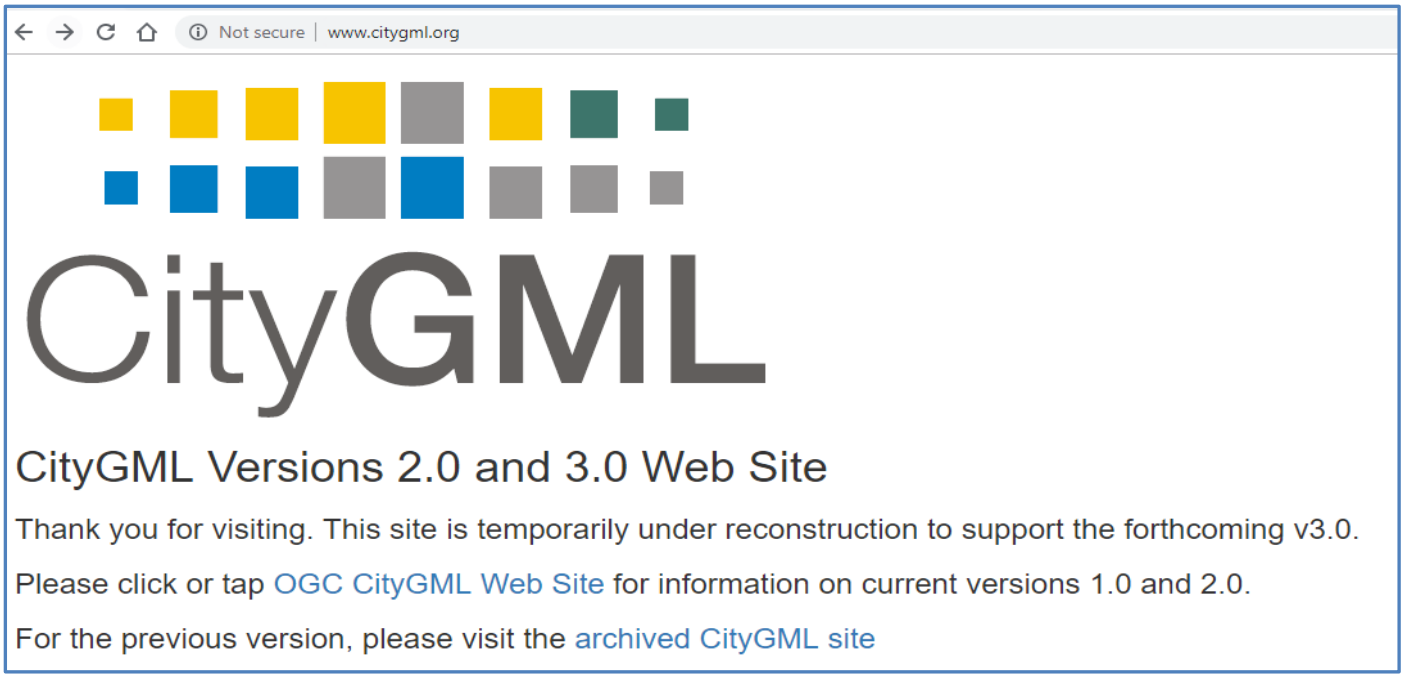
Exploring CityGML – Part 1

Moving from proprietary GIS applications to Open Source geospatial and now working with an Autodesk Partner as a *'Geographer in a CAD World'*, I have used a variety of spatial data formats over the past 20 years. However, it wasn't until recently that I started to look at what **CityGML** could provide to me and the clients that I work with. I started from knowing very little about CityGML and as this is only **Part 1** I definitely still have quite a bit to understand about this data format and how to get the most from it.

This blog aims to detail the start of my journey exploring CityGML from where you can **source examples** of this data format, to how to **translate** the data into usable formats and then its use within various **software packages** such as **QGIS** and **Autodesk InfraWorks**.

Ok so I know very little, where should I start?..... **Google!** .... A quick search for CityGML and I found the **CityGML homepage:**

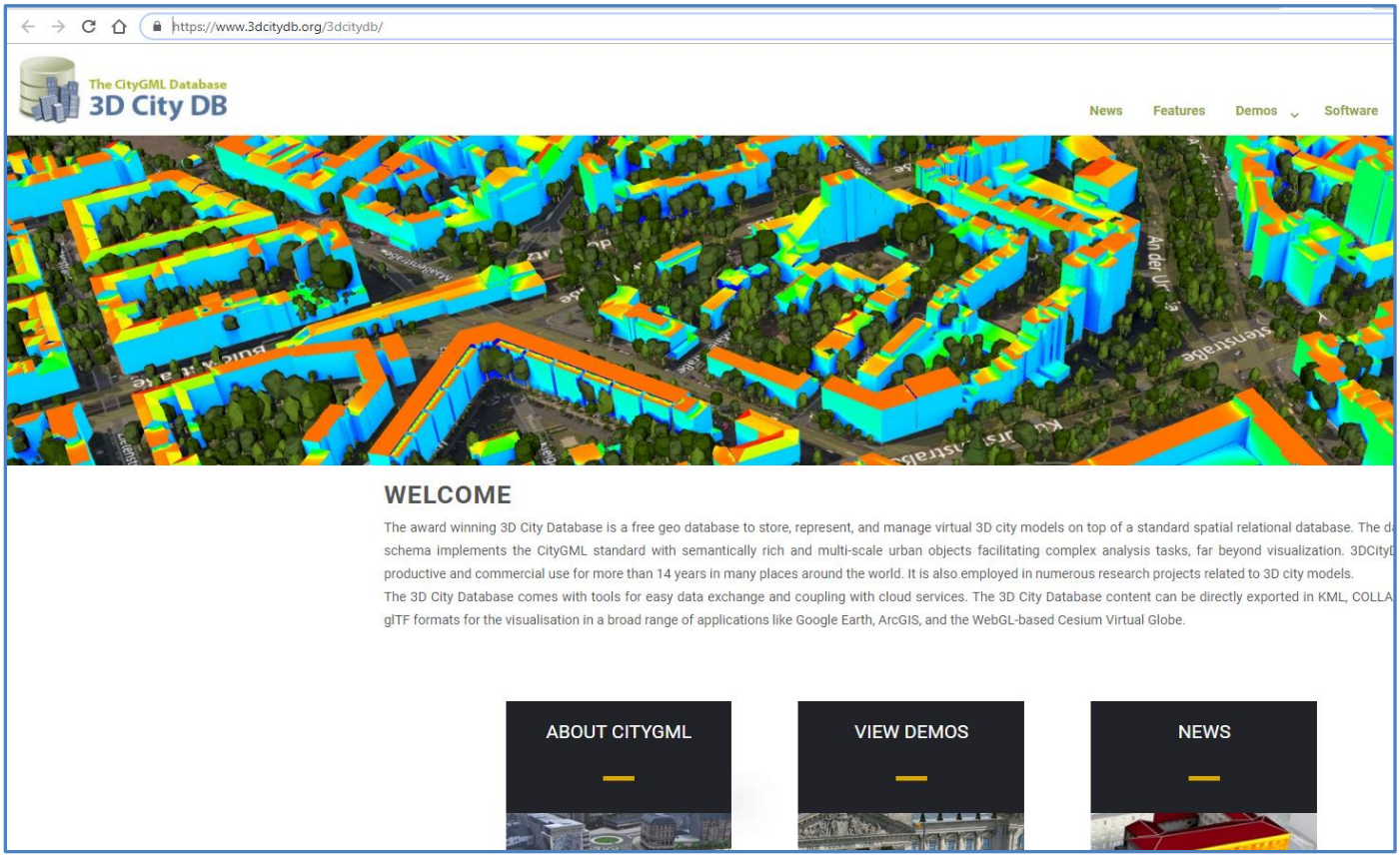
http://www.citygml.org/



However, at time of writing this blog (May 2019) the website was under reconstruction.

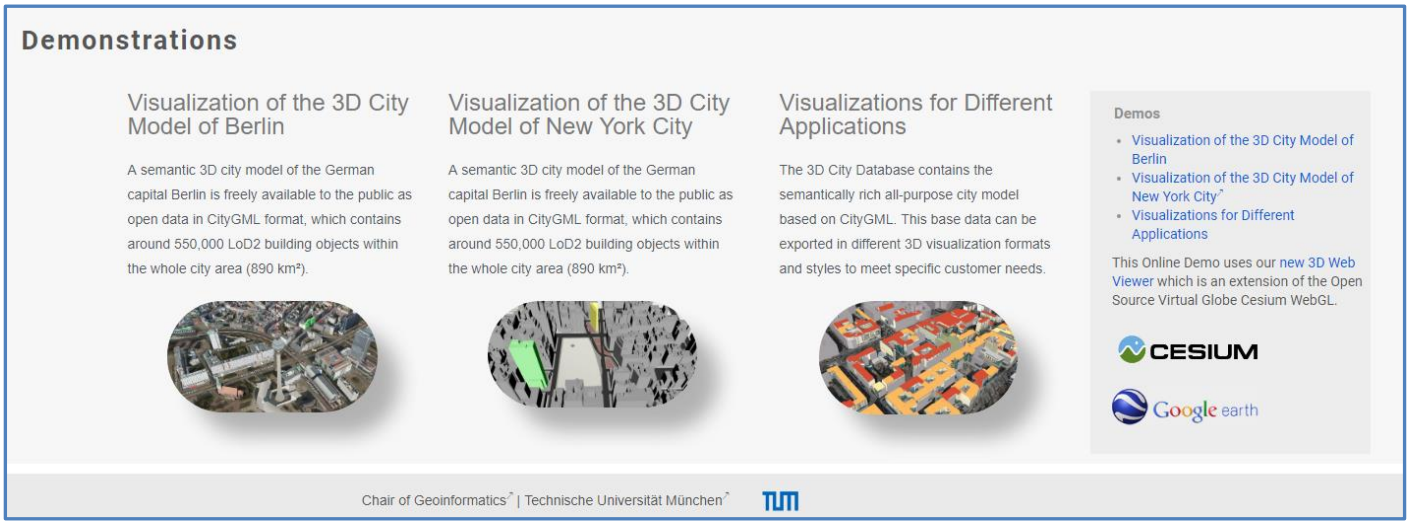
So, after another google search I then found this website:

https://www.3dcitydb.org/3dcitydb/

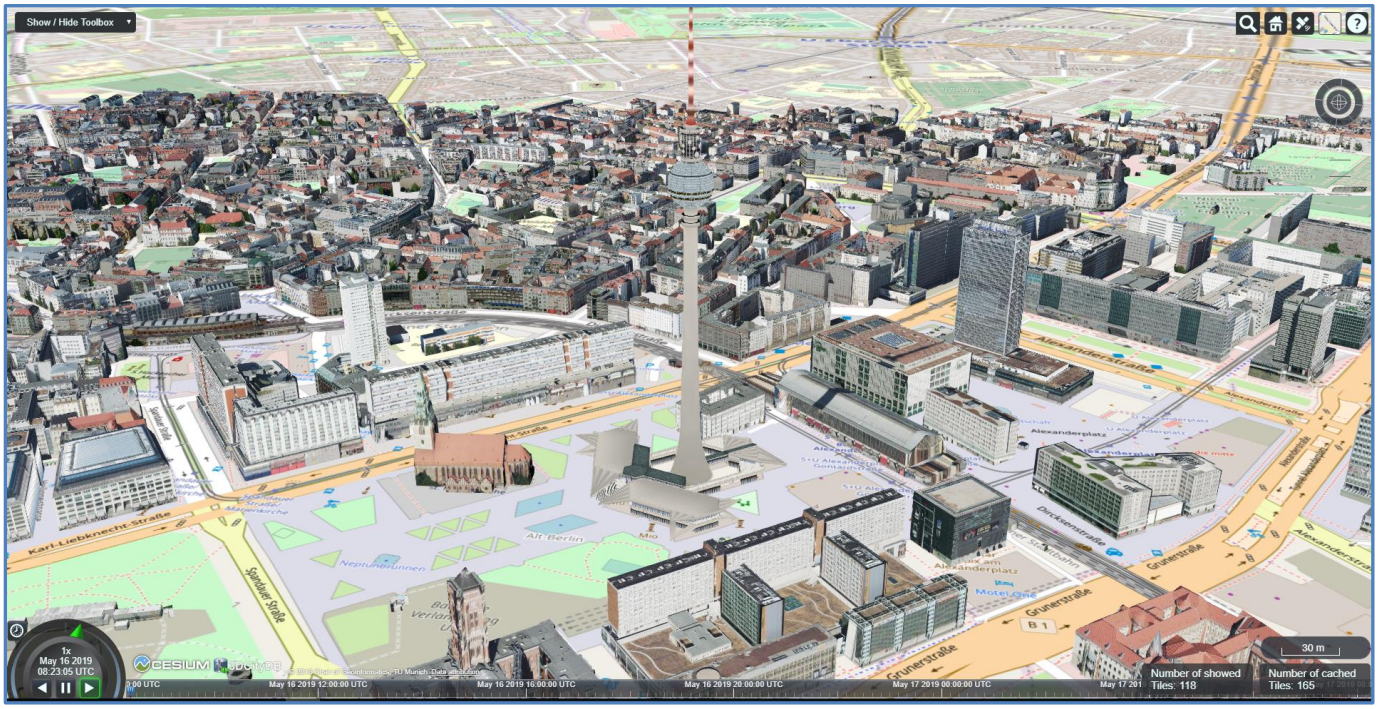


As the homepage states it is a **3D City Database** with a free geo database to store the 3D City models. I liked the words ‘free’ and ‘database’, so decided this was a good place to start my journey! There may have been more sensible places to start.. but this was my journey and I like to explore.

