UNIVERSITY of SOUTH FLORIDA

BIM Guidelines and Standards

For Architects, Engineers and Contractors

Facilities Management

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BIM Guidelines and Standards

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SECTION 1: BIM STANDARDS OVERVIEW

The USF Building Information Model (BIM) Standard document describes the processes and procedures required for the preparation and submission of BIM technology for USF projects.

1.1 Introduction

Building Information Modeling (BIM) is the new industry standard that is changing the way planning, design, construction and facility operations are conducted. BIM uses computer-based simulations to study and validate project design and construction before it is actually built. BIM is far more than basic 3D modeling; BIM is a business approach that integrates multiple streams of project-related information. BIM moves users away from the traditional "document-centric" approach, which only addresses the capital construction side of a facility, toward a "data-centric" approach, which supports the facility lifecycle operation. Resulting in a more effective holistic approach for the design, estimating, scheduling, and the construction phases. BIM breaks down traditional barriers related to interdisciplinary collaboration, facilitating off-site prefabrication, improving design options, and most importantly, reducing risk, rework, and cost. BIM also allows for the integration of construction phasing through project scheduling software, automated quantity takeoffs, automated material takeoffs, and green building analysis, among many others.

1.2 Purpose

The USF BIM Guidelines and Standards ensure that the Design Team will produce, release and receive data in a consistent format. This will maintain an efficient exchange of data between disciplines and the compatibility of each discipline's BIMs and the compatibility with various out-side consultants. USF's BIM practice is comprised of several Autodesk products. The USF BIM Guidelines and Standards will generally use terminology and references that are unique to the Autodesk-based software applications.

1.3 Applicability

Regardless of size, the BIM application process and the use of standards can progressively build and update comprehensive BIMs of any USF facility. USF's goal is to leverage existing BIM project models for smaller projects allowing consultants and contractors access to existing models when the creation of BIMs would otherwise be difficult or non-justifiable on an individual project basis. The BIM repositories of each facility would contain new and updated information supplied via design/construction projects, significant renovations, and routine maintenance and operations systems, which in return offers a valuable life cycle tool to operate the University's facilities.

SECTION 2: MODEL DEVELOPMENT

This section establishes the technical criteria required to develop a project using BIM technology for the University of South Florida.

2.1 Model Requirements

All BIMs shall be developed in accordance with the **USF-BIM-EP**, **USF-BIM** and **USF-CAD** documents.

2.2 Model Quality

The University of South Florida requires that all BIMs be developed using object-based elements only, such as Columns, Beams, Walls, Doors, Windows, etc. along with their associated parametric information. This requirement shall be maintained throughout the entire project.

2.3 Model Level of Development

The BIM Level of Development (LOD) describes the level of completeness to which a BIM is developed and their minimum requirements. The Level of Development is accumulative and should progress from Level to Level. (Reference **USF-BIM-EP** Section 8 for detailed description of Level of Development)

a. At a minimum, all required BIMs shall be detailed to the Level of Development required by each Design Phase and/or Sub-Phase.

b. BIMs shall be created and include all geometry, physical characteristics, information and data necessary so to describe and facilitate the design, intended construction, and cost estimating of a project as necessary to meet the requirements, as described in this document and the **USF-BIM-EP**, for each Design Phase and/or Sub-Phase of a project. In addition, all drawings, simulations, and services required for analysis and review shall be extractions from the BIMs.

c. Required Building Elements need not illustrate/depict individual parts that are required for the assembly and/or the manufacture of the Modeled Building Element. The intent and requirements for a Modeled Building Element is different for each phase and LOD. It is to provide overall size, shape, clearances, information, data, and the orientation of a Modeled Building Element for its installation and coordination with other required work, as well as for the population of required Schedules.

NOTE: This document contains document abbreviations as referenced above and throughout this document (Example: USF-BIM-EP), full names and the location of these documents can be found in the "USF Referenced Documents and Abbreviations" located at the end of this document.

SECTION 3: SOFTWARE AND MODEL REQUIREMENTS

3.1 Software Requirements

The designated BIM software for the University is Autodesk's Revit (Architecture, Structural, MEP), which complies with current industry interoperability standards and is able to be used in a collaborative environment. All software used for USF projects shall meet the following requirements:

a. The project shall be delivered in Autodesk's Revit 2014 or current release as stated on the http://www.autodesk.com/ website.
b. Utilize commercially available collaboration software that provides interoperability between the different software applications
c. Traditional 2D documentation shall be prepared and completely derived from the BIM authoring software. Plans, elevations, sections, schedules, and details shall be derived and fully coordinated with the coordinated BIM.
d. All 2D documents are to be submitted per the **USF-CAD** and Contract Document requirements.

3.2 Optional BIM Authoring & Collaboration Software

The Civil Engineer may optionally use alternative software such as AutoCAD Civil 3D. All other members of the Design Team, MEP, and Structural are required to use Autodesk Revit. Tekla BIMsight may also, optionally be used for collaboration.

