

Using the Autodesk Revit GSA Spatial Template



This document helps you to get started in using the “GSA Spatial Template” Revit file in a project. This template is derived from a test model created by Autodesk as part of ongoing efforts to support GSA’s BIM Guide development. Refer to the GSA BIM Guide Series¹ for a detailed explanation of GSA space standards and required space data that must be assigned to rooms in a Revit project model.

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¹ GSA BIM Guide for Spatial Program Validation, <http://www.gsa.gov/portal/content/102281>

1. The Revit GSA Template Download

Contained within the GSA Revit Space Template zip file are:

- Revit GSA Spatial BIM Template.pdf (this document)
- GSA Spatial BIM Template_Revit Arch 2011.rvt
- GSA Agency Bureau Lookup Table.xls

2. Familiarizing Yourself with the Template

The Revit template model was set up with special project parameters, room schedules, schedule keys, and gross building area schedules - all related to classifying rooms and areas in accordance with the GSA Space Assignment Guide specifications.

To get an overview of the GSA-specific space/room data that is attached to the Revit Model:

- In a Revit worksession, open the template file -> **GSA Spatial BIM Template.rvt**
- Click on the **Level 2** floor plan view
- Hover the cursor over any room
- When an "X" is highlighted by the cursor, left click the room object
- All of the data associated with a room object will be listed in the **Properties** menu (located by default on the upper left side of the Revit workspace)
- The required fields for the GSA spaces will be listed under the **IFC Properties** section in the menu. These are custom parameters created for, and included in this GSA Space Template.

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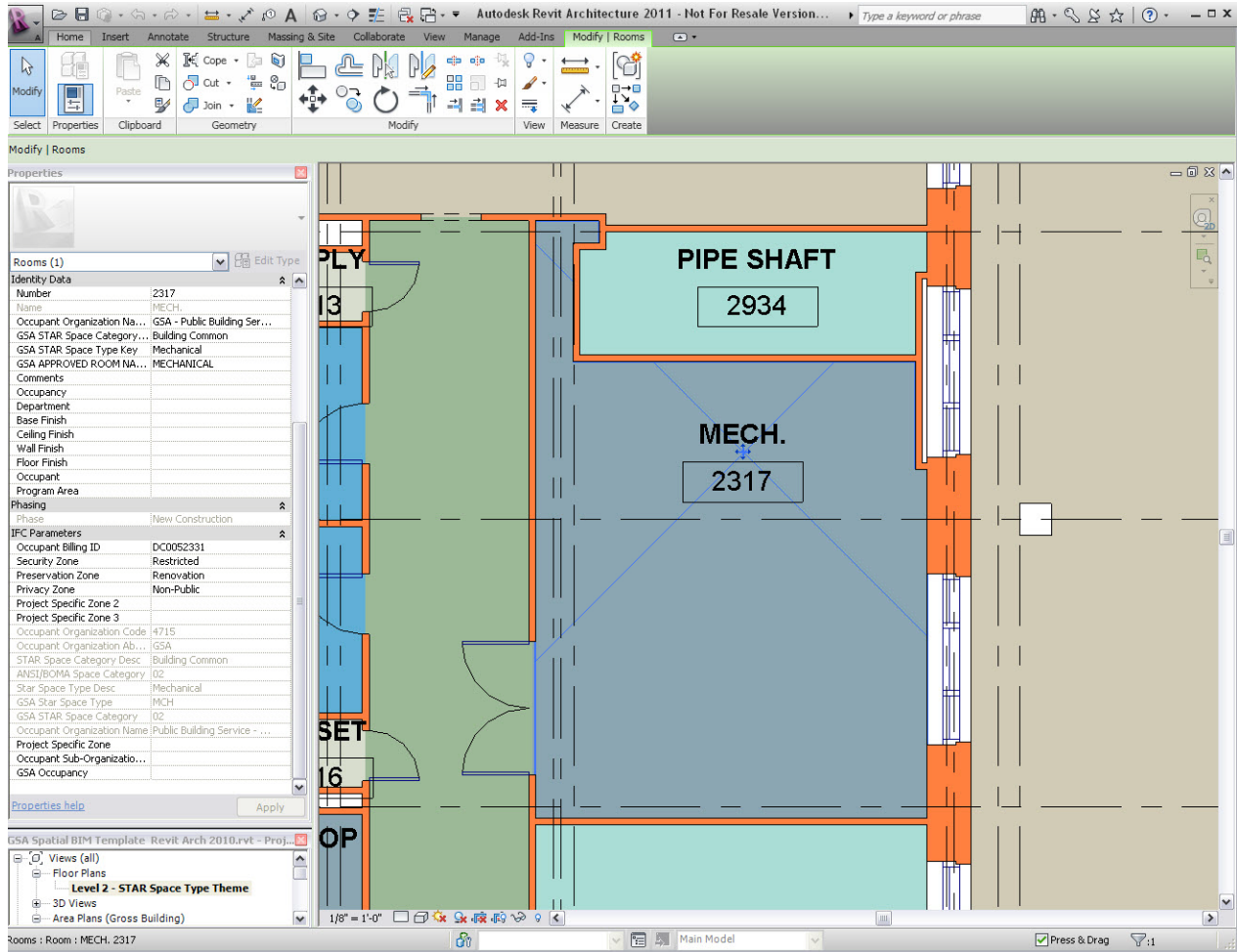
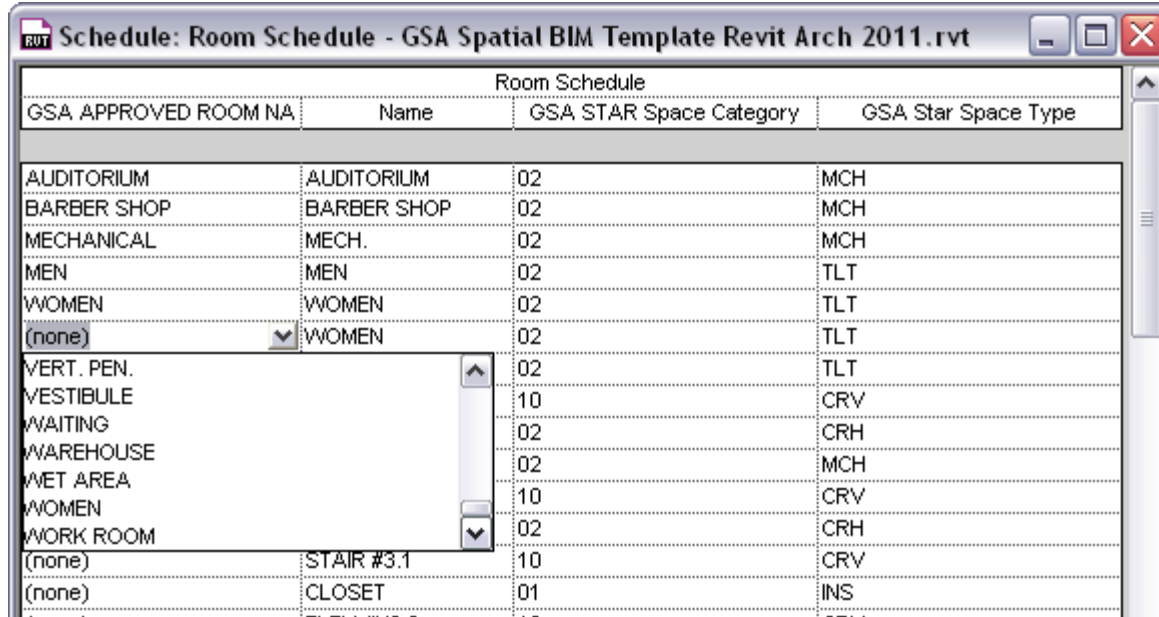


