gbXML Geometry Benchmark Tests
Test Case #4 - Atrium Example with Continuous Hole

Introduction

Geometry benchmark tests help to ensure that, as building geometry produced by building designers becomes more complex, the geometry produced for energy and heating and cooling loads analysis maintains the integrity of information that is required for a proper and detailed analysis.

gbXML.org maintains this battery of benchmark tests for vendors and other interested parties to ensure compliance with gbXML.org's standards for geometry accuracy and completeness. These tests are prescriptive and serve as marks of excellence that identify the ability of a technology to translate geometry properly from its native format to gbXML

Test #1 Instructions and Requirements

Space Name	*Your file*
Level_2_Open_Space	*confirmed* ☐
Level_1_W_Perimeter	*confirmed* ☐
Level_1_N_Perimeter	*confirmed* ☐
Level_1_E_Perimeter	*confirmed* ☐
Level_1_S_Perimeter	*confirmed* ☐
Level_1_Interior	*confirmed* ☐
Level_3_Roof_Void	*confirmed* ☐

Table 1

This test (Test Case #4) is a two-story space with an atrium skylight that allows light to pass through both floors via a hole cut in the floor plate of the second floor. The second floor space is a single zone, over a first floor space that is zoned perimeter-core. Therefore, this test is designed to ensure that second level space boundaries are properly-defined for this second floor space, and, that the hole in the floor is properly defined.

There are some special features of this model to take into account. The skylights have been modeled as openingType=OperableSkylight. Please ensure that your model's skylights are modeled as such.

The skylight is modeled as having a curb. The curb is expected to be modeled as a series of short squat walls and are not ignored.

The hole in the second floor is modeled as a gbXML Opening, with OpeningType=Air. The hole could have alternatively been modeled as a Surface with surfaceType=Air, but this method is not employed in this test.

