EDSL Guide for Revit gbXML Files

Introduction

This guide explains how to create a Revit model in such a way that it will create a good gbXML file. Many geometry issues with gbXML files can be corrected within Tas but in general the best solution is to correct the issue within the Revit file, as this saves on extra work if the gbXML file is used again or if the Revit file is edited and a new gbXML is exported.

The Revit term "room" will be used throughout, but the rules apply equally to "spaces" in Revit MEP.

The guide also explains how to identify gbXML issues within the Tas 3D modeller, which helps to highlight areas of the Revit file which need work.

It is recommended that users watch the videos available at http://edsl.myzen.co.uk/downloads/misc/Revit gbXML Training Files.zip before using this guide. These videos serve as an introduction to the topic of good gbXML creation, and this guide is intended for users who have watched the videos.

## Contents

1. Resolving issues within Revit

This section explains the most commonly encountered issues with Revit models which lead to incorrect geometry within the gbXML file, and gives solutions in each case. The best way to ensure a good gbXML import from Revit is to have these guidelines in mind from the beginning of the project – correcting an existing Revit model is much more complicated and time-consuming.

1.1. Geometry

The aim of this section is to ensure that when rooms are applied to the Revit model the resulting gbXML will have a complete set of surfaces and all the surfaces will have the correct type.

Ignoring these rules may cause confused and incorrect geometry in the gbXML, e.g., missing walls, walls which have no connection to the building, adjacent rooms failing to join together, and internal surfaces exposed to the outside air.

1.1.1. Walls made of multiple elements
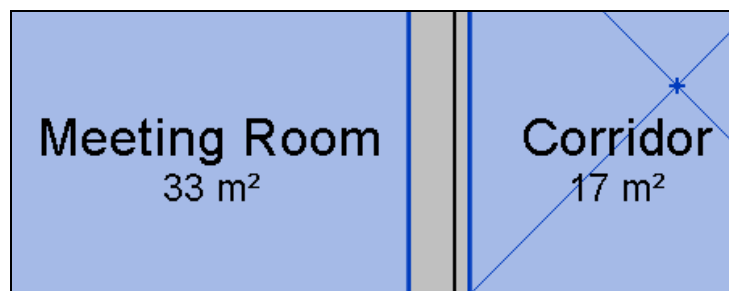
Where two parallel walls are in contact with each other without an intervening void (see example above) this will cause an issue once rooms are applied. Each room borders a wall but nothing will link the two walls in the gbXML, so although the rooms may look joined, they are in fact not. The best solution is to replace the two walls with a new element with a thickness equal to the combined thickness of the two walls. Making one of the walls non-room-bounding is a quicker solution but not always as good.

A common variant of this problem is when a room separation line has been placed parallel and in contact with a room-bounding wall. In effect this line stops the room from touching the wall, and it should be removed.

Room separation lines should only be used to separate two rooms, and not for any other purpose.

1.1.2. Overlapping walls

When two walls overlap it will cause the same issues as the case where two parallel walls are in contact, but is not always as easy to spot as the two overlapping walls may look like a single element. However, Revit will give a warning if two walls overlap, so check the list of warnings for the building, looking out for the message "Highlighted walls overlap".

1.1.3. Floors and ceilings made of multiple elements
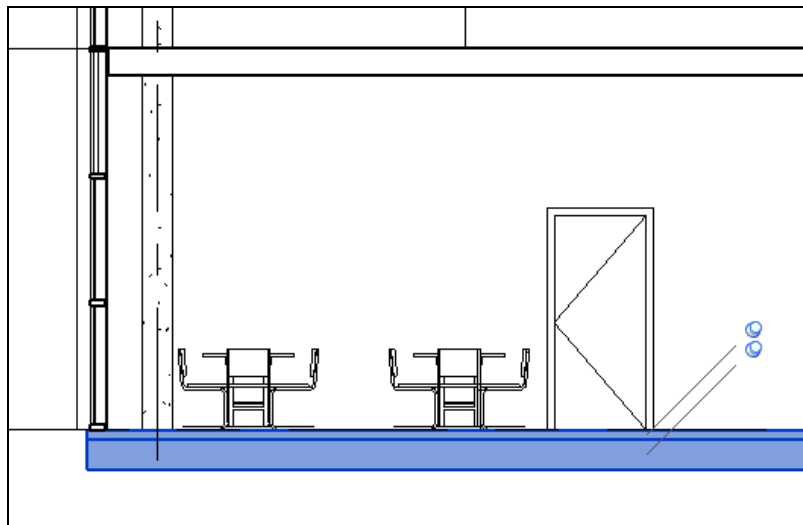
As with walls, there should be no instances where floors and/or ceilings are placed directly in contact with each other. In the case shown by the section above, the room is only considered to be in contact with the uppermost floor element, and the lowest floor element is disregarded. The best solution here is to replace the two floors with a single, thicker element. The quickest solution is to make the top layer non-room-bounding.

Similarly, a floor or roof should never overlap and occupy the same space as another floor or roof.

1.1.4. Roof and floor footprints

When drawing the building's roof, bear in mind that any gaps in the roof will allow Revit rooms to leak from the building. Try to ensure that the roof footprints are sufficient to fully cover the rooms below them. The same principle applies to the internal and ground floors.
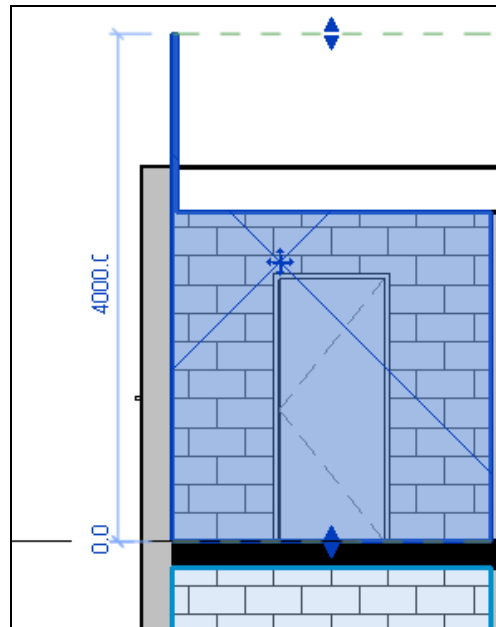
The section above demonstrates that a very small gap in a roof can have a large effect on the room beneath it. The room, highlighted in blue, is leaking out upwards through the gap between the roof and the wall. If this model was exported to a gbXML the room shown would have two large exposed air surfaces.

1.1.5. Exterior elements

All floor surfaces which are intended to be in contact with the ground must have the function "Exterior". If the same floor type is to be used elsewhere in the building, duplicate the floor type before changing its function.
Similarly, all walls intended to be in contact with the outside air should have function "Exterior". If the same wall type is used for internal purposes, duplicate it before changing its function.

1.2. Defining rooms

The aim of this section is to ensure that all areas of the building are occupied by a room, that all rooms are properly contained, and that all rooms link correctly to neighbouring rooms or to external elements of the building.

Any part of the building which is not occupied by a room will not be exported correctly to the gbXML. If a room is prevented in any way from touching the surfaces associated with it, the data exported to the gbXML will be incorrect.