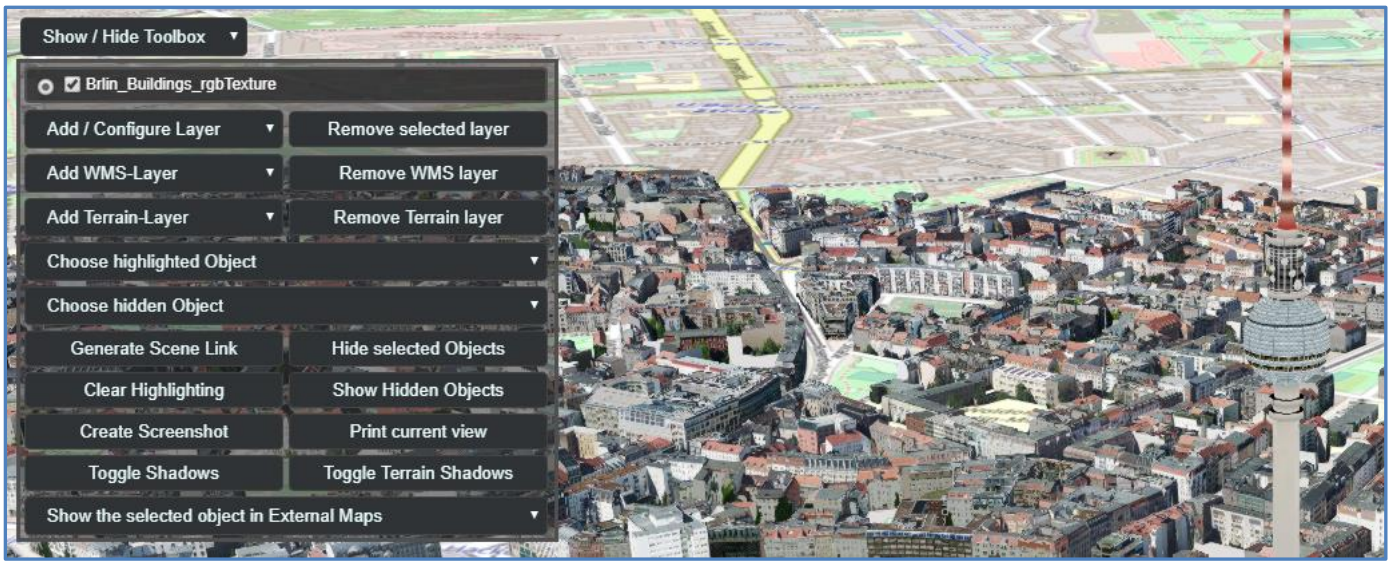
I clicked on the **Demonstrations** link which indicated that they had 3D Models online for **Berlin** and New York.



I started with the 3D City Database **Online Viewer** for Berlin.



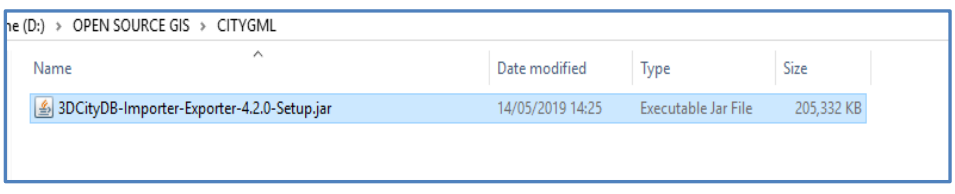
The viewer was quite simple to **navigate**, but rather more complex when it came to the **toolbox**.



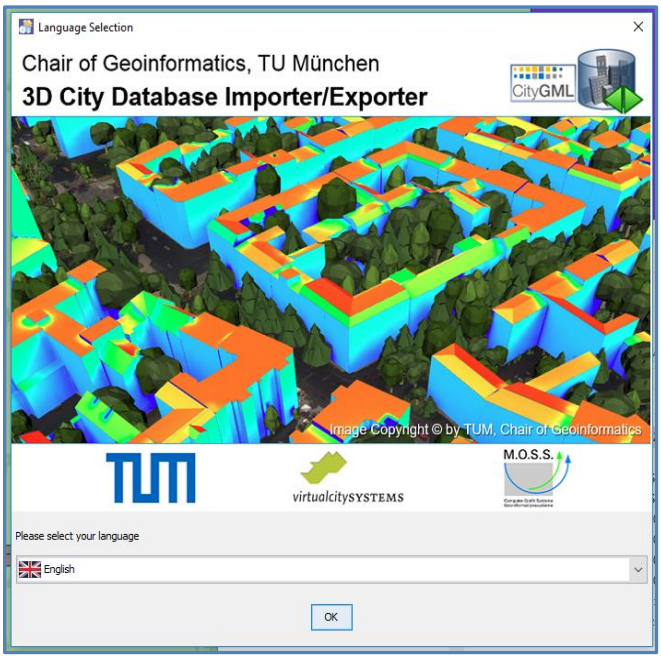
The viewer also provided different **basemapping** options e.g. Mapbox Aerial Imagery and navigating around the model it was clear how useful the real-life **façades** of the properties could be.

Next steps??? Ok let's get some of this **data** and see how I can use it. On the 3D City Database I found a **Downloads** page which included links to install a **Universal Installer**.

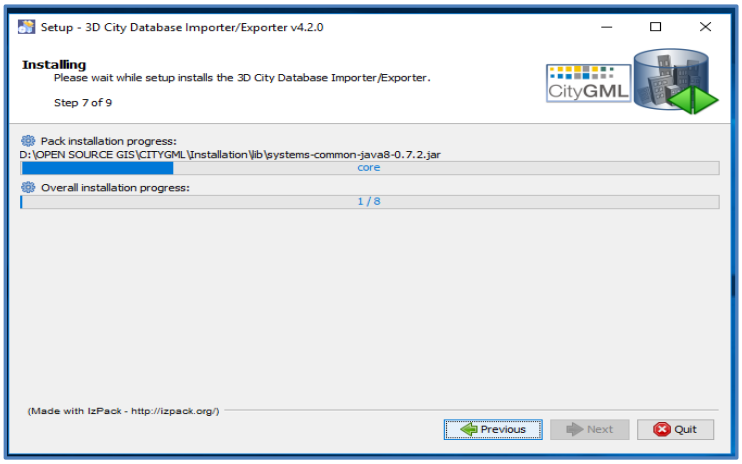
The installer download a **.JAR file.**

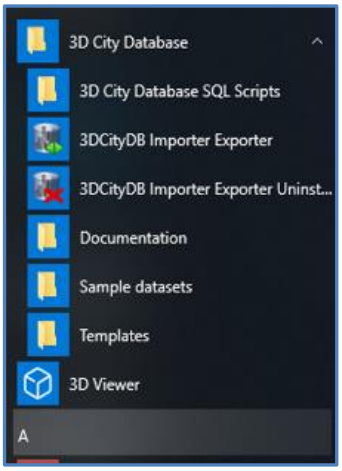


To run the installer, I simply **double clicked** the .JAR file and the installer opened.

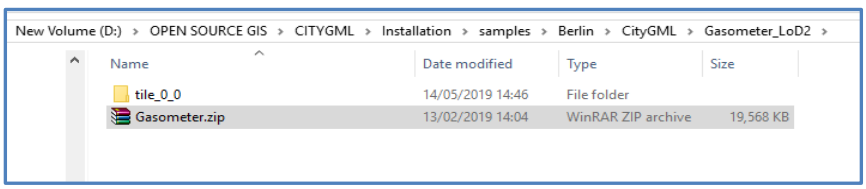


This added a new **shortcut** to my desktop, which included an **Importer and Exporter tool** and some **sample scripts** for creating and managing a 3D Database.

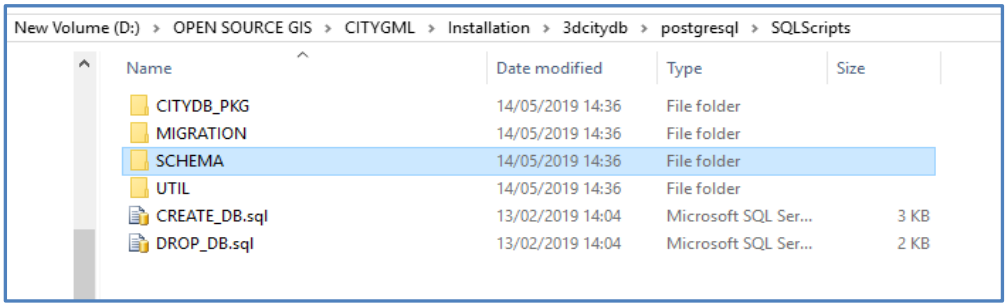




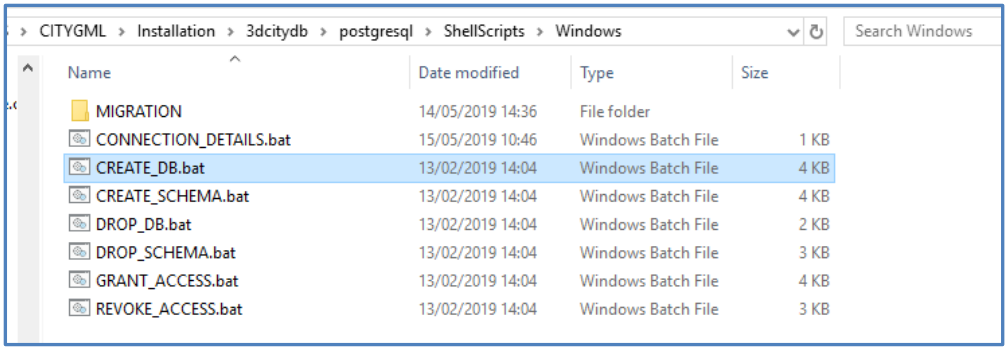
The installer also included a series of sample datasets (**KML** and **CityGML**) including the data for the Berlin 3D Model.



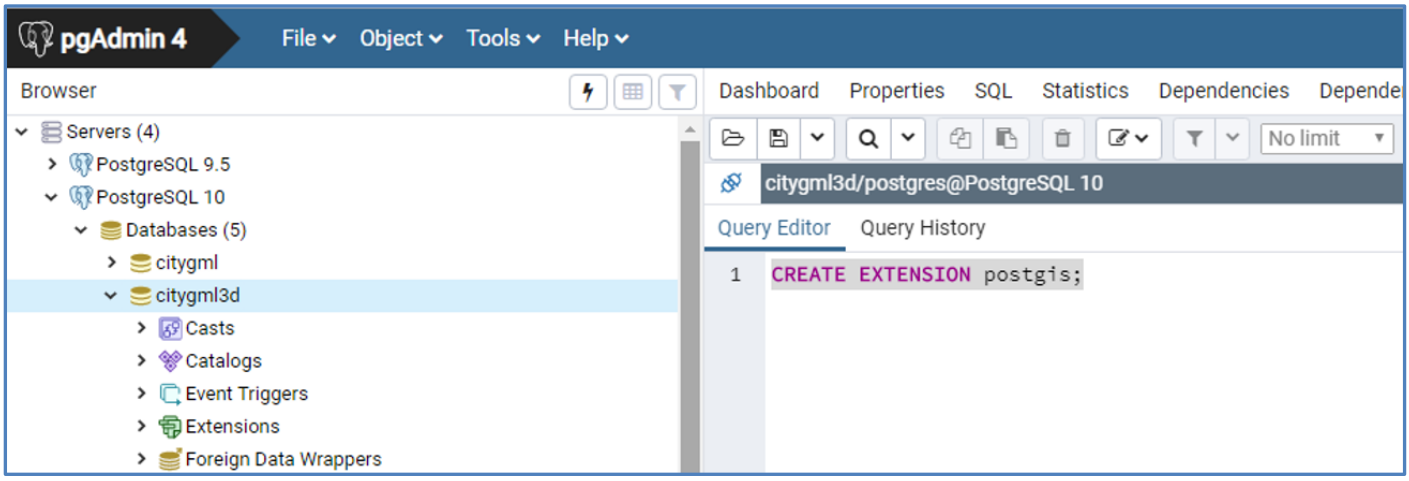
The sample scripts were installed to the destination location and included scripts for both **Oracle** and **PostGIS**.