Figure 1 above - A room object is selected in Revit (Mech. Room), its object properties are listed on the Properties Menu (left side of user interface)

Some of the data fields for GSA Revit room objects have been set up so that they can be populated through use of the Revit *Schedule Key* capability. Revit schedule views have been created to contain reference information that will be used to populate room parameter fields - such as room names. A schedule key can be referenced in a Revit schedule to provide users with "drop-down" menu selections of pre-populated values. In this Revit template, schedule keys have been provided for:

- GSA STAR Space Category
- GSA STAR Space Type
- GSA Approved Room Names
- GSA Occupant

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| GSA APPROVED ROOM NAME | Name | GSA STAR Space Category | GSA Star Space Type |
|------------------------|-------------|-------------------------|---------------------|
| AUDITORIUM | AUDITORIUM | 02 | MCH |
| BARBER SHOP | BARBER SHOP | 02 | MCH |
| MECHANICAL | MECH. | 02 | MCH |
| MEN | MEN | 02 | TLT |
| WOMEN | WOMEN | 02 | TLT |
| (none) | WOMEN | 02 | TLT |
| VERT. PEN. | | 02 | TLT |
| VESTIBULE | | 10 | CRV |
| WAITING | | 02 | CRH |
| WAREHOUSE | | 02 | MCH |
| WET AREA | | 10 | CRV |
| WOMEN | | 10 | CRV |
| WORK ROOM | | 02 | CRH |
| (none) | STAIR #3.1 | 10 | CRV |
| (none) | CLOSET | 01 | INS |

Figure 2 (above): Drop-down menu for entering GSA Room Name field in Revit Room Schedule - populated from "GSA APPROVED ROOM NAMES" schedule key.

Room Schedule View

The room schedule view included in this template contains four fields by default:

Occupant Key Table

Note that GSA maintains over 1000 unique classifications for Agency Bureau Codes and Names to use in its real property records. In this Revit template, the Occupant Key Table contains only a subset of these classifications. As you develop your specific building project, you will have to add and adjust the names and codes contained in the Occupant Key Table provided by this template. An Excel-format spreadsheet containing the complete list of bureau codes and names is included with the GSA Revit Spatial BIM template's distribution.

We recommend test the template on a back-up copy of a current project or copy of a past project to familiarize yourself with the template before deploying on a live project.

3. Applying the Template to Your Project

- In your Revit worksession, open both the GSA Revit template file and the Revit project model that is going to receive the GSA template framework.
- While active in the template model:
 - In the Revit Project Browser, highlight all of the views under "Schedules/Quantities". Do this by clicking on the top schedule, and then while holding down the *Shift* key, select the last schedule view (this should be Room Schedule)
 - Right click the mouse, and select "*Copy to Clipboard*"

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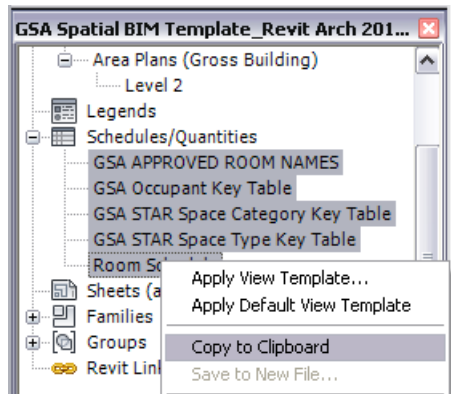


Figure 3 (left) - Revit **Project Browser** window, showing GSA schedules to copy to your existing Revit model, if so desired.

