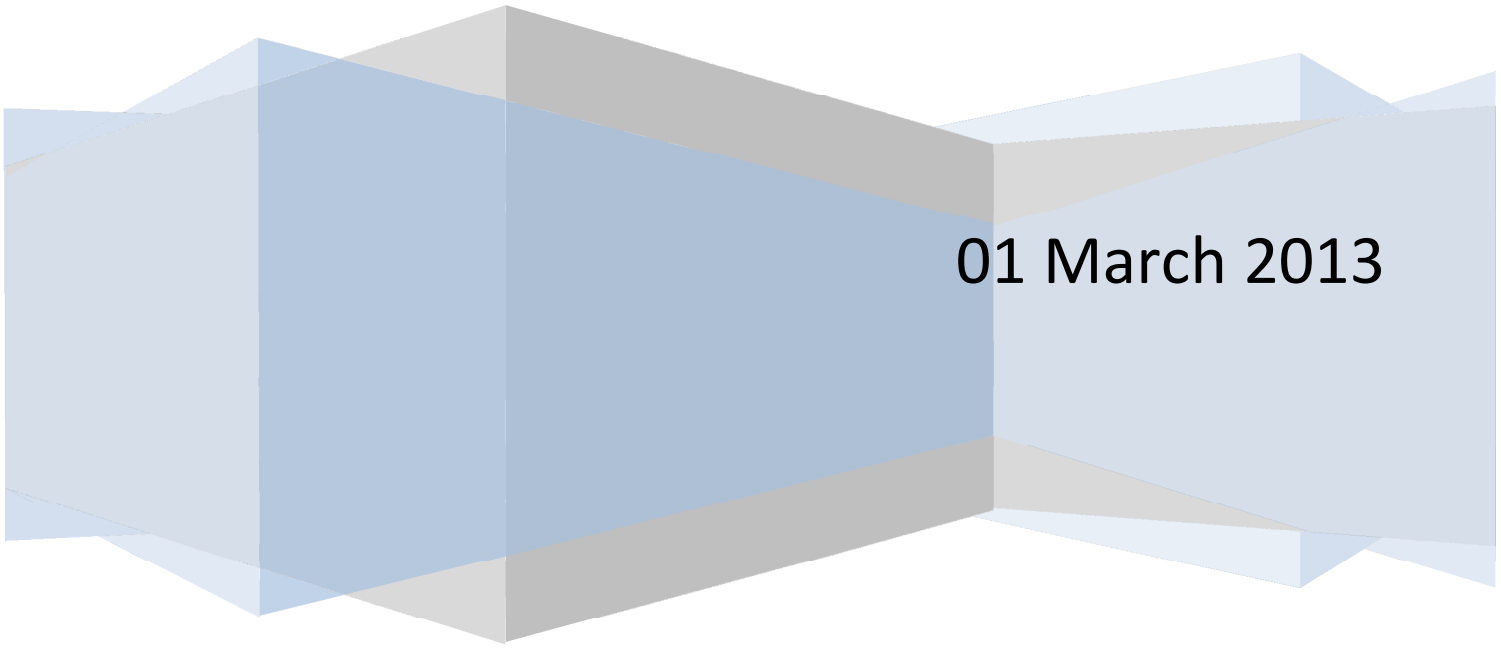
Georgia State Financing and Investment Commission

GSFIC BIM Guide

Series 01: Model Analysis and Validation

Design



01 March 2013

Contents

Disclaimer: This Series is considered a living document that is constantly changing and being updated as the technology matures. While GSFIC has tried to highlight the major points of the BIM validation program, GSFIC cannot take into account all the special cases and changing technology. Therefore, if you have any questions or comments regarding the content of this Series, please contact GSFIC for the most up-to-date information

Introduction

Objective of this Guide

The purpose of this guide is to aid Architects and Engineers (A/Es) in their Building Information Modeling (BIM) efforts related to design and construction of GSFIC managed projects. This release – series 01 addresses BIM for Design requirements only. Subsequent releases will deal with requirements for BIM for construction and BIM for facilities operations and maintenance.

Wherever BIM is required as a deliverable the A/E shall refer to and comply with the requirements of this guide. Also where the design professional bid solicitation states that BIM capability is preferred and the design professional contract is awarded on the premise that the A/E is BIM enabled and shall provide a Building Information Model as part of the deliverables; the requirements of this guide shall apply.

This guide describes the standards that all BIMs for GSFIC construction projects shall abide by. BIM deliverables shall be verified by the GSFIC Design Review Group. During the verification process BIMs shall be reviewed according to the items outlined in this guide in four main areas. The Building Information Model will be used for:

1. Building Constructability Review
2. Building Life Safety Components Review
3. Clash Detection
4. Checking Building Model Quality (Third Party BIM Validation[1])

BIM as a Supplement

A Building Information Model is a placeholder for information about a building or facility. The Building Information Model begins with the owner's space/program[2] requirements and is made up of whatever information needs to be collected regarding a site or a building. This information includes but is not limited to program spaces, structural elements, ductwork, electrical installation, fire protection, occupancy, energy consumption, etc.

The BIM deliverable does not replace the standard project deliverables stated in section 2 of the GSFIC Design Professional Contract(s) (CM/GC, DBB and DB).

For all projects where BIM is required it will be in addition to all current design submission requirements set forth in the design professionals contract and design review process guide. Most of the required submittals will overlap as illustrated by Table 1.1.

