisurf_1	lod0FootPrint
16	id_building_08	lod1Solid	id_building_08_lod1_Solid_8	lod1Solid

2 selected / 46 row(s)

X: ..... Y: ..... EPSG:28992 METER

CITYGML - CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 68% Extents Maximize Full Screen Reader Writer Transformer Annotation

Navigators Start Main

- GEO5014\_Alderaan [CI...
- GEO5014\_Alderaan\_out...
- Transformers (9)
  - Aggregator [Aggre...
  - AreaCalculator [Are...
  - AttributeFilter [Attri...
  - AttributeKeeper [Att...
  - AttributeRenamer [...]
  - AttributeRenamer\_2...
  - Deaggregator [Dea...
  - GeometryPropertyE...
  - GeometryRemover [...]
- Bookmarks (1)
- User Parameters (24)
  - Published Parameter...
  - Private Parameters
  - FME Server Paramet...
  - Workspace Resources
  - Workspace Parameters
  - [Workspace Search...](#)

Transformer Gallery

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

CityModel 1 CityObjectGroup 1

Building 23

Remove geometries

GeometryRemover

Output

23

This is the "attributes" line

Aggregate attributes and geometries again grouping by the gml\_id

Aggregator

Aggregate

1

Building

Geometry operations

AttributeKeeper

Output

gml\_id

23

AttributeRenamer

Output

gml\_id\_building

23

Deaggregate geometries

Deaggregator

Deaggregated

gml\_id\_building

geometry\_name

46

Filter them

AttributeFilter

Empty

Missing

Null

Unfiltered

IsOfFeature

gml\_id\_building

geometry\_name

gml\_id

citygml\_id\_name

IsSolid

23

AreaCalculator

Output

gml\_id\_building

geometry\_name

gml\_id

citygml\_id\_name

ground5...acofna

23

Rename gml\_id\_building back to gml\_id

AttributeRenamer\_2

Output

gml\_id

geometry\_name

citygml\_id\_name

ground5...acofna

23

Keep only the gml\_id and rename it e.g. to gml\_id\_building, e.g. to avoid conflicts with the gml\_id of the geometries

GeometryPropertyExtractor

Extracted

gml\_id\_building

geometry\_name

gml\_id

citygml\_id\_name

Unmatched

Rejected

46

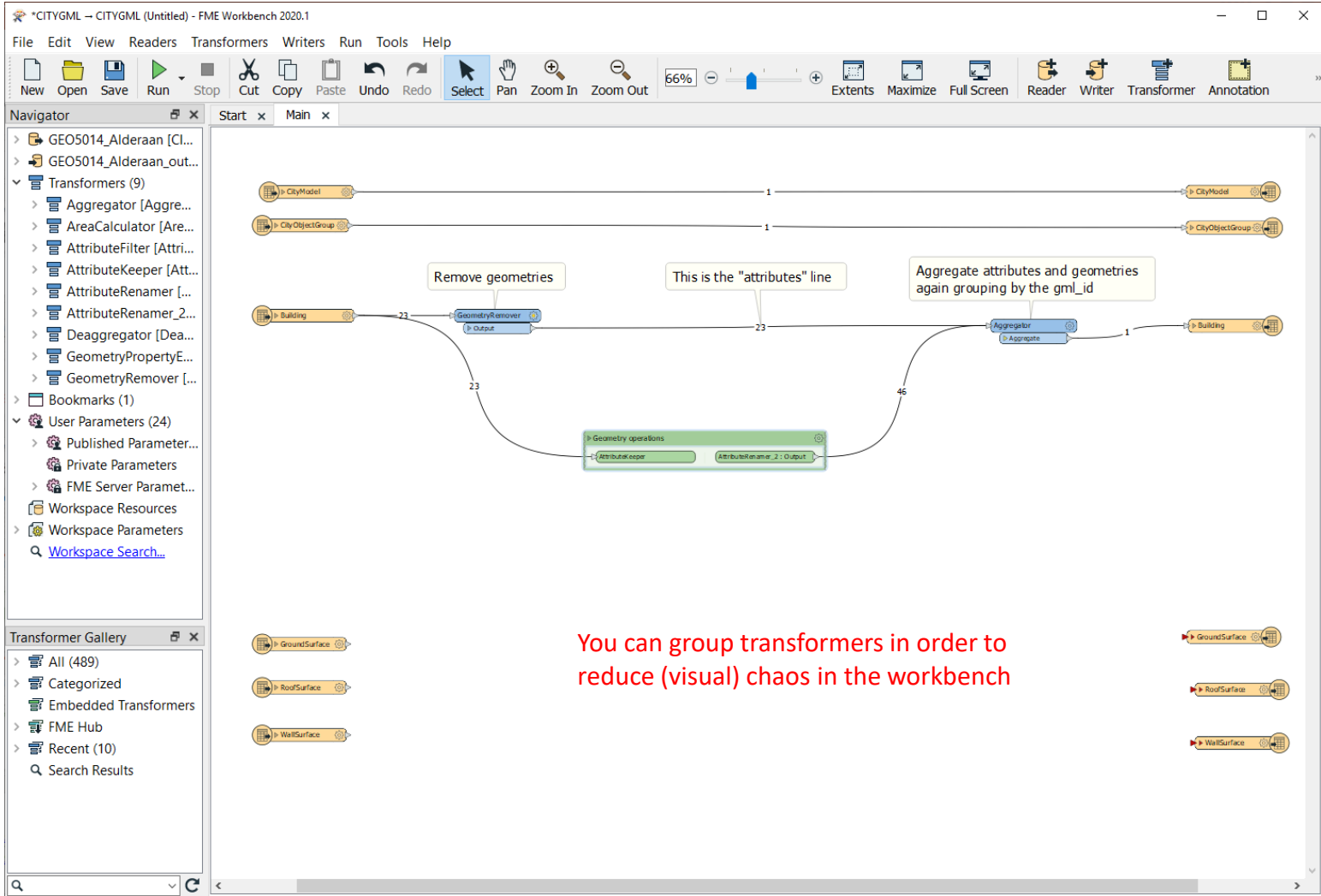
Extract geometry traits

GroundSurface

RoofSurface

WallSurface

You can group transformers in order to reduce (visual) chaos in the workbench



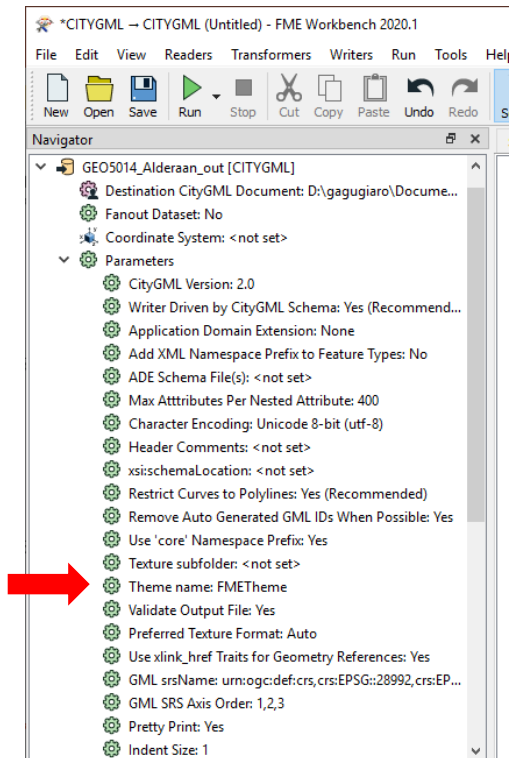
Sample dataset  
Introduction  
Good habits  
Reading CityGML  
Writing CityGML  
Good habits 2  
**Appearances**  
Implicit Geometries  
ADEs

# CityGML Appearances in FME

# Appearances in FME

Sample dataset  
Introduction  
Good habits  
Reading CityGML  
Writing CityGML  
Good habits 2  
**Appearances**  
Implicit Geometries  
ADEs

- To remove an existing appearance you use an **AppearanceRemover**, to add an appearance you use the **AppearanceSetter**; the **AppearanceStyler** gives you additional options
- If you are working with data that has no pre-existing appearance, and you want just one Appearance object, FME will take care of it automatically.
  - You can set the parameter Theme Name (default: *FMETheme*)
- If you are working with data that has one pre-existing appearance, and you want to keep it, FME will take care of it automatically
- If you are working with data that has two or more pre-existing appearances, FME will take only the first one by default. All the other will be lost, unless you "manually" load the **Appearance** and **X3DMaterial** (and/or **ParametrizedTexture** and/or **GeoreferencedTexture**) writers (see later)



# Appearances in FME

- FME generally creates global appearances by default
- Appearance, X3DMaterial, ParametrizedTexture and GeoreferencedTexture are **GML Features!** So
  - You still deal with them with *gml\_id*, *parent\_id*, *citygml\_feature\_role*, and possibly *attribute\_name\_xlink\_href* attributes!
- Check the UML diagrams for reference