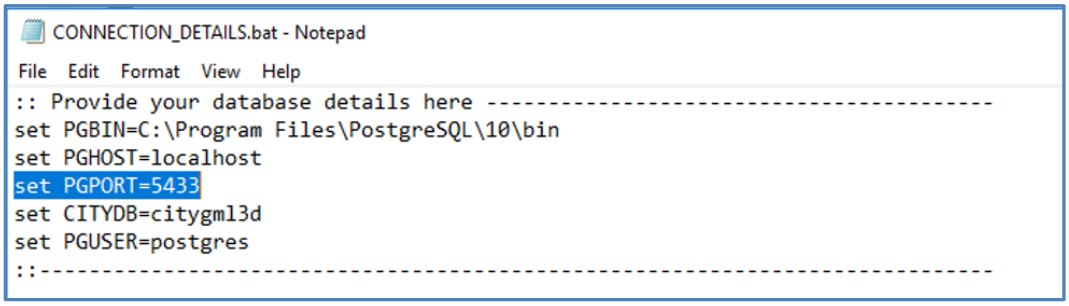
This also included a series of **.BAT files** that automatically ran the scripts for you.



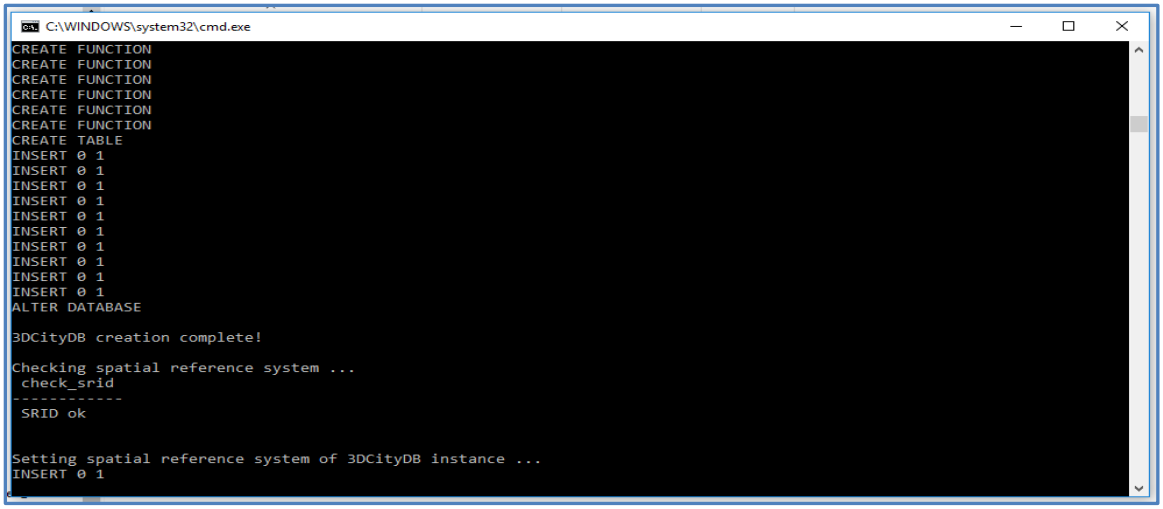
Step one was to create a new blank **PostGIS database** instance using PGAdmin.

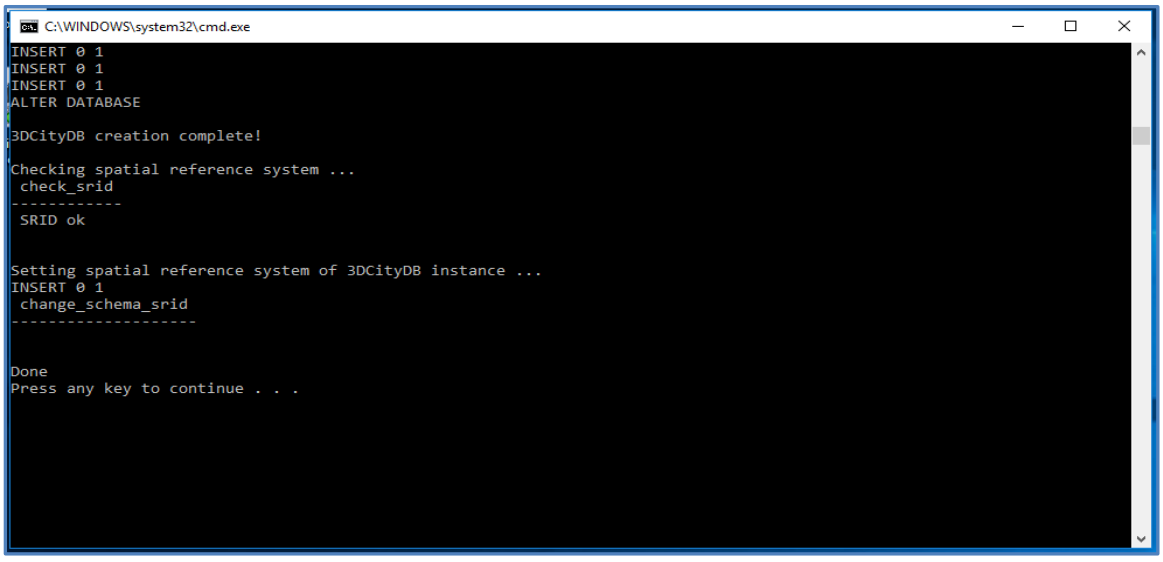


Step 2 was to use the **.BAT files** provided by the installer to automatically create the empty Database Tables. For the Create Database.BAT file to successfully run, I needed to edit the **CONENCTION_DETAILS.BAT** file to successfully access my PostGIS instance. I opened the .BAT file in Notepad and made the relevant edits.



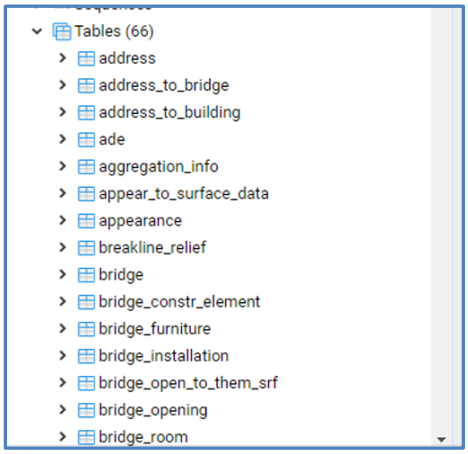
With the connection details correct, I could now run the **Create_DB.BAT** file and a command shell opened and ran each of the individual postgres SQL scripts, creating tables and inserting values where required.



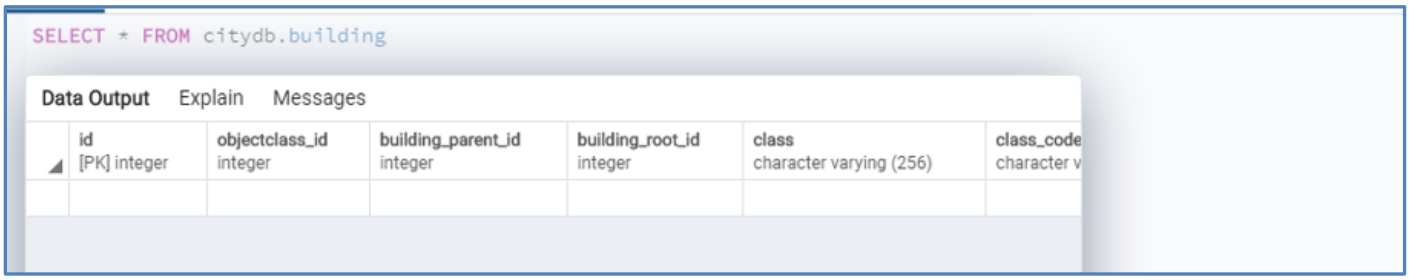


Note – *the first part of the Create_DB.BAT asks you the projection to assign to the tables in your database and as I would be importing data from Berlin I chose the DHD / Soldner Berlin Projection System – (3086).*

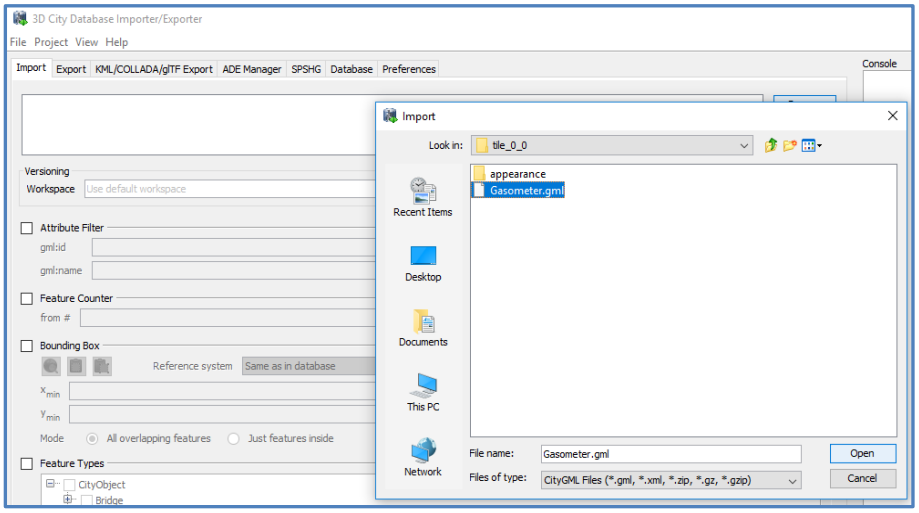
Refreshing and checking my PostGIS database, it was clear that the Create_DB.BAT file had ran the scripts as there were now **66 Tables** in the new CityGML PostGIS database.



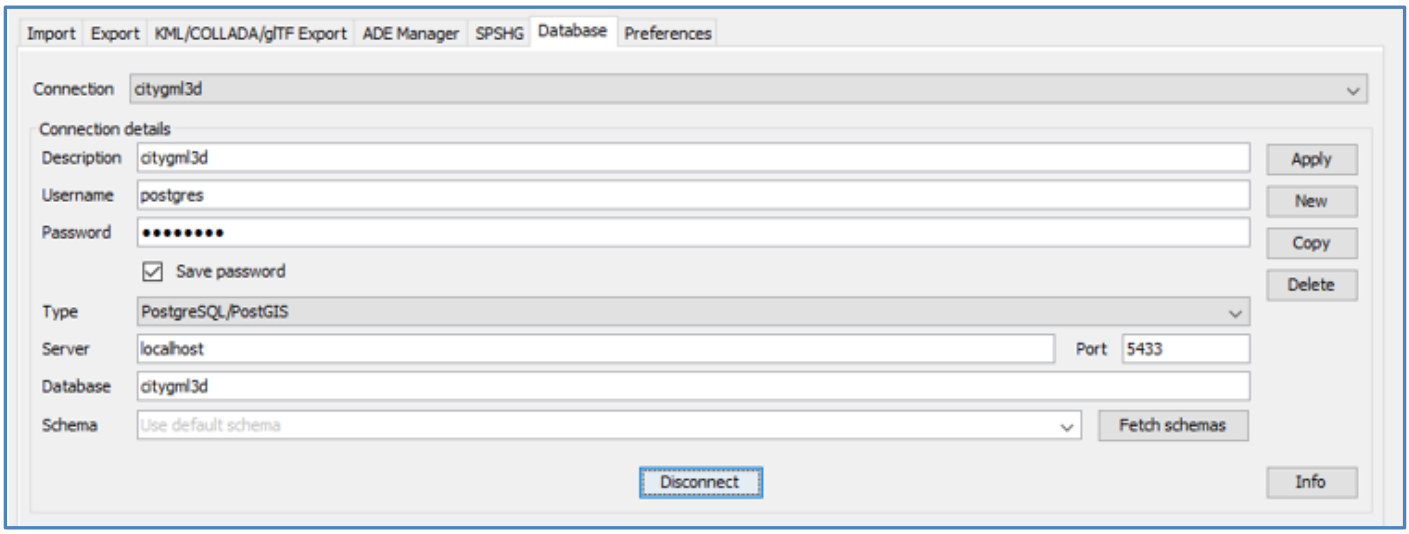
However, the main spatial tables e.g. Buildings were **empty**.