This deliverable should be seen as a tool to aid GSFIC's review of the design submissions.

Design Submittal Consistency

GSFIC encourages project teams to gain efficiencies through creating the required 2D drawings from the BIM. The goal is for the BIM submission and design documents submission to be consistent.

[1] The third party referred to here is the GSFIC Design Review Group.
[2] Project Development File or Program that has been approved by the Office of Planning and Budget, State of Georgia.

GSFIC will review the BIM submissions to ensure compliance with the requirements defined in this Guide and with those defined by specifications for the Industry Foundation Class (IFC) BIM standard:

Requirements and Deliverables

Model Ownership: The Building Information Model constitutes an instrument of service as defined by the Design Professional Contract section 2.1.2.1 (2.1.4.1 in Design Build (DB) contract). Therefore all items pertaining to instruments of service as set forth in section 2.1.1 (2.1.4 in DB contracts) shall apply to the model. This means that as the building Owner; GSFIC shall also have ownership of the model and can make it available to the *using agency*[3] at any time as required. Refer to Appendix C of this guide for Instruments of Service section from the Design Professional Contract.

The BIM deliverables required in the Preliminary[4] and Final design submission include:

- A single BIM file in IFC 2x2 format (preferred) or IFC 2x format.
- BIM file(s) in the native format of the BIM-authoring application(s).

GSFIC is aware of issues related to converting BIM files to IFC format from the native file format and therefore acknowledges that the IFC format is not completely robust at this time. A/Es are therefore required to document any known issues with IFC BIM at the time of upload. The list of issues should be submitted as a word document to accompany the BIM file.

A/Es should use the appropriate BIM tool to create objects. For example, "Wall" objects should be created using a "Wall" tool. If an object is not directly supported with an appropriate BIM tool, A/Es should consult with their BIM-authoring vendor to determine the best way to model those objects (see section 3 of this guide). Objects created using the wrong tool set in a BIM authoring application become problematic when exporting to an IFC BIM because they will be exported with the wrong object types.

How to use this Series 01 – GSFIC Building Information Model Validation

This series is divided into 4 major sections:

- **Section 1: Constructability Review BIM** – This section describes the overall objective and process for submission of the constructability BIM. It describes the high-level modeling requirements for creating the BIM and for the IFC BIM submission.
- **Section 2: Life Safety Review BIM** – This section describes how and where to create the space boundaries and describes how to assign the required spatial information to space objects.
- **Section 3: Building Elements** – This section describes the required building elements for model validation and other GSFIC reviews.
- **Section 4: BIM-analysis Rules** – This section describes the BIM-analysis rules that the A/E submissions will be checked against. This section also highlights special cases that may affect the BIM analysis. A/Es should read carefully through this section to understand these cases.

[3] State agencies and other State entities for which GSFIC provides construction management services.
[4] Preliminary design submittals include programming, schematic and design development phases.

1.0 BIM for Building Constructability Review

As required by the GSFIC Design Review Process Guide (GSFIC _DRPG), constructability reviews performed by the Design Review Group check for conformance to:

- GSFIC policies and guidelines
- Applicable building and engineering codes and standards
- Completeness and coordination of documents

1.1 Required Constructability Review Information

Constructability reviews of all projects are performed prior to advertisement for bids (Design-Bid-Build delivery method) or issuance of a Component Change Order (CM/GC or Design-Build delivery method) at all phases of design: Programming, schematic design, design development and construction documents. CM/GC delivery methods will likely include component change orders (CCO) in-between these phases.

The Building Information Model will be used to perform constructability reviews based on items listed in Table 1.1 of this Guide for each design phase.

This table has been developed from ASTM E 1804-02 which is currently referred to in the GSFIC Design Professional Contract as a guideline for information which is generally developed at each phase of the design.

The information in the highlighted fields is not required to be represented in 3D, however these items are still required as part of the building information submittal package.

1.11 Topographic and Property Line Surveying

It is encouraged that Surveys be provided in electronic format and at a minimum include 3D topographic information including paving and retaining walls. The file(s) shall be in a format that allows for importing into the A/E's BIM Authoring software.

All land surveys must be tied to the State's GIS GA State Plane West, NAD83 (1991) coordinate system and USGS datum. The surveyor shall provide electronic files that clearly define the project site and include accurate x/y/z coordinates on all survey items. The file(s) must be in a format that allows for importing directly into the State's GIS system. Survey points must "land" within the State's GIS datum within the margin for error that is normal in the industry.

1.12 Existing Conditions

All existing conditions needed to explain the extent of work for renovation, alteration and addition projects shall be modeled.

1.13 Energy and Sustainability Analysis

In instances where energy modeling is a required deliverable, the A/E shall use early energy modeling tools integrated with the BIM Authoring software to develop comparative energy analysis. Modeling parameters shall be based on local climate data and actual site conditions.