Sample dataset

Introduction

Good habits

Reading CityGML

Writing CityGML

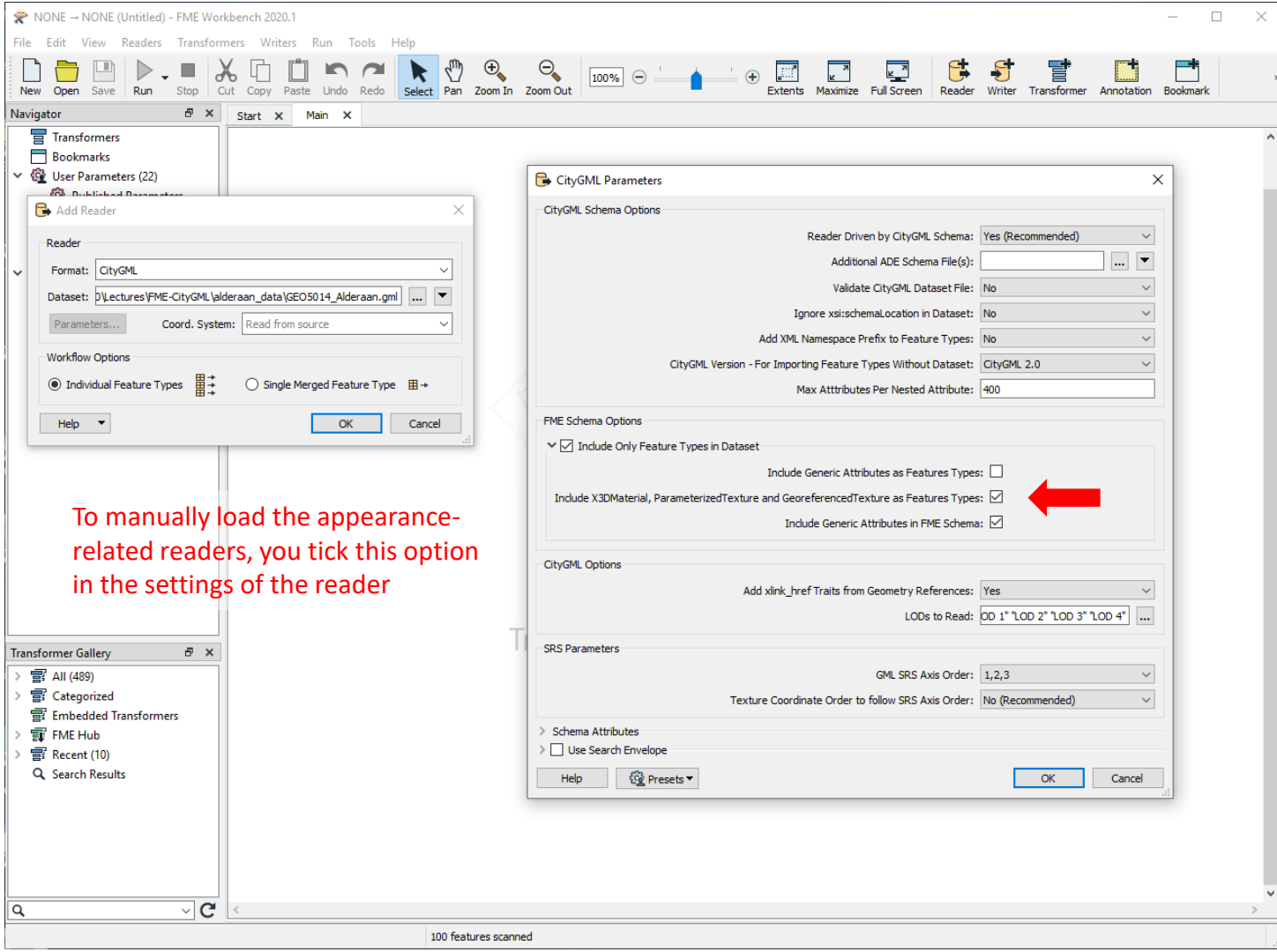
Good habits 2

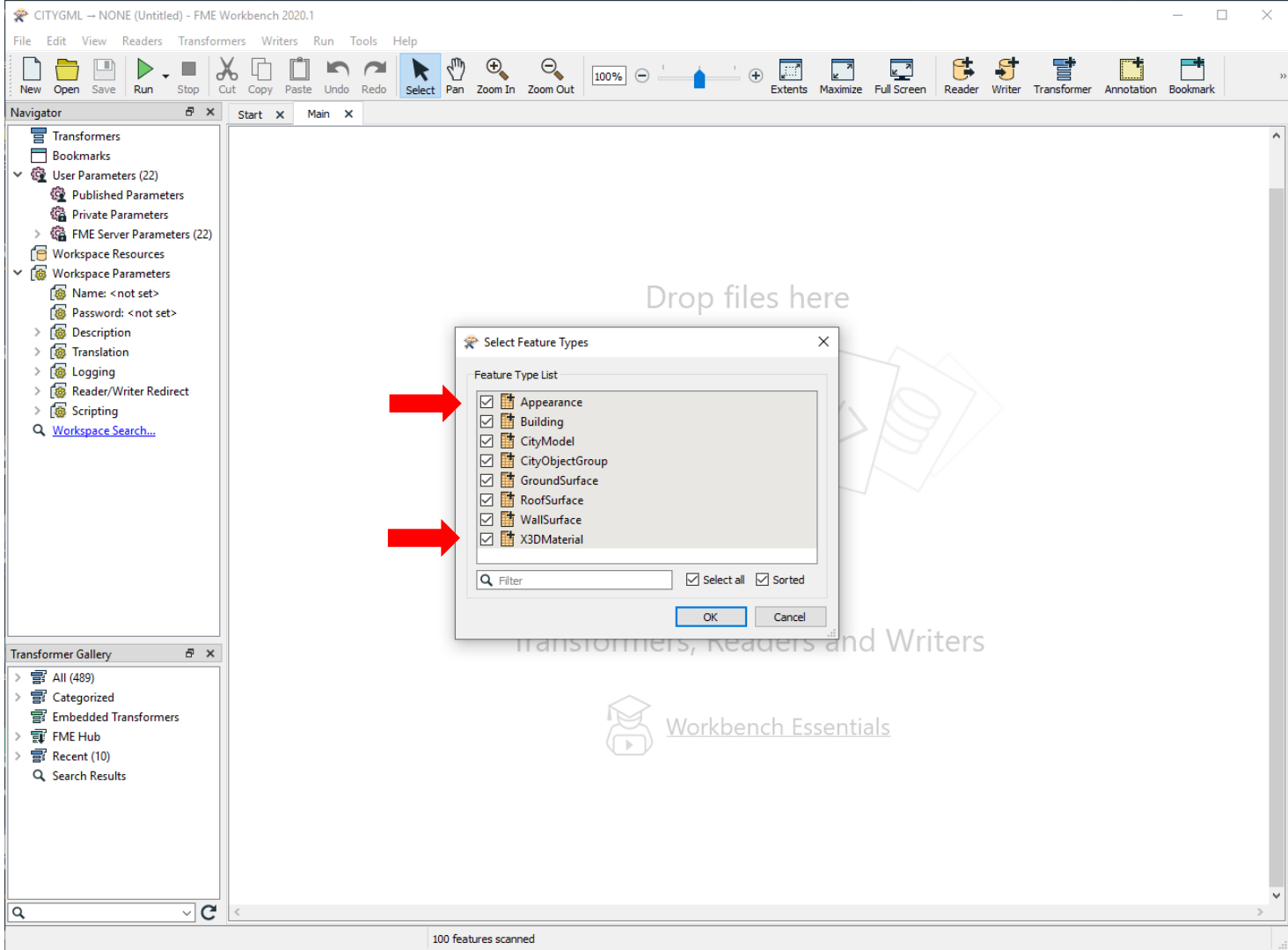
**Appearances**

Implicit Geometries

ADEs

To manually load the appearance-related readers, you tick this option in the settings of the reader





\*CITYGML -> CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 100%

Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

**Navigator**

- Fanout Dataset: No
- Coordinate System: <not set>
- Parameters
  - CityGML Version: 2.0
  - Writer Driven by CityGML Schema: Yes (Recommend...)
  - Application Domain Extension: None
  - Add XML Namespace Prefix to Feature Types: No
  - ADE Schema File(s): <not set>
  - Max Attributes Per Nested Attribute: 400
  - Character Encoding: Unicode 8-bit (utf-8)
  - Header Comments: <not set>
  - xs:schemaLocation: <not set>
  - Restrict Curves to Polylines: Yes (Recommended)
  - Remove Auto Generated GML IDs When Possible: Yes
  - Use 'core' Namespace Prefix: Yes
  - Texture subfolder: <not set>
  - Theme name: FMETheme
  - Validate Output File: Yes
  - Preferred Texture Format: Auto
  - Use xlink:href Traits for Geometry References: Yes
  - GML srsName: urn:ogc:def:crs:EPSG::28992,crs:EP...
  - GML SRS Axis Order: 1,2,3
  - Pretty Print: No
  - Indent Size: 1
  - Replace Tabs with Spaces: No
- Feature Types (8)

**Transformer Gallery**

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

**Start Main**

CityModel 1 CityModel

CityObjectGroup 1 CityObjectGroup

Building 23 Building

GroundSurface 12 GroundSurface

RoofSurface 24 RoofSurface

WallSurface 48 WallSurface

Appearance 4 Appearance

X3DMaterial 10 X3DMaterial

Appearance

X3DMaterial

Create a new workspace

FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background Add Background Map

Display Control

View 2 (14)

- inspector [FFS] (14)
  - Appearance (4)
  - X3DMaterial (10)

inspector [FFS] - Appearance

	gml_id	gml_parent_id	citygr	citygr	citygr	citygr	gml_descript	gml_name	citygml_theme
1	Appearance_Buildings_LoD0	<missing>	http...	<mi...	<mi...	<mi...	This appea...	Alderaan LoD0 Buildin...	LoD0_buildings
2	Appearance_Buildings_LoD1	<missing>	http...	<mi...	<mi...	<mi...	This appea...	Alderaan LoD1 Buildin...	LoD1_buildings
3	Appearance_Buildings_LoD2	<missing>	http...	<mi...	<mi...	<mi...	This appea...	Alderaan LoD2 Buildin...	LoD2_buildings
4	Appearance_Ancillary_Buildings	<missing>	http...	<mi...	<mi...	<mi...	This appea...	Alderaan Ancillary Buil...	Ancillary_buildings

Feature Information

Property Value

Feature Type Appearance

Coordinate System EPSG:28992

Dimension 2D

Number of Vertices 0

Min Extents nan, nan

Max Extents nan, nan

Attributes (12)

citygml\_target\_uri ... http://www.opengis.net/citygml/appearance/2.0 ...