3.3 Digital Submittal Requirements

All submitted electronic files must be compatible with the version of the Autodesk Revit software currently being used by USF and must conform and comply with the latest version of the **USF-BIM**, **USF-BIM-EP**, and **USF-CAD** documents. The following formats are required on every submission:

- RVT : Autodesk Revit files
- NWD : Autodesk Navisworks Master files
- NWC : Autodesk Navisworks Cache files
- XLS: COBie Spreadsheet (Microsoft Excel file format)
- Check with USF for additional approved formats

3.4 Model Geographical Location

a. The spatial coordination (coordinates) of the master BIM file shall be set at the beginning of the project. Once established, spatial coordinates shall only be changed by mutual consent of the team and the USF Project Manager, with the matter recorded in the meeting minutes. Once the design coordinate system is agreed upon, any BIMs of existing buildings relevant to the project shall be converted into the coordinate system used for the project.

b. As standard practice, USF requires that a building within a BIM file include a geo-reference to accurately locate the building within the designated project site. The final project geographical location shall be the actual project site location using Florida State Plane coordinates. The following datum's should be used: North American Datum (NAD) 1983 for horizontal control and North American Vertical Datum (NAVD) 1988. All models shall maintain this reference throughout the project phases.

3.5 Requirements for Modeling Space

a. Space information shall be exported from the BIM for use in the university's space management system.

b. Areas of ten square feet or greater shall be tracked and identified by name and room number, even if those spaces are not listed in the program.

c. Spatial data shall be generated, and associated with bounding elements (Walls, doors, windows, floors, columns, ceilings).

d. The Net Square Footage (NSF) shall be modeled for each functional space in the BIM, using the appropriate space/object in the BIM to capture and carry the information. Spaces shall be represented and broken down into functional spaces (Example: Medical Exam Room, Laser Treatment Room, Waiting Room, etc.) as defined in the project program even though they may be parts of a larger physical space. A physical space may contain several areas that are treated individually (lobby, partitions, cubicles, entrance areas). If two areas have different functional space classifications, even though they are within the same physical space, they shall be modeled as two separate spaces. For example, a work area such as a built-in reception desk within an entrance or lobby shall be modeled as separate non-overlapping spaces. These spaces might also be grouped into a Zone, for visualization and analysis purposes (e.g., for thermal simulation calculations). Space/area schedules and diagrams must be dynamically updated from the model geometry.

e. Review **USF-CAD** Room Standards for all space and room number assignments. (All room numbers shall be approved by USF and the University Space Coordinator at 50% CD's)

SECTION 4: DELIVERABLE REQUIREMENTS

Hardcopy and Electronic Deliverables are required for every project.

4.1 Hardcopy Deliverables

Provide hard copy drawings, and deliverables as indicated in section 5 of this document and the **USF-BIM**, **USF-BIM-EP** and **USF-CAD** documents.

4.2 Electronic Deliverables

BIM Models and electronic files are required for each milestone and during phase project development as indicated in the **USF-BIM**, **USF-BIM-EP** and **USF-CAD** documents. The following are data requirements for all deliverables:

- Fully coordinated, Architectural, Structural, and MEP 3D model(s) in Revit and Civil model in Civil 3D at 100% Construction Documents and Final Record Documnets phase submittals
- Equipment schedules and COBie deliverables as generated from the parameters embedded in the Revit model objects
- Provided in the native file format used in the authoring software (As specified in section 3 and in the **USF-BIM-EP** and **USF-CAD** documents)
- BIM files submitted to USF, shall be cleaned of extraneous “scrap” or “working space” (Layers, stories, abandoned designs, object creation and testing places, empty layers, and other content, which is typically produced in BIM production)

4.3 Final Deliverables

The Design Team and Construction Team shall work together in a coordinated effort to fulfill the responsibility of Record Drawing requirements, and shall ensure that the BIMs are updated per the Construction Team’s Recorded Field Data. The responsibility for the delivery of the Record BIMs and Documents submission to the University has been determined to be the Design Team; this assumption throughout this document is based on long-standing practices followed by architects, engineers and contractors. The **USF-BIM-EP** may realign and/or change the responsibilities and required deliverables for a specific project as agreed upon by the University and the Project Team.

Construction Record Documents

The Construction Team shall keep at the construction site a complete set of full size prints of the Contract Documents. During construction, these prints shall be marked to show all deviations in actual construction from the contract drawings. The color red shall be used to indicate all additions and green to indicate all deletions. The following are specific requirements for The Recorded Field Data for the tracing of construction changes to Contract Documents and shall show this information but not be limited thereto:

a. The locations and description of any utility lines and other installations of any kind, or description known to exist within the construction area. The location includes dimensions and elevations of permanent features.

b. The locations and dimension of any changes within the building or structure, and the accurate location and dimension of all underground utilities and facilities.

c. Correct grade or alignment of roads, structures, and utilities if any changes were made from contract plans.

d. Correct elevations if changes were made in site grading from the contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Construction Team including, but not limited to, fabrication erection, installation, and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

f. The topography and grades of all drainage installed or affected as part of the project construction.

g. All changes or modifications from the original design and from the final inspection.

h. Where Contract Documents or specifications allow options, only the option actually used in the construction shall be shown on the Record Documents. The option not used shall be indicated as deleted.