Design Phase Submittal Table 1.1 (ASTM E 1804-02)

8.1.1[5] PROGRAM PHASE	8.2 SCHEMATIC DESIGN PHASE	8.3 DESIGN DEVELOPMENT PHASE	8.4 CONSTRUCTION DOCUMENTS PHASE
8.1.1.3 Site configuration	8.2.1 Site Development	8.3.1 Site Development	8.4.1 Site Development
	Paving and parking requirements	Site Plans[6]	Final Site drawings
	Finish building grades	Topographical Information	Utility locations and design showing all underground structures and utility lines
	Original site drawings[7]	Utility Location (Showing all underground structures and lines)	Demolition, landscaping, miscellaneous, site structures and related details
	Storm drainage solution	Demolition Plans and Information	Elevations and sections
Location of available utility services to the building	Existing utility location[8]		Details, schedules and notes to be used in the construction of the project
	Site retaining walls		
	Site lighting requirements		
8.1.1.1 Design Program	8.2.2 Building Work:	8.3.2 Building and Specialty Structures	8.4.2 Building and Specialty Structures
Detailing the project function, purpose, and characteristics.	Principal floor plans	Current Floor Plans	Current floor plans
	Exterior wall sections	Exterior wall sections	Exterior wall sections
General information about the exterior building elevations and floor configuration		Building elevations and sections	Building elevations and building sections
	Finish schedule by room types	Preliminary design finish schedule with material selections	Finish schedule and notes
	Structural foundation system. Typical structural framing system	Structural foundation design, typical structural framing, lateral load resisting system(s)	Structural plans, notes and details fully describing the structural building requirements
		Mechanical, electrical and plumbing system descriptions[9]	Mechanical plans and sections[10]
	Roof system selections.	Typical interior wall types	Typical interior wall partition details
		Acoustical guidelines	Details of exterior walls, stairs, toilet rooms etc.)
			Special details and conditions (mill work handrails etc
			Conveyance plans and sections fully describing elevators escalators and lifts
	8.2.3 Specialty structures[11]		Electrical plans and sections[12]

[5] Preceding numbers indicate corresponding section of ASTM E 1804-02.
[6] Including all paved areas, site utilities, landscaping ideas and building or vertical structure locations
[7] Do not have to be in 3D
[8] Only as needed to explain extent of new work, see section 1.12.
[9] and one line diagrams reflecting the design of HVAC, plumbing, fire protection and electrical and riser diagrams with panel information
[10] Mechanical plans notes and sections fully describing plumbing, HVAC and fire protection requirements.
[11] Structure type (bridge, gazebo, etc.) and Height and floor plan dimensions.
[12] Electrical plans notes and sections fully describing the electrical communications, security and equipment requirements.

1.14 Component Change Order (CCO) BIM

Each Component Change Order Model shall be treated the same as Construction Documents (CD) Phase in Table 1.1. Except the Building Information Model submitted for each CCO shall include all items defined by the scope of work for that specific CCO modeled to the level of completeness that would be required at CD phase for those items. Items included in the model for reference only, that are not part of the CCO scope of work could be at a lesser level of development provided they do not create conflicts with the required CCO items.

1.2 Other Constructability Review Items

Other items are required by ASTM E 1804-02 but not included in Table 1.1. These items do not need to be modeled and can be submitted in the form of supporting documents such as reports and manuals. These items are listed in sections 1.21 through 1.24.

1.21 Programming Phase Documents

Other programming phase items include material information relating to the gross floor area of prime building spaces equipment and building systems (ASTM E 1804-02 section 8.1.1.1). Cost limitations and allowances (ASTM E 1804-02 section 8.1.1.2), site limitations, known soil and rock information (ASTM E 1804-02 section 8.1.1.3) do not need to be modeled.

1.22 Schematic Design Phase

Site lighting requirements (ASTM E 1804-02 section 8.2.1.7) do not need to be modeled. Also specifications outline (ASTM E 1804-02 section 8.2.2.2) and mechanical/electrical/plumbing systems outline (ASTM E 1804-02 section 8.2.2.4).

1.23 Design Development Phase Documents

Design Development documents that do not need to be modeled include: Project Specification outline with selected equipment and acceptable manufacturers (ASTM E 1804-02 section 8.3.2.2).

1.24 Construction Documents

Other construction phase documents include: Project specifications completely describing materials and manufacturers (ASTM E 1804-02 section 8.4.2.1), Conveyance specifications (ASTM E 1804-02 section 8.4.2.10).

2.0 Building Life Safety Components

A construction permit is issued by the State Fire Marshal's Office for all state projects. Certified state fire inspectors under GSFIC employ perform fire marshal reviews of GSFIC managed projects for the purposes of issuing construction permits. Fire marshal reviews check for compliance with life safety codes as outlined by the Rules and Regulations of the Fire Safety Commissioner 120-3-3. The model shall include the information listed in Table 2.1 of this guide for the relevant permits at each phase of construction.

The Life Safety Review will utilize the spatial components of the building information model.

Fire Marshal Review Phase Submittal Table 2.1[13]

SUBSURFACE SITE APPROVAL LETTER (If Applicable to the Project)	**SHELL ONLY APPROVAL LETTER** (If Applicable to the Project)	**CONSTRUCTION PERMIT** (Required)
Current applicable codes listed on drawings	Current applicable codes listed on drawings	Current applicable codes listed on drawings
Life Safety Plans (signed and sealed) to include: • Occupancy Classification • Occupancy Separations • Construction Type • Number of Occupants • Square Footage • Sprinklers (Yes or No) • Number of Exits/ Exit Capacity • Travel Distance • Exit Remoteness	Life Safety Plans (sealed): Complete Civil Drawings (signed & sealed) Complete Structural Drawings (signed & sealed)	All Construction Documents Signed Sealed Life Safety Plans Complete Civil Drawings Complete Structural Drawings Complete Architectural Drawings (including): • Door Schedule • Accessibility Details Mechanical Drawings (including): • Fire/Smoke Damper Locations Plumbing Drawings Electrical Drawings Fire Alarm Systems Drawings
Complete Civil Drawings (signed & sealed)		
Architectural Floor Plans	Architectural Drawings (including): • Floor Plans • Fire Walls Details (include UL numbers Exterior Wall Ratings • Exterior Wall Ratings Fire Walls Details • Fire Separation Distance • Wall/Opening Protection • Elevations • Elevator Lobbies • Smoke Barriers • Building Elements Fire Ratings Smoke Control Analysis (Atriums) Life Safety Evaluation	Smoke Control Analysis (Atriums) Life Safety Evaluation (Smoke Protected Seating) Other Interior Life Safety Issues as Required