- Now switch your Revit view to the project model you've loaded, or a new Revit project that you have started, and:
 - On the "Modify" menu tab, click on "Paste" and "Paste from Clipboard"

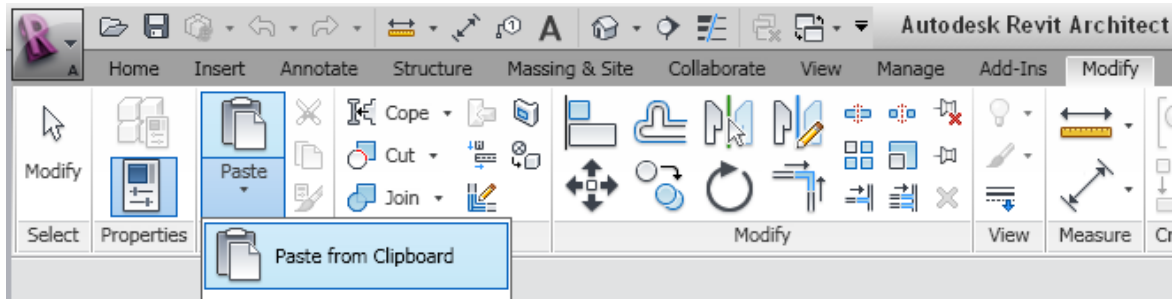


Figure 4: Execute the Revit command: **Paste** > **Paste from Clipboard** (on the **Modify** tab)

- You should see that these GSA views have been added under *Schedule/Quantities* in the Revit Project Browser window (Figure 3 above)
 - Create a new room object, or click on an existing one and examine its properties to verify that the GSA space classifications have been added
 - While your cursor is active in the Room Properties menu, under the *Identity Data* section, verify that schedule keys for Occupant, STAR Space Type and STAR Space Category are listed. Experiment with selecting different values in those fields to validate that the schedule keys are functioning as designed.
 - Note: that if copying to an existing model you may now have more than one Room Schedule view. The newly copied Room Schedule from the GSA template will then be renamed with a sequentially higher than the existing schedule (e.g. Room Schedule1)
- You should now be ready to proceed with creating your initial assignment sheets and classifying these rooms according to the GSA's assignment guidelines.

4. An Introduction to Using Revit for GSA Projects

For all major projects receiving design funding (Fiscal Year 2007 and beyond), GSA requires submission of spatial program BIMs to the Office of the Chief Architect for Final Concept approvals by the Public Building Service (PBS) Commissioner. The GSA PBS's Office of the Chief Architect (OCA) has validated Autodesk Revit as a BIM authoring application that can be employed in creating Spatial BIM deliverables (as noted in the GSA BIM Guide Series 2 - Spatial Program Validation).

This validation clears architects and engineers working on GSA projects to use Revit to create their concept design submissions. The submitted BIM files must be provided to GSA in both the native format of the BIM Authoring Application and in an IFC (Industry Foundation Class) format file. For projects developed in Revit, the project team will submit a Revit .rvt file, along with an IFC-format file (.ifc) of the same model, saved from a Revit worksession by use of the Export -> IFC command.

The GSA BIM Guide Series 02 also provides an appendix document to provide guidance on applying specific BIM authoring tools features and functions to the GSA Spatial BIM requirements. Highlights of this discussion is included in this document.

The GSA BIM Guide Series in its entirety can be downloaded from the agency's web site:
www.gsa.gov/bim

5. General Guidelines for Creating a GSA Spatial Program BIM

GSA's Office of the Chief Architect (OCA) has developed a "GSA Concept Design View" which details that organization's requirements for spatial data management in BIM. The GSA Concept Design View is aligned with a standard called a *Model View Definition (MVD)*, which details a workflow and data schema for exchanging building data electronically.

MVDs have been developed and published by the BuildingSmartAlliance (bSa), in its efforts to establish BIM standards and interoperability. MVDs are a subset of the IFC data format for BIM models, also detailed and developed by this organization. The GSA Concept Design View and IFC file format for data exchange is supported by several vendor applications, including Autodesk Revit.

Outside of GSA spatial program requirements that detail non-graphic data to be associated with rooms in the model, there are no required practices for modeling buildings for the GSA that differ from any other Revit project. The sections that follow in this document, detail some GSA-specific recommendations for developing Revit rooms and their affiliated area data, as well as detailing how a user can employ Revit schedule keys to automate the entry of the GSA spatial program non-graphic data.

Please refer to the Revit online documentation and tutorials for detailed guidance on the specifics of creating a BIM model using Autodesk Revit, and specific capabilities, such as parameters, schedule keys, exporting, and other commands.

6. Modeling Tips and Techniques

Spaces can be created in Revit by modeling either rooms or areas. With both methods, the resulting spaces are automatically generated and "parametrically" associated with the bounding elements, which can be walls or room separators. As the bounding elements such as walls change, associated spaces will change as well, and affiliated views - including the associated room or area schedules, will reflect the modifications, updated with new area and volumetric calculations.

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6.1 Rooms

A user creates a room in Revit by placing a room object into a location in the model that is bounded by either three or more room-bounding walls, or three or more room separation lines. If the space is bounded by walls, the room area is calculated, by default, from the inside face of the walls.