citygml\_theme (encode... LoD0\_buildings

fme\_feature\_type (string) Appearance

fme\_type (string) fme\_no\_geom

gml\_description ... This appearance defines the colours of the LoD0...

gml\_id (encode... Appearance\_Buildings\_LoD0

gml\_name (encode... Alderaan LoD0 buildings appearance

multi\_reader\_full\_id (... 0

multi\_reader\_id (32 ... 0

multi\_reader\_keywo... CITYGML\_1

multi\_reader\_type (string) CITYGML

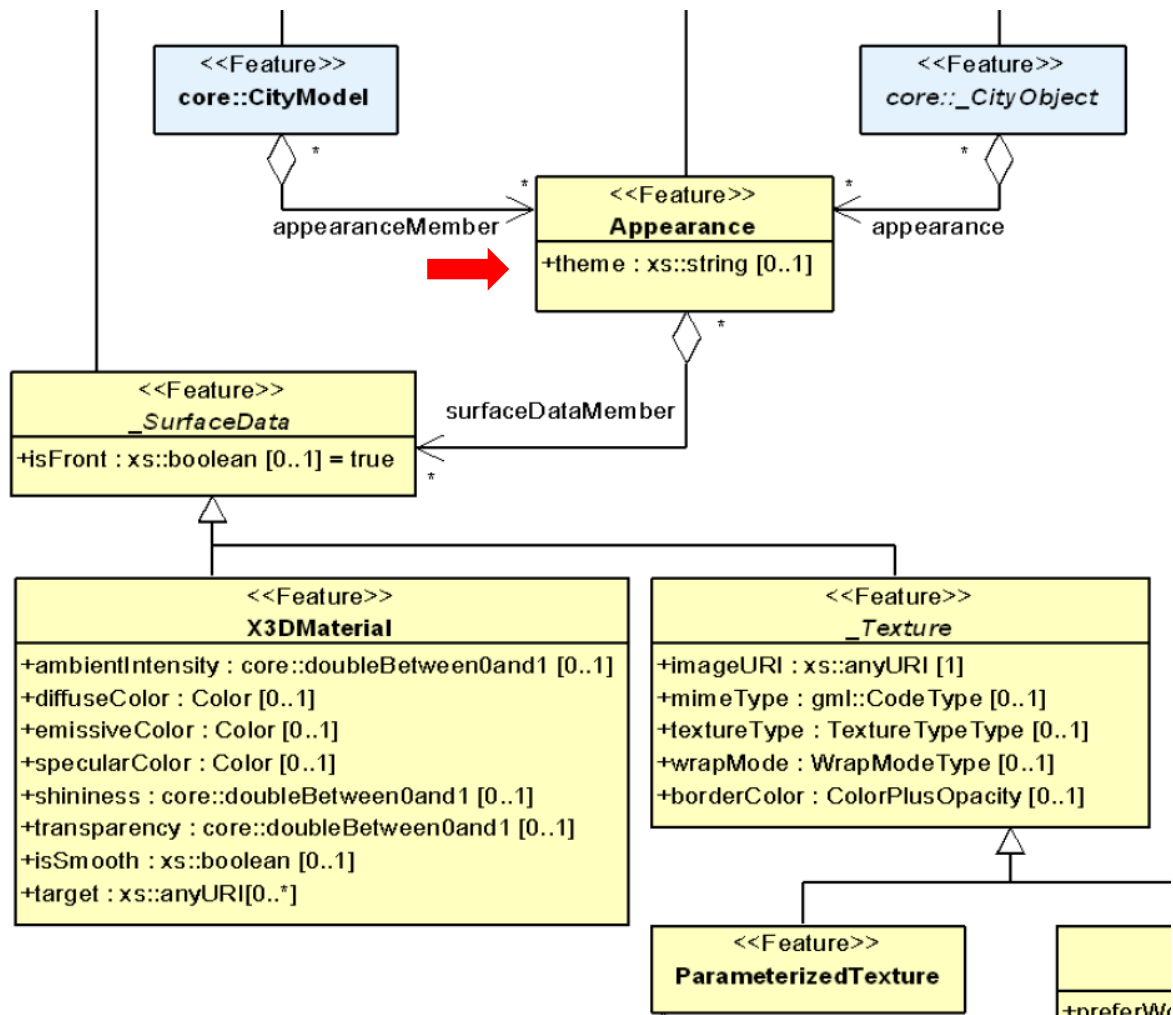
xml\_type (string) xml\_no\_geom

IFEMENULL

1 selected / 4 row(s)

Features Selected: 1 of 1 4

X: ..... Y: ..... EPSG:28992 METER



FME Data Inspector - 2020.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background Add Background Map

Display Control View 2 (14)

- Inspector [FFS] (14)
  - Appearance (4)
    - X3DMaterial (10)

Inspector [FFS] - X3DMaterial

Appearance X X3DMaterial X

	gml_id	gml_parent_id	citygm	citygml_feature_role	citygr	citygr	gml_d	gml_nar
1	id_SurfaceData_Footprint_Gray_FRONT	Appearance_Buildings_LoD0	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
2	id_SurfaceData_Footprint_Gray_BACK	Appearance_Buildings_LoD0	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
3	id_SurfaceData_LoD1_Gray_FRONT	Appearance_Buildings_LoD1	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
4	id_SurfaceData_LoD1_Gray_BACK	Appearance_Buildings_LoD1	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
5	id_SurfaceData_GroundWallSurface_White_FRONT	Appearance_Buildings_LoD2	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
6	id_SurfaceData_GroundWallSurface_White_BACK	Appearance_Buildings_LoD2	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
7	id_SurfaceData_RoofSurface_Red_FRONT	Appearance_Buildings_LoD2	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
8	id_SurfaceData_RoofSurface_Red_BACK	Appearance_Buildings_LoD2	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
9	id_SurfaceData_AncillaryBuildings_Gray_FRONT	Appearance_Ancillary_Buildings	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD
10	id_SurfaceData_AncillaryBuildings_Gray_BACK	Appearance_Ancillary_Buildings	http...	surfaceDataMember	<mi...	<mi...	<mi...	SurfaceD

The *citygml\_target* attribute is a list containing the xlinks to the gml\_ids of the geometries

**Remember:** Xlinks are prefixed with #

Feature Information

Property Value

Feature Type X3DMaterial

Coordinate System EPSG:28992

Dimension 2D

Number of Vertices 0

Min Extents nan, nan

Max Extents nan, nan

Attributes (26)

citygml\_diffuse\_color 0.854 0.854 0.854

citygml\_feature\_role surfaceDataMember

citygml\_is\_front true

citygml\_target\_uri http://www.opengis.net/citygml/appearance/2.0

citygml\_target(0) ... #id\_building\_1\_footprint\_multisurf\_1

citygml\_target(1) ... #id\_building\_2\_footprint\_multisurf\_1

citygml\_target(2) ... #id\_building\_3\_footprint\_multisurf\_1

citygml\_target(3) ... #id\_building\_4\_footprint\_multisurf\_1

citygml\_target(4) ... #id\_building\_5\_footprint\_multisurf\_1

citygml\_target(5) ... #id\_building\_6\_footprint\_multisurf\_1

citygml\_target(6) ... #id\_building\_7\_footprint\_multisurf\_1

citygml\_target(7) ... #id\_building\_8\_footprint\_multisurf\_1

citygml\_target(8) ... #id\_building\_9\_footprint\_multisurf\_1

citygml\_target(9) ... #id\_building\_10\_footprint\_multisurf\_1

citygml\_target(10) ... #id\_building\_11\_footprint\_multisurf\_1

citygml\_target(11) ... #id\_building\_12\_footprint\_multisurf\_1

fme\_feature\_type (string) X3DMaterial

fme\_type (string) fme\_no\_geom

gml\_id (encode...) id\_SurfaceData\_Footprint\_Gray\_FRONT

gml\_name (encode...) id\_SurfaceData\_Footprint\_Gray\_FRONT

gml\_parent\_id (encode...) Appearance\_Buildings\_LoD0

multi\_reader\_full\_id (0)