1.2.1. Rooms overview
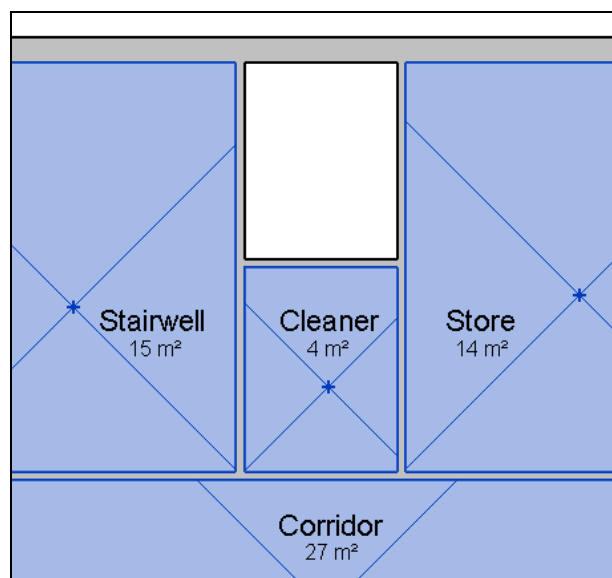
Rooms must be applied to all areas of the building. There should be no region within the shell of the building that is not filled by a room, including risers, ceiling voids, wall voids, floor voids, etc. Any areas not filled by a room will be missing from the gbXML file, and neighbouring walls will be marked as an incorrect type in the gbXML.

For example, in the picture above we see a riser which does not contain a room. This can be remedied in one of three ways:
1) Make a neighbouring wall non room bounding so the neighbouring room will fill this space.
2) Adjust the limits of a room above or below the vacant area to fill it.
3) Place a new room in the vacant area.

Solution 1 is often the best solution if, e.g., two small spaces which neighbour each other can be merged together without having a negative impact on the model. Solution 2 can be applied when one riser or lift shaft room can be extended to fill the whole shaft. Solution 3 is applicable in all cases, and the best solution when neither solution 1 or 2 can be used.

Just as the building must be filled with rooms from side to side, it must be filled with rooms from top to bottom. Room limit offsets should be extended, where necessary, so that the top and bottom of each room is in contact with either another room, or a room-bounding element.

A good rule of thumb is to set the upper limits of rooms to the level of the storey above them, and both base and upper limit offsets to zero. If there is no storey above (i.e. a roof defines the top of the room), then it is often necessary to extend the upper limit offset to reach up to (or beyond) the top face of the roof surface. This ensures that the roof will be exported as a single element.
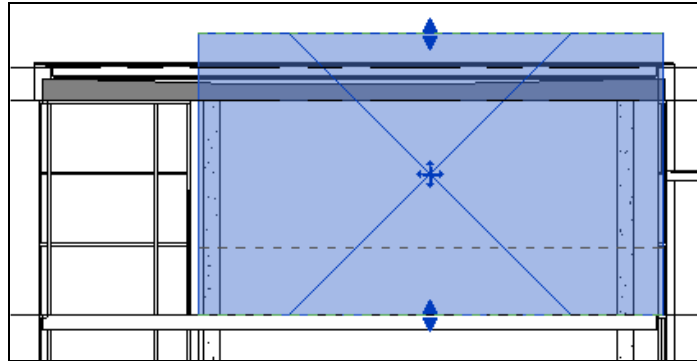
In the section above a room protrudes through the roof. The two most likely causes are that the roof is not room bounding, or that the option "Areas and Volumes" has not been selected in the "Area and Volume Computations" dialog. It is a good idea to select this option before attempting to resolve any room bounding issues, to avoid confusion.

1.2.2. Room separation lines

Room separation lines should only be used to separate one room from another. For example they could be used to subdivide a large area, or to form a boundary between two areas which do not have a wall between them.

In all other instances room separation lines should be deleted.

Room separation lines should never overlap walls or other room separation lines. If they do then this will show up as a warning within Revit, so check that any such warnings have been resolved before exporting the model, and look out for the messages "Highlighted room separation lines overlap" and "A wall and a room separation line overlap".

1.2.3. Columns

All columns must be made non-room bounding. Room bounding columns create external links within the building, meaning the column surfaces are treated as if they were exposed to the outside air. Room-bounding columns can also lead to confused geometry being output to the gbXML, such as missing areas.

Where columns form part of a wall between two rooms and removing the column would cause the rooms to occupy the same area, the wall should be extended to fill the gap left by the column.
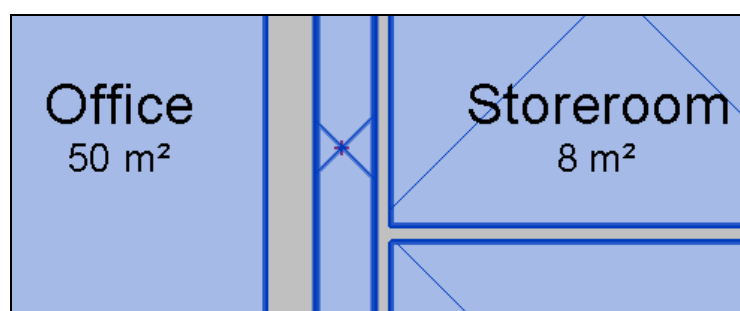
1.2.4. Wall voids
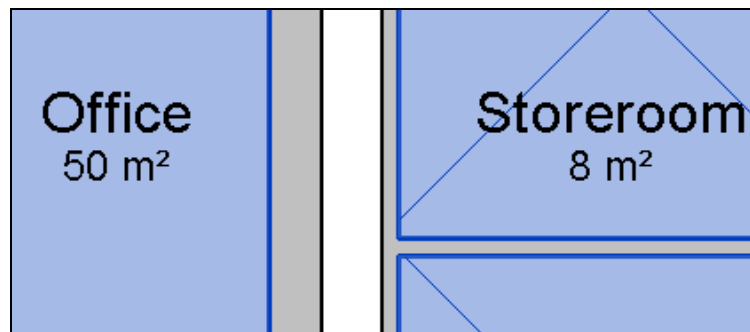
There can be no wall voids that do not contain rooms. As an example, see the picture above – two existing rooms are separated by two walls with a void between them. The geometry would be incorrect if a gbXML was made from this model; the two rooms would have no link and their walls would be marked as the wrong type.

Possible solutions:
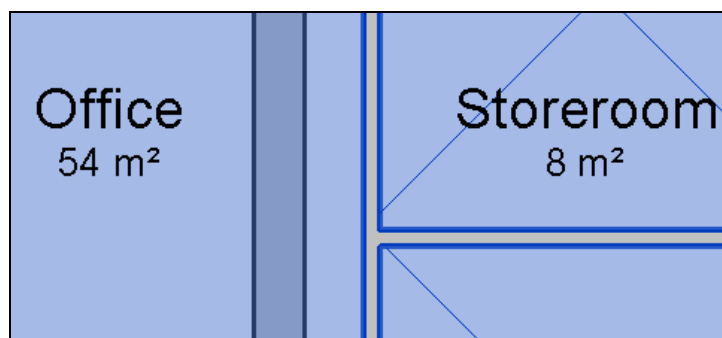
1. Make one of the walls non-room-bounding.

This is one of the quickest solutions, and is best applied in cases where the wall void is very small or the wall separates off an area which logically belongs to the larger room (e.g. a small storage area, or a thin wall hiding toilet cisterns). In the case above it wouldn't be a very good solution as the wall void is thick, as is the wall itself, and making the wall non-room-bounding has increased the floor area of the left-hand room significantly.