One of the purposes of validating the Building Information Model is to efficiently and accurately assess design performance, relative to Life Safety Code requirements.

[13] Documents in the shaded portion of Table 2.1 shall be signed and sealed by the corresponding A/E

Certain items such as the smoke control analysis will not be reviewed via the Building Information Model. Such submittals and reviews will be done using traditional methods.

2.2 Required Spatial Information for all Projects

Spatial information will be used for assessment of conformance to applicable life safety and building codes. It will also be used for design assessment relative to the spatial program issued by the Using Agency to the A/E at the programming constructability review phase. See section 1 of this guide.

Consequently, modeling spaces accurately is one of the most important tasks in creating BIMs. Space objects are normally represented in plan drawing view with a data tag (e.g., name, number, etc.).

A/Es should ensure that all names (e.g., space name, occupant organization name) match established using agency conventions. Where no using agency conventions exist A/E shall defer to Appendix D of this guide.

At a minimum, A/Es are required to have the objects that constitute a Life Safety Plan in a valid 3D geometry representation: Full-Floor Space, Wall objects (with Door objects and Window objects) Slab objects, Column objects and Beam objects. In addition, spaces must include the following information:

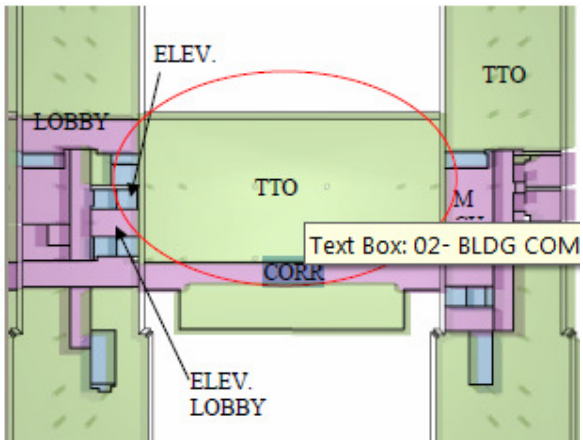
- Space Area (Net or Gross as required for occupant load calculation per NFPA 101 Table)
- Space Name
- Space Number

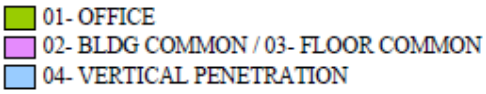
These spaces might also be grouped into a Zone, for visualization and analysis purposes (e.g., to differentiate private vs. public zones, for thermal simulation calculations).

Note that the boundary is to the inside face of all of the walls, and that the columns are deducted from the net area.

2.2.1 Example of Modeling a Space Object

Figure 3 demonstrates how net area is defined and the resulting impact upon the occupant load calculations.





This view is built upon IFC 2x and 2x2 and is currently supported by Autodesk Revit and Architectural Desktop, Bentley Architecture, Graphisoft ArchiCAD, Onuma Planning System, and Solibri Model Checker.

3.0 Building Elements

3.1 Modeling Precision

The system of measure for modeling GSFIC new construction projects is the United States Customary System (English Units). The dimensional tolerance should be 1/8 inches. The coordinate system origin for BIM files submitted must be located logically and in close proximity to the building geometry (e.g., at a grid intersection). This origin must not be moved during the course of the project since most objects in an IFC BIM use relative placement, which traces back to the project coordinate system origin.

3.2 Retaining Original Global Unique Identifiers (GUIDs)

One cornerstone of the IFC BIM schema is a unique identifier assigned to each object in the model. These IDs are used in cross-object references, relationships, and to enable tracking of what has changed in a model between two states or versions. All software applications that support export of IFC BIMs are able to generate unique object identifiers called Global Unique Identifiers (GUIDs). If a BIM-authoring application provides the option to keep the original GUID, this option should always be selected.

BIM-authoring applications generally allow the user to identify a model subset (or filter) when exporting to an IFC BIM. In some cases, this is done by exporting only the layers that are currently visible in the BIM-authoring application. This allows users to export only the parts of the model relevant to the purpose of the export. Please refer to the BIM-authoring application vendor's specific instructions on how to filter the objects to be included in the export to an IFC BIM.

Regarding a BIM submission to GSFIC, all non-BIM related layers, objects, text styles and other elements not used in the Final Concept design configuration shall be purged before submission. For example, early phase "what if" scenarios that have been abandoned but were left in the model should be deleted from the native file before the complete native model file(s) and exported IFC BIM are generated.

When uploading IFC BIMs in either .IFC or .IFX formats, users should not compress the files (e.g., using WinZip®) unless explicitly agreed otherwise.