Floor 1 Drawing Instructions and Dimensions

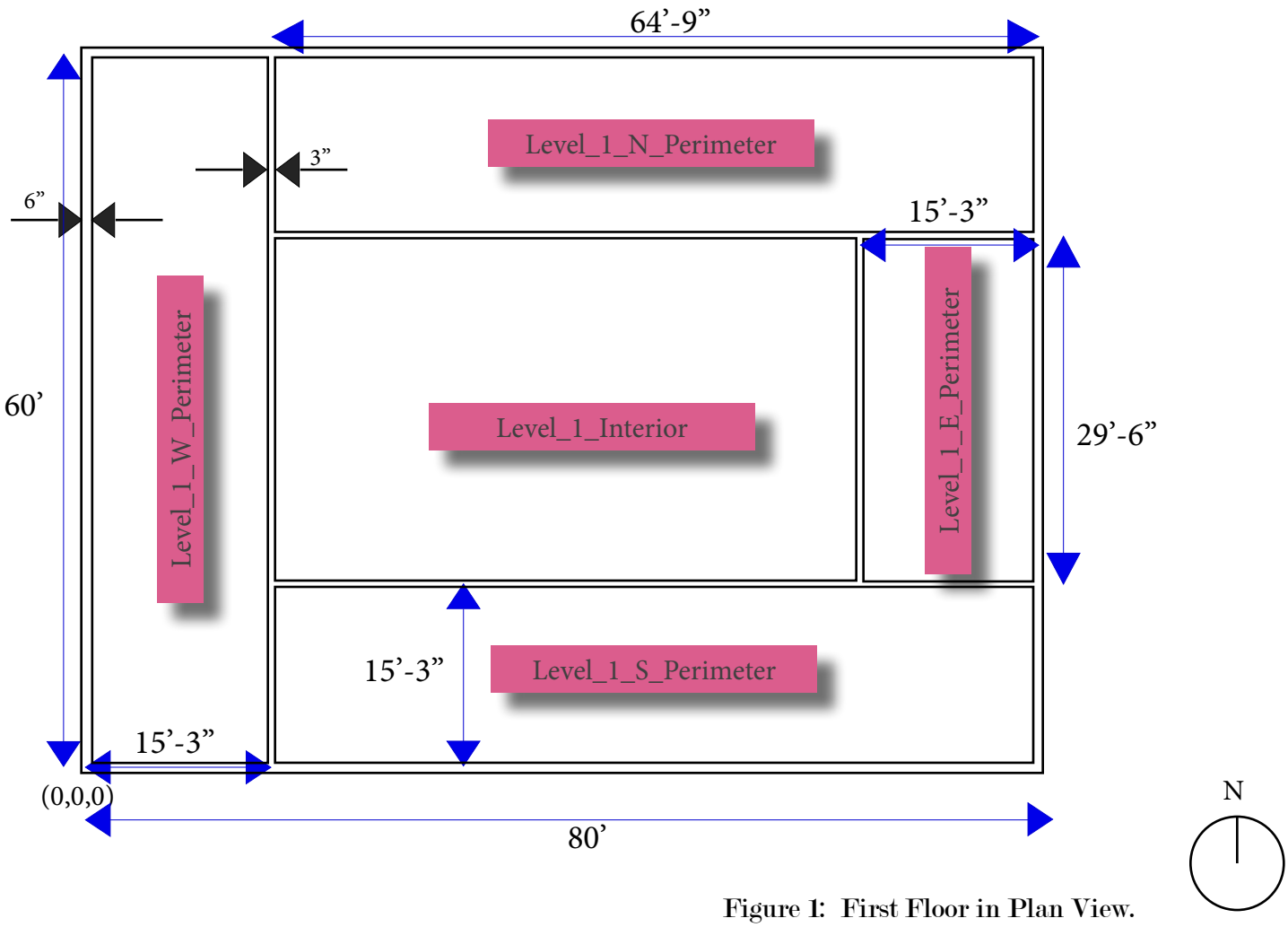

Figure 1: First Floor in Plan View.

The entire test case file uses exterior walls with 6” wall thickness and interior walls which are 3” throughout. North is indicated with the compass rose in Figure 1 above. Take note that the project origin is located at the SW corner of Level_1_W_Perimeter. All dimensions shown are in US-IP feet. All dimenstions shown are the centerline-to-centerline distances.

Level 1 interior is where the opening to Level 2 will appear, as will be shown in Figure 2.