2. Place a new room between the two walls.

This is another quick solution, and is best applied in cases when the wall void is wide. For thinner voids (less than about 300mm) it should be avoided. In this case the wall void is quite wide and this solution would be reasonable.
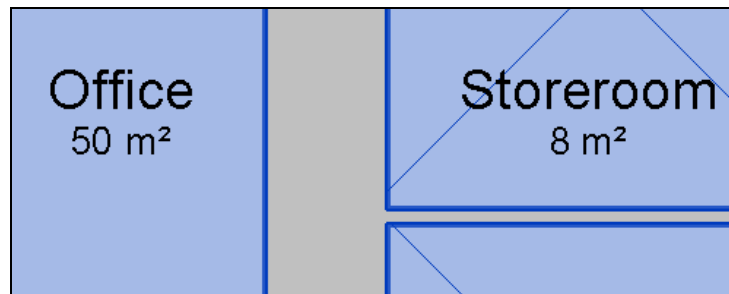
3. Replace the two walls with a single wall element.

A new wall type is made whose total thickness is equal to the thickness of the two walls plus their void. This is then applied in place of the two walls that existed here previously. In most cases this is the best solution as it keeps floor areas correct and avoids complicating the model with unwanted void rooms.

1.2.5. Floor and ceiling voids

The same principles that apply to walls between two spaces apply to floors and ceilings between spaces.
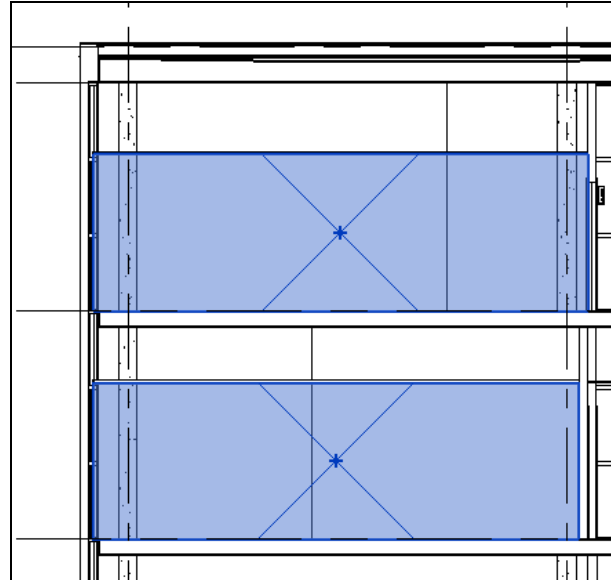
In the section above, two rooms, one directly on top of the other, are separated by a ceiling and a floor with a void between these two elements. If a gbXML was created with the model as it is, the two rooms would not have a link to each other. The solutions are the same as the wall void case:

1. Make one of the elements non-room-bounding. This is a quick solution which is the best option if one of the elements does not completely separate off a sealed region, for example a suspended ceiling which only partially covers the room. In most cases this solution should be avoided as it will give incorrect room volumes.
2. Add a new room in the void. In this case a new level has to be created which runs between the ceiling and floor. The new room would then be assigned on this level. This solution is best for large floor and ceiling voids (more than about 500mm).
3. Replace the floor and the ceiling with a single element. The new element's thickness should equal the combined thickness of the two elements plus the thickness of the void. In most cases this is the best solution.

In all cases, ensure the offsets of the rooms in question (including the void room if this option has been used) are correct; their tops and bottoms must reach a room bounding element.

1.2.6. Checking for roof gaps in Revit

Small gaps in roofs and floors can have a big impact on the surface geometry of the rooms they are supposed to be containing. One quick way to check for gaps in the roof of the model is to increase the upper limits of the rooms on the top floor and then go to the File → Export → gbXML dialog.
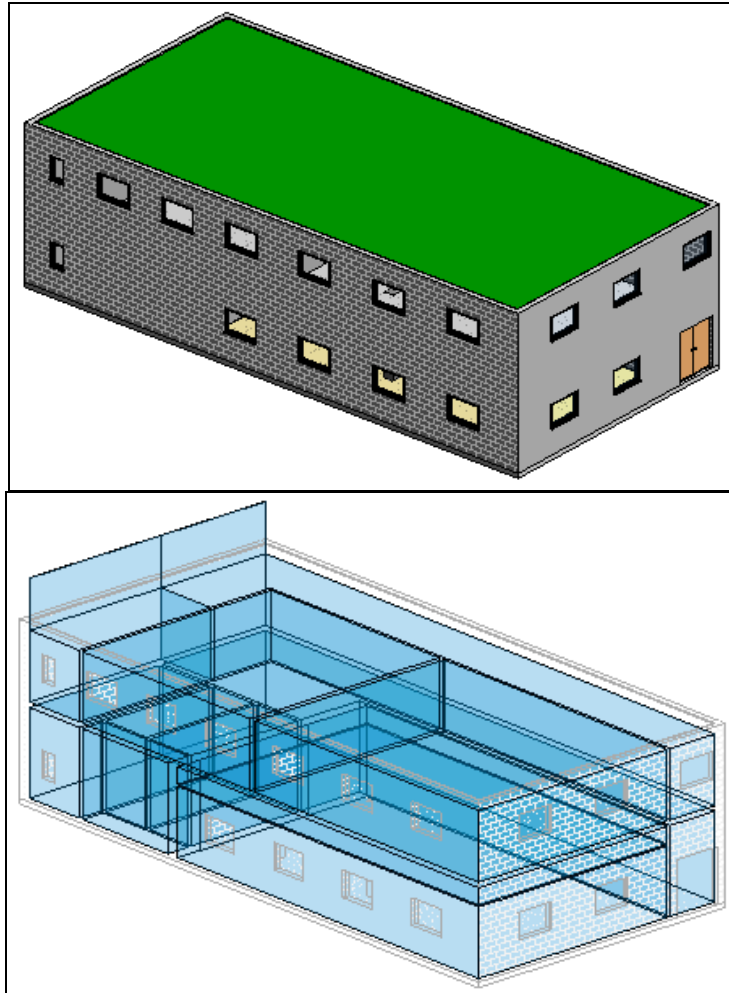
The images above show an example of a building with a gap in its roof. The first image is the building as it appears in the Revit 3D view, and no roof issues are immediately obvious here. The second image shows the building in the Export gbXML dialog. The blue shaded areas are the rooms, and on the left hand side of the image two rooms are sticking out through a thin gap in the roof of the building. The footprint of the roof should be extended to prevent this.

1.3. Summary

1.3.1. Checklist

- Turn on the "Areas and Volumes" option.
- Make columns non-room-bounding.
- Assign rooms to all areas, including lifts, risers, and voids.
- Ensure room limits are sufficient for each room to have a bounding element or another room at the top and bottom. (In general, set upper limit to floor above.)
- Remove all room separation lines that do not separate two areas.
- Ensure that two or more room-bounding walls have not been placed in parallel and in contact with each other. Do the same for floors and roofs.
- Resolve any warnings about overlapping walls and room separation lines.
- Resolve any issues with overlapping rooms.
- Change function of external walls and ground floors to "exterior".
- Ensure all areas have a floor.
- Make half-height internal walls non room bounding. If there are different rooms on either side of the wall use a room separation line to mark the boundary between them.
- Ensure that roof footprints are sufficient to cover the areas below.
- Where possible, replace bay windows with windows directly in the main wall.
- Use the "Automatically Imbed" option to place curtain glazing within walls instead of making holes in the wall's profile.