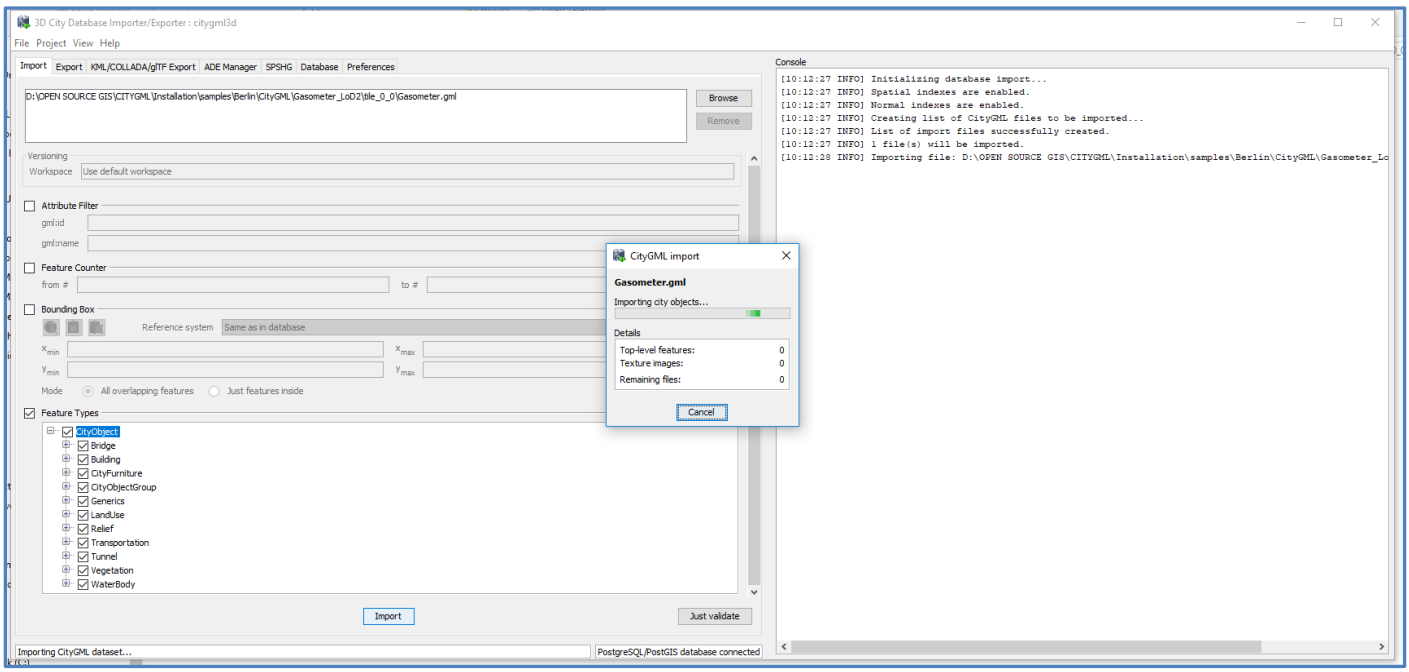
Step three was to utilise the **Import/Export Tool** to now import the sample CityGML data into my new PostGIS database. From the **Import** menu I chose browse and located one of the sample Berlin GML tiles.



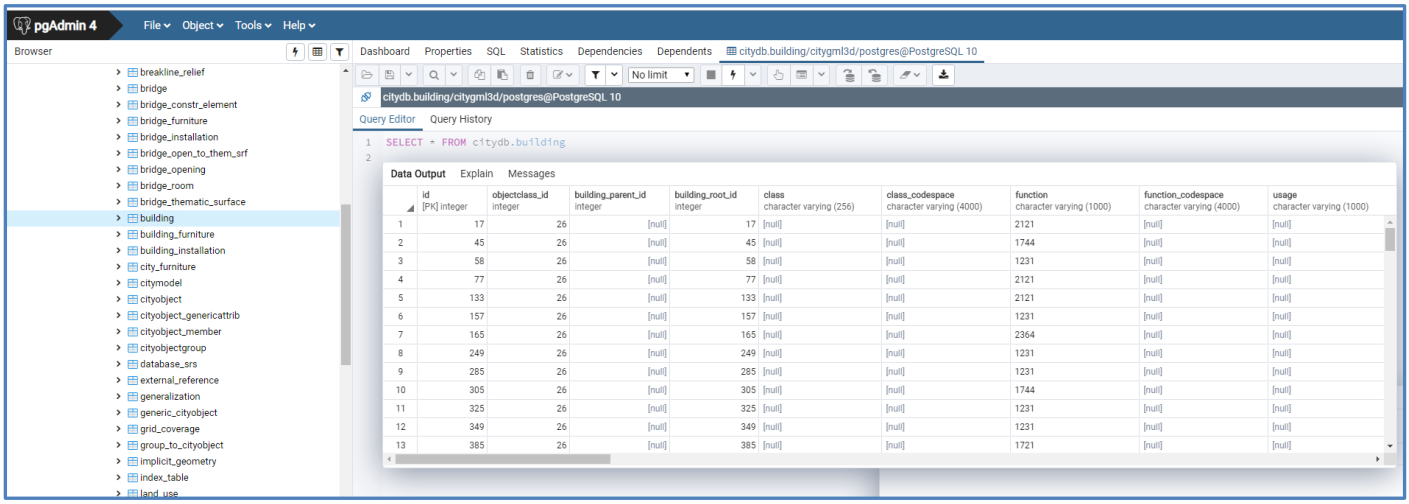
Before running the import, I needed to ensure that on the **Database** tab the Database connection details were correct.



Once the connection to my new PostGIS CityGML database was successful I could then use the **Import** Tab to choose **which features** to import and then start the import process.

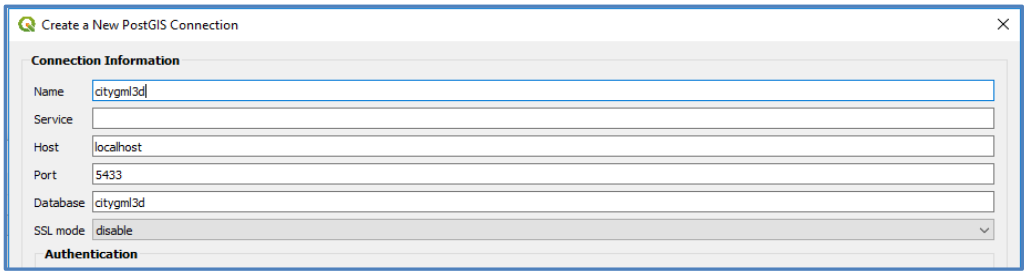


The import process took only **20 seconds** and after refreshing my PostGIS database I could see that I now had records in my spatial tables.

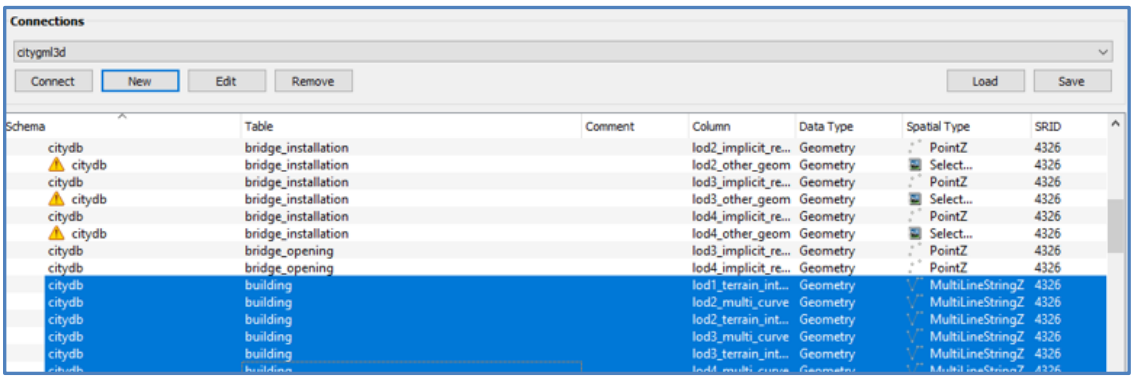


So we now have a new PostGIS database with 3D CityGML datasets for Berlin!.... how can we visualise these? My first thought was definitely **QGIS.**

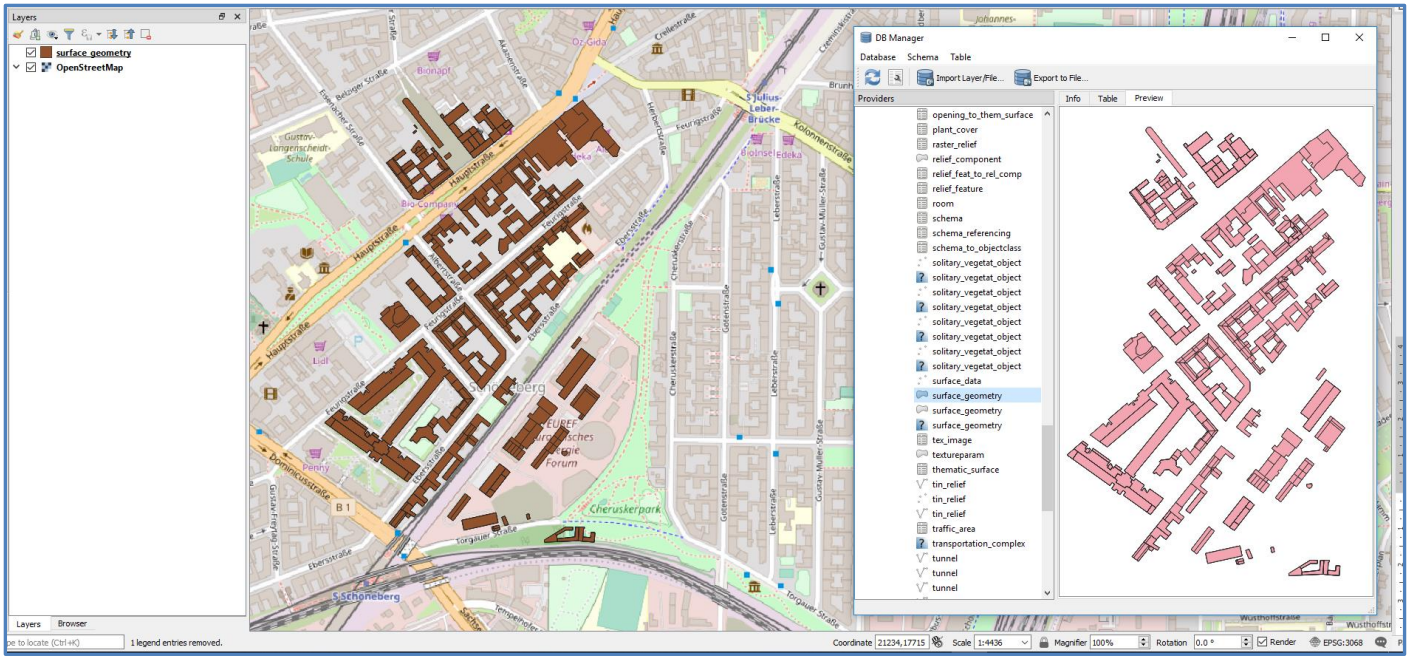
In QGIS I created a **Connection** to my new PostGIS CityGML database.



Then in the **Data Source Manager** I chose to load in the **Building Layers**.