These deviations shall be shown in the same general detail utilized in the contract drawings. Markings of the prints shall be pursued continuously during construction to keep them up to date. This information shall be maintained in a current condition at all times until the completion of the work. The resulting field-marked data shall be referred to and marked as “Recorded Field Data” and shall be used for no other purpose. This Recorded Field Data shall be made available for inspection by the Design Team and/or USF representative whenever requested during construction. Inspections for accuracy and completeness shall be done by a responsible contractor representative and documented prior to submission of each monthly pay request. Failure to keep the Recorded Field Data (including Equipment-in-Place lists in the COBIE spreadsheet) current shall be sufficient justification to withhold a retained percentage from the monthly pay request.

4.4 COBie/Commissioning Deliverables

USF has adopted Construction Operations Building Information Exchange (COBie) as the methodology to electronically transfer building information from the design process and BIMs to other University systems. Autodesk provides a utility (Autodesk - COBie Toolkit for Revit) to facilitate the automatic creation and transfer of data between BIM and the COBie Microsoft Excel spreadsheet format. Where possible, automatic means should be used to create and fill in the COBie data.

- The Design/Construction Team shall consult their BIM software vendor(s) for the most current COBie utilities. However, the completed COBie worksheets may also contain some information that is entered manually into the Microsoft Excel electronic file, either because the information currently cannot be conveniently extracted from the BIM or because it does not reside in the BIM.
- The Design/Construction Team is encouraged to provide COBie data as known at the time of each deliverable. The required COBie worksheets shall be filled out in step with the LOD design and project phases.
- The Design/Construction Team shall submit the COBie data in version 2 release 4, the team is required to coordinate with USF prior to submission to verify the version for submittal. The COBie data will be required along with other required deliverables at each project phase. With Construction Document deliverables, the COBie Type and Component worksheets are required.

SECTION 5: MODEL PHASE REQUIREMENTS

5.1 Programming/Pre-Design Phase

a. **Programming & Planning Tools:**
The Design Team is encouraged to use electronic programming and planning tools that integrate into their BIM authoring software to capture early target cost, target schedule and target program information during design phases. These tools, along with continued validation, should be used for the remaining phases and milestone deliverable submissions on projects.

b. **Topographic and Property Line Surveying:**
Detailed requirements of what is to be included in surveying deliverables are managed by USF in consultation with the Design Team on a project-by-project basis. Surveys shall be provided in electronic format and minimally include 3D topographic information including paving and retaining walls. The file(s) shall be in a format that allows for importing into the Design Team's BIM authoring software.

- All underground utilities shall be 3D objects located at topographic elevations illustrating, nominal sizes, type of utility (gas, electrical, chill water, steam, etc.). Depths of existing utilities shall be located with ground penetrating radar. Where necessary for physical clarification some utilities located within the project need to be physically verified and recorded in the x/y/z locations along the utilities. Surveys are to be developed in AutoCAD Civil 3D for all surveying surface features and gravity based drainage systems. All pressure based systems such as natural gas, chill water, steam, electrical system, etc. shall be developed using AutoCAD MEP.
- The surveyor must 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 Design Team's BIM and the USF GIS system. Survey points must land within the State's GIS datum within the margin for error that is normal in the industry.

c. **Energy Information Modeling (EIM) Requirements:**
The purpose of the programming phase energy BIM is to narrow down design strategies from the multitude of design possibilities to those that are in line with, and will achieve, the projects energy goals and targets.

- Development and agreement on energy targets are encouraged. The Design Team and USF will develop specific energy targets early during this design phase, if not already included within the project program. Some subsystem and environmental targets are: Lighting loads, Interior plug loads, External skin loads, Acoustic analysis, and Glare analysis.
- The Design Team shall develop a simplified BIM for use in conceptual energy modeling for comparative analysis. This BIM shall define the building footprint and include all exterior walls. Interior spaces of similar use and occupancy shall be grouped into larger blocks or rooms, with interior walls limited to those separating areas of dissimilar use.
- Provide energy BIM in conformance with current version of LEED, Energy and Atmosphere Standards: Demonstrate a 28% improvement in the minimum energy cost savings.
- Design Team is encouraged to analyze the design using software that interacts with the BIM in order to refine day lighting, natural ventilation, acoustics, code issues, and design issue. Additional software may be used as needed and identified in the **USF-BIM-EP**.

d. **Comparative Design:**

- **Comparative Cost Analysis**: The Project Team shall extract quantity information using BIM authoring software and other quantity takeoff (QTO) tools to support comparative costs analysis of options studied. Analysis and options must include building perimeter, square foot zones by cost type, exterior envelope area, construction type, envelope, materials, and/or others appropriate to the project. Outputs shall be converted to Microsoft Excel spreadsheet format and submitted as part of the design solution justification at end of this phase.