3.3 Handling Multiple BIM Versions

A BIM exists as a digital model of the building at a given point in time. It may be produced by a number of parties using various software tools. BIMs submitted to GSFIC should only contain the current state of the design. Submissions should not contain alternative or abandoned design schemes. Several versions of the BIM may be created during the design process. BIM versions may be published for specific uses by various project stakeholders. In each case, the BIM version normally needs to contain only the subset of information that is relevant to the intended user at the current phase of the project.

Each design alternative included in the Preliminary Concept design submission to GSFIC shall be supported by a separate BIM in IFC format that contains only the information relevant to the subject design alternative. Similarly, Final Concept design submission to GSFIC shall be supported by a BIM in IFC format containing only information relevant to the Final Concept design.

3.4 Model Containment Hierarchy

The model structure (or containment hierarchy) of BIM is normally generated by the BIM-authoring application. Users have little if any possibility to influence it. In situations where the user can define the model containment hierarchy, it should be structured as in the IFC BIM standard. Typically, spaces and building elements are contained in a building floor, building floors are contained in buildings, buildings are contained in a site, and a project can contain one or more sites. In the submission to GSFIC, the site object is optional (in which case the building is contained directly by the project) and the building floor object is also optional (in which case spaces and building elements are directly contained by the building).

This containment hierarchy can be summarized as follows:

- Project
    - Site
        - Spaces
        - Building Elements
        - Buildings (same as below)
    - Buildings
        - Building Floors
            - Spaces
            - Building Elements

Spaces can also be members of one or more Zones (e.g., daylighting, HVAC, or even an organizational department). See section 2 for more detail on Spaces and Zones.

In general, the BIM-authoring application will manage this for the A/E, but it is important to be aware

3.5 Model setup

- Each discipline is to have its' own file(s)
- There is to be one master (or CENTRAL) file, linking in all disciplines' models
- All phases to be within one file, and to be separated into phases of work
- All model objects to be set to accurate dimensions (not overridden dimensions) and real-world dimensions to be used (not nominal dimensions)
- All drawing sheets should be generated from the model
    - Exception: Highlighted exclusions to Table 1.1

Wall objects must include the "interior or exterior" property as defined in IFC. The BIM-authoring application will include this in export to IFC, but the user may be required to "set'" the property value in some cases. Please see vendor documentation for instructions on how this property is set.

In order to ensure that all instances of each object type in the BIM are complete and meet the requirements defined in this Guide, users are advised to use one of the BIM-authoring applications listed in appendix E of the appendix supplement to this guide, or independently validated as compliant with these requirements.

3.6 Required Model Elements and Proper Modeling Methods

The following object types are required in IFC BIM(s) submitted to GSFIC

3.6.1 Architecture

3.6.1.1 Required

Exterior walls not included in Structural model (including all wall layers, penetrations and openings)

Doors and openings (all types), door leaves and frames

Windows, curtain walls, storefront systems, skylights, borrowed lites and windows leaves (including all frames and mullions)

Roofing systems

Canopies

Stairs (treads, risers, stringers and monolithic stairs)

Ramps

Railings (including all handrails, guardrails and posts)

Stoops not included in Structural model

Wells not included in Structural model

Interior partitions and furring (including all wall layers)

Columns not included in Structural model

Ceilings (including all soffits)

Elevators and escalators (need to be at least blocked out)

Casework

Fixed furniture systems

Access flooring

Slabs and floors not included in Structural model

Stone floor toppings not included in Structural model

3.6.1.2 Optional

Built-up rigid insulation on roof decks

Scuppers and drains not included in MEP models

Railings that represent the actual railing systems rather than placeholders

Fixed Equipment not included in MEP models

Support stanchions and struts for access flooring

Significant artwork (at least blocked out)

Fountains and pools not included in Civil model

3.6.1.3 Proper Methods

Precast panels to be modeled as separate panels (e.g. moving one panel does not affect the others)

Access panels to be modeled as separate panels

Other exterior wall types to be split from floor to floor

Exterior wall cladding to be separate from main wall structure (e.g. brick cladding, metal panel, etc.)

Concrete cores (stair towers, elevator shafts, etc.) to be split from floor to floor

Interior partitions and furring that extend multiple floors to be split floor to floor

Columns not included in Structural model that extend multiple floors to be split from floor to floor

Concrete should not be split into different pours

(*Extra information that is not listed under the needed items, can typically be drafted instead of modeled.)

3.6.2 Structure

3.6.2.1 Required

Concrete slabs

Foundation walls and other structural walls

Deep Foundations and footings

Grade beams

Concrete beams

Concrete columns

Shear walls

Other concrete pours (stoops, wells, monolithic stairs, etc.)

Primary steel members (columns, beams, trusses and joists)

Secondary steel members (bracing, façade support angles, lintels and bracing)

Structural stair components

Decks (metal, wood, concrete and concrete on metal)

Equipment pads (anticipated sizes based on design)

3.6.2.2 Optional

Secondary steel members (gusset or base plates, equipment supports, support angles, kickers, etc.)