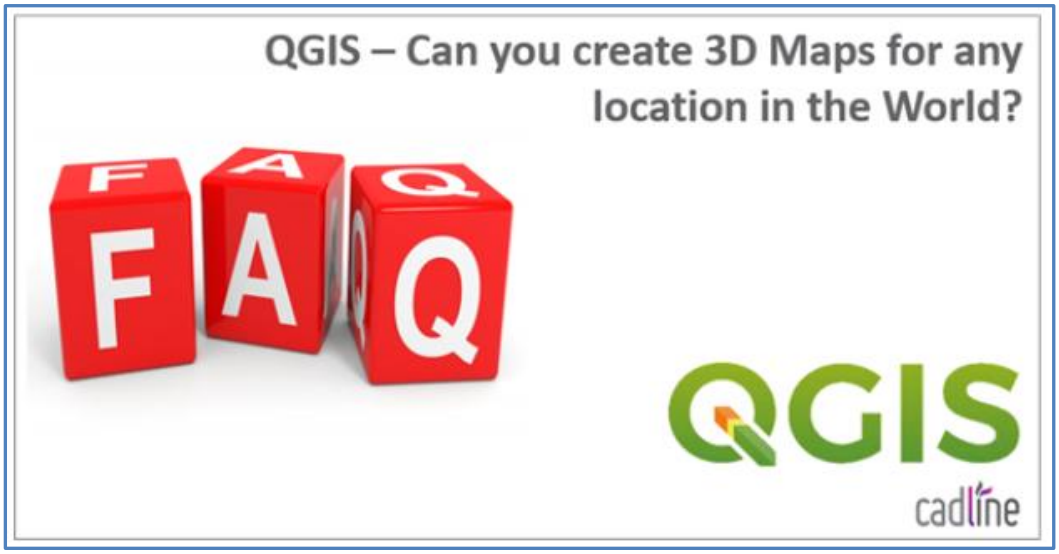


However, as the Data Source Manager indicated the Buildings geometry type was **MutliLineString** and didn't provide a footprint for the buildings. After a little searching in the database I found that the **Surface_Geometry** layer provided the **polygons** for the building outlines.

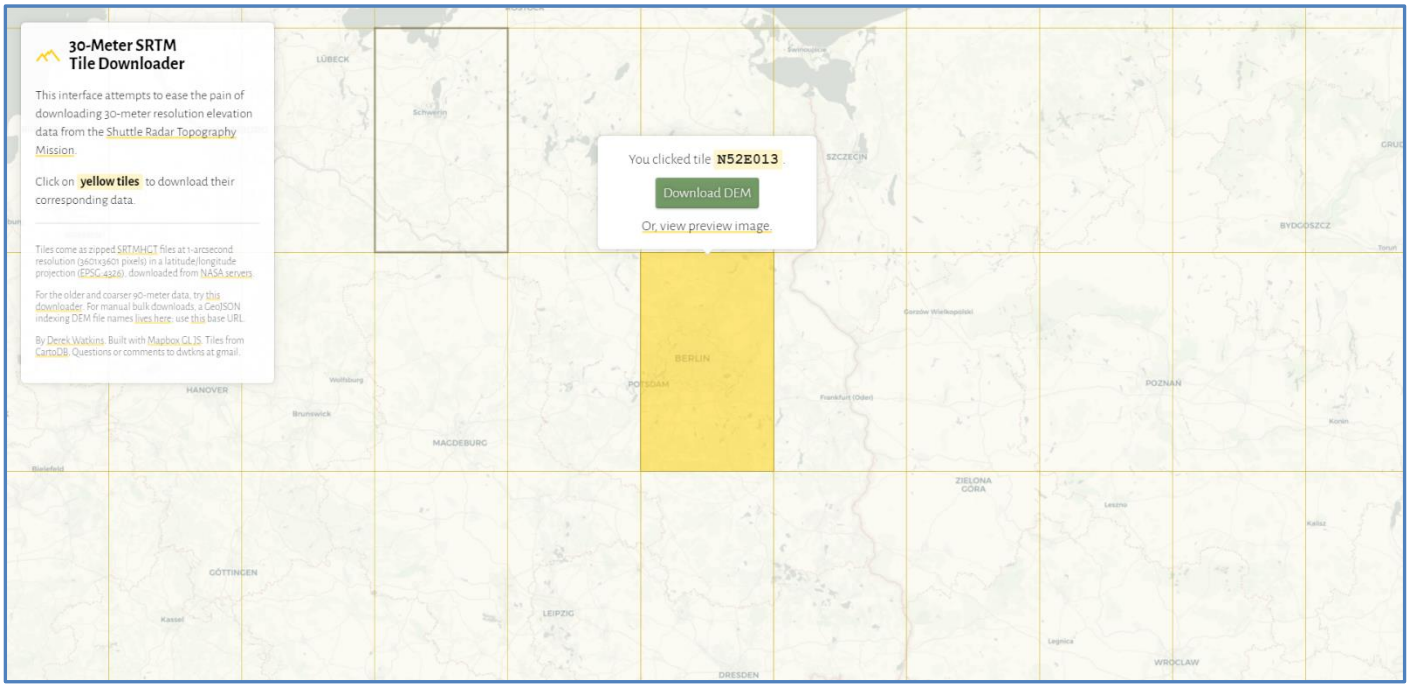


In order to view the CityGML data in true 3D, draped over surface terrain, I needed to source **terrain data** for Berlin. This **Cadline FAQ** outlines how you can source **world-wide terrain data for free** –

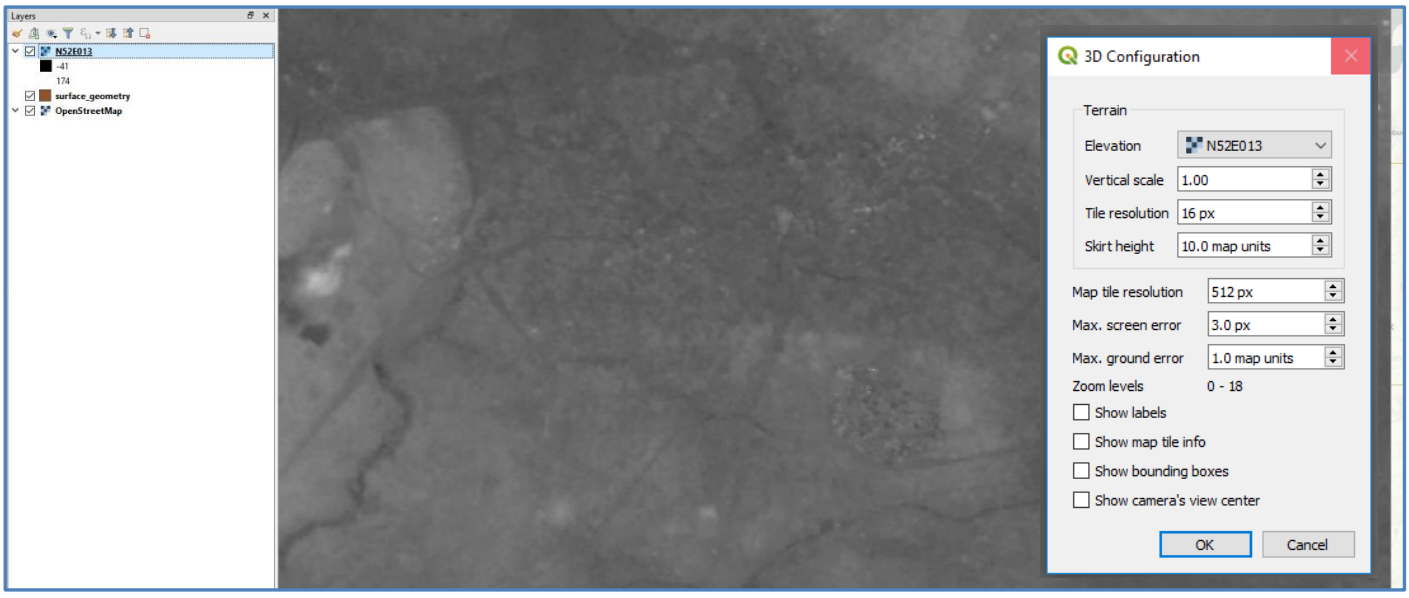
https://www.cadlinecommunity.co.uk/hc/en-us/articles/360001501558-QGIS-World-3D-Mapping



I was then able to source **3D terrain data** for the area around **Berlin**.

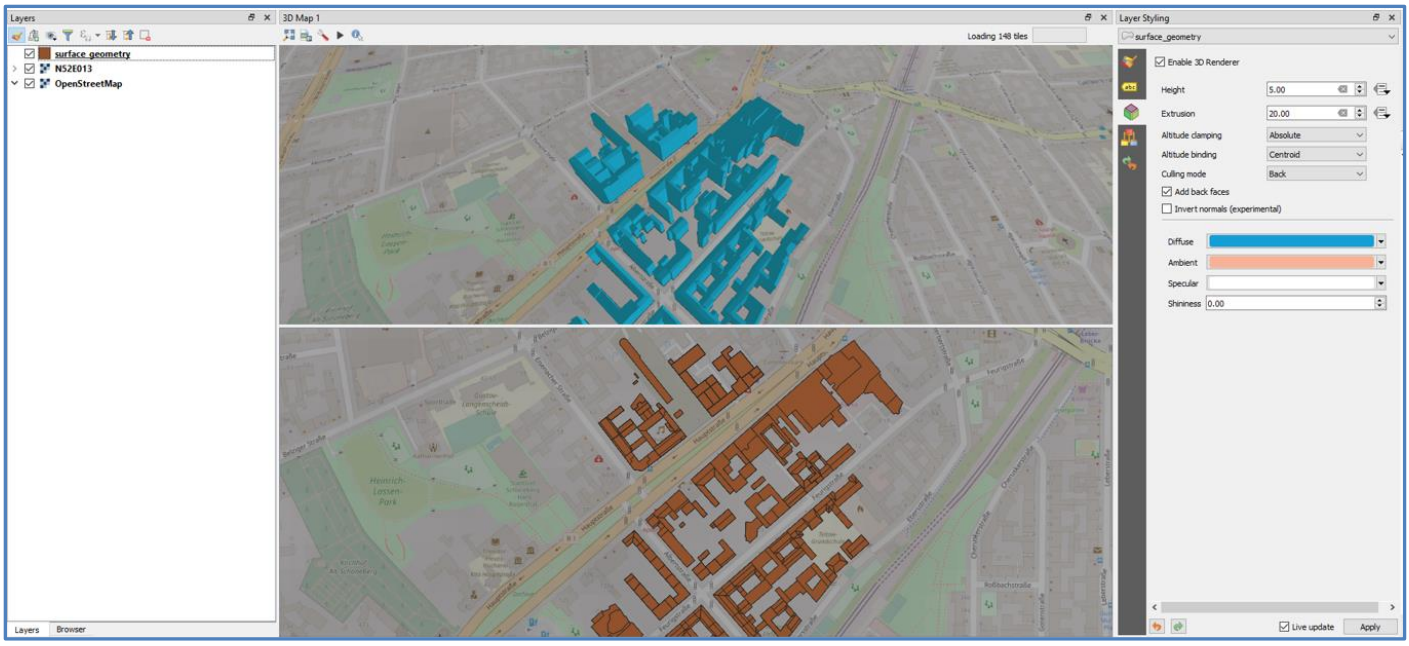


Once the file was downloaded I simply **dropped** the terrain into my QGIS map window.

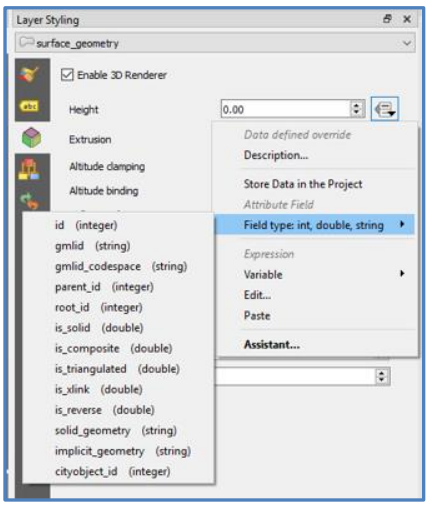


To open the QGIS 3D viewer, from the **View** menu I chose **New 3D Map window**. Once the 3D Map window was open I selected the **configuration settings** and set the **Elevation** to use the Berlin Terrain data (N52E013).

To view the CityGML data in 3D, you need to use the **Layer Styling Pane**, and activate **Enable 3D Renderer**. Once this is activated, you can choose a **Height** value and **Extrusion**.



The Height and Extrusion values can be a static value for all features e.g. 5 metres for Height, or you can use the **Field** values in the source dataset. However, I couldn't find a field in my PostGIS table that contained the height value.