- **Comparative Energy and Sustainability Analysis:** Design Team shall use early energy modeling tools, preferably integrated with the BIM authoring software, to develop comparative energy analysis. Changing one variable at a time and comparing those results to the results of other iterations in a "percent better" or "percent worse" scenario shall perform multiple simulation iterations. Design components that present "percent better" that are in line with the project energy goals will then be developed further in the schematic design phase.

- **Comparative Design Concept Modeling:** The Design Team shall submit to USF, in Microsoft Excel spreadsheet format, the list of design alternatives and comparisons of the design iterations. The spreadsheet shall include columns for Peak Monthly Load, Peak Yearly Load, Total Yearly Load, Total Yearly Energy, and Use by Source Type.

e. **Existing Conditions:**

The Design Team shall model all existing conditions needed to explain the extent of the construction work for alterations and additions projects. The extent of modeling beyond the affected areas and the level information to be included will be determined based on project needs. These requirements may be stated in the project program, or discussed during the project kickoff meeting. The modeling of as constructed conditions shall have a high level of accuracy. The **USF-BIM-EP** should define the agreed upon scope of the modeling effort. The use of laser scanning and selective conversion of the resulting point clouds to model Record BIM data is encouraged.

5.2 Schematic Design Phase

a. **Design Tools:**

The Design Team may use any method to begin the design process but shall be using a BIM authored data file(s) by completion of this phase. All information needed to describe the schematic design shall be graphically or alphanumerically included in and derived from these BIMs. USF expects the Design Team to use analysis tools, static images, and interactive 3D to describe the design concepts.

b. **Schematic Design Quantity Take Off (QTO):**

The design team shall extract categorical quantity take off information using interoperable BIM tools to support comparative quantity analysis of options. Outputs shall be converted to Microsoft Excel spreadsheets and submitted as part of the design solution justification at end of this phase.

c. **Energy Information Model (EIM) Requirements:**

The purpose of the Schematic Design Energy Analysis deliverable is to measure the performance of the designed BIM against programmatic criteria.

- **Energy Information Model:** The design team shall continue the development of the EIM for use in schematic energy modeling. USF may request more advanced EIMs and analyses than are typically required for this phase. To accomplish these goals the following should be added to the EIM at least at a schematic level:

- The model shall define the building footprint
- All exterior shell components and Interior walls
- All exterior and interior openings
- All overhangs, sun shades and roof monitors
- All ceilings must be modeled as height of spaces
- All rooms should be modeled and individually bounded.
- All room names and numbers must be defined and entered into the element properties to be consistent with space program requirements supporting the university space management system.

The following information shall also be narrated and/or incorporated into the energy BIM:

- Detailed electric and fuel rates as defined by USF Facilities Management
- Building function and occupancy
- Building operating schedules
- Building lighting information in watts/ft2 and schedules
- Building HVAC equipment information (EER, COP, MBH, kW, tons, etc.) and schedules.
- Building plug load information (kW, Btuh) and schedules
- Building process load information (kW, Btuh) and schedules
- Building envelope construction components including U-values, SHGC, absorptivity, SRI value, color, thickness, etc., as applicable to the component.

- The Schematic Design Phase energy BIM shall build upon the BIM developed in the Pre-Design Phase. This energy BIM shall be complete enough to use for additional submissions, such as calculations required by LEED certification. This BIM shall be detailed and finalized enough to use as an indicator of approximate building energy use after occupancy. After building completion and occupancy of a minimum of one year, actual building performance shall be evaluated against this BIM. This BIM shall be used as a tool to facilitate post-occupancy commissioning should discrepancies between modeled and actual energy use arise. Caution is advised in this, as deviations from design in weather, occupancy, plug loads, schedules, electric and fuel costs, etc. will affect actual energy use, and these factors must be taken into account. (Refer to the **USF-BIM-EP**)
- In addition to the items included and submitted in the Pre-Design Phase, the Schematic Design, and Construction Phase BIMs shall include: Energy Conservation Measures (ECMs). ECMs shall be used to evaluate control strategies and additional components for energy savings; life cycle cost (LCC) and returns on investment (ROI) costs.
- The Design Team shall submit to USF, in Microsoft Excel spreadsheet format, the list of design iterations and comparisons of the design iterations. The spreadsheet should include columns for Peak Monthly Load, Peak Yearly Load, Total Yearly Load, and Total Yearly Energy Use by Source Type. Output format shall clearly communicate and be appropriate to project needs and submitted as part of the design solution justification at the end of this phase.
- The design components that provide a “percent better” result as developed in the schematic energy model shall now be modeled based on the schematic BIM. Multiple iterations shall be performed and compared in order to ascertain the best design of envelope, lighting, domestic water, and HVAC system for the project to meet the projects energy goals and targets. The results from the energy BIM shall be submitted to justify the design solution. The results shall include, but are not limited to, the following:

- Annual and monthly energy usage broken down by component in kBtu, kBtu/ft2 and cost in dollars.
- Annual and monthly energy usage broken down by component in kWh or Therm.
- Annual and monthly demand broken down by component in demand kW or demand MBH.

d. **Program and Space Validation:**
The Design Team shall use the BIM authoring software or other analysis tools to compare and validate stated program requirements with the actual design solution. The space validation shall be based on The Post-secondary Education Facilities Inventory and Classification Manual (FICM).