Concrete Reinforcing

3.6.2.3 Proper Methods

Concrete should not be split into different pours

Concrete and steel columns to be split from floor to floor

Concrete infills around column bases to be separate objects

3.6.3 Mechanical

3.6.3.1 Required

Cooling towers

Chillers

Boilers

Pumps

Heaters

Compressors

Dryers

Tanks

Other mechanical and air handling equipment (anticipated sizes based on design)

Ductwork

Diffusers, return air ducts and flex duct

Piping associated with mechanical equipment and not included in Plumbing model

Electrical associated with mechanical equipment and not included in Electrical model

Equipment pads (anticipated sizes based on design) not included in Structural model

Valves and fittings

3.6.3.2 Optional

Hard insulation or fireproofing around, or included in the size for the ductwork and piping

Required clearance areas or access zones (modeled as separate semi-transparent components)

Duct joints and flanges

3.6.3.3 Proper Methods

Hangers for ductwork and piping should not be included

Label components by type (e.g. Supply, Return, etc.)

3.6.4 Electrical

3.6.4.1 Required

Power feeds

Switch gear

Transformers

Panel boards

Generators

Other equipment (anticipated sizes based on design)

Light fixtures

Cable trays

Specialty systems (generators, UPS, etc.)

Conduit and fittings (all conduit 2” in diameter or greater)

Pull boxes

Equipment pads (anticipated sizes based on design) not included in Structural model

3.6.4.2 Optional

Conduit and fittings under 2” in diameter

Security cameras

Required clearance areas or access zones (modeled as separate semi-transparent components)

3.6.4.3 Proper Methods

Hangers should not be included

Label components by type (e.g. Power, Data, Telecomm, etc.)

Outlets and groups of wire without conduit should not be included

3.6.5 Plumbing

3.6.5.1 Required

Tanks

Pumps

Other equipment (anticipated sizes based on design)

Piping (including all hard piping 2” in diameter or greater whether its for water, gas, drainage, etc. and must reflect slopes)

Floor and roof drains

Plumbing fixtures not included in Architectural

Electrical associated with plumbing equipment and not included in Electrical model

Valves, fittings and cleanouts

Equipment pads (anticipated sizes based on design) not included in Structural model

3.6.5.2 Optional

Piping under 2" in diameter

Hard insulation or fireproofing around, or included in the size for the piping

Required clearance areas or access zones (modeled as separate semi-transparent components)

3.6.5.3 Proper Methods

Hangers should not be included

Label components by type (e.g. Storm Drainage, Domestic Water, etc.)

Extra information that is not listed under the Needed items, can typically be drafted instead of modeled.

3.6.6 Fire Protection

3.6.6.1 Required

Tanks

Fire pumps

Other equipment (anticipated sizes based on design)

Piping (all mains)

Valves and fittings

3.6.6.2 Recommended

Piping (branch lines and smaller)

Sprinkler heads

Fire pumps

Required clearance areas or access zones (modeled as separate semi-transparent components)

3.6.6.3 Proper Methods

Hangers should not be included

Label components by type (e.g. Wet, Dry, Pre-Action, etc.)

4.0 BIM Analysis Rules

With a BIM-analysis application (such as the example described in Appendix B of the appendix supplement to this guide), GSFIC associates and project teams can:

Measure Area of Spaces

Measure Travel Distances

Review Vertical Openings (such as Atrium's, Communication Spaces, and Convenience Openings etc.)

Perform Clash Detections

Conflicts between structural bracing and architectural (doors, windows, wall types, etc.)

Ceiling heights versus depth of structural elements

Coordination between architectural floor/roof elevations, depressions, or slopes with structural

Coordination between architectural and structural for floor/roof openings

Coordination with equipment locations (mechanical and architectural) and structural

Structural columns sizes with architectural

Exterior edge of slab/beams with architectural exterior walls

Clashes between ducts and shafts with structural elements

Structural integrity

Point of crossing of pipe profiles

Appendix A (File Clean Up Process)

1. Make all objects within the file visible.
2. Check the 0,0,0 origin. If there is no absolute coordinate system in the software application you are working in, make sure you leave crosshairs in the file representing the 0,0,0 origin.*
3. Purge the model of any unused elements, if the software application has that feature. (Remove demolition plans and different versions/design alternatives.)
4. Audit (check and fix any errors in) the file, if the software application has that feature.
5. Detach all links (external references) to other files.
6. Delete or detach any images.
7. Designate and save a specific view for export to Navisworks.
8. Run internal clash detection (interference checking) and provide list of any unresolved clashes at the time of upload.
9. Save clash report and upload with model submittal.

Check filename and send. Once the new file is created, make sure the name is correct (according to GSFIC file naming standard), and upload file to the GSFIC Web Portal (E-Builder).

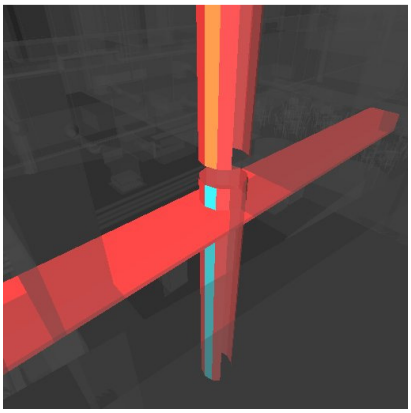
Note: Whenever updates are provided upload only files that have been modified and provide the list of changes.

*Define how coordinates are shared see Appendix F: BIM Execution Plan.

Appendix B (BIM-Analysis Application Example)

Navisworks Manage

GSFIC Design Review Group will utilize Navisworks Manage to check building information models for coordination between architectural and engineering disciplines, to identify clashes and also to simulate and optimize scheduling.



Sample clash detection between mechanical and structural elements.