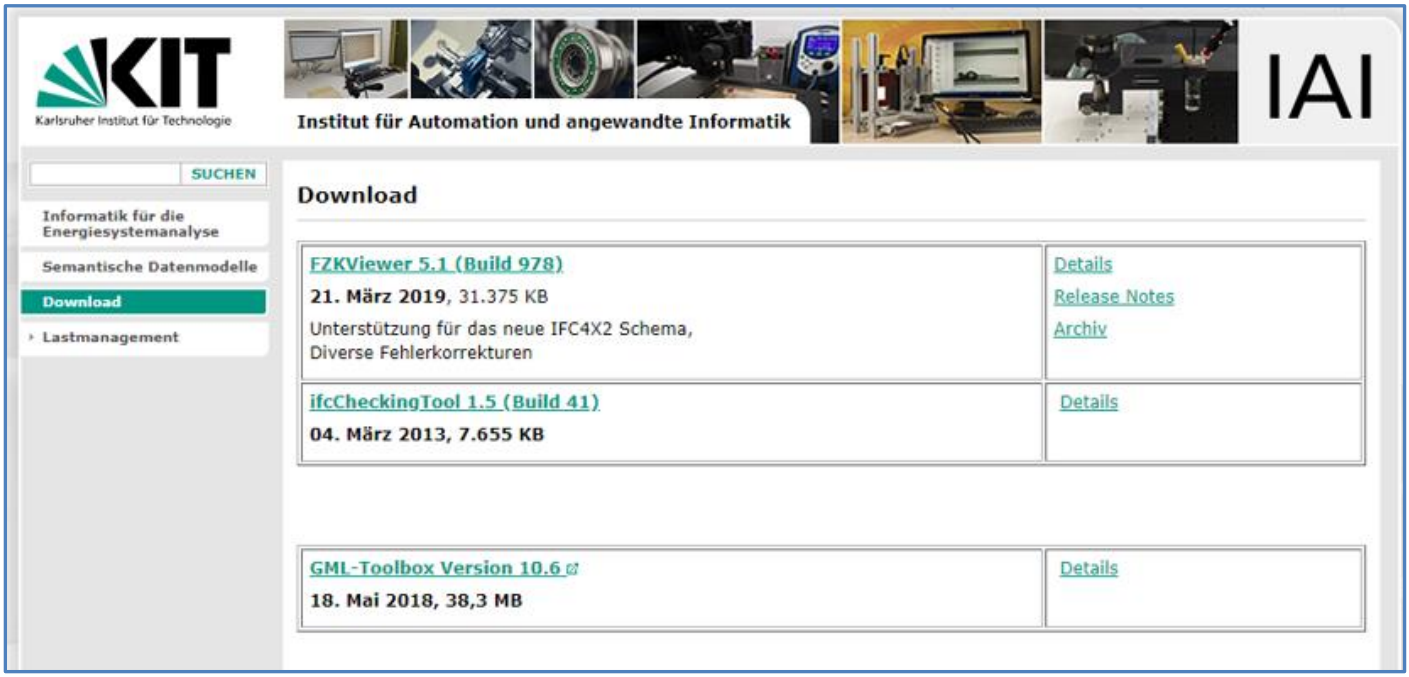


This indicated that there was likely other settings or translation steps I would need to do in order to visualise CityGML correctly within QGIS, but as a first attempt I was happy using a static height value for all features.

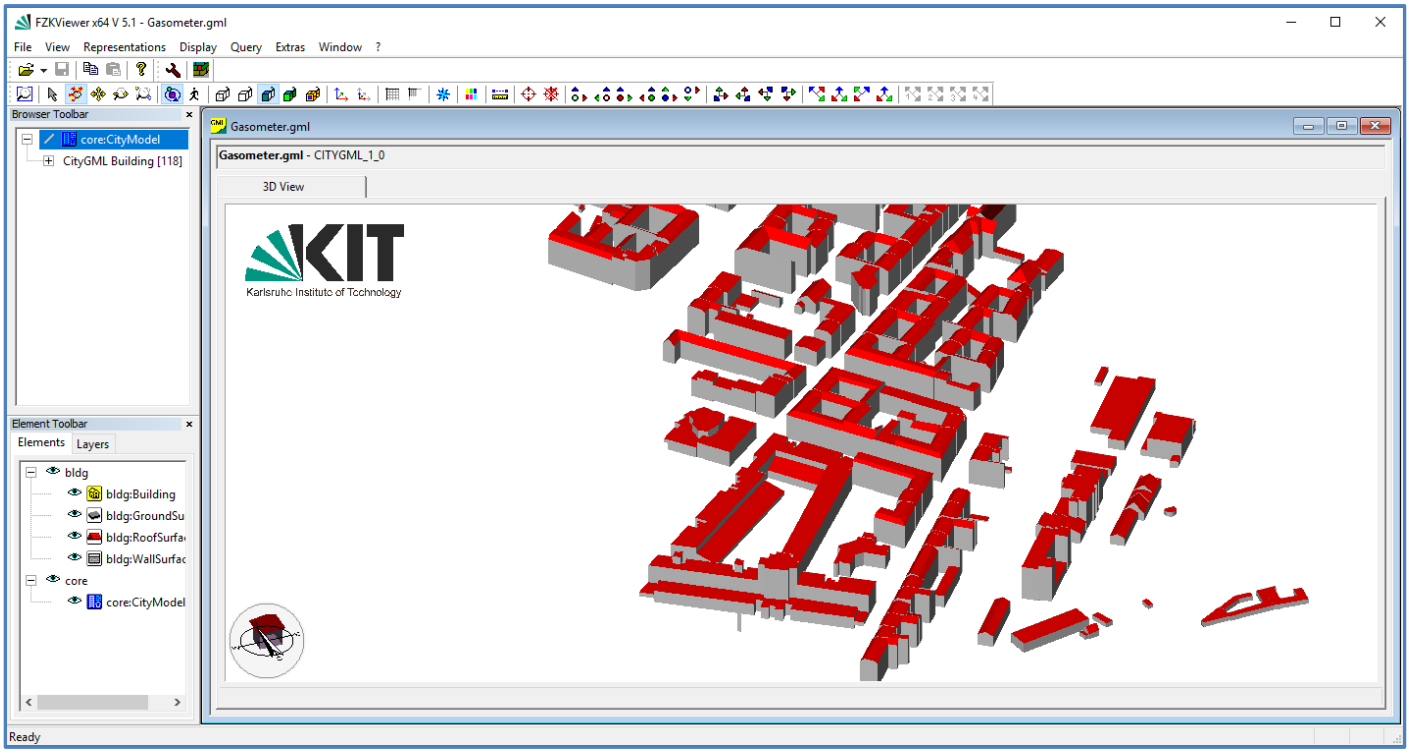
This was the first time I had viewed CityGML data in a client application and it was from a **PostGIS database** instance that I controlled…. **Very exciting!**

If you don't have QGIS, or you aren't a GIS user, I also found another free to use Viewer so that you too can view and sample CityGML datasets. Follow this link - http://www.citygmlwiki.org/index.php/Freeware

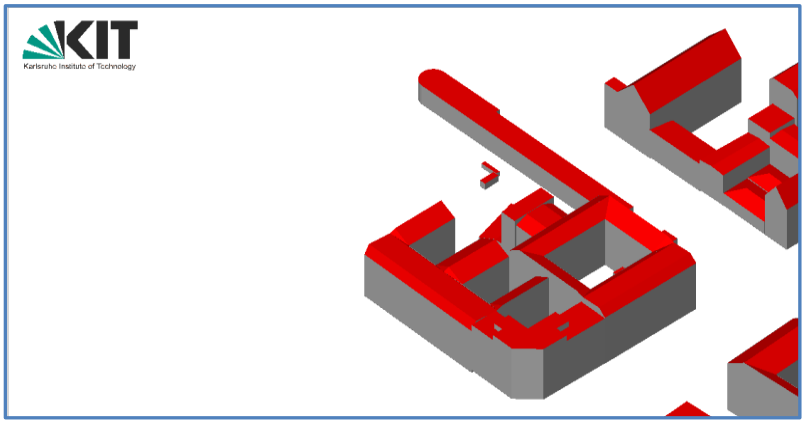
To download the **KIT Viewer** - https://www.iai.kit.edu/1302.php



I then simply used the **Open** button to find my Berlin CityGML file – **Gasometer.gml** – and the CityGML features opened into the KIT Viewer window.



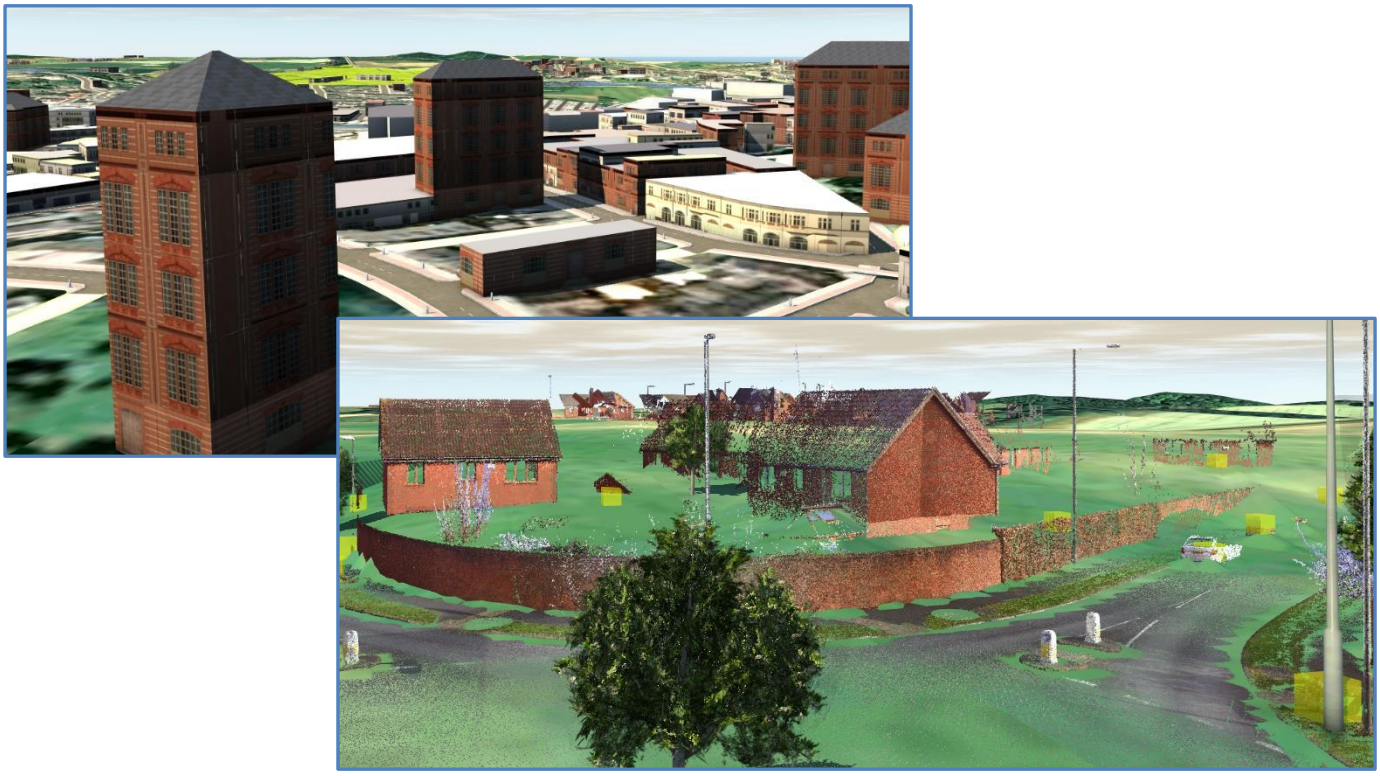
This was a great find as I could then check the features in the source CityGML file in the **KIT Viewer**.