multi\_reader\_id (32) 0

multi\_reader\_keywo... CITYGML\_1

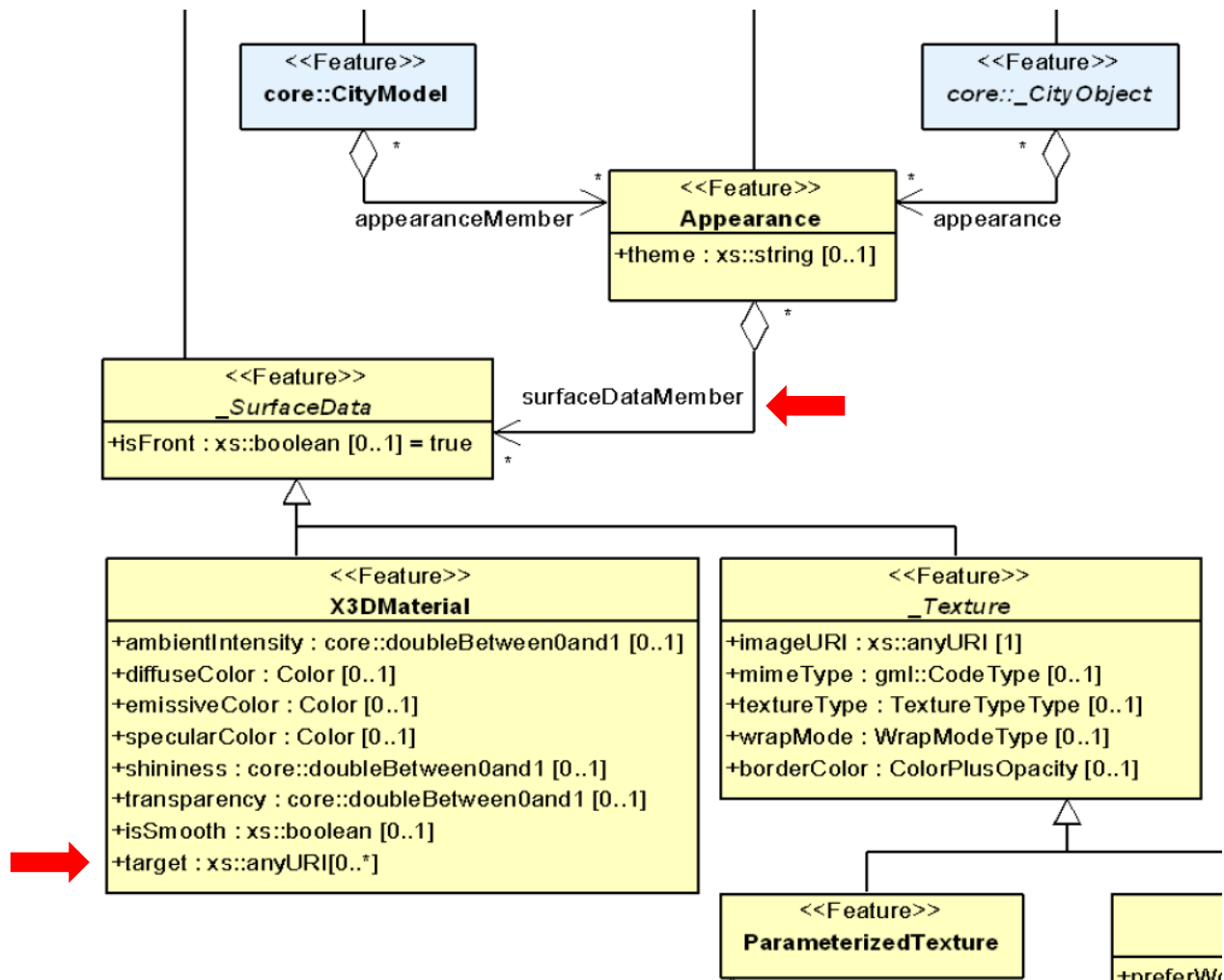
multi\_reader\_type (string) CITYGML

xml\_type (string) xml\_no\_geom

IFMENULL

Features Selected: 1 of 1

X: EPSG:28992 Y: EPSG:28992 METER



\*CITYGML -> CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 97%

Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

**Navigator**

GEO5014\_Alderaan\_out [CITYGML]

- Destination CityGML Document: D:\gagugiaro\Docume...
- Fanout Dataset: No
- Coordinate System: <not set>
- Parameters
  - CityGML Version: 2.0
  - Writer Driven by CityGML Schema: Yes (Recommend...
  - Application Domain Extension: None
  - Add XML Namespace Prefix to Feature Types: No
  - ADE Schema File(s): <not set>
  - Max Attributes Per Nested Attribute: 400
  - Character Encoding: Unicode 8-bit (utf-8)
  - Header Comments: <not set>
  - xs:schemaLocation: <not set>
  - Restrict Curves to Polylines: Yes (Recommended)
  - Remove Auto Generated GML IDs When Possible: Yes
  - Use 'core' Namespace Prefix: Yes
  - Texture subfolder: <not set>
  - Theme name: FMETHeme
  - Validate Output File: Yes
  - Preferred Texture Format: Auto
  - Use xlink\_href Traits for Geometry References: Yes
  - GML srsName: urn:ogc:def:crs:crs:EPSG::28992,crs:EP...
  - GML SRS Axis Order: 1,2,3
  - Pretty Print: Yes
  - Indent Size: 1

**Transformer Gallery**

All (489)  
 Categorized  
 Embedded Transformers  
 FME Hub  
 Recent (10)  
 Search Results

**Start Main**

CityModel 1 CityModel

CityObjectGroup 1 CityObjectGroup

Building 23 AppearanceRemover  
 Output  
 Unmatched  
 <Rejected>

GroundSurface 12 Appeara...mover\_2  
 Output  
 Unmatched  
 <Rejected>

RoofSurface 24 Appeara...mover\_3  
 Output  
 Unmatched  
 <Rejected>

WallSurface 48 Appeara...mover\_4  
 Output  
 Unmatched  
 <Rejected>

Appearance 4 Appearance  
 Appearance

X3DMaterial 10 X3DMaterial  
 X3DMaterial

In case of multiple appearances, FME reads the first one and assigns it per default to the features. You have to remove it (Appearance remover) and...

\*CITYGML -> CITYGML (Untitled) - FME Workbench 2020.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 97%

Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark

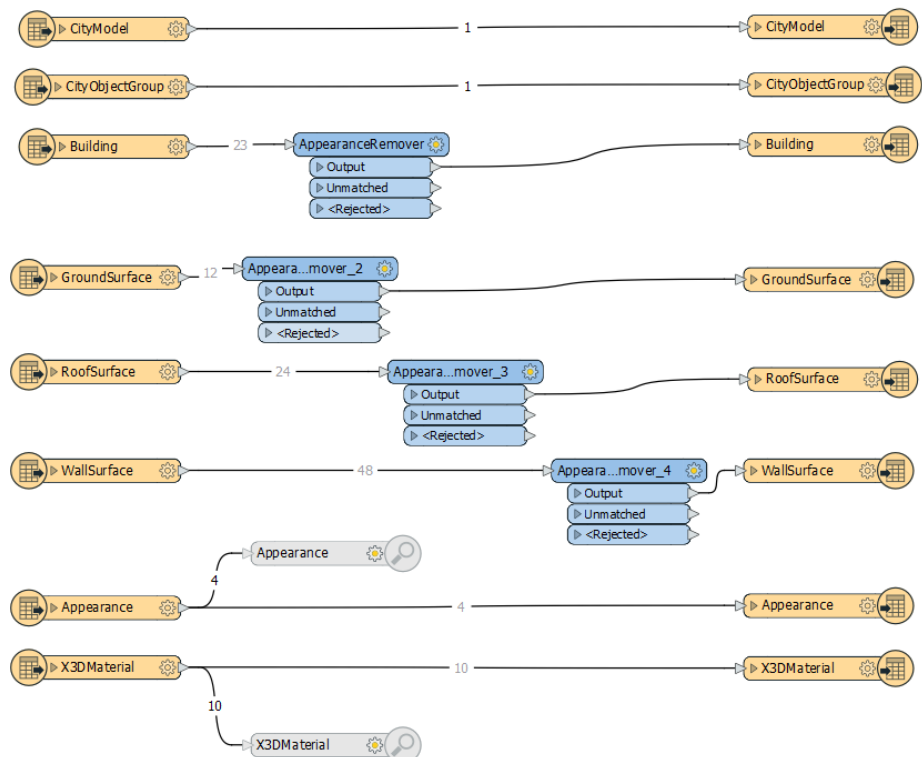
**Navigitor**

- ADE Schema File(s): <not set>
- Max Attributes Per Nested Attribute: 400
- Character Encoding: Unicode 8-bit (utf-8)
- Header Comments: <not set>
- xsis:schemaLocation: <not set>
- Restrict Curves to Polylines: Yes (Recommended)
- Remove Auto Generated GML IDs When Possible: Yes
- Use 'core' Namespace Prefix: Yes
- Texture subfolder: <not set>
- Theme name: FMTheme
- Validate Output File: Yes
- Preferred Texture Format: Auto
- Use xlink\_href Traits for Geometry References: Yes
- GML srsName: urn:ogc:def:crs:EPSG::28992,crs:EP...
- GML SRS Axis Order: 1,2,3
- Pretty Print: Yes
- Indent Size: 1
- Replace Tabs with Spaces: No
- Feature Types (8)
- Transformers (6)
  - Appearance [Inspector]
  - AppearanceRemover [AppearanceRemover]
  - AppearanceRemover\_2 [AppearanceRemover]
  - AppearanceRemover\_3 [AppearanceRemover]
  - AppearanceRemover\_4 [AppearanceRemover]
  - X3DMaterial [Inspector]

**Transformer Gallery**

- All (489)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

**Start Main**



CityModel 1 CityModel

CityObjectGroup 1 CityObjectGroup

Building 23 AppearanceRemover

GroundSurface 12 AppearanceRemover\_2

RoofSurface 24 AppearanceRemover\_3

WallSurface 48 AppearanceRemover\_4

Appearance 4 Appearance

X3DMaterial 10 X3DMaterial

Output Unmatched <Rejected>

...let the Appearance and X3DMaterial readers/writers do their job

<Rejected>

Sample dataset  
Introduction  
Good habits  
Reading CityGML  
Writing CityGML  
Good habits 2  
Appearances  
**Implicit  
Geometries**  
ADEs