Clashes - Windows Internet Explorer

E:\Ifiok\structcols vs mechduct.html

File Edit View Favorites Tools Help

Google

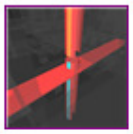
Clashes

Clashes

Report Batch

Structcols Vs Mechduct Clash

Tolerance	0.17ft
Self Intersect	0
Total	30
New	28
Active	1
Reviewed	1
Approved	0
Resolved	0
Type	Hard
Status	Old



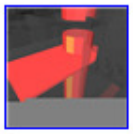
Name	Clash1
Distance	-0.69ft
Description	Hard
Status	Old
Clash Point	118.92ft, 59.08ft, 10.99ft
Date Created	2011/2/3 19:51:33

Item 1

Layer	S-Column-Goo
Path	File ->File ->Meadowgate - Structure.dgn ->S-Column-Goo ->DWG_PR ->Cell ->Shape
Item Name	DWG_PR
Item Type	Shape

Item 2

Entity Handle	45B0
Layer	M-STND-Duct
Path	File ->File ->Meadowgate - Services - Ground Floor Ductwork.nwc ->M-STND-Duct ->Duct
Item Name	M-STND-Duct
Item Type	Duct



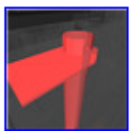
Name	Clash2
Distance	-0.66ft
Description	Hard
Status	Old
Clash Point	118.91ft, 59.12ft, 22.47ft
Date Created	2011/2/3 19:51:33

Item 1

Layer	S-Column-Goo
Path	File ->File ->Meadowgate - Structure.dgn ->S-Column-Goo ->DWG_PR ->Cell ->Shape
Item Name	DWG_PR
Item Type	Shape

Item 2

Entity Handle	459A
Layer	M-STND-Duct
Path	File ->File ->Meadowgate - Services - First Floor Ductwork.nwc ->M-STND-Duct ->Duct
Item Name	M-STND-Duct
Item Type	Duct



Name	Clash3
Distance	-0.66ft
Description	Hard
Status	Old
Clash Point	118.91ft, 59.12ft, 34.94ft
Date Created	2011/2/3 19:51:33

Appendix C (Instruments of Service)

2.1.2 Instruments of Service.

2.1.2.1 Definition of Instruments of Service. Instruments of Service are those drawings, specifications, and other documents, including those in electronic form, prepared specifically for this Project by the Design Professional and its consultants. In recognition of the public ownership of the Project, the Design Professional and its consultants agree and shall be deemed to have prepared their respective Instruments of Service as architectural and engineering works and as works for hire as defined in 17 U.S.C. §§102(a)(8) and 201(b), thereby transferring and vesting in the Owner, pursuant to 17 U.S.C. §201(d), all common law, statutory, and other reserved rights, including copyrights in the Instruments of Service and in the buildings, improvements, and structures constituting the Project.

2.1.2.2 Copyright. Upon execution of this Contract, the Design Professional expressly grants, assigns, transfers, and otherwise quitclaims to the Owner, its successors, and assigns, pursuant to 17 U.S.C. §201(d), all common law, statutory, and other reserved rights, including copyrights in both the Instruments of Service and in the buildings, improvements, and structures embodying the architectural and engineering works that constitute the Project, provided that the Owner shall comply with all obligations, including prompt payment of all sums, when due, under this Contract.

The Design Professional shall obtain similar grants, assignments, transfers, and quitclaims from its consultants consistent with this Contract. The Design Professional warrants (and shall cause each of the Design Professional's consultants to warrant also) that this transfer of copyright and other rights is valid against the world.

2.1.2.3 License to the Design Professional. Notwithstanding the rights, ownership, grants, assignments, transfers, and quitclaims set forth in Paragraphs 2.1.2.1 and 2.1.2.2 of this Article above, the Owner expressly grants, assigns, and transfers a permanent and exclusive license to the Design Professional, its successors, and assigns, for the Design Professional's Instruments of Service, and to each consultant (including the consultant's successors and assigns) of the

Design Professional for such consultant's Instruments of Service, to use, reproduce, sell, transfer, and accomplish derivative works therefrom, for any and all purposes.

2.1.2.4 Release of Liability. The Owner agrees and hereby forever releases the Design Professional from all liabilities that might arise from the Owner's use of the Instruments of Service or other licensed portions of the Construction

Documents for any alterations, additions, subtractions, or modifications of the Instruments of Service or of the buildings, improvements, and structures of the Project resulting therefrom, or for use in other Projects; provided, however, that this release does not apply to liabilities arising from the original Instruments of Service and the buildings, improvements, and structures of the Project that have not been altered, added to, subtracted from, or modified subsequent to completion of construction of the Project by the Owner, its successors, or assigns.

2.1.2.5 Use of Instruments of Service. Except for the rights and licenses granted in this Article, no other license or right shall be deemed granted or implied under this Contract. The Owner permits and authorizes the Contractor, Subcontractors, sub-Subcontractors, and material or equipment suppliers to reproduce applicable portions of the Instruments of Service appropriate to and for use in their execution of the Work.

2.1.2.6 Documents in Electronic Format. Within forty-five calendar days of the receipt of the marked-up Construction Documents that are required to be furnished by the Contractor pursuant to the Contract Documents, the Design Professional shall provide the Owner with Record Drawings and Final Documents as specified in Article 2.2.11. In the event that the Project is terminated prior to construction, the Design Professional, upon the Owner's request, shall provide on CD ROMs two copies of all drawings and Project Manual content then existent. Electronic drawings shall be made available for viewing in PDF, Autodesk DWF, or other approved format.