- **Program Space IDs:** Program space IDs are to be tracked within the BIMs to validate program, design and construction space requirements. The following shall be developed automatically from the BIM. (See the Glossary for acronym definitions)
  - Net Assignable Square Feet (NASF)
  - Non-Assignable Square Feet (Non-ASF)
  - Gross Area Square Feet (GSF)

- **Comparative Design Concept Analysis**: The Design Team shall exhibit comparative design concept alternatives, which include, but are not limited to project phasing, bid alternates, and other project related options to maintain targeted, project costs, schedule and value. During this phase, the Design Team shall explore design options and make recommendations against programmatic characteristics. The comparative design concept analysis shall directly influence project schedule and enhance project deliverables.

  Variables shall include orientation, massing, form, sun controls, wall construction, natural ventilation, area of glass, day lighting and other factors appropriate to decision making. Modeling parameters shall be based on local climate data and actual site conditions. Output format shall clearly communicate and be appropriate to project needs and submitted as part of the design solution justification at the end of this phase.

  The Design Team shall present a minimum of three comparative alternatives for each of the following for example, dependent on project objectives and goals:

  - Site placement and building footprint
  - Finishes and materials
  - General space program plan and layout

e. **Level of Development (LOD):**
The Schematic Design Phase requires LOD 100. (Refer to the **USF-BIM-EP** Section 8 for specific content requirements for Level of Development for each project)

f. **COBie Design Data:**
The Design Team shall submit to USF, in Microsoft Excel spreadsheet format, COBie (Construction Operations Building Information Exchange) data, using the COBie version as specified in the **USF-BIM-EP**. This data set shall include those COBie design worksheets related to architectural program. The designer shall specifically identify spatial and systems zoning to reflect the space circulation zones and building service zones that are reflected in the design drawings and specifications.

- The following COBie Design Data worksheets shall be provided in the Schematic Design deliverable:
  - Contact - People and companies

- Facility – Facility or facilities referenced in the file
- Floor - Description of vertical levels
- Space - Spaces referenced in a project
- Zone - Sets of spaces sharing a specific attribute

5.3 Design Development Phase

a. **General Modeling Guidelines:**
Modeled elements from all disciplines should at least meet the deliverable standards as set forth in the **USF-BIM-EP**. Due to the nature of using BIM software, additional elements may be necessary to describe the design intent. The detail, and responsibility to fulfill these modeling requirements should be addressed by the Design Team.

b. **Interference Reporting:**
Clearance zones required for operation, maintenance, repair and general accessibility shall be indicated for those categories of objects as needed. The method for indicating clearance zones will vary depending on the category of object and potential interference checking with other categories of objects as needed. For example, a door may only be required to indicate push/pull side, accessible approach and swing clearances in a 2D plan representation only, were as a mechanical equipment object may require a 3D service clearance zone volume to allow for clash detection with other 3D components.

- Submit the report generated by the BIM authoring /checking software showing conflicts have been resolved.

c. **Program and Space Validation:**
The Design Team shall continue to track program requirements comparing against actual designed space to validate which goals are being achieved. This information will either be directly included and represented in the BIM project models or by employing software specifically designed to author/import/edit program information and link to the BIM project models for validation tracking and reporting. Any programming software intended for use must be able to update actual design values compared to program values. If programming software will be used, provide examples of reports and key features of the software to USF for review prior to use on USF projects.

d. **Other Analysis and Checking Tools:**
The Design Team is encouraged to analyze the design using software that interacts with the model in order to refine acoustics, code issues, reporting, and design issues, etc.

e. **Systems Cost Estimating:**
The Design Team shall extract square foot and system information using BIM authoring software and other BIM integrated tools to support comparative costs analysis of options studied. Outputs shall be converted to Microsoft Excel spreadsheet format, and submitted as part of the deliverable at end of this phase.

f. **Level of Development (LOD):**
The Design Development Phase requires LOD 200. (Refer to the **USF-BIM-EP** Section 8 for specific content requirements for Level of Development for each project)

g. **COBie Design Data:**
The Design Development Phase deliverable shall be an update to the COBie Schematic Design deliverable. The COBie worksheets shall identify the types of equipment to be installed. The Component worksheet shall identify the major individual pieces of equipment individually identified at the Design Development Phase. The following worksheets shall be provided:

- Contact - People and companies

- Facility – Facility or facilities referenced in the file
- Floor - Description of vertical levels
- Space - Spaces referenced in a project
- Zone - Sets of spaces sharing a specific attribute
- Type - Types of equipment/products
- Component - Individually named components, materials and equipment