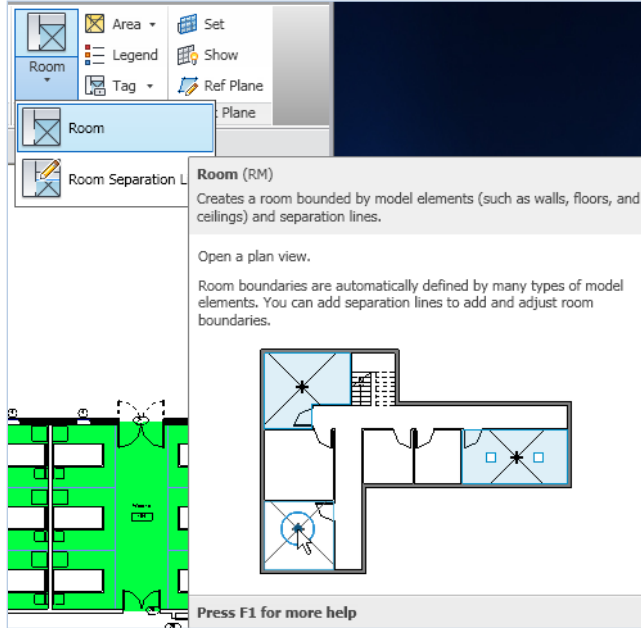


Figure 5: Room command , on the Revit ribbon menu's home tab

Considerations when using Revit 'rooms' in the context of working with recommendations within the GSA Spatial BIM Guidance:

- In the concept design phase, many details of the building may not be fully defined, such as wall types and window specifications. The Revit rooms objects, and resulting room schedules, provide users with a very accurate and instantaneous method for determining if the design is meeting the space program requirements
- In a concept design phase, the model may not have all of the interior walls/partitions fully delineated yet, or the concept may consist of 'logical' but not physical spaces which reside within a larger bounded room. In this case, you can use Revit **room separators** to subdivide spaces in smaller functional groups. For example, a building lobby may require a separate security area in the main lobby space, that will require separate tracking as a room, and which will not be bound by any physical walls.

6.2 Areas

As an alternative to using room objects, Revit has an area analysis capability that allows users to create area boundaries to define useable space in buildings. You can create multiple area measurement schemes with this facility. By default, Revit creates two area schemes:

- Gross Building: Total constructed area of a building.
- Rentable: Area measurements based on the BOMA standard method for measuring floor area in office buildings.

You can define areas boundaries by drawing them or by picking walls. Once created, these area boundaries are associated parametrically with their adjacent walls or room separators. Refer to the Autodesk Revit online help system for more information on area analysis tools. Once these discrete

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areas have been created, users have the option to apply area rules to them based on an area type. If the area type is modified, Revit will automatically change the area boundary line. For example, rules dictate that the area for office space is measured at the wall center line, while exterior area is measured to the exterior wall face.

6.3 Manipulating Spaces

When manipulating a space (e.g. – resizing, copying, mirroring, scaling, etc.) in Revit, the user must verify that the Space Number assigned to that space/room object is updated and correct, ensuring that each Space Number in the model is unique. Note, that when copying rooms, Revit will not duplicate room names.

6.4 Columns and Shafts in Spaces

In its area calculations for a room or a space, Revit does not by default subtract column areas from the total. GSA net area calculations require certain areas subtractions need to be factored in to the total net area of the room. To accommodate this, Revit provides an option to exclude columns and shafts from calculated areas. To ensure deduction of column, for example, in Revit area calculations, the user must check the column object's properties, and adjust the "Room Bounding" property to have its value clicked (checked) on, as depicted in the Figure below.