2.1.2.7 Acknowledgement of Risks Concerning Electronic Media. The Owner acknowledges that the automated conversion or transfer of electronic documents may introduce inexactitudes, anomalies, or errors. Copies of documents that may be relied upon by the Owner are limited to printed copies (also known as hardcopies) that are signed or sealed by the Design Professional and its consultants. Files in electronic media format or text, data, graphic, or other types that are furnished by the Design Professional to the Owner, are only for the convenience of the Owner. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. When transferring documents in electronic media format, the Design Professional makes no representations as to long-term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware different from those in use by the Design Professional and its consultants at the beginning of this assignment.

2.1.2.8 Copies of Contract Documents to Contractor. Without charge to the Contractor (but reimbursable to the Design Professional, pursuant to Paragraph 4.1.3.2), the Design Professional shall furnish to the Contractor up to twenty-five sets of completed Contract Documents in hardcopy, one set of reproducible and electronic background floor and reflected ceiling plan drawings, and, if requested, one copy in read-only electronic format. The Contractor may obtain such additional sets of Contract Documents as the Contractor deems necessary and shall pay the cost of reproduction of such additional sets to the Design Professional.

Appendix D (GSFIC Naming Conventions)

File Name

The file shall be named according to the GSFIC project number followed by the using agency abbreviation and project title. For example:

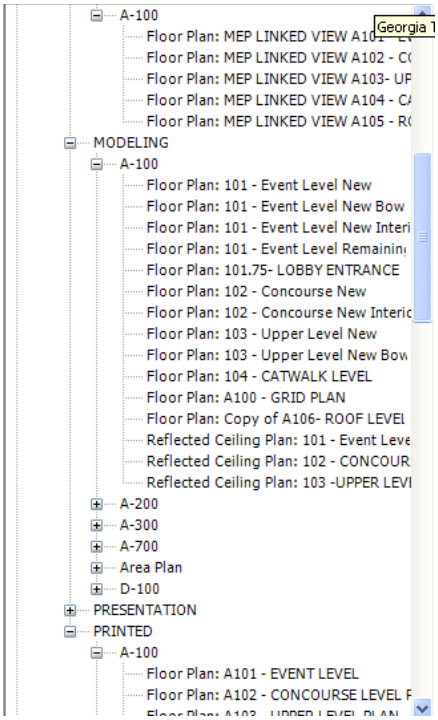
I-93 UGA Special Collections Library.ifc[14] or

TCSG-245 Griffin Tech Medical Technology Building.ifc

Model View Name

Model views shall be named according to the discipline abbreviation and corresponding floor level. For example:

All the architectural views associated with the first floor shall be located under sub-folder A-100. (See figure below.)

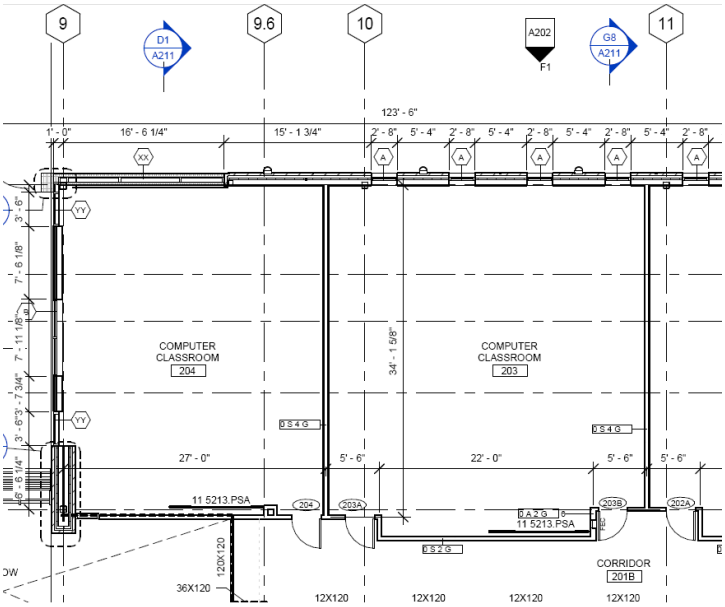


Space Name

The room name shall correspond to the use of the space. Room numbering shall coordinate with the floor level and shall be sequentially located adjacent to each other. Each space shall be labeled with

[14] Or whatever file extension applicable to the native format

the room name, followed by the room number. For example a second floor computer classroom shall be labeled as: **Computer Classroom 204**. (See figure below.)



Appendix E (BIM Authoring Applications)

The following BIM applications are IFC certified.

Autodesk Revit: is Autodesk's Building Information Modeling (BIM) software enabling architects and designers to create and communicate design intent and understand performance, appearance, and cost early in the building design process. The suite includes Revit Architecture, Revit Structure and Revit MEP.

Bentley Architecture: Bentley Architecture V8i is Bentley's BIM application for architectural design that is part of a large integrated multi-disciplinary set of building solutions for design, analysis, and collaboration, built on the new MicroStation V8i platform.

Graphisoft ArchiCAD: ArchiCAD 14 is the new release of Graphisoft's BIM application for architectural design, which includes a server-based collaboration module as well as translators for enhanced interoperability with engineering applications.

Appendix F (BIM Execution Plan)

See attachment.