# CityGML Implicit Geometries in FME

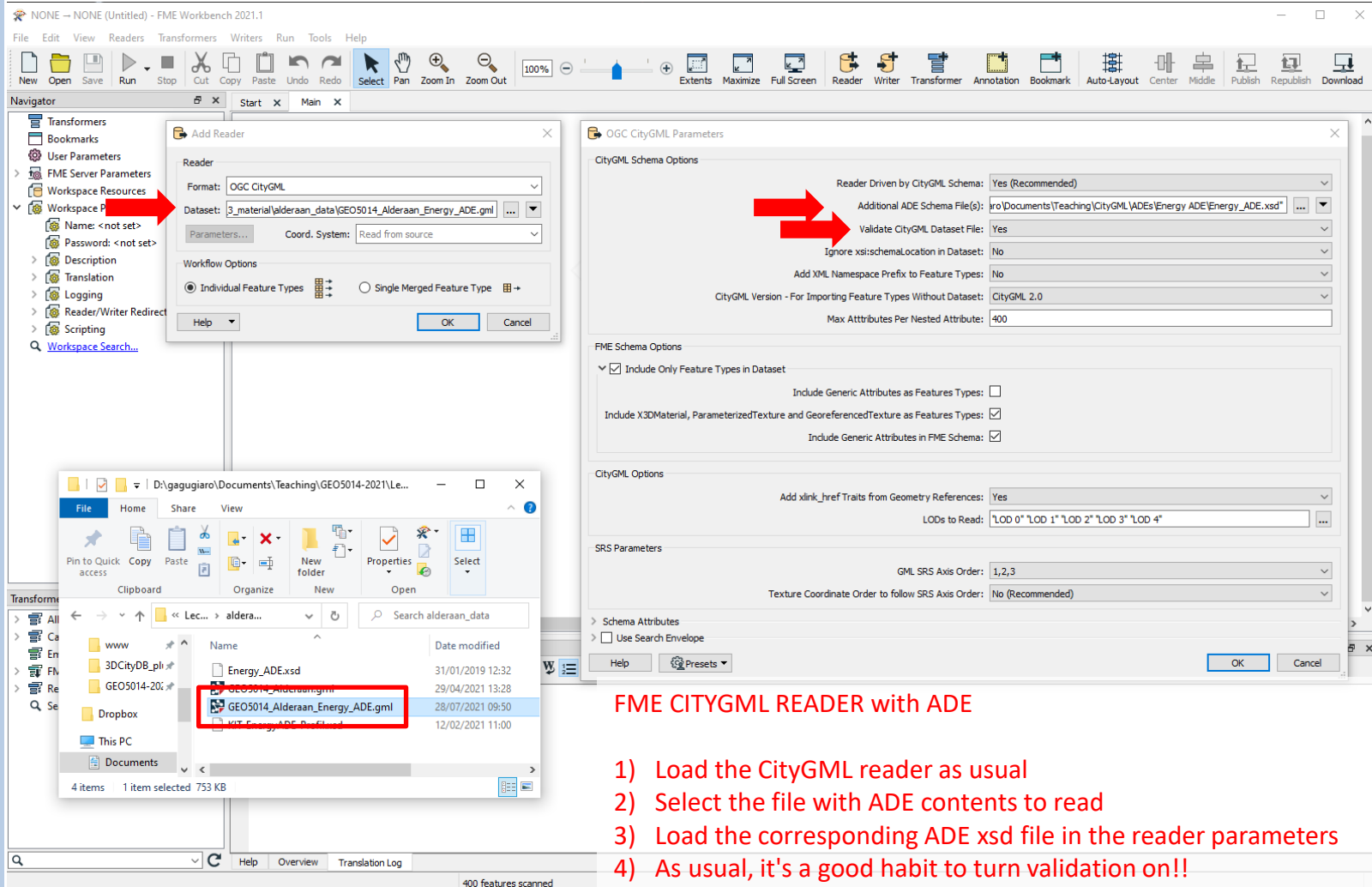
This section is still work in progress and will be added in future

Sample dataset  
Introduction  
Good habits  
Reading CityGML  
Writing CityGML  
Good habits 2  
Appearances  
Implicit Geometries  
**ADEs**

# CityGML ADEs in FME

# CityGML ADEs in FME

- FME supports CityGML Application Domain Extensions (ADE)
- To read and write ADE contents, FME needs the **xsd file** of the corresponding ADE
- Both the CityGML reader and writer allow to select one (or more) xsd files, i.e. it is possible to work with multiple ADEs at the same time
- In principle, the same rules apply as with standard CityGML:
  - All new ADE classes that are derived from a **GML Feature** class are mapped to the corresponding reader and writer
  - Classes that extend existing CityGML classes via the so-called ADE-hook mechanism are "merged" with the corresponding CityGML reader/writer
    - For example: Energy ADE \_AbstractBuilding properties are merged to those of standard Building or BuildingPart readers and writers



**OGC CityGML Parameters**

CityGML Schema Options

Reader Driven by CityGML Schema: Yes (Recommended)

Additional ADE Schema File(s): I:\Documents\Teaching\CityGML\ADEs\Energy\_ADE\Energy\_ADE.xsd

Validate CityGML Dataset File: Yes

Ignore xsi:schemaLocation in Dataset: No

Add XML Namespace Prefix to Feature Types: No

CityGML Version - For Importing Feature Types Without Dataset: CityGML 2.0

Max Attributes Per Nested Attribute: 400

FME Schema Options

Include Only Feature Types in Dataset: ☒

Include Generic Attributes as Features Types: ☐

Include X3DMaterial, ParameterizedTexture and GeoreferencedTexture as Features Types: ☒

Include Generic Attributes in FME Schema: ☒

CityGML Options

Add xlink\_href Traits from Geometry References: Yes

LODs to Read: LOD 0" LOD 1" LOD 2" LOD 3" LOD 4"

SRS Parameters

GML SRS Axis Order: 1,2,3

Texture Coordinate Order to follow SRS Axis Order: No (Recommended)

Schema Attributes

Use Search Envelope: ☐

Help Presets

OK Cancel

**FME CITYGML READER with ADE**

- 1) Load the CityGML reader as usual
- 2) Select the file with ADE contents to read
- 3) Load the corresponding ADE xsd file in the reader parameters
- 4) As usual, it's a good habit to turn validation on!!

CITYGML - NONE (Untitled) - FME Workbench 2021.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 100% Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark Auto-Layout Center Middle Publish Republish Download

Navigator

- Transformers
- Bookmarks
- User Parameters
- FME Server Parameters
- Workspace Resources
- Workspace Parameters
  - Name: <not set>
  - Password: <not set>
  - Description
  - Translation
  - Logging
  - Reader/Writer Redirect
  - Scripting
- Workspace Search...

Transformer Gallery

- All (496)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

Select Feature Types

Feature Type List

- ☒ Appearance
- ☒ Building
- ☒ CityModel
- ☒ Construction
- ☒ DHWFacilities
- ☒ ElectricalAppliances
- ☒ EnergyDemand
- ☒ GroundSurface
- ☒ Household
- ☒ Layer
- ☒ LayerComponent
- ☒ LightingFacilities
- ☒ Occupants
- ☒ RoofSurface
- ☒ SolidMaterial
- ☒ ThermalBoundary
- ☒ ThermalOpening
- ☒ ThermalZone
- ☒ UsageZone
- ☒ WallSurface
- ☒ WeatherStation
- ☒ X3DMaterial

Q Filter ☒ Select all ☒ Sorted

OK Cancel

Translation Log

```

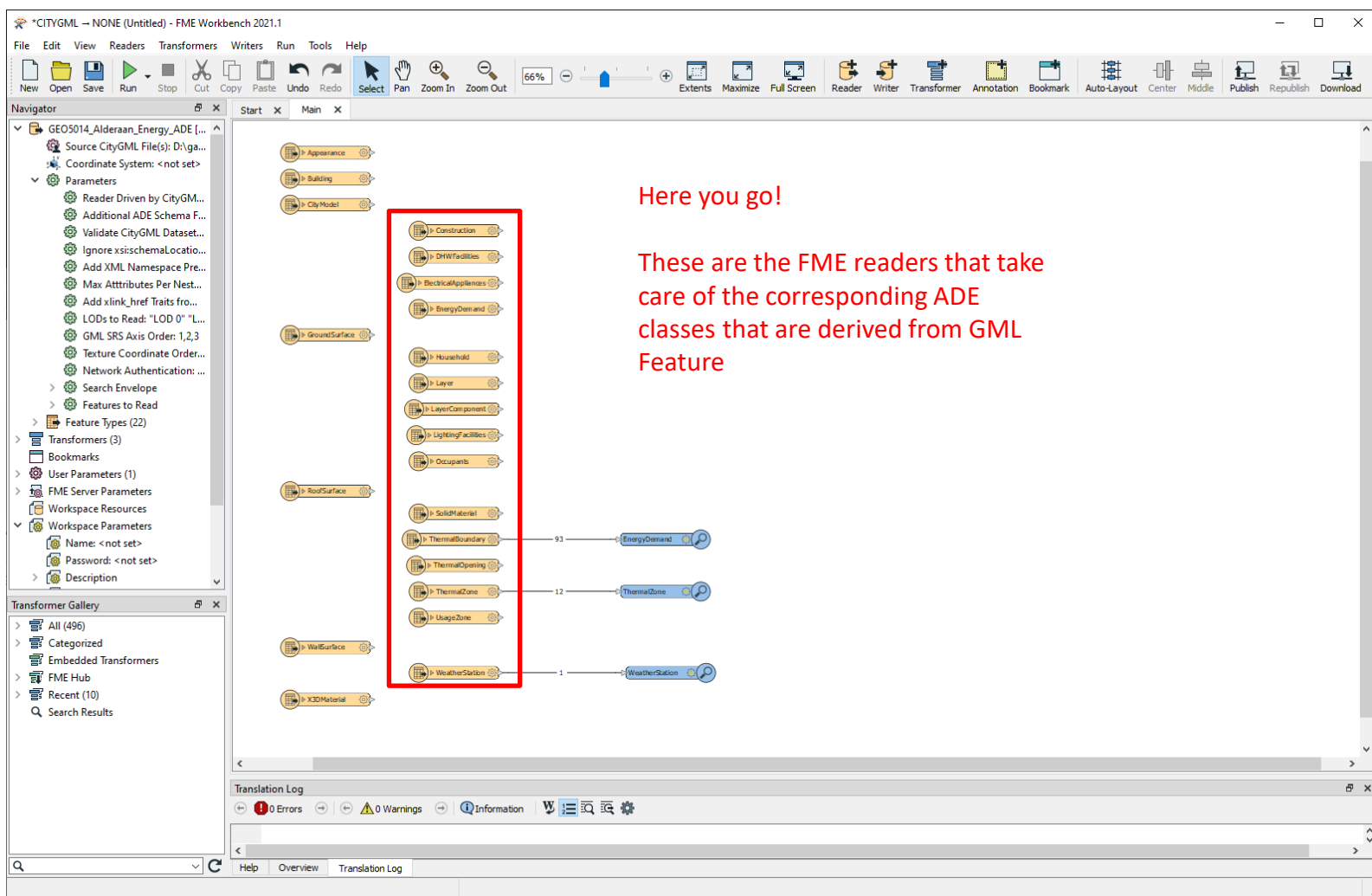
52 FME Configuration: Using FME Reprojection Engine
53 Pre-processing xfmap 'C:\Users\GAGUGI-1\AppData\Local\Temp\wbrun_1627458292662_12500\fmtemp_2\FME_1627459283449_5488.xfmap' with macro stylesheet 'C:\Program Files\FME\xfmap\xfmap_mac
54 The XML Reader is using xfmap 'C:\Users\GAGUGI-1\AppData\Local\Temp\wbrun_1627458292662_12500\fmtemp_2\NOMACRO_XFMAP_1627459284453_5488.xml'
55 Generating Schema Features, please wait...
56 Parsing XML document 'D:\gagugiaro\Documents\Teaching\GE05014-2021\Lectures\Lecture_3_material\alderaan_data\GE05014_Alderaan_Energy_ADE.gml'
57 Merged 22 schema features read from 1 datasets into 22 resulting feature types
58 Opened mapping File C:\Users\GAGUGI-1\AppData\Local\Temp\FME_1627459282637_12500.fmw for output
59 Mapping File Generation was SUCCESSFUL
60 Mapping File Generation was SUCCESSFUL
61 FME Session Duration: 1.8 seconds. (CPU: 1.5s user, 0.2s system)
62 END - ProcessID: 5488, peak process memory usage: 160732 kB, current process memory usage: 96028 kB
  