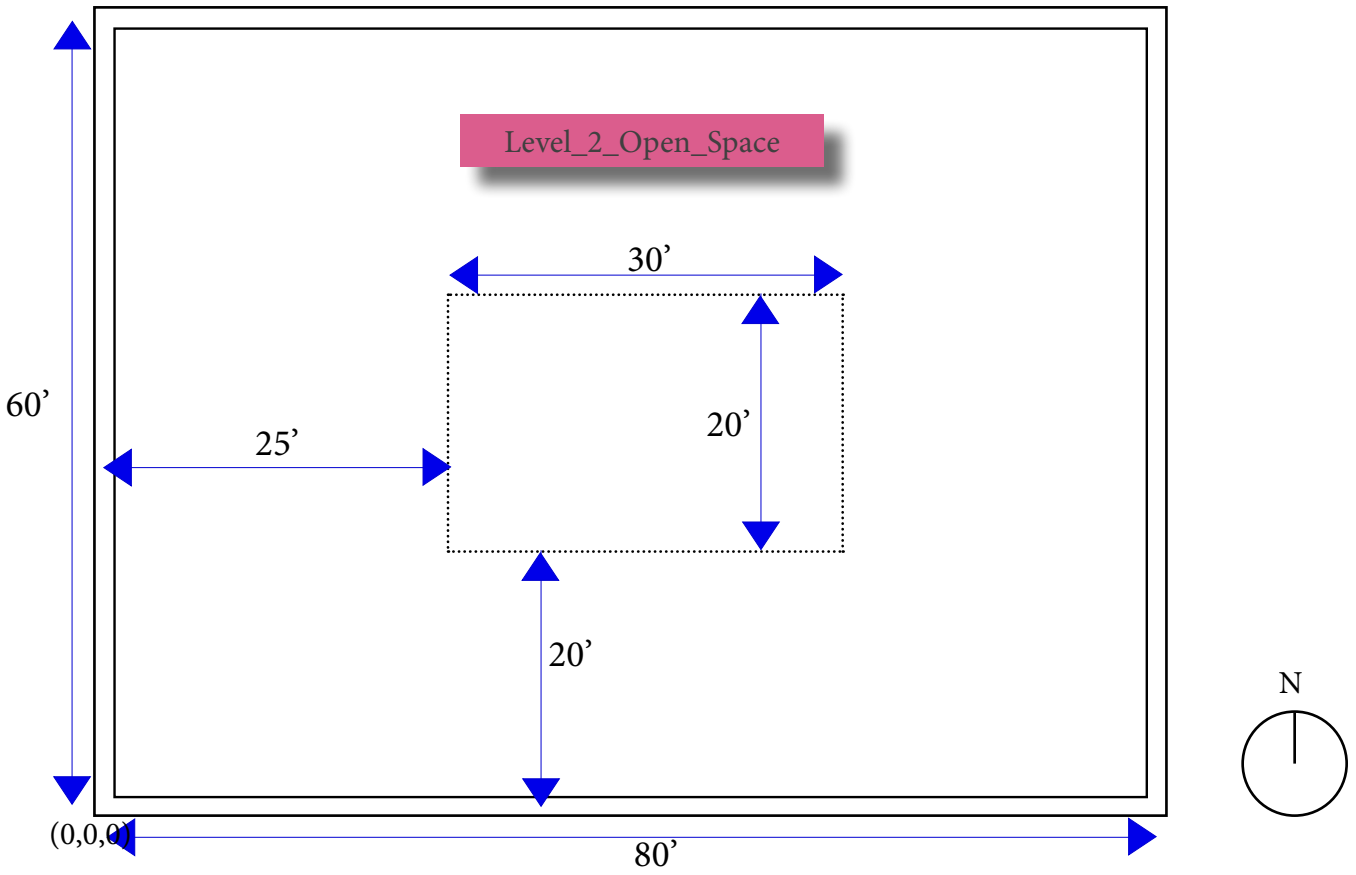

Figure 2: 2nd Floor in Plan View

The second floor is a single large open atrium space with a hole (Opening) in the floor, that opens to Level _1_Interior below. Its total dimensions are 80’ x 60’ with no interior walls.

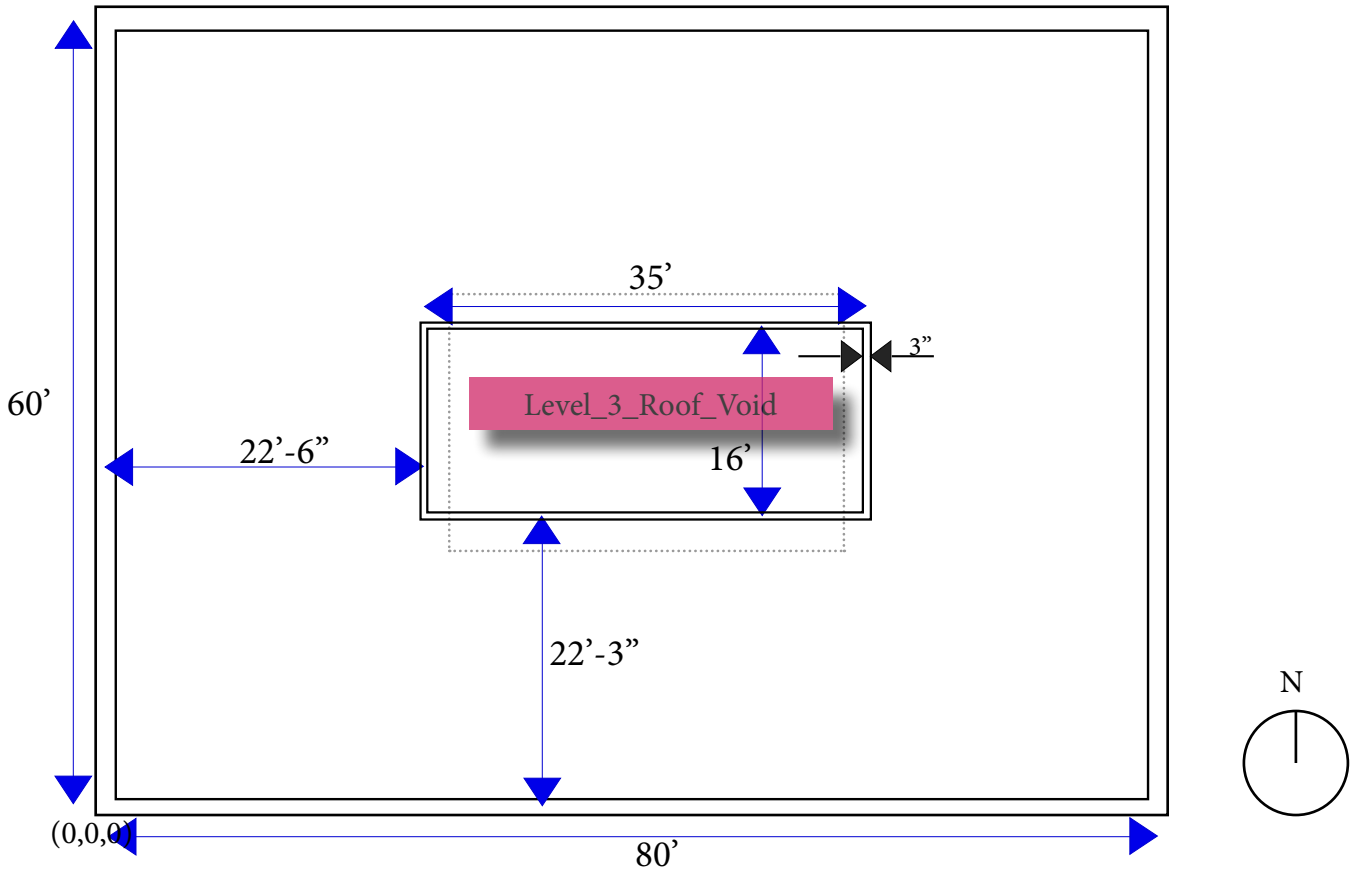

Figure 3: Skylight Curb Dimensions

Figure 3 above details the skylight curb dimensions and how the curb and skylight above is oriented relative to the hole cut in the floor if Level_2_Interior below (the dotted grey line). The skylight curb forms the boundaries for the space with id Level_3_Roof_Void, as shown in Figure 3 above. All of the dimensions shown are centerline-to centerline distances, in US-IP feet inches.