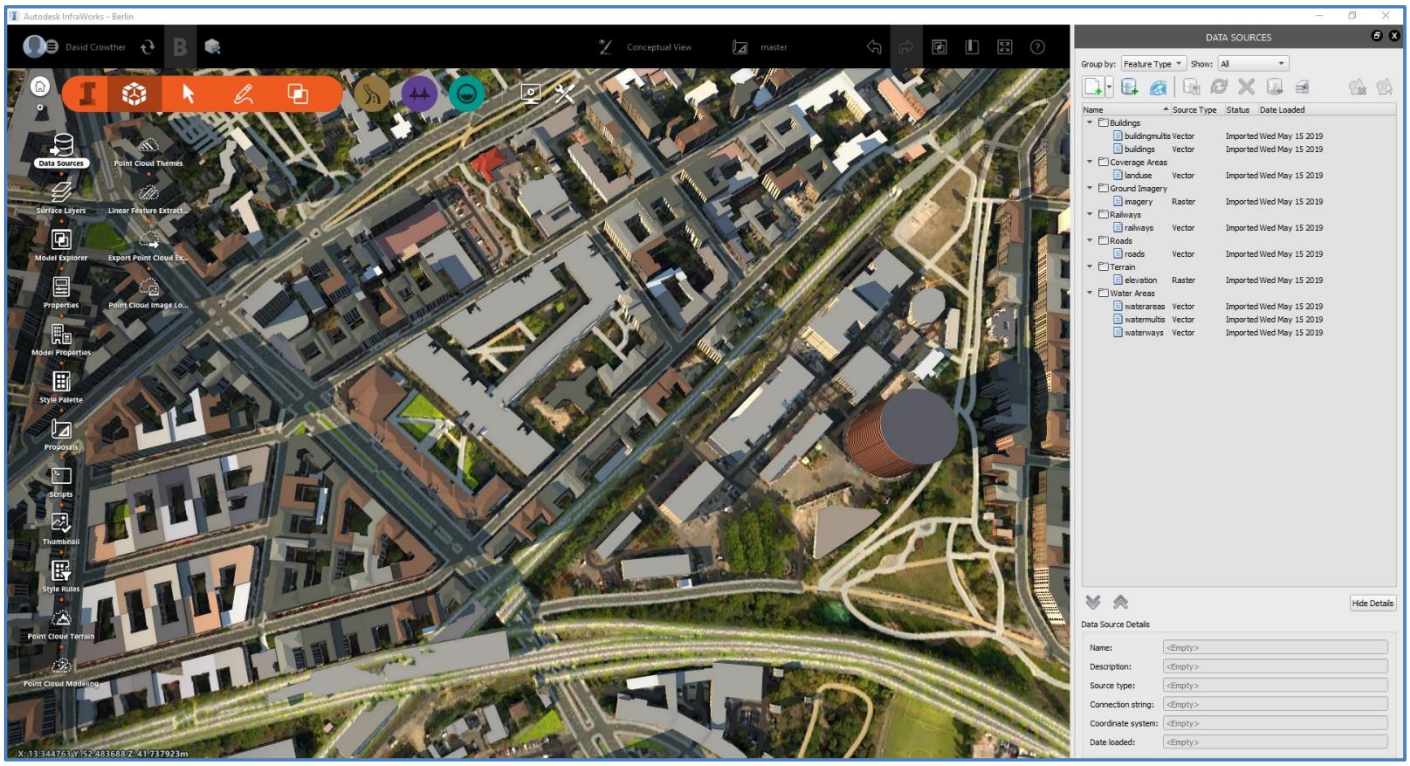
Against the features as imported into my PostGIS database and being visualised in **QGIS**.. and they were the same!

With my limited knowledge there was only so far I could go with viewing CityGML within QGIS, so I decided to concentrate next on accessing my CityGML datasets within Autodesk InfraWorks.

InfraWorks is definitely no stranger to visualising 3D datasets. In fact, you can create 3D Models of most places around the world using the freely available **OpenStreetMap** datasets, or if working in the **UK** you could link your Models to **OS Mastermap** and use the new **Building Height Attributes** for even more accuracy. In addition, with onsite surveying you can also open **Point Cloud** datasets to visualise real-world assets.

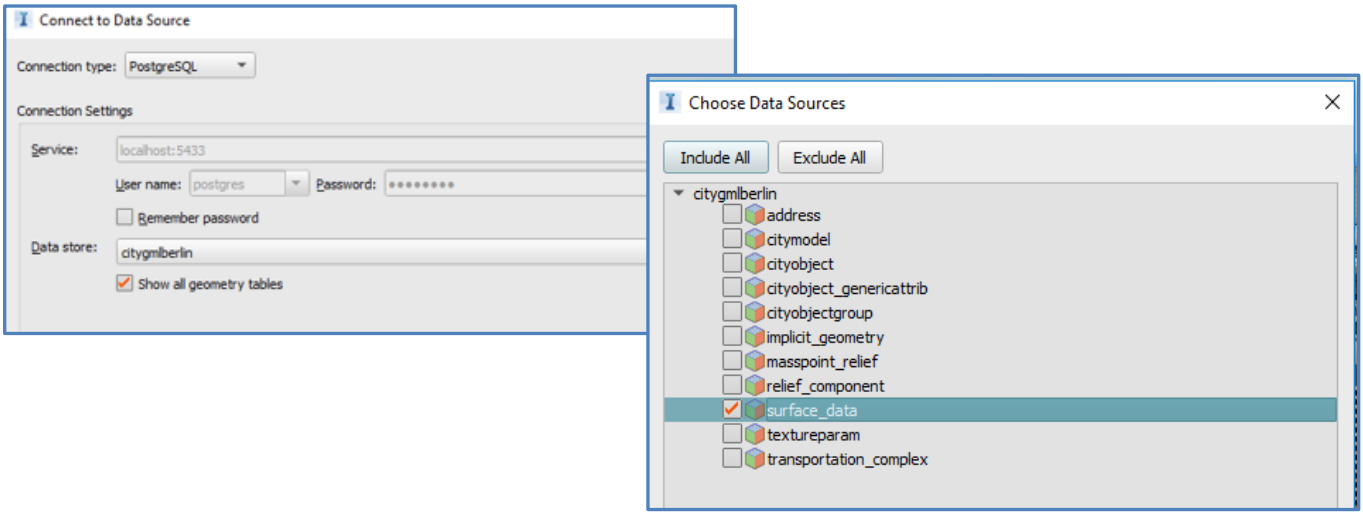


To visualise the CityGML features in InfraWorks I used the **Model Builder** tool to create a 3D Model of Berlin.

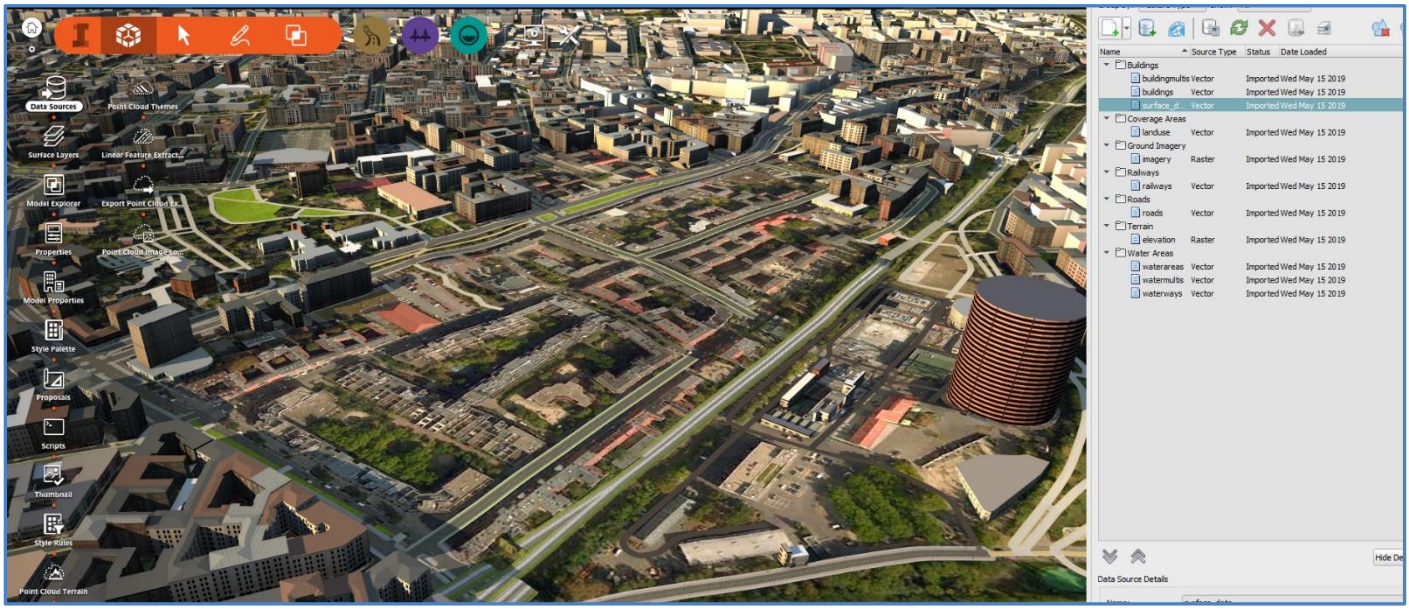


And then **deleted** the existing **OpenStreetMap** buildings from the centre of my Berlin Model.

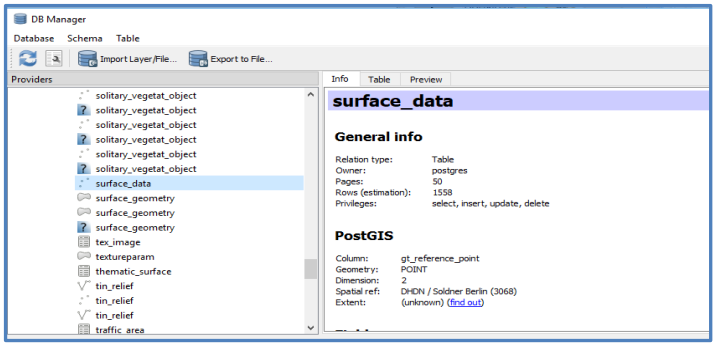
Using the **Data Source** options in InfraWorks I connected my Model to my **PostGIS database** and loaded in the **Surface_data** table.



After configuring the Surface_data layer as **Buildings**, I refreshed the model however no building features were added into the model.



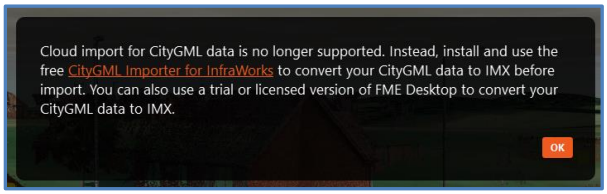
Reviewing the Surface_data layer in PostGIS I could see the geometry was **POINT** data and so wouldn't generate buildings within InfraWorks. However, the Surface_Geometry layer which we used in QGIS wasn't available from the InfraWorks PostGIS import options.



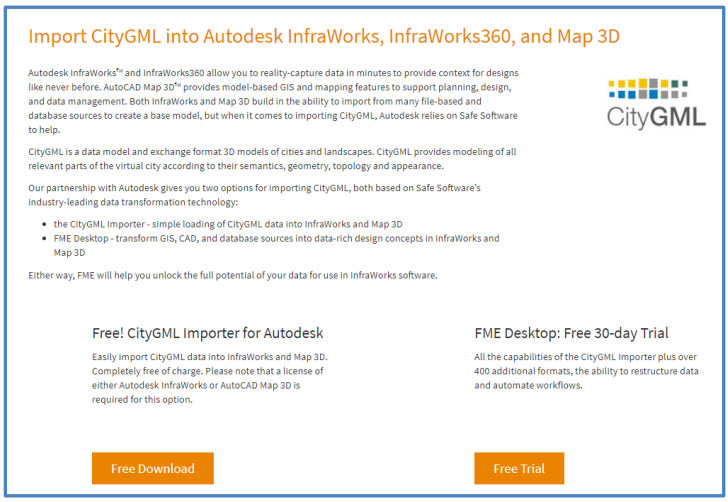
So for the moment, I wasn't able to connect InfraWorks to the CityGML data in my PostGIS database. The next option was to use the open **CityGML** tool directly from within the **Data Sources** Pane.

However, at some point it appears that this link is **no longer supported** and InfraWorks requires that the CityGML format is translated into **.IMX format** in order to open into InfraWorks.

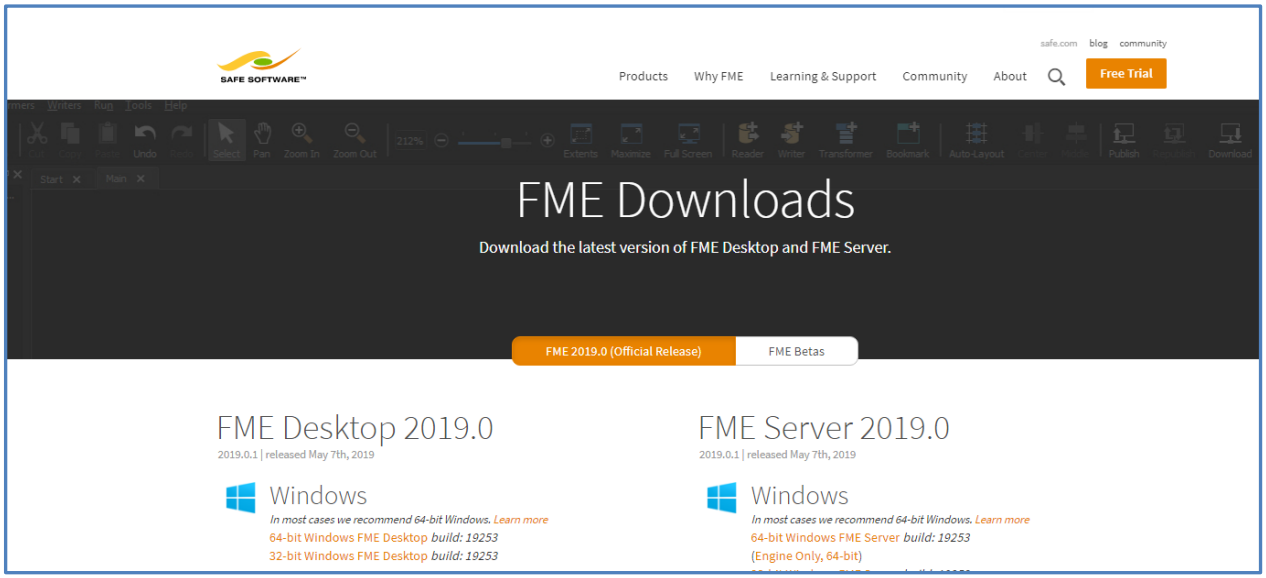
Clicking the CityGML button in Infraworks gave me the link to the free to use importer.