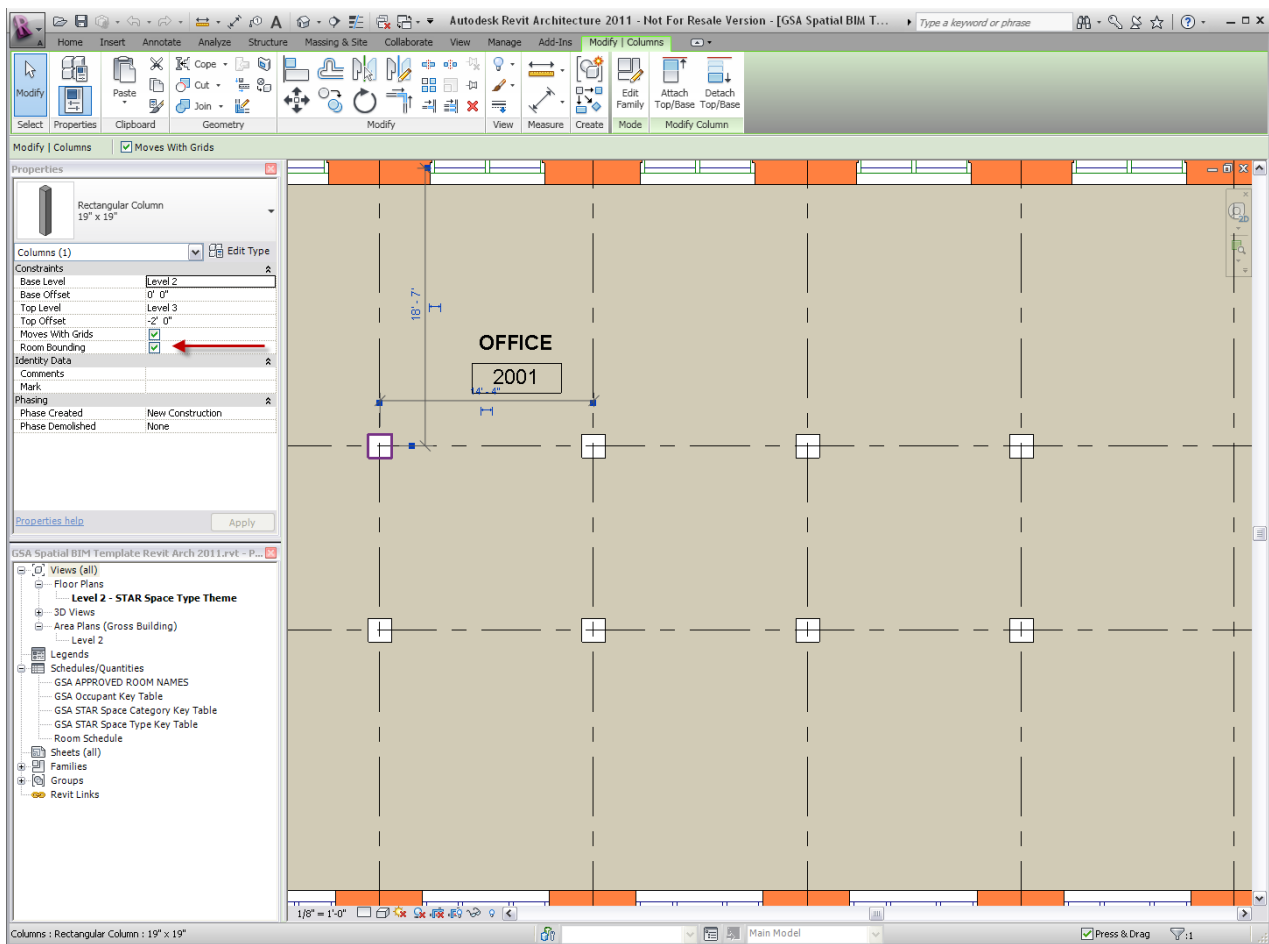


Figure 6: Revit screenshot showing room bounding parameter checked on, in the Properties menu for a column object.

7. Inputting GSA Spatial Program BIM Requirements

7.1 Entering Spatial Data

A Revit room schedule can be set up so that all of the GSA “approved” room names are available for selection in a drop down menu in both the room schedule or in the element properties window.

The template also provides drop-down selection lists for additional GSA-specific spatial data fields, which are to be associated with the spaces/room objects in the project model. The GSA-specific space properties are implemented in Revit through the use of custom parameters, which are associated with all the rooms and areas in the project model.

Revit’s Schedule Key capability facilitates the population of the drop down lists in Revit Schedule views. The template is pre-loaded with populated Schedule Keys which hold GSA standard room data, such as GSA Standard room names. For instance, in the figure below, the user has selected a room object (room 2001). The room object’s element properties window is displayed, and in the value field for ‘Name’, a drop down menu is displayed from which, the user can select a GSA standard room name.

| GSA STAR Space Type Key Table | | | |
|-------------------------------|---------------------|----------------------------|--------------------------|
| Key Name | GSA Star Space Type | Star Space Type Desc | ANSI/BOMA Space Category |
| Antennas | ANT | Antennas | 02 |
| Auditorium | AUD | Auditorium | 01 |
| Automated Data Processing | ADP | Automated Data Processing | 01 |
| Child Care | CLD | Child Care | 01 |
| Circulation Horizontal | CRH | Circulation Horizontal | 03 |
| Circulation Vertical | CRV | Circulation Vertical | 04 |
| Conference/Training | CFT | Conference/Training | 01 |
| Construction | CON | Construction | 05 |
| Courtrooms/Judiciary | CRJ | Courtrooms/Judiciary | 01 |
| Custodial | CST | Custodial | 03 |
| Fitness Center | FIT | Fitness Center | 01 |
| Food Service | FDS | Food Service | 01 |
| Health Unit | HUT | Health Unit | 01 |
| Judges Chambers, US Courts | JCC | Judges Chambers, US Courts | 01 |
| Judicial Hearing Room | JHR | Judicial Hearing Room | 01 |
| Laboratory | LAB | Laboratory | 01 |
| Land | LND | Land | 05 |
| Light Industrial | INS | Light Industrial | 01 |
| Mechanical | MCH | Mechanical | 02 |
| Private Toilet | PTL | Private Toilet | 01 |
| Quarters & Residence | QRR | Quarters & Residence | 01 |
| Structurally Changed | STC | Structurally Changed | 01 |
| Structured Parking | STP | Structured Parking | 05 |
| Tenant Floor Cut | TFC | Tenant Floor Cut | 01 |
| Toilet | TLT | Toilet | 03 |
| Total Office | TTO | Total Office | 01 |
| Unsuitable for Occupancy | UFO | Unsuitable for Occupancy | 05 |
| Warehouse | WRH | Warehouse | 01 |