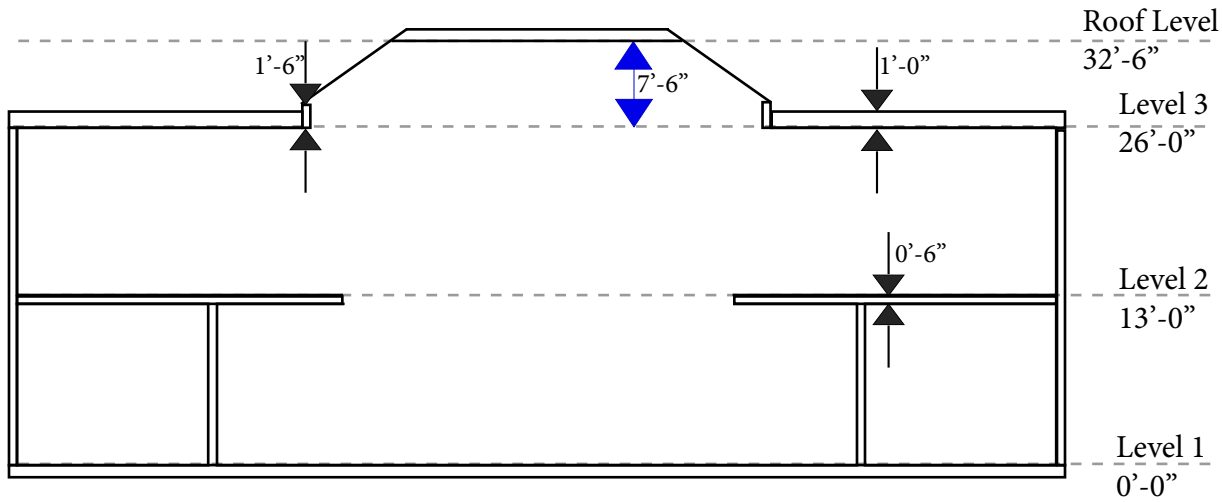

Figure 4: Section view with Dimensions

Figure 4 above shows the dimensions in section view. The Slab on Grade Floor does not factor into the PolyLoop Definitions. Nor does the Roof thickness (1'0" on Level 3). The Level_3_Roof_Void also exhibits some roof thickness where the glass joins at the height of the skylight. But this thickness is essentially ignored. The floor thickness at Level 2 should satisfy the agreement requirements for internal floors with some thickness. Finally, the curb walls (1'-6") are assumed to be unaffected by the thickness of the roof adjacent to it. A review of the accompanying gbXML file example will reveal that these walls are all 1'6" tall and the constructions assigned to the curb wall are are not affected by the roof insulation adjacent.

Test #4 Common Outcomes and Test Results

Occasionally it has been observed that, when the hole is cut in the floor, extra surfaces (interior walls) will appear in the gbXML file where the hole creates vertical surfaces with a height equal to the slab thickness. See the circled area in Figure 4 for a location where these surfaces are sometimes defined, but should not be.

Because the roof skylight will be created differently by each BIM/CAD tool, there is expected to be some variation in calculated volume and surface PolyLoop definitions for this space, particularly the sloping members that form the skylight itself. But if the instructions are followed, the tolerances set in the test should allow for some deviations and the test should still pass.

Typical validator output in these cases:

1. ***In the first case, the Surface Count Test Result will fail, because there are extra Surfaces in your test file. This will be confirmed by the Interior Wall Surface Test Count also failing. It is also possible for these extra Surfaces to be defined as Shading Surfaces.***
2. ***In the second case mentioned above, it is quite possible that the Space Volumes Test for Level_3_Roof_Void will fail. In addition, the Detailed Surface Checks, and Potentially the Detailed Opening Checks, will fail. Wider tolerances have been granted in this test, to prevent failure. But it still may be possible, since the Detailed Surface and Detailed Opening checks are comparing actual coordinate values of the PolyLoops in the gbXML standard file and your gbXML test file to one another***
3. ***It is also possible that second level space boundaries, if you are still having difficulty generating the second level space boundaries correctly, could still be creating errors. In this case, the Surface Count Test could again return incorrect results. In this case however, instead of the Surface Count Test Result and Interior Wall Surface Test failing as in Number 1 above, in this case the Surface Count Test and Interior Floor Surface Count Test would fail. The floor for Level_2_Open_Space should be broken into 5 different Interior Floor Surfaces.***