5.4 Construction Phase

a. **General Guidelines:**
The Design Team shall continue development of the models created in the Design Development Phase. Maintain parametric links within the respective models to enable automatic generation of all plans, sections, elevations, custom details, schedules, and data export/import, analysis as well as 3D views. All information needed to describe the construction documents shall be graphically or alphanumerically included in and derived from these models only.

b. **Pre-Bid Interference Reports:**
Submit at 95% Construction Document Submittals

c. **Program and Space Validation:**
The Design Team shall continue to use the methodology as described in the Schematic Design Phases.

d. **Detailed Energy Information Model (EIM) Requirements:**
The Design Team is encouraged to continue to analyze the design using software that interacts with the BIM to refine load calculations, day lighting, natural ventilation, acoustics, code and design issues. Further development of the Energy Information Model (EIM) will be part of the milestone deliverable of this phase. The results should be documented by the input assumptions about all facility use schedules, mechanical equipment assumptions, maximum and minimum weather days and other assumptions to validate subsequent energy modeling results.

e. **Quantity Cost Estimating:**
The Design Team shall extract square foot area and quantity takeoff information using BIM authoring software and other BIM integrated tools to support comparative costs analysis of options studied. Outputs shall be converted to spreadsheets and submitted as part of the design solution justification at end of this phase.

f. **Level of Development (LOD):**
The Construction Documents Phase requires minimum LOD 350 with LOD 400 as needed and agreed upon in the **USF-BIM-EP**. (Refer to the **USF-BIM-EP** Section 8 for specific content requirements for Level of Development for each project)

g. **Facilities Management**
It is USF's intention to use the BIMs for Facilities Management upon occupancy. Information that matures during the construction process shall be captured in the appropriate BIMs on an on-going basis throughout the construction phase.

h. **COBie Design Data:**
The Construction Document set shall be an update to the Design Development COBie data deliverable. All named products and equipment appearing in design schedules shall be listed in the Components Table. The designer shall ensure that the list of equipment provided in the COBie "Component" worksheet includes all equipment specifically identified on the design drawings and BIM. The following worksheets shall be provided:

- Contact – People and companies
- Facility – Facility or facilities referenced in the file
- Floor - Description of vertical levels
- Space - Spaces referenced in a project
- System - Systems referenced in a project
- Zone – Sets of spaces sharing a specific attribute
- Component - Individually named materials and equipment
- Type – Types of equipment, products, and materials
- Documents – All documents identified and required, provides linked manufacturer documents to building information model objects.

5.5 Project Closeout - Record Deliverables Phase

a. **Design Team:**
Shall update their respective models with contractor (Recorded Field Data) changes. Republish record documents in paper, .dwg and .pdf formats. They must also submit full Revit model(s) with all needed objects and reference drawings, in original authored software. (The Submittal shall include all as outlined above in the Construction Phases)

The Design Team is required to submit all deliverables per the **USF-BIM-EP**, **USF-BIM** and the **USF-CAD** documents, and the Project Contract Documents within 45 days after substantial completion and prior to final payment.

- Design Team shall provide space data & room finish data in COBie format to be included in the Construction Team's COBie deliverables.

b. **Construction Team:**
Shall submit the original (Recorded Field Data) and full size color .pdf scans in addition to the required final deliverables and BIMs for Record Documents at substantial completion. The Construction Team will transmit the BIMs back to the Design Team who shall then be responsible for the final preparations and delivery of the Record BIM and Documents to the University.

- Construction Team shall provide COBie data in .xls file format containing room, equipment and product data information at a minimum.

c. **Level of Development (LOD):**
The Record BIMs and Document Phase requires LOD 500 in nature with LOD 350 being the base. (Refer to **USF-BIM-EP** Section 8 for specific content requirements for Level of Development for each project)

d. **O&M (Operations & Maintenance) Manuals:**
The Construction Team shall submit the following information to USF, two paper copies in binders of the O&M Manuals along with the Construction Operations Building Information Exchange (COBie) data in Microsoft Excel format.

- Manufacturer's documents including cut sheets, installation instructions, and recommend maintenance tasks, test data & reports and other reports. An electronic format of the O&M manuals shall be submitted along with the paper copies, the format shall be color PDF and native Excel (.XLS) files. Due at substantial completion. USF Recommends O&M manual documents be independently linked to components and systems within the BIM and COBie deliverable.

e. **Notice to Design and Construction Teams**
The Owner may withhold payments due and/or reject payment requests for failure to comply with the **USF-CAD**, **USF-BIM-EP** and **USF-BIM**.