Figure 7: Revit **Schedule Key** containing **GSA STAR Space Type** data

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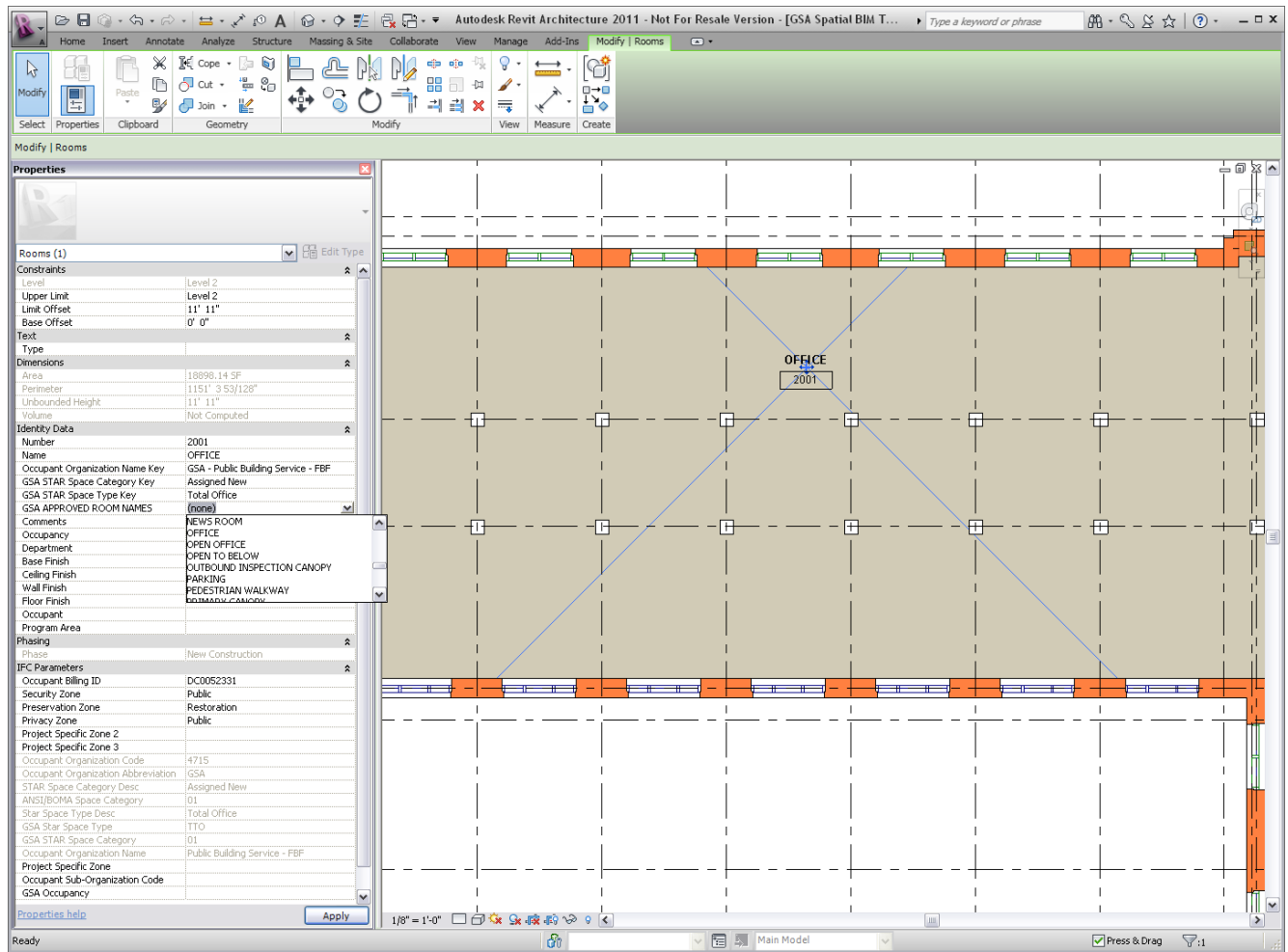
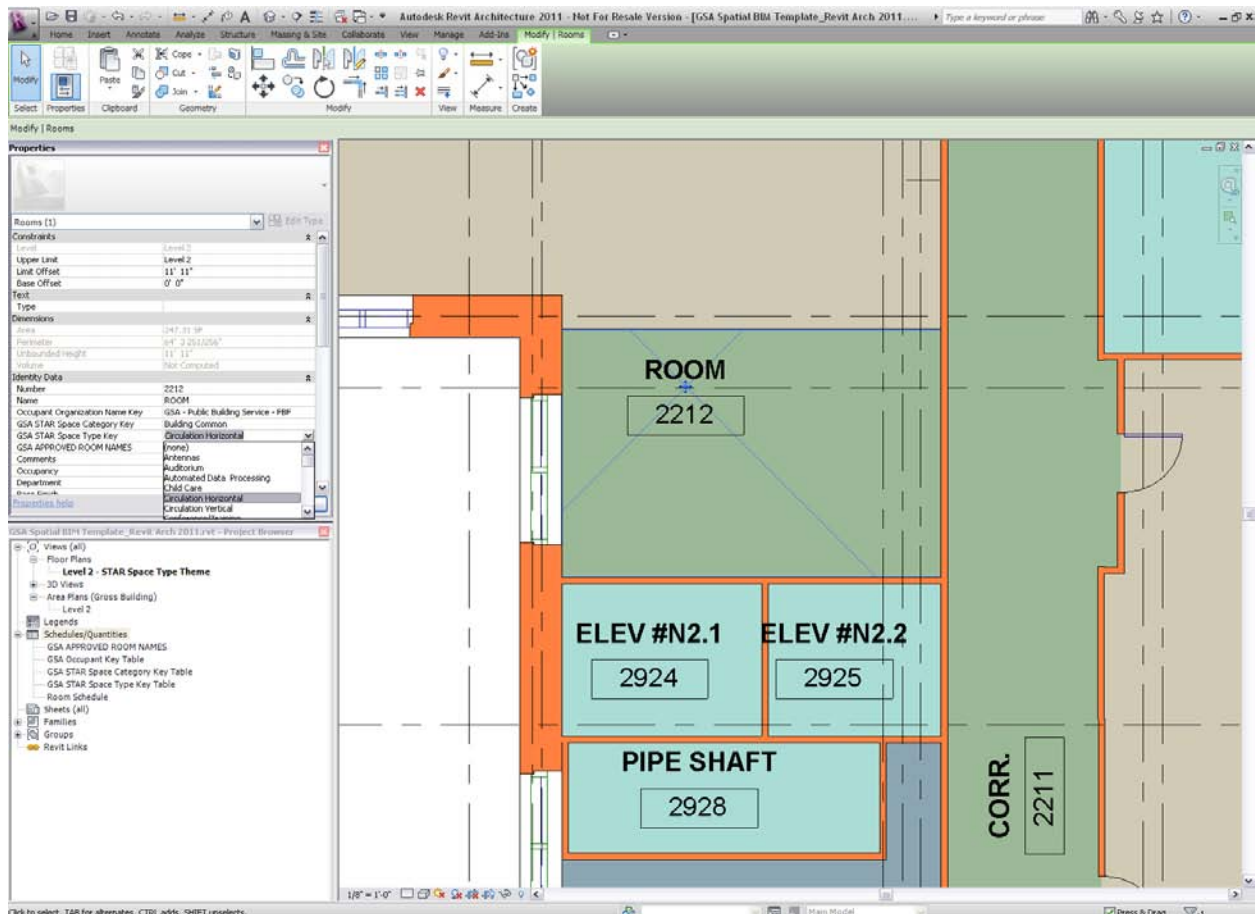