```

400 features scanned

FME CITYGML READER with ADE

The standard CityGML readers will pop up, TOGETHER with those of the ADE

As usual, you can select them all, or pick only some, depending on your needs



The screenshot shows the FME Workbench 2021.1 interface. The main workspace displays a list of FME readers, with a red box highlighting the following readers:

- Construction
- DHWFacilities
- ElectricalAppliances
- EnergyDemand
- Household
- Layer
- LayerComponent
- LightingFacilities
- Occupants
- SolidMaterial
- ThermalBoundary
- ThermalOpening
- ThermalZone
- UsageZone
- WeatherStation

These readers are connected to various ADE (Application Defined Extension) classes, such as EnergyDemand, ThermalZone, and WeatherStation. The bottom of the interface shows the Translation Log, which currently displays 0 Errors and 0 Warnings.

Here you go!

These are the FME readers that take care of the corresponding ADE classes that are derived from GML Feature

FME Data Inspector - 2021.1

File View Camera Tools Window Help

Open Add Close Save As Save Selected Refresh Stop 2D 3D Table Slideshow Measure Orbit Select Pan Zoom In Zoom Out Zoom Selected Zoom Extents Select No Geometry Filter Mark Background Background map off

Display Control View 5 (106)

- View 5 (106)
  - inspector [FFS] (106)
    - EnergyDemand (93)
    - ThermalZone (12)
    - WeatherStation (1)

Here the Energy ADE ThermalBoundaries are shown

Energy ADE properties are generally mapped to attributes beginning with the namespace of the ADE (here: energy\_)

Look for example at the *citygml\_feature\_role* and the *citygml\_lod\_name* attributes. Check the UML diagram in the next slide

Feature Information

Property	Value
<b>Attributes (27)</b>	
citygml_feature_role (string: UTF-16LE)	boundedBy
citygml_level_of_detail(0) (string: UTF-16LE)	
citygml_target_uri (string: UTF-16LE)	http://www.sig3d.org/citygml/2.0/energy/...
energy_area (string: UTF-16LE)	70.71
energy_area_units (string: UTF-16LE)	m^2
energy_azimuth (string: UTF-16LE)	270
energy_azimuth_units (string: UTF-16LE)	CW decimal degrees from North (-1 is Non...
energy_construction_xlink_href (string: UTF-16LE)	#id_construction_roof_3
energy_delimits(0).xlink_href (string: UTF-16LE)	#id_building_4_thermal_zone_1
energy_inclination (string: UTF-16LE)	45
energy_inclination_units (string: UTF-16LE)	decimal degrees from horizontal plane
energy_refurbishment_measure(0).energy_refurbis...	2018-03-11
energy_refurbishment_measure(0).energy_refurbis...	Advanced
energy_refurbishment_measure(0).energy_refurbis...	http://hub.geosmartcity.eu/registry/codeli...
energy_thermal_boundary_type (string: UTF-16LE)	roof
fme_feature_type (string: UTF-8)	ThermalBoundary
fme_geometry (string: UTF-8)	fme_aggregate
fme_type (string: UTF-8)	fme_surface
gml_description (string: UTF-16LE)	This is a thermal boundary obtained fro...
gml_id (string: UTF-16LE)	id_building_4_therm_bdry_1
gml_name (string: UTF-16LE)	Thermal boundary 1 (Building 4)
gml_parent_id (string: UTF-16LE)	id_building_4_thermal_zone_1
multi_reader_full_id (32 bit integer)	0
multi_reader_id (32 bit integer)	0
multi_reader_keyword (string: UTF-8)	CITYGML_1
multi_reader_type (string: UTF-8)	CITYGML
xml_type (string: UTF-8)	xml_surface
<b>IFEMEMultiSurface (1 Part)</b>	
Name (encoded: UTF-16LE)	surfaceGeometry
<b>Geometry Traits (4)</b>	
citygml_level_of_detail (string: UTF-16LE)	f
citygml_lod_name (string: UTF-16LE)	surfaceGeometry
gml_geometry (string: UTF-16LE)	

Features Selected: 1 of 1

Columns...

	gml_id	gml_parent_id	citygml_target_uri	citygml_feature_role	citygml_feature_role_attr_name	citygml_feature_role_attr_val	gml_description	gml_name	citygml_creationDate	citygml_terminationDate
1	id_building_1_t...	id_building_01	http://www.sig3d.org/...	thermalZone	<missing>	<missing>	This is a single ther...	ThermalZone 1 ...	<missing>	<missing>
2	id_building_2_t...	id_building_02	http://www.sig3d.org/...	thermalZone	<missing>	<missing>	This is a single ther...	Thermal Zone 1...	<missing>	<missing>

12 row(s)

Enable Slideshow for the current view

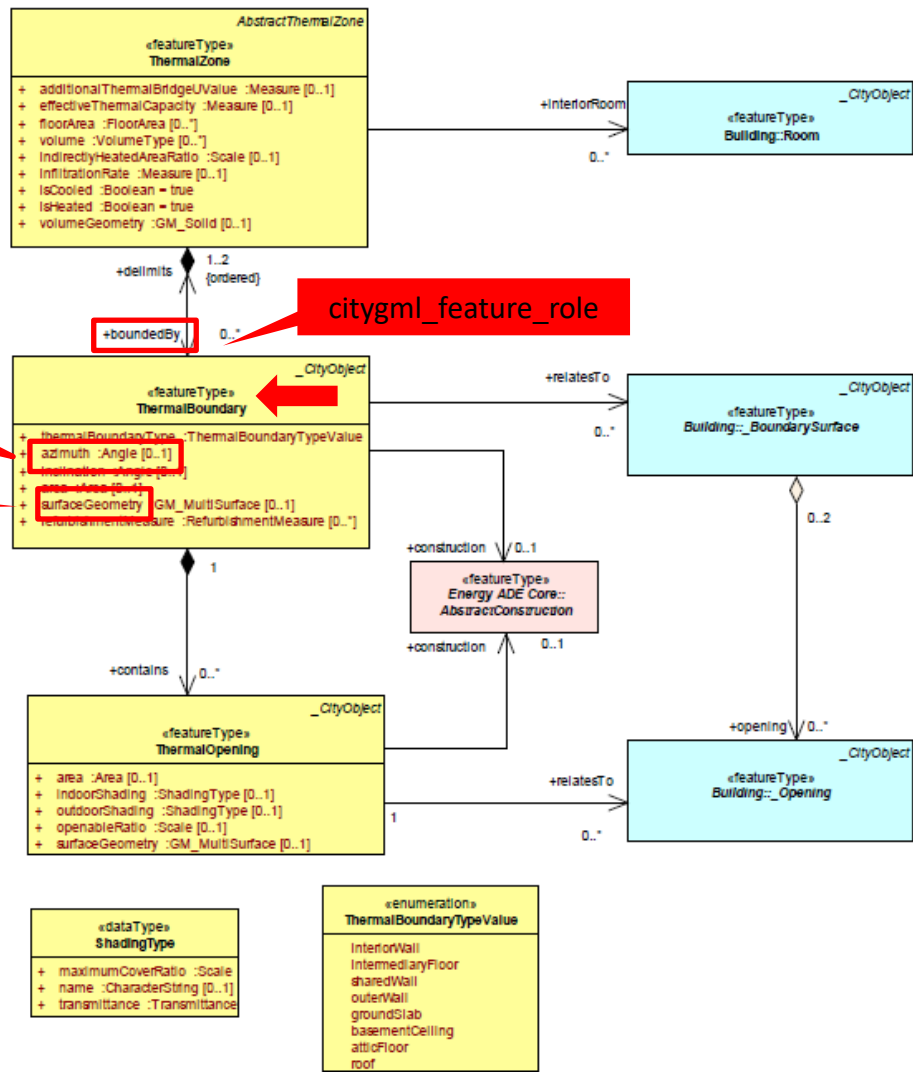
X: ----- Y: ----- EPSG:28992 METER

## UML diagram of the Energy ADE Building physics module (excerpt)

Example of ADE property  
(by the way: the Angle type  
requires the unit of measure!)

citygml\_lod\_name

**Watch out!** This is an  
alternative way of representing  
a relation to a GML class  
representing a geometry  
(here: GM\_MultiSurface)



Screenshot taken from the UML diagram of the CityGML Energy ADE. More details in:

Aguiar, G., Benner, J., Cipriano, P., Nouvel, R., 2018, **The Energy Application Domain Extension for CityGML: Enhancing interoperability for urban energy simulations.**

Open Geospatial Data, Software and Standards, 2018 3:2. SpringerOpen, United Kingdom. (open access)

<https://opengeospatialdata.springeropen.com/articles/10.1186/s40965-018-0042-y>

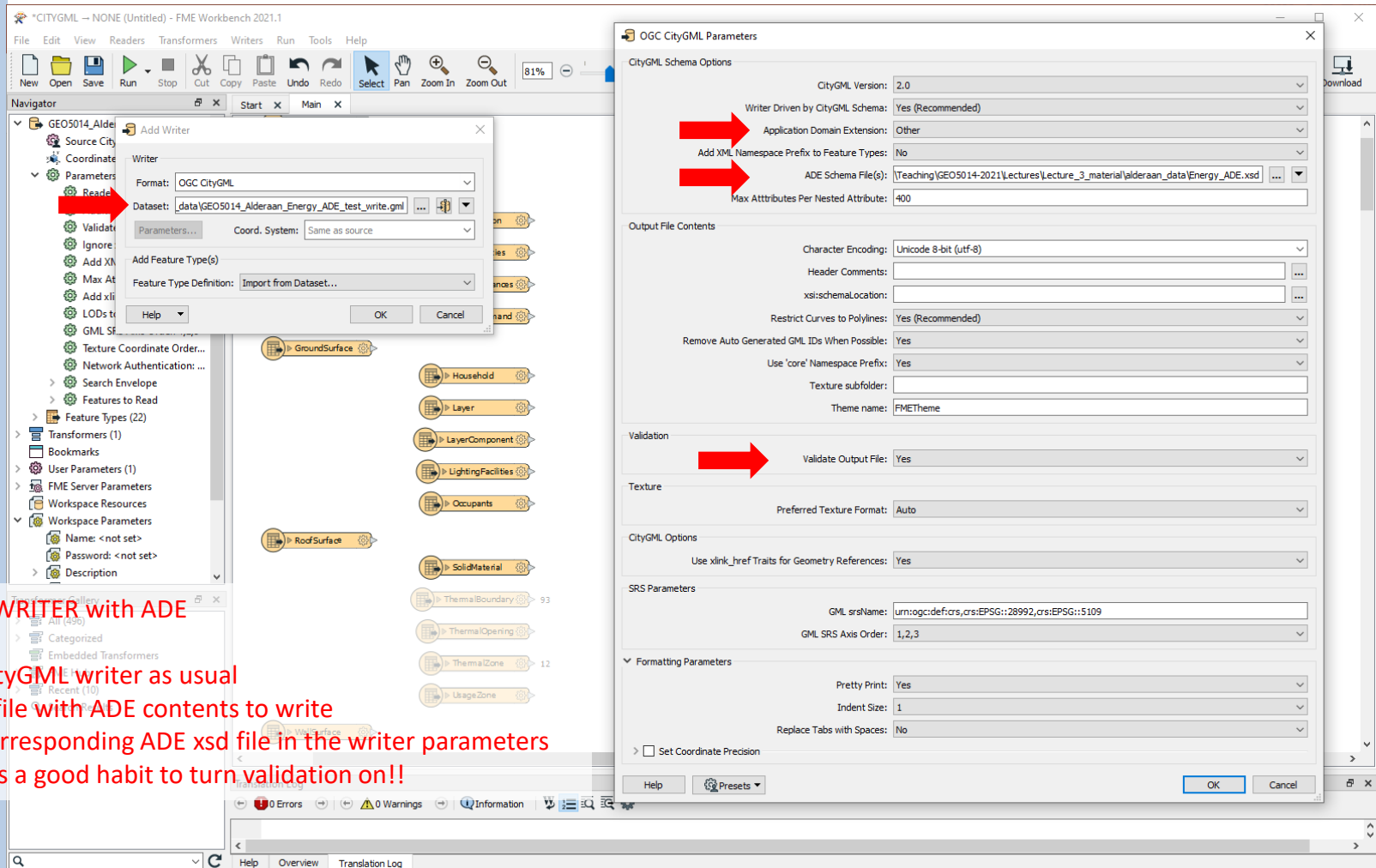




Agugiario, G., Benner, J., Cipriano, P., Nouvel, R., 2018, **The Energy Application Domain Extension for CityGML: Enhancing interoperability for urban energy simulations**. Open Geospatial Data, Software and Standards, 2018 3:2. SpringerOpen, United Kingdom. (open access)

## FME CITYGML WRITER with ADE

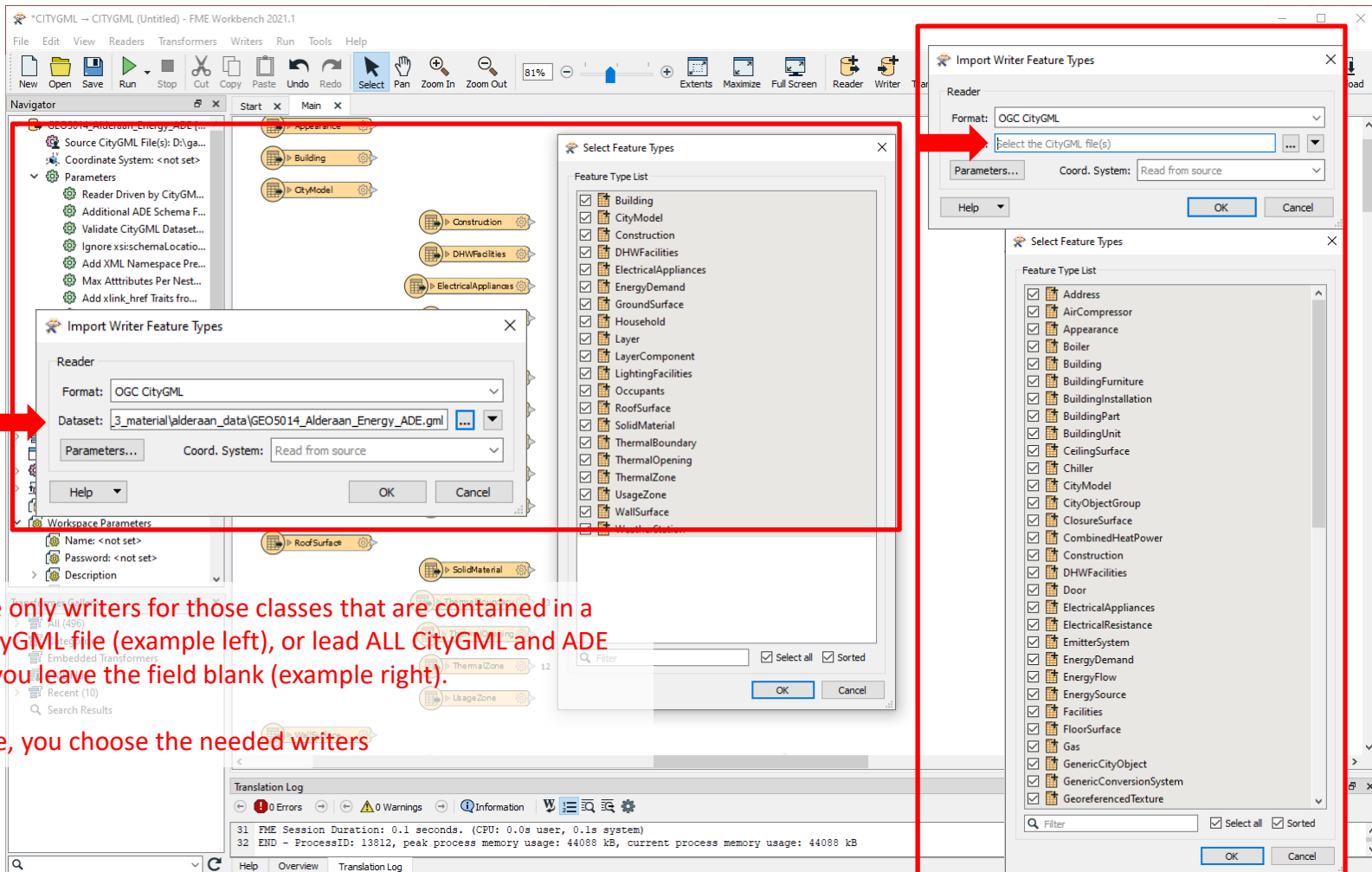
- 1) Load the CityGML writer as usual
- 2) Define the file with ADE contents to write
- 3) Load the corresponding ADE xsd file in the writer parameters
- 4) As usual, it's a good habit to turn validation on!!



The screenshot shows the FME Workbench interface with the 'Add Writer' dialog and the 'OGC CityGML Parameters' dialog open. The 'Add Writer' dialog shows the 'Format: OGC CityGML' and 'Dataset: data\GEO5014\_Alderaan\_Energy\_ADE\_test\_write.gml'. The 'OGC CityGML Parameters' dialog shows various options for writing CityGML files, including 'CityGML Version: 2.0', 'Writer Driven by CityGML Schema: Yes (Recommended)', 'Application Domain Extension: Other', 'ADE Schema File(s): [Teaching\GEO5014-2021\Lectures\Lecture\_3\_material\alderaan\_data\Energy\_ADE.xsd]', 'Max Attributes Per Nested Attribute: 400', 'Character Encoding: Unicode 8-bit (utf-8)', 'Header Comments', 'xsi:schemaLocation', 'Restrict Curves to Polylines: Yes (Recommended)', 'Remove Auto Generated GML IDs When Possible: Yes', 'Use 'core' Namespace Prefix: Yes', 'Texture subfolder', 'Theme name: FMETheme', 'Validation: Validate Output File: Yes', 'Preferred Texture Format: Auto', 'CityGML Options: Use xlink\_href Traits for Geometry References: Yes', 'SRS Parameters: GML srsName: urn:ogc:def:crs:EPSG::28992,crs:EPSG::5109, GML SRS Axis Order: 1,2,3, Formatting Parameters: Pretty Print: Yes, Indent Size: 1, Replace Tabs with Spaces: No, and 'Set Coordinate Precision'.