1.3.2. Walls summary
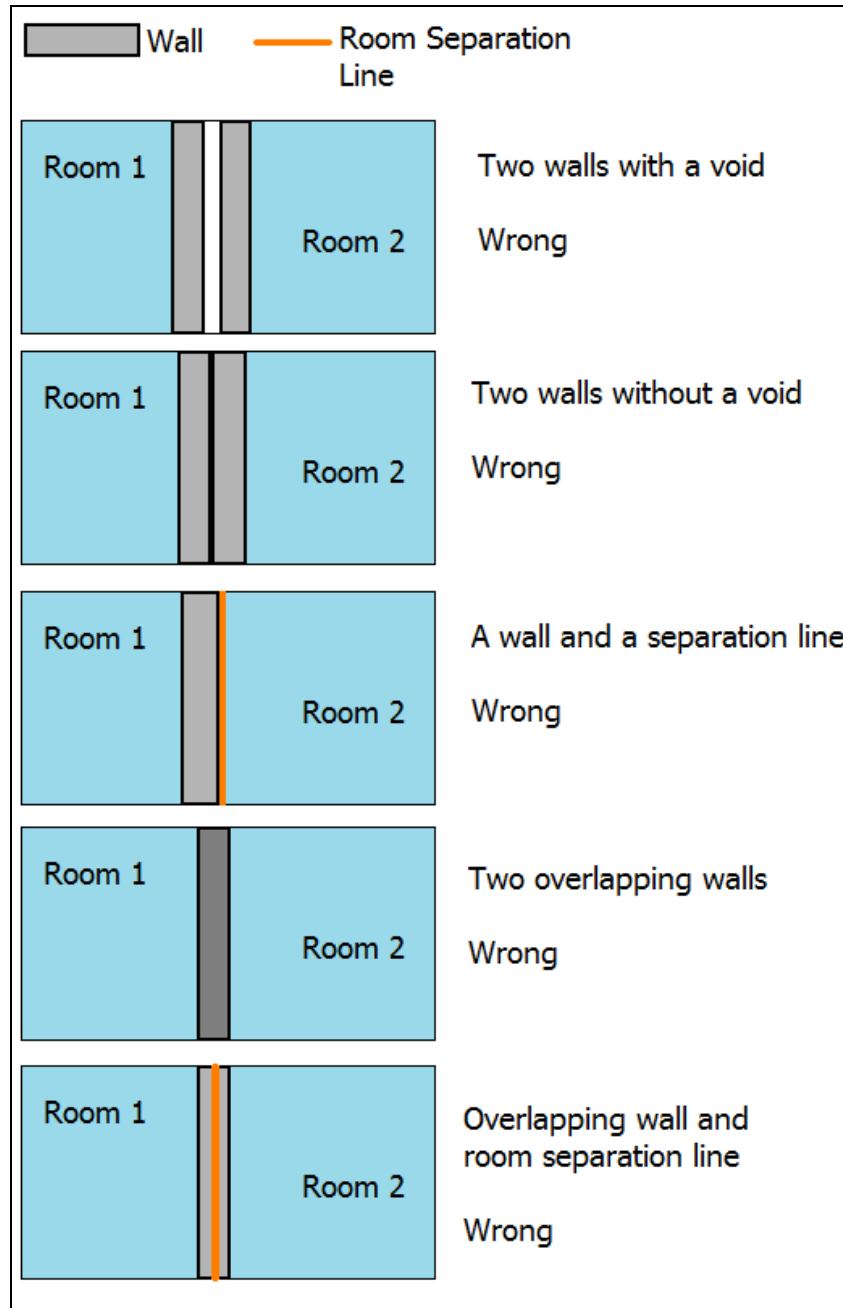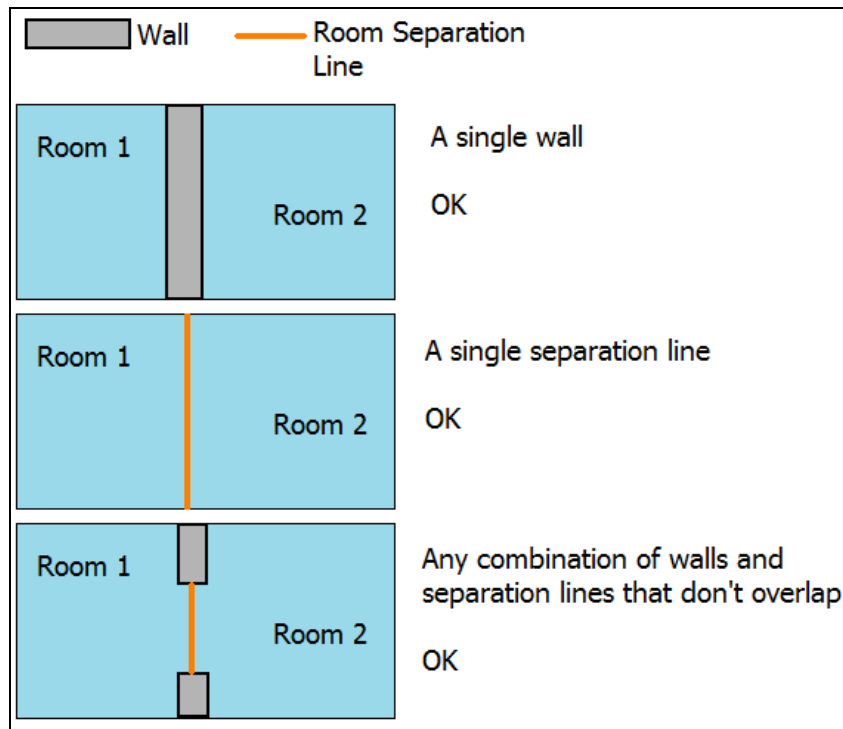
Note that these rules apply equally to links between a room and the outside air, as they do to links between two rooms.

2. Identifying gbXML issues using Tas3D

2.1. The gbXML model

       The image below shows a simple gbXML which has been imported into Tas3D, prior to turning the gbXML into a Tas model. At this stage checks can be carried out on the model to ensure that the geometry has been exported as required into the gbXML – the gbXML does not need to be converted into a T3D before analysing for geometry issues.
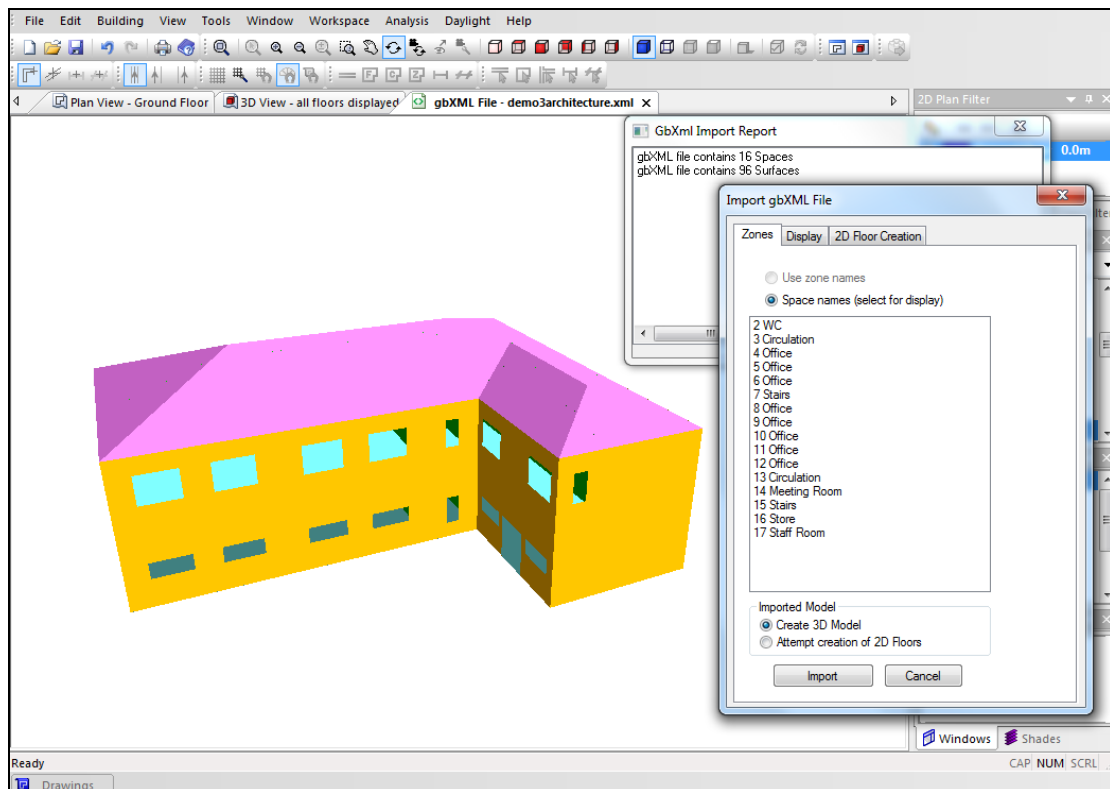
2.1.1. Checking shade surfaces