Figure 8 (above): Revit Architecture interface with the GSA template file loaded, showing Properties for the selected room. The GSA 'Identity Data' fields all have drop down lists to aid user input.

| GSA APPROVED ROOM NAMES | |
|-------------------------|---------------|
| Key Name | ROOM |
| AQUARIUM | AQUARIUM |
| ATM | ATM |
| ATRIUM | ATRIUM |
| ATTIC SPACE | ATTIC SPACE |
| AUDITORIUM | AUDITORIUM |
| BALCONY | BALCONY |
| BARBER SHOP | BARBER SHOP |
| BOX LOBBY | BOX LOBBY |
| BREAK | BREAK |
| CAFETERIA | CAFETERIA |
| CANOPY | CANOPY |
| CHILD CARE | CHILD CARE |
| CLASSROOM | CLASSROOM |
| CLOSET | CLOSET |
| COMPUTER | COMPUTER |
| CONFERENCE | CONFERENCE |
| CONSTRUCTION | CONSTRUCTION |
| CONTROL BOOTH | CONTROL BOOTH |
| COPY | COPY |
| CORRIDOR | CORR |

Figure 9 (left): Partial Revit Schedule Key for GSA Approved Room Names. This data is employed in the Properties menu pull-down (shown above in the example in Figure 8)

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From the example above, selecting the Property - Identity Data - **GSA STAR Space Type Key** “Circulation Horizontal” automatically populates the corresponding IFC Parameter values for ANSI/BOMA Space Category (03) and Star Space Type Description (Circulation Horizontal).

| Identity Data | |
|------------------------------------|-------------------------------------|
| Number | 2212 |
| Name | ROOM |
| Occupant Organization Name Key | GSA - Public Building Service - FBF |
| GSA STAR Space Category Key | Building Common |
| GSA STAR Space Type Key | Circulation Horizontal |
| GSA APPROVED ROOM NAMES | (none) |
| Comments | |
| Occupancy | |
| Department | |
| Base Finish | |
| Ceiling Finish | |
| Wall Finish | |
| Floor Finish | |
| Occupant | |
| Program Area | |
| Phasing | |
| Phase | New Construction |
| IFC Parameters | |
| Occupant Billing ID | DC0052331 |
| Security Zone | Restricted |
| Preservation Zone | Renovation |
| Privacy Zone | Non-Public |
| Project Specific Zone 2 | |
| Project Specific Zone 3 | |
| Occupant Organization Code | 4715 |
| Occupant Organization Abbreviation | GSA |
| STAR Space Category Desc | Building Common |
| ANSI/BOMA Space Category | 03 |
| Star Space Type Desc | Circulation Horizontal |
| GSA Star Space Type | CRH |
| GSA STAR Space Category | 02 |
| Occupant Organization Name | Public Building Service - FBF |
| Project Specific Zone | |
| Occupant Sub-Organization Code | |
| GSA Occupancy | |

Figure 10: From the Properties menu for room 2212, showing all of the GSA required space properties added to the room element data as Revit project parameters, under “Identity Data” and IFC “Parameters”.

Note: Values that are “grayed out” were automatically populated by selecting schedule key fields.

7.2 Adding Additional Space Descriptions

To comply with GSA Spatial BIM program guidelines, it is important that the name assigned to the room or space be chosen from a list of approved room names, per the GSA assignment guide. Some projects may require additional building and/or occupant-specific names for rooms or spaces. If this is the case, users can utilize the other Revit identification fields of department and occupant to hold this information, or create custom project parameters.

7.3 Design Gross Areas

In addition to applying GSA space properties to room objects, the GSA space model must contain a gross area space representing a Design Gross Area for each floor. Every floor of a building will need to contain a Revit area object that is defined by the area inside a boundary drawn to the exterior finish face of the walls, per BOMA requirements².

Briefly, to create full floor spaces (areas) for your GSA Spatial BIM in Revit:

- Create an Area Plan (Gross Building) view for the floor
- Allow Revit to automatically generate the boundaries
- Modify area boundary if the generated gross area object does not conform to BOMA for your building

Refer to Revit documentation and tutorials for more information on using Area Analysis tools.

See the *GSA BIM Spatial Validation* document for a detailed discussion on the GSA requirements for space objects. Regional GSA project teams may have additional requirements as well.