SECTION 6: COORDINATION

6.1 General

The BIMs shall consist of objects and elements that represent the actual dimensions of the building elements and the building equipment that will be installed in the project. Before modeling begins, all BIM Managers as defined in the **USF-BIM-EP** will work with the Design Team to develop the model and model view extraction structure for all the construction document files to assure coordination between disciplines. This structure shall be provided to USF so that the models can be re-constructed at a later date for re-extraction. BIM coordination requires the following model structure and features:

- The Design Teams BIM Manager shall establish the floor elevation protocol so that the Technical Discipline/Trade BIM's are modeled at the correct elevation.
- Clearance Reservations: All models shall include separate 3D representations of required clearances for all mechanical equipment for repair, maintenance, and replacement, light fixture access, overhead cable tray access, etc. These clearance/access models should be in a separate layer(s) for each trade clearly labeled as such.
- The granularity of elements in the BIM shall correspond with the proposed sequence of the installation at the site (e.g. not one wall element for the entire floor).
- All 3D model files submitted for clash detection shall be "clean;" all extraneous 2D references and or 3D elements must be stripped from the BIM.
- When emailing notification of file uploads or for any other email correspondence pertaining to the project, all email subject line headings must be prefaced with the acronym for the Project Name.

6.2 Subcontractor Coordination

Prior to installation, the General Contractor shall hold trade coordination meetings with subcontractors. The coordinated BIM will be used to review and optimize scheduling and field installation. Subcontractors will be expected to have individuals attend who can actively engage in the subcontractor coordination process and make schedule commitments.

6.3 Digital Fabrication

USF encourages a collaborative process so that the deep knowledge and associated efficiencies of the fabricator are embedded into the Construction BIMs. The following construction trades are suggested (At a minimum) and shall provide 3D fabrication models with parametric model objects:

- Structural Steel
- Mechanical System Duct
- MEP subcontractors (incorporate vendor models if available)
- Curtain Wall
- Building Envelope Systems (rain screens, pre-cast panels, glazing systems)
- Casework and furniture systems
- Any additional fabrication models generated by subcontractor.

6.4 Suggested Coordination Process

The process outlined below describes requirements and provides some guidance for a suggested coordination process.

a. The Contractors BIM Manager shall develop a BIM folder structure in coordination with the Design Teams BIM Manager to be utilized in the designated project server or portal for access by the entire project team for uploading project data and the 3D models produced by the

Design/Construction and Sub-contracting Teams. These BIMs will be accessible to authorized team members for individual coordination purposes on a trade by trade basis.

b. The Design Team BIM Manager shall be responsible for integrating all of the 3D models into a single consolidated Navisworks NWF and NWD per floor, running clash detection and creating viewpoints of identified issues.

c. The MEP and fabrication detailers are required to submit models that are clash free from any structural components that are included in the structural model provided, to the best of their ability.

d. One integrated BIM per floor or zone shall be published in a Navisworks NWD file format and shall include numbered and labeled view sets of clashes and/or other design/ constructability issues that the General Contractor uncovers during this process. The individual team members will be responsible for reviewing the saved views one by one prior to the next coordination meeting. To this end, all team members must have at their disposal one copy of Navisworks Manage.

e. Software to allow automatic notification when any project files are uploaded should be utilized. All email communications on this project shall preface the subject line with the acronym for this project name.

f. The General Contractor shall create a 3D grid for incorporation into the Navisworks file. A minimum of one copy of the 3D grid should be placed at each floor level and should be named according to the level that it is placed. This will provide the viewer with a quick point of reference when navigating through the BIM.

g. All 3D detailers and associated foremen shall be required to attend regularly scheduled interactive coordination sessions facilitated by the Design Team BIM Manager. Designers should be available upon request and should expect to attend a number of these sessions as well. During these sessions, the coordination team shall review the consolidated BIM and the saved viewpoints on a floor by floor basis and find solutions to identified issues. (Attendance via webcast is an option)

h. The Construction Team must provide a BIM coordination room in a mutually agreed upon location for regularly scheduled 3D coordination meetings. The “BIM Room” must be equipped with the following minimum equipment and software specifications:

- 64 bit operating system on a desktop or laptop
- Navisworks Manage
- Document viewing software
- Projection system that allows for dual display

i. The Construction Team must be vigilant about engaging the design team on a regular basis to review, assess and provide feedback on any design related issues as they arise.

j. Shear wall and slab penetration location information must be provided to the Structural Engineer as soon as a set location for said penetrations has been determined as a result of the 3D coordination effort.

SECTION 7: CLASH DETECTION

7.1 General

a. Upon receipt of USF's written notification of acceptance of the Contract Documents Phase (100% Construction Documents), the Consultant shall submit an electronic copy of the required Coordination/Clash Detection Report ("Navisworks") to USF with the final submission of the Contract Documents for construction.

b. All conflicts and interferences shall be identified within the BIM and/or BIMs, which would adversely affect the work described within the Construction Documents, shall be rectified prior to the final submission of the 100% Construction Documents to USF for review and acceptance.