On the "Import gbXML File" dialog box, go to the "Display" tab and disable the "Shades" checkbox in the "Display Surfaces" section (see below). This will hide any surfaces which are not in contact with a room. If any surfaces disappear which are supposed to be in contact with rooms (e.g. walls, floors, or roofs), then the gbXML file is incorrect. Shades should only appear for surfaces that are not directly part of the analysed area but which will be taken into account for the shading calculations, for example roof overhangs, external shading devices, or neighbouring buildings.
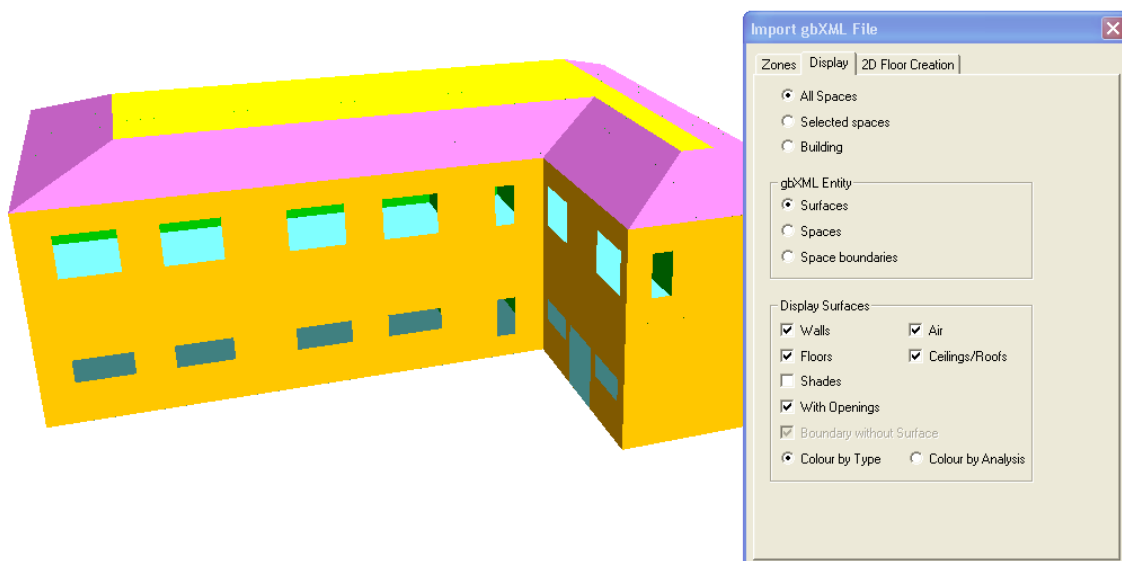
In the image above, hiding the shade surfaces has caused part of the roof to disappear – in this case the issue was that the room limits were set too low and they didn't reach the top of the roof. In general, if anything disappears which shouldn't when the shades checkbox is disabled, the solution is to ensure that a room was applied to the area and that the room isn't prevented from reaching the building surfaces by e.g. a room separation line or badly defined room limit.

Be sure to look underneath the model to inspect the floor surfaces.

2.1.2. Air surfaces

The "Air" checkbox (also in the "Display Surfaces" section of the "Display" tab) is used to toggle the display of surfaces which do not have a solid building element applied to them. The only cases for which this would be correct are room separation lines between neighbouring rooms and for the interface between two rooms, one on top of the other, without a floor between them.

In the image below, disabling the "Air" checkbox has made the floor vanish – in this case the issue is that there isn't a room-bounding floor on the bottom of the building.
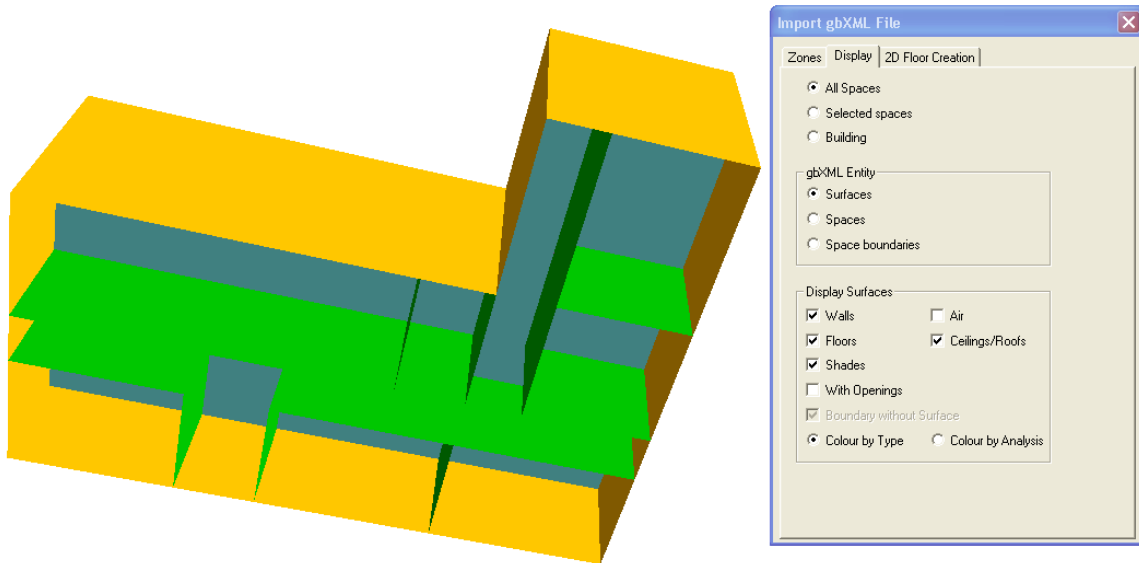
Note that the "With Openings" checkbox is disabled. This option toggles the display of openings on the surfaces (windows, doors and rooflights). The reason for disabling this option is to distinguish between air surfaces that are not displayed and surfaces that are not displayed due to the fact that they are windows and doors.

Air surface issues often occur at the same time as shade surface issues, the reason being that if a room doesn't reach its wall, for example, the wall will become a shade surface and the room will end with an air surface instead of a wall.

Air surfaces can be reassigned to a different building element after the Tas model has been created, using the Set Wall / Floor / Ceiling Element tool.

It is not uncommon, even with a good Revit model, to end up with small air surfaces in the gbXML, usually at the corners of walls. These cannot always be helped, but exposed air surfaces will be marked as the building element "Air-exposed" in Tas3D, which can be given an appropriate construction later, e.g. external wall.