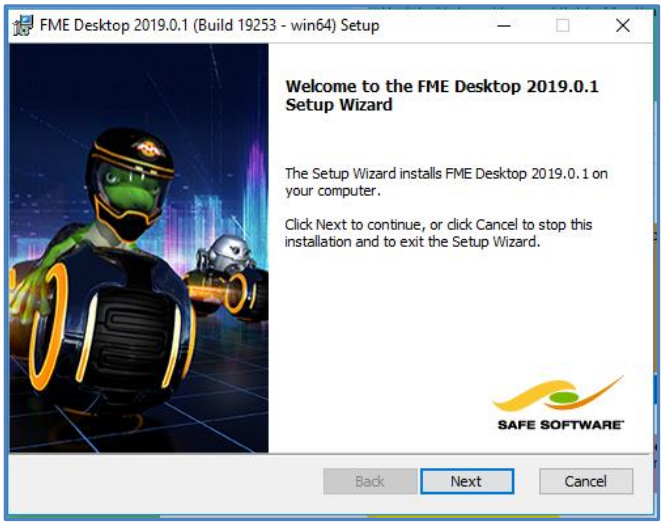
The link opened the download page for the **CityGML Importer** on the **Safe Software** webpage - https://www.safe.com/citygml-importer/



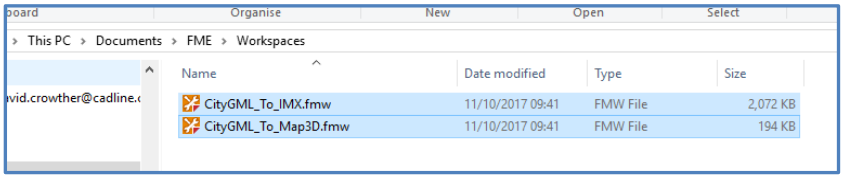
Clicking the **Free Download** link meant that I had to **register** before I could access the **FME download** page.



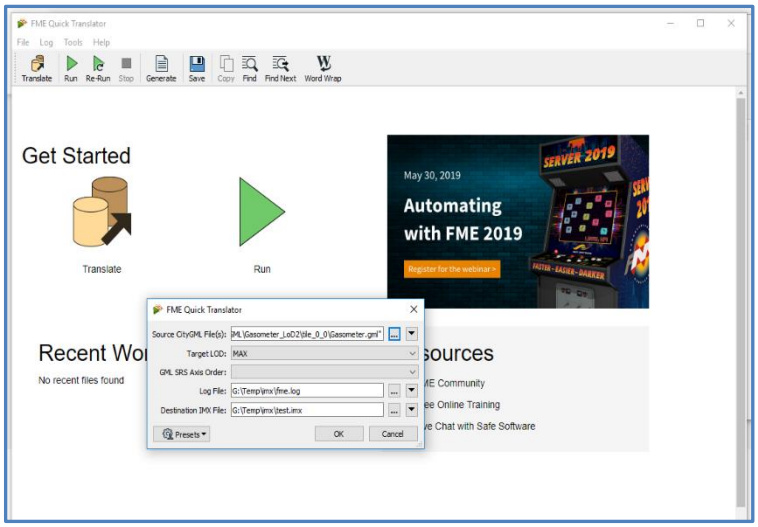
After installing **FME desktop** I used the free evaluation licence code I was emailed to activate the software.



One of the welcome emails also had a link to download the **Workbenches** required for translating CityGML to .IMX format, which I had to copy to the **/FME/Workbenches/** folder.

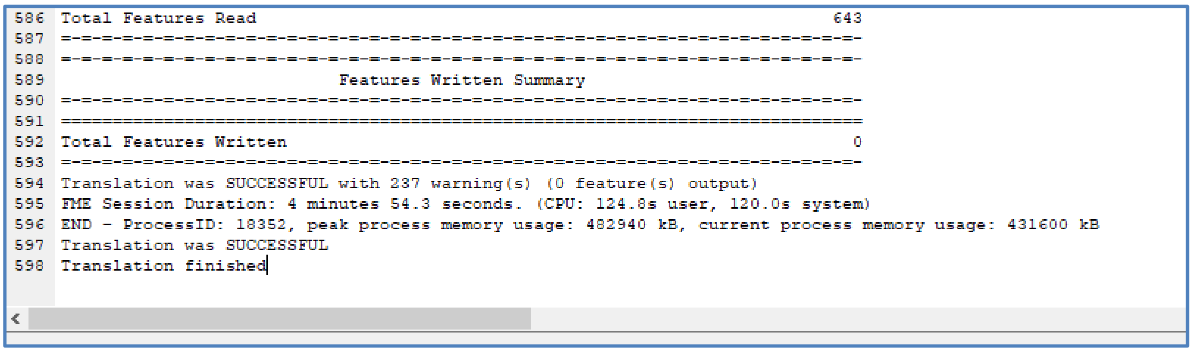


From my **Start** menu I opened the **FME Quick Translator** tool and **Ran** the **CityGML to IMX Workbench**, loading the Berlin GML file and editing the location of any LOG files and the output .IMX file.

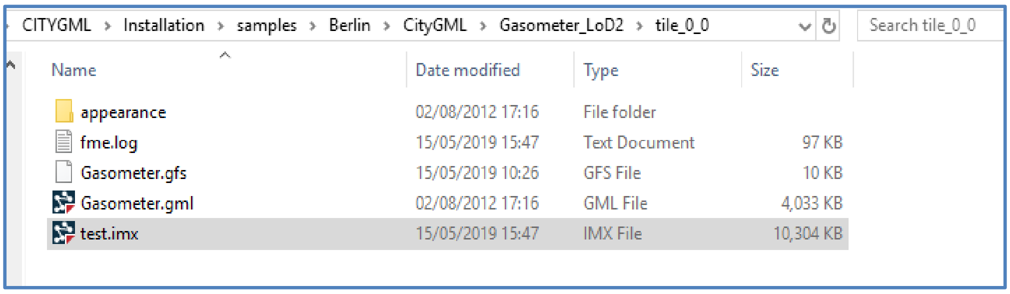


Note – *I had to uninstall FME and re-install with the Python 2.7 option ticked for the translation to be successful.*

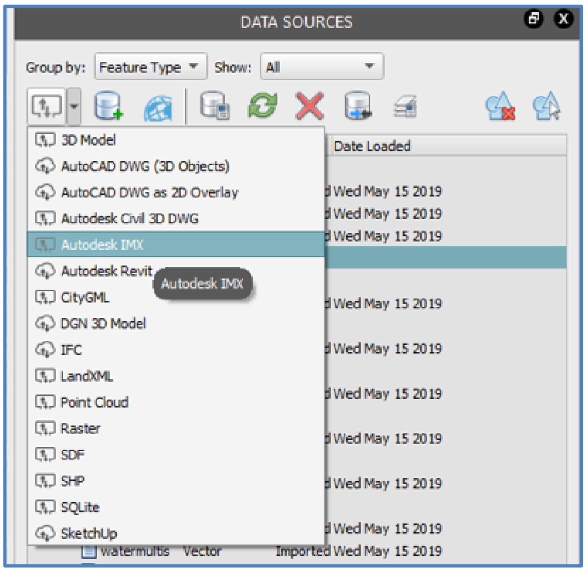
The translation process took about **2-3 minutes** to run but was successful.



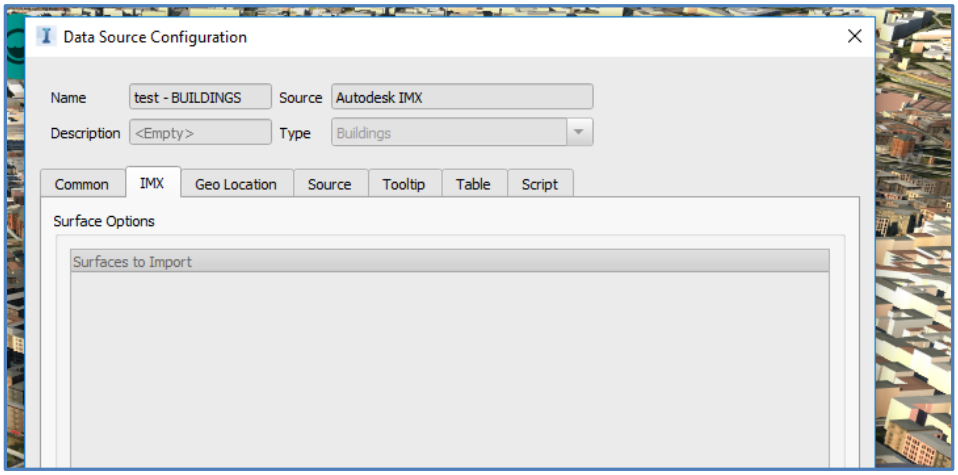
And generated the required **.IMX** ouptut file.



Now within InfraWorks I was able to use the **Data Source** pane and open an **Autodesk IMX** file.

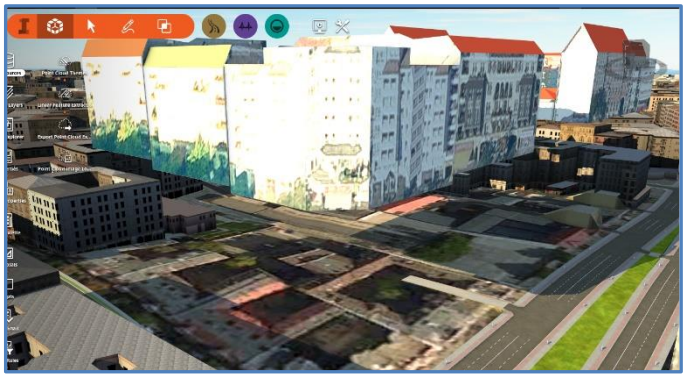


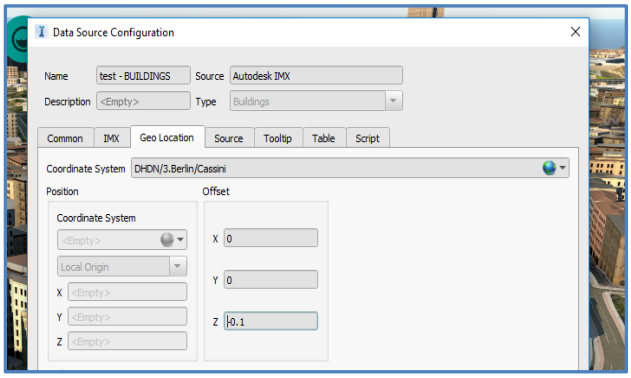
Configuring the Berlin .IMX file to be **Type – Buildings**.



Once the configuration was completed, the InfraWorks model **refreshed** and was updated with the CityGML features now added to the model.

On closer inspection the features were raised above the surface, so I used the **Data Source Configuration** to offset in the **Z** direction **-0.1 metres**, which then corrected the issue.





I now had an updated InfraWorks model with CityGML features added into the centre of the model.

With **textures/facades** automatically applied, as well as **roof slopes** added.

This is the first time that I have been able to visualise CityGML features in a 3D model where I have had the facades truly represented. This is great news, as it means that I no longer have to tell people that an InfraWorks model ***'isn't Google StreetView!'***,.. well it's definitely getting closer that's for sure 😊.

That was the start of my journey into exploring CityGML, and the **end of Part 1** of my blog. I am not sure where Part 2 of my journey will take me, but I have a feeling I want to better utilise my **PostGIS CityGML** instance and better understand how I can utilise CityGML data within **InfraWorks**. So watch out for Part 2 of this blog series.