You create only writers for those classes that are contained in a certain CityGML file (example left), or load ALL CityGML and ADE writers if you leave the field blank (example right).

In any case, you choose the needed writers



The screenshot shows the FME Workbench 2021.1 interface. The main workspace contains a 'Reader' transformer connected to a 'Writer' transformer. The 'Reader' transformer is configured with the format 'OGC CityGML' and the dataset '3\_material\alderaan\_data\GEO5014\_Alderaan\_Energy\_ADE.gml'. The 'Writer' transformer is configured with the format 'OGC CityGML' and the dataset '3\_material\alderaan\_data\GEO5014\_Alderaan\_Energy\_ADE.gml'. The 'Import Writer Feature Types' dialog is open, showing the 'Reader' section with the format 'OGC CityGML' and the dataset '3\_material\alderaan\_data\GEO5014\_Alderaan\_Energy\_ADE.gml'. The 'Select Feature Types' dialog is also open, showing a list of feature types with checkboxes. The 'Import Writer Feature Types' dialog has a red arrow pointing to the 'Dataset' field. The 'Select Feature Types' dialog has a red arrow pointing to the 'Feature Type List'.

**Import Writer Feature Types Dialog:**

- Reader:
  - Format: OGC CityGML
  - Dataset: 3\_material\alderaan\_data\GEO5014\_Alderaan\_Energy\_ADE.gml
  - Parameters... (button)
  - Coord. System: Read from source
  - Help (dropdown)
  - OK (button)
  - Cancel (button)

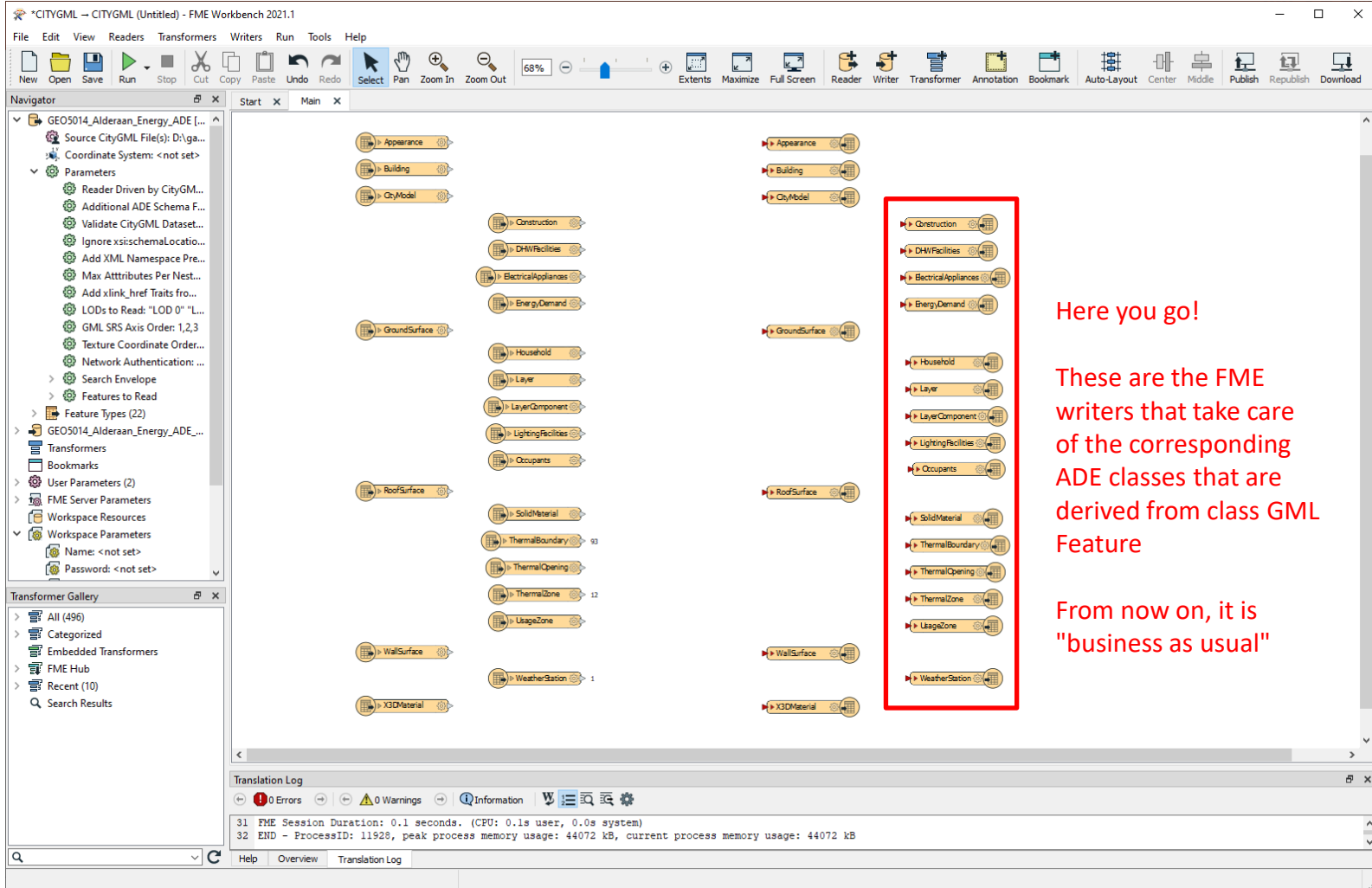
**Select Feature Types Dialog:**

- Feature Type List:
  - ☒ Building
  - ☒ CityModel
  - ☒ Construction
  - ☒ DHWFacilities
  - ☒ ElectricalAppliances
  - ☒ EnergyDemand
  - ☒ GroundSurface
  - ☒ Household
  - ☒ Layer
  - ☒ LayerComponent
  - ☒ LightingFacilities
  - ☒ Occupants
  - ☒ RoofSurface
  - ☒ SolidMaterial
  - ☒ ThermalBoundary
  - ☒ ThermalOpening
  - ☒ ThermalZone
  - ☒ UsageZone
  - ☒ WallSurface
- Filter (text input)
- Select all (checkbox)
- Sorted (checkbox)
- OK (button)
- Cancel (button)

**Translation Log:**

```

31 FME Session Duration: 0.1 seconds. (CPU: 0.0s user, 0.1s system)
32 END - ProcessID: 13812, peak process memory usage: 44088 kB, current process memory usage: 44088 kB
  
```



The screenshot shows the FME Workbench interface with the CityGML dataset loaded. The left pane displays the Navigator tree, and the right pane shows the FME writers for the ADE classes. A red box highlights the FME writers for the ADE classes, which are derived from the GML Feature class.

Here you go!

These are the FME writers that take care of the corresponding ADE classes that are derived from class GML Feature

From now on, it is "business as usual"

Translation Log

```

31 FME Session Duration: 0.1 seconds. (CPU: 0.1s user, 0.0s system)
32 END - ProcessID: 11928, peak process memory usage: 44072 kB, current process memory usage: 44072 kB
  
```

\*CITYGML -> CITYGML (Untitled) - FME Workbench 2021.1

File Edit View Readers Transformers Writers Run Tools Help

New Open Save Run Stop Cut Copy Paste Undo Redo Select Pan Zoom In Zoom Out 68% Extents Maximize Full Screen Reader Writer Transformer Annotation Bookmark Auto-Layout Center Middle Publish Republish Download

Navigator

- GEOS014\_Alderaan\_Energy\_ADE [...]
- Source CityGML File(s): D:\ga...
- Coordinate System: <not set>
- Parameters
  - Reader Driven by CityGM...
  - Additional ADE Schema F...
  - Validate CityGML Dataset...
  - Ignore xsi:schemaLocation...
  - Add XML Namespace Pre...
  - Max Attributes Per Nest...
  - Add xlink\_href Traits fro...
  - LODs to Read: "LOD 0" "L...
  - GML SRS Axis Order: 1,2,3
  - Texture Coordinate Order...
  - Network Authentication: ...
  - Search Envelope
  - Features to Read
  - Feature Types (22)
  - GEOS014\_Alderaan\_Energy\_ADE\_...
  - Transformers
  - Bookmarks
  - User Parameters (2)
  - FME Server Parameters
  - Workspace Resources
  - Workspace Parameters
    - Name: <not set>
    - Password: <not set>

Transformer Gallery

- All (496)
- Categorized
- Embedded Transformers
- FME Hub
- Recent (10)
- Search Results

Start Main

Appearance 5 Appearance

Building 12 Building

CityModel 1 CityModel

Construction 6 Construction

DHWFacilities 12 DHWFacilities

ElectricalAppliances 12 ElectricalAppliances

EnergyDemand 24 EnergyDemand

GroundSurface 12 GroundSurface

Household 31 Household

Layer 4 Layer

LayerComponent 16 LayerComponent

LightingFacilities 12 LightingFacilities

Occupants 12 Occupants

RoofSurface 24 RoofSurface

SolidMaterial 16 SolidMaterial

ThermalBoundary 93 ThermalBoundary

ThermalOpening 36 ThermalOpening

ThermalZone 12 ThermalZone

UsageZone 12 UsageZone

WallSurface 48 WallSurface

WeatherStation 1 WeatherStation

X3DMaterial 14 X3DMaterial

Translation Log

0 Errors 0 Warnings Information

Help Overview Translation Log

ElectricalAppliances [GEOS014\_Alderaan\_Energy\_ADE [CITYGML]] -> ElectricalAppliances [GEOS014\_Alderaan\_Energy\_ADE\_write\_test [CITYGML]]

Connect, run,  
 (validate) and...  
 done! 😊



**Dr. Giorgio Agugiaro**

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3D Geoinformation Group

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