2.1.3. Roof issues

Holes in the building's roof can be identified easily in the gbXML model. In the instance below, the model had a tall lip sticking up from one end of the building. Unticking the "shades" tickbox did not make this lip disappear – if it had, this would show it was a parapet wall used for shading only but not connected to any room. However, the anomaly remained and as further evidence that this geometry is incorrect, the building is shown below using the "spaces" option under "gbXML Entity". On the left hand side of the model two rooms can be seen sticking upwards above the rest of the building. The reason for this issue is that there is a gap in the roof here. The roof footprint should be changed in the Revit model to prevent this.
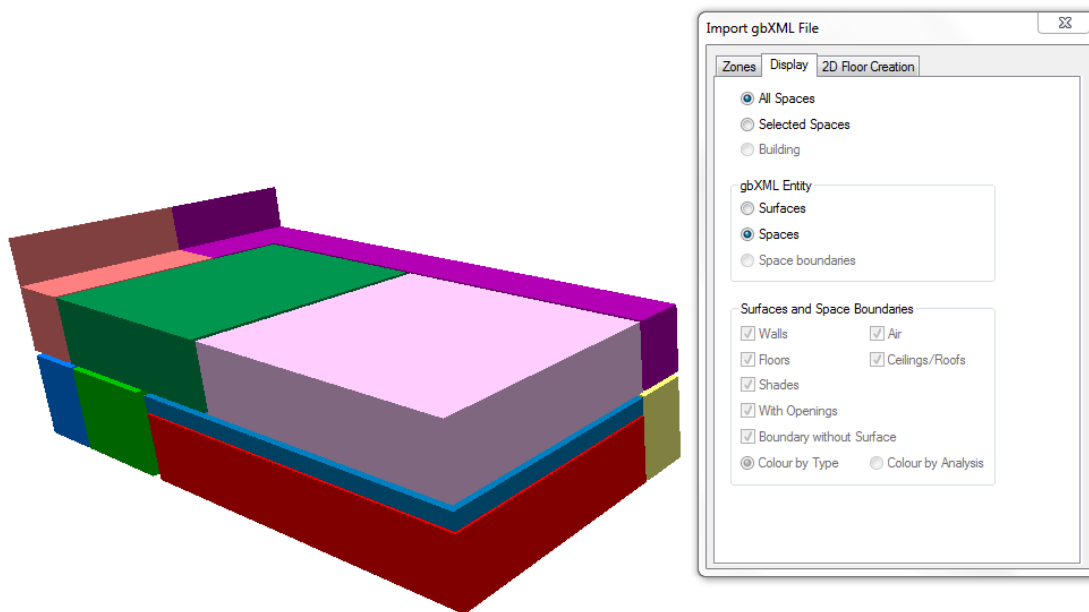
2.1.4. Colour by analysis

At the bottom of the "Display" tab is a radio-button which toggles between colouring the model by the building element type, or by "analysis". This refers to the surface link type (for example, ground, external, internal, adiabatic, or a link to another zone). This option is used to see if the surface is correctly specified.
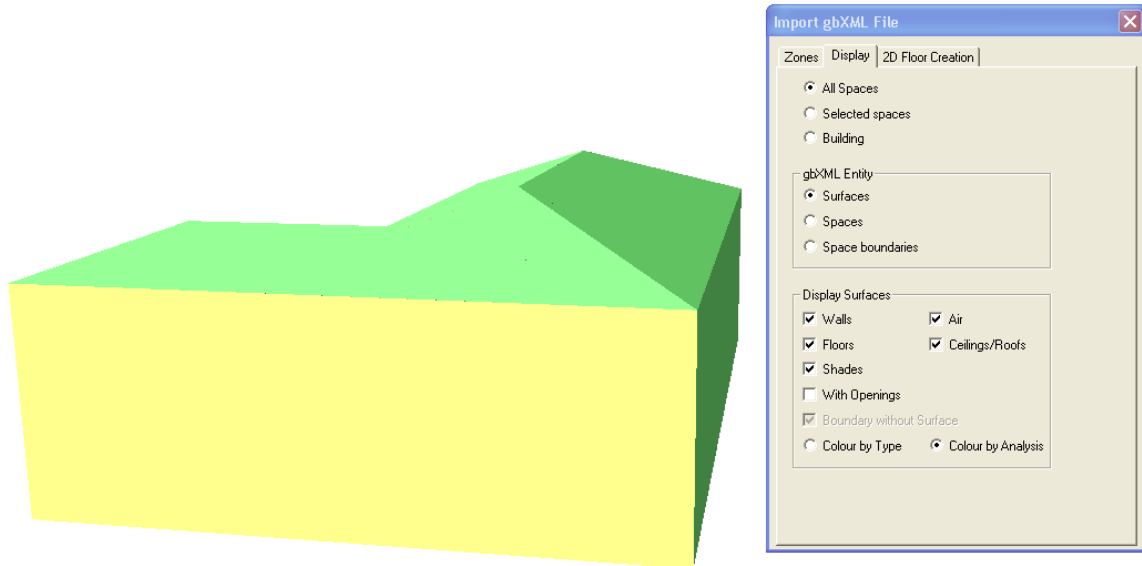
The most common issues related to surface analysis types are ground floors which do not link to the ground and external walls marked incorrectly as "internal". The image above shows an example of the latter issue. As before, the windows and doors are removed from the graphic for clarity. The surfaces exposed to the outside climate are represented by the colour green but the wall facing out of the page is coloured yellow. This indicates that it is incorrectly specified as an internal building component. This can be corrected in Revit by changing the wall function to "Exterior".

The surface type represented by each colour may be seen by clicking "Analysis Colours" in the "View" menu of Tas3D (see below). The user has the option to change the colours used.
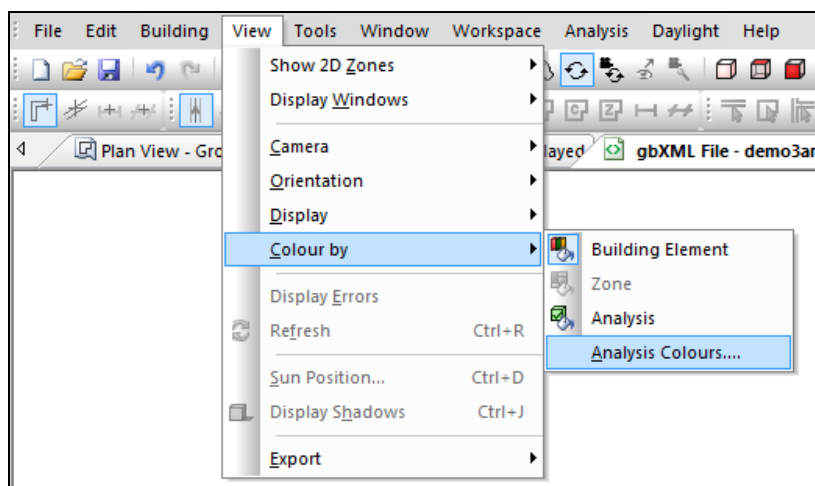
2.1.5. Looking inside the model

As not all issues are related to the building envelope, it may be necessary to investigate the internal surfaces of the gbXML file. There are two ways to do this.

The first method is to use the checkboxes in the "Display Surfaces" section to hide certain surface types. For example, the roofs can be hidden to take a look at the surfaces below.

The second method is to view only a selection of rooms. On the "Zones" tab, click the spaces to investigate (hold down the Ctrl key to enable multi-select). After this, click the "Display" tab and enable the "Selected spaces" radio-button. In the image below, the "Selected spaces" and "Colour by analysis" options are used to check surface types for the ground floor offices.