² Guidance available in the BOMA e-book “Gross Areas of a Building: Standard Methods of Measurement”, <http://shop.boma.org>

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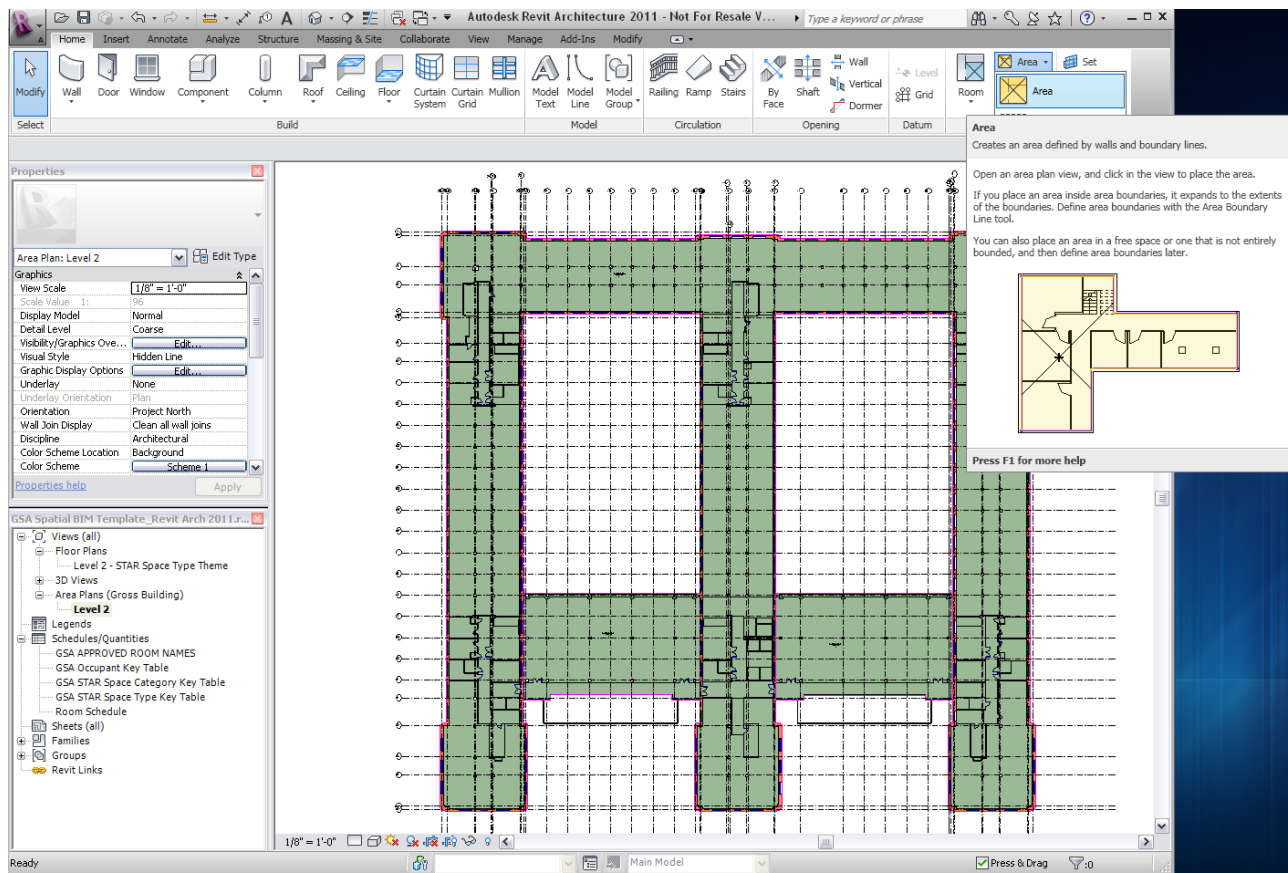


Figure 11 : Revit screen showing Area Plan (Gross Building) and Area command (upper right)

8. Handling Project Models

8.1 Working with BIM Models

In contrast with other BIM software applications, Revit supports the creation of a single building model. In many cases, a concept design deliverable could be contained within in a single Revit file. This can help to minimize the data management challenges. However, in most projects, multiple team members will be working on portions of the BIM model at the same time. Multiple Revit models may also comprise the project model.

There will also be cases where the project is complex or you are working with Structural and MEP consultants who will be submitting their respective .rvt files for linking into your architectural model. It is important that a project team deploys some kind of project collaboration portal to keep track of and manage all of your Revit files, supportive and derived files like DWG, DWF, and other files associated with the project. Coordination is especially critical if team members are spread out among multiple offices and geographic locations.

It is critical that a project team receives proper training and implementation advice on the best practices and a BIM execution plan be formulated before project initiation.

8.2 IFC BIM Import/Export

Revit also offers both IFC export and import capabilities directly within the application. Documentation on options for these facilities, including element mapping, is included in the online help system for Autodesk Revit. Element mapping may be required if the project model contains special conditions or assemblies that are not detailed in the IFC standard.

8.3 Optimizing File Sizes

With every new release of Revit, Autodesk strives to make performance improvements, including optimizing the size of exported IFC files, which tend to be significantly larger than the Revit file they are exported from. The best strategy for minimizing the size of exported IFC files is to minimize the size of the project Revit model itself. Users can facilitate this by following best practices when creating custom content with the Revit Family editor. Inefficiently or overly detailed objects can very rapidly increase the size of a model. Also, on very large building projects, it is often more pragmatic to break the model into smaller files for project production.