In the image below the rooms are free of problems. Look out in particular for internal surfaces which have been marked as having the "external" type. If these occur, return to the Revit model and check the affected surfaces − the cause is probably adjacent or overlapping surfaces and/or room separation lines.
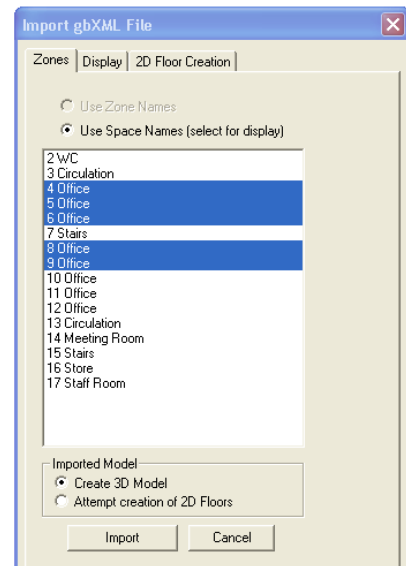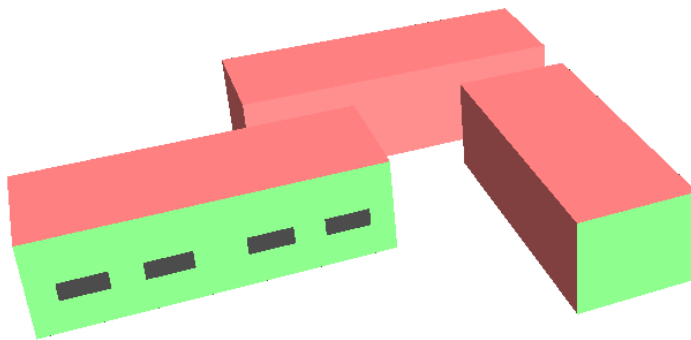
2.2. Creating a Tas 3D model from the gbXML

There are two import options available on the import gbXML file dialog box. The "attempt creation of 2D Floors" option will attempt to split the model into floors and create a model with all the options normally available within the Tas 3D modeller. It is strongly recommended that this option is only attempted if no major issues were encountered when using the "create 3D model" option.

The "create 3D model" option creates a model where the geometry is taken directly from the gbXML file rather than being converted into a normal Tas 3D file. Some of the modelling options of 3D Tas are unavailable (for example new windows cannot be placed and the geometry of imported rooms cannot be changed), but building element types, zone assignments, and window types, dimensions, and frames can be edited. New geometry can be added to a model imported using the "create 3d model" option. For example, external shades can be added to the imported geometry. In most cases, "create 3D model" is the best option to use, and it is the option which will be discussed in more detail below.

In either case an import should only be attempted after all issues identified using the methods explained above have been resolved.

2.2.1. Understanding the gbXML import report

After pressing the import button, it is worth checking the "gbXML Import Report" window. In most cases the errors and warnings shown here indicate that a problem needs resolving within the Revit model. Note that following the guidelines in section 1 of this document can greatly reduce the number of messages here. The meanings of the errors and warnings are discussed below:

"INFO Space <name> has no geometry to define volume and floor area."
This message appears if a room has not been placed in a properly enclosed region in the Revit file. This may be because there is a gap in the building geometry or because the room was placed outside the building.

"INFO Space <name> has no surface geometry and will not be imported."
This message appears if a room has not been placed in a properly enclosed region in the Revit file. This may be because there is a gap in the building geometry or because the room was placed outside the building.

"INFO <number> surfaces have been reversed due to inconsistent gbXML data for polygon and angles"

This message appears when the angle and polygon data in the gbXML file are inconsistent. Tas3D assumes that the angles are correct and reverses the polygon to match them. Note that this message may appear in the import report even with well-made Revit models. The problem occurs during the export from Revit to gbXML, but as it is corrected automatically in the Tas3D import it should be no cause for concern.

"INFO There are <number> surfaces specified as adjacent to a space on both sides – they will be "Adiabatic" surfaces unless "Set Exposed" option is used."

This message appears when instead of linking to another room, the ground, or the outside air, a surface has a link to the same room on both sides. Tas3D will automatically make these surfaces adiabatic, rather than exposing them to the outside air. The most common causes of the message are:

- The surface is an internal wall without another room on the other side, either because not all areas have rooms assigned, or because the wall has a void or touches another parallel wall.
- The surface is supposed to be an external wall but has the function "interior".
- The room has bad limits and this message refers to an air surface at the top or bottom of the space.
- The surface is supposed to be a ground floor but has the function "interior".
- A room separation line is preventing the room from reaching a wall.

This message can also appear in relation to small additional surfaces which sometimes appear at the corners of walls. These surfaces, defined within the gbXML from Revit, can appear even in well-drawn models and cannot always be corrected. In general, when these surfaces are small they will not have a significant effect on the simulation of the Tas model.

As a general rule, small internal adiabatic surfaces will have little impact on the building simulation, but in the case of large or external surfaces the best course of action is to return to the Revit model and correct the underlying issue. The issue may be obvious by simply inspecting the room in question, but if needed the surface can be identified in Revit from its code name in the "Export gbXML" dialog with the "Analytical Surfaces" option selected.

Adiabatic surfaces can be changed to exposed surfaces in Tas3D by using the "Select Wall" tool to select the affected surface, and selecting "Set Exposed" from the right-click options menu.

"WARNING Space reference for <name> is not unique – surface adjacencies may be incorrect"

This message appears when two rooms have identical names, which can lead to incorrect surface links in the Tas model. The only way to correct this is to return to the Revit model and rename one of the rooms.

"ERROR Space <name> has incomplete or inconsistent surface geometry."
        This message appears when it seems the gbXML geometry cannot be put together to create a sensible room. This happens either because the model was badly drawn or because the geometry has become confused during the export from Revit. A common cause is that the model contains room-bounding columns. Note that the named room may still be present in the imported model, but it may have incorrect surfaces, for example two floors instead of a floor and a ceiling.
        This can also appear if there are thin gaps between surfaces. The user can check whether this is the case by using the analysis model errors and warnings dialog (see section 2.2.2). In general, when these gaps are small they will not have a significant effect on the simulation of the Tas model.

        If there appear to be no changes needed to the Revit model but messages still appear in the import report, it may be worth attempting an import using the "attempt creation of 2D floors" option. This is only recommended for advanced Tas users as it may involve locating, identifying, and correcting complicated geometry issues. Remember that some messages may still appear for good models, for example in cases where Tas has automatically corrected surface orientations.

2.2.2. Analysis model errors and warnings

        After importing a gbXML using the "create 3D model option", messages specific to gbXML files may appear in the "analysis model errors and warnings" dialog box in the 3D view. The meanings of the messages are explained below:

"INFO – Imported surface has unknown adjacency – exported as Adiabatic"
        These are surfaces whose type wasn't clearly defined in the gbXML. Many of these surfaces are "air" surfaces where Tas3D has automatically filled in gaps in the model. Tas3D has made these into adiabatic because if the model has many small gaps it is better not to expose these to the outside air.
        In the dialog box the user can see how large each surface is and decide whether its analysis type should be changed. Small adiabatic surfaces will have little impact on the analysis. An adiabatic surface can be changed into an exposed surface by using the "Select Wall" tool to select it, and choosing "Set Exposed" from the right-click options menu.

"WARNING – Imported Space has gaps between surfaces"
        As a general rule, small gaps will have little impact on the building simulation, but in the case of large gaps the best course of action is to return to the Revit model and find the gaps which are preventing the space from being properly enclosed. When the warning is selected in the dialog, the gap will be highlighted on the Tas model.

"WARNING – Imported Space has surfaces that may have incorrect orientations"
        If this message appears then it indicates that some surface edges do not match with the edges of another surface, and as a result it has not been possible to create an enclosed space with no gaps in its geometry. This is a result of confused geometry in the gbXML file. Room-bounding columns are a common cause of this error.
        To correct this, the user can use the "Select Wall" tool to select the affected surface, and choose "Reverse Geometry" from the right-click options menu. To attempt the automatic correction of multiple reversed surfaces, use the "Reverse Incorrect Orientation Surfaces" option from the "Tools" menu. Another course of action is to return to the Revit model and investigate the affected room, but it may not be possible to resolve the issue here.
        As a general rule, if an internal wall has an incorrect orientation then this will have little impact on the results and can be left as it is, but external surfaces should always be corrected.

"WARNING – Imported Space has overlapping surfaces"
        This message means that two or more surfaces related to the same space are overlapping. Where overlapping surfaces are small (it may be almost impossible to see the overlap), the effect on the analysis will be negligible, but the message can indicate a more serious issue, so checking each instance of the warning is recommended.
        Overlapping surfaces cannot be resolved within Tas, so if the warning indicates a serious issue it will be necessary to return to the Revit model.

"WARNING – Imported Space has overlapping surfaces and also have surfaces that need to be reversed"
        This message indicates that the space has overlapping surfaces and also surfaces with incorrect orientations – see above for details of each issue.

"WARNING – Window(s) not contained within wall/roof – this will give incorrect results in daylighting calculations"
        This will not present a problem if no daylighting calculations are to be carried out on the model.
        The probable cause of this issue is that some surfaces are overlapping the edges of the window due to the thickness of the building elements. The issue can be resolved by editing the window dimensions or by changing the thickness of the building element (it might be advisable to create a new building element for this purpose and apply it only in the areas which have this problem).

2.3. Troubleshooting

Issue:

Parts of the building are missing from the imported file.

Potential solutions:
- Ensure that there are rooms in all areas of the building, including voids, lift shafts, risers, etc., in Revit.
- Ensure that rooms have appropriate limits in Revit.
- Check whether room separation lines are preventing rooms from reaching the walls in Revit. Separation lines should only be used to form a boundary between two rooms and only in cases where there is no other room bounding wall between them (see section 1.3.2).

Issue:

Surfaces are missing from the imported file.

Potential solutions:
- Ensure that nothing has been accidentally hidden in Tas3D – change the display to show all areas of the building and all surface types.
- Ensure that surfaces are room bounding in Revit.
- Room bounding surfaces that are not in contact with a room will not be included in the gbXML unless an export option that includes shade surfaces is chosen in Revit.
- Shading features in the Revit model will not be included in the exported gbXML regardless of export option. Add these in Tas3D instead.
- Ensure that the surface exists in the Revit file. Floors are sometimes left out by Revit users.
- In rare cases with floors and roofs it may be necessary to extend the limits further in Revit (so that the room would extend outside the building if the floor or roof was not present, or in the case of internal floors the two neighbouring rooms would overlap if not for the intervening floor).

Issue:

A roof, floor, or wall has come into Tas3D as a shade surface.

Potential solutions:
- In some cases this behaviour is correct, for example for an overhanging roof or a roof parapet wall.
- Ensure that there is a room applied in this part of the Revit model.
- If hiding the shade surface reveals a non-air surface behind then two surfaces may have been placed in contact with each other in Revit (see sections 1.1.2 and 1.1.3).
- For a roof or floor, ensure that the room limits are sufficient to reach the surface in Revit. For roofs it may be necessary to extend the room limits to reach the top face of the roof (or even extend above it).
- For a wall, ensure that there isn't a room separation line preventing the room from touching the surface in Revit.

Issue:
> A roof has come into Tas3D as two surfaces – a shade surface above and a roof surface beneath.

Potential solutions:
- Ensure that in the Revit model there is only one room-bounding roof here, and not two or more (see section 1.1.3).
- Extend the room limits to reach the top face of the roof (or extend above it).

Issue:
> A surface that should be exposed to the air has been marked in Tas3D as being in contact with the ground, or vice versa.

Potential solutions:
- Change the building element type in Tas3D.
- Adjust the ground plane level in the Revit file.

Issue:
> A surface that should be exposed to the air or in contact with the ground has been marked as "adiabatic" (may appear as "internal" rather than "adiabatic" before the gbXML is converted into a Tas3D file).

Potential solutions:
- Change the surface type in Tas3D by right-clicking on it and selecting "Set Exposed". To make the surface link to the ground, change the building element type in Tas3D.
- Change the function of the surface to "Exterior" in Revit.

Issue:
> A surface that should form a link between two rooms is marked as "adiabatic" or exposed to the outside air.

Potential solutions:
- Ensure that rooms are applied to both areas in the Revit model.
- Ensure that there is only one surface separating the two rooms in the Revit model, rather than two elements.
- For walls ensure that there are no room separation lines in Revit preventing the rooms from meeting (see section 1.3.2).
- For internal floors ensure that the limits of each room have been set correctly in Revit and are sufficient to reach the floor.
- In rare cases with internal floors it may be necessary to extend the limits further in Revit (so that the rooms would overlap if not for the intervening floor).

Issue:
> Rooms extend upwards past the expected limit of the building rather than stop at the roof.

Potential solutions:
- Ensure the "Areas and Volumes" option is used in Revit.
- Ensure that the roof is room bounding in Revit.
- Check for shaft openings in the Revit model.
- Check the footprint of the roof in Revit to see if there are any gaps.
- Extend the footprint of the roof in Revit to completely cover the areas below.

Issue:
>Windows do not look as expected in Tas3D.

Potential solutions:
- For bay windows, replace the bay in Revit with a window placed directly into the wall.
- For curtain glazing, use the "Automatically Imbed" option in Revit to place glazing within a wall.
- Use "Complex" export option from Revit rather than "Simple".
- Windows will not be exported to the gbXML if they are below the ground plane in Revit. Lowering the ground plane in Revit may result in surfaces being marked as exposed to the outside air which should link to the ground. This can be resolved by changing the building element type in Tas3D.
- Use the "break up" option on stacked walls.

Issue:
>Unexpected holes in floors, ceilings, or roofs.

Potential solutions:
- Ensure that there are no room bounding columns in the Revit model.
- Check the footprint of the surface in Revit to see if there are any gaps.
- Check for shaft openings in the Revit model.

Issue:
>External surface appears grey in Tas3D instead of its proper colour.

Potential solutions:
- Right click on surface in Tas3D and select "Reverse Geometry".
- Select the option "Reverse Incorrect Orientation Surfaces" from the "Tools" menu.

Issue:
>After exporting to TBD, there are one or more zones with zero floor area.

Potential solutions:
- In the Tas3D model, select the option "Reverse Incorrect Orientation Surfaces" from the "Tools" menu.
- Ensure that these zones have a floor surface in the 3D model.
- Manually correct the orientation of the floor surface. Right click on the floor surface in Tas3D and select "Reverse Geometry".

Issue:
>A room separation line in Revit has come through as an internal wall in Tas.

Potential solutions:
- This may be caused by a short wall parallel to the room separation line in the Revit model.
- Check that the upper and lower limits of the Revit walls in this area are correct. Are any walls breaking through internal floors from other storeys?
- Change the wall's building element to "Null" in Tas3D.