   - At a minimum, the Design Team shall use automated conflict checking software ("Navisworks") to identify coordination issues within and between the BIMs that would adversely affect the execution of the work required by the Contract Documents (Drawings) during and at the conclusion of 100% Construction Documents.
   - The Design Team shall, at a minimum, use the "Interference Check Tool" within "Revit" on a routine basis during and at the conclusion of each Design Phase and or Sub-Phase, and as per their approved "Quality Control Program."

c. It is the Design and Construction Team's responsibility to conduct and manage an adequate and thorough clash detection process so that all major interferences between building components are detected and resolved before construction begins. It shall be the goal of the Design and Construction Teams to reduce the number of changes during construction due to major building interferences to zero.

d. The Design and Construction Team's BIM Managers shall assemble a composite BIM from all of the BIMs from each design discipline for the purpose of performing a visual check of the building design for spatial and system coordination. Vertical shafts should also be reviewed to ensure that adequate space has been allocated for all of the vertical mechanical systems and that all of the shafts line up floor to floor. Prior to each scheduled coordination meeting, an updated clash report will be issued by the Construction Team BIM Manager to the technical discipline consultants.

e. On a multistory project, the BIMs may need to be split on a level by level basis for coordination. If a floor is particularly large, it may also need to be split by zones to reduce file size. Typically, 3D clash detection/coordination continues on a single floor until building systems are fully coordinated, and then continues on the next floor up.

f. Coordination software shall be used for assembling the various design BIMs to electronically identify, collectively coordinate resolutions, and track and publish interference reports between all disciplines. The technical disciplines shall be responsible for updating their BIMs to reflect the coordinated resolution.

g. The Project Team shall review the model and the clash reports in coordination meetings on a regular as-needed basis throughout the design phases until all spatial and system coordination issues have been resolved.

h. During the construction phase, the accuracy of fabrication BIMs shall be verified. Prior to each fabrication submittal for approval, fabrication contractors shall submit their BIMs to the Construction Team BIM Manager for integration and clash detection/coordination and resolution.

i. Internal clash resolution, design consultants and subcontractors who are responsible for multiple scopes of work are expected to coordinate the clashes between those scopes prior to providing those BIMs to the appropriate Design/Construction BIM Manager for spatial and system coordination.

j. Spatial coordination verification: Verification and tracking of resolved conflicts of all trade coordination issues which could result in change orders or field conflicts shall be provided to USF during project milestone dates, and should be fully resolved before bidding or construction.

7.2 Trade Colors for Clash Detection

- Architecture: White
- Structural Steel: Maroon
- Concrete: Gray
- HVAC Duct: Blue
- HVAC Pipe: Lime Green
- Electrical: Cyan
- Plumbing: Magenta
- Fire Protection: Red
- Pneumatic Tube: Dark Green
- HVAC Equipment: Gold
- Communication Conduit: Light Blue
- Equipment (Medical): Light Green
- Medical Gas: Light Green
- Security Systems: Orange
- Fire Alarm: Fuchsia

SECTION 8: SPECIFICATIONS

This section specifies BIM requirements for the intention of producing a highly efficient project BIM for facilities management. It describes which components should be modeled for each building system and the object properties that should be included in the project BIM.

8.1 Types of Model Elements

Model elements shall be derived from the following sources:

a. **Manufacturer's Model Elements**
Elements created by and acquired from manufacturers often have more information than is prudent to keep in the BIM; the appropriate level of detail should be retained for the design element. However, embedded performance data shall remain for analysis and specification purposes.

b. **Custom Created Model Elements**
Custom model elements that are created must utilize the appropriate BIM authoring tool to create custom elements. Custom model components need to be assigned as a part and part of a family or group. Information pertaining to the custom model elements shall be embedded for future information for the purpose of extraction. Custom model elements should not include reference to manufacturer name or data.

8.2 BIM Equipment Objects

Each BIM equipment object shall contain geometric data and a set of attributes. Equipment attribute data shall have the ability to be extracted from the project BIM and loaded into a facility management database application. These attributes are also required to be submitted in the COBie Microsoft Excel .xls file format. (Verify the COBie version identified in the **USF-BIM-EP**)

Required BIM Equipment Model Element Attribute Data	
Data	**Description**
Building Prefix	3 Alpha character USF building Prefix (Provided by USF project manager)
Building Number	4 Digit USF building number (Provided by USF project manager) Specific building number where the asset is located EXAMPLE: 0323 = indicates building 323 (The building number must be expressed in four digits)
Asset Tag	1-5 Alpha character (5 Character max.) equipment acronym (See the USF-BIM-EA supplementary document)
Asset Room Number/Location Code *	1-2 Alpha character prefix, 4 digit room number and an optional 1 character alpha suffix (7 Character maximum). If a 2 character prefix is needed, approval must be given by USF prior to use. (See USF-CAD room number standards) EXAMPLE: C0001A indicates a corridor with room number 1A EXAMPLE: U0000 indicates a generator that is located outside the building (The numeric portion of the room number must be expressed in four digits)
Asset Sequential Number	1-5 Digit sequential item number (Input consecutively as created in BIM)
System Tag	1-5 Alpha character equipment acronym of the connected asset (Used when equipment asset is part of a system)
System Sequential Number	1-5 Digit sequential item number of the connected asset (Used when equipment asset is part of a system)
Asset Description	Describes the asset defined in the Asset tag field EXAMPLE: Air Handling Unit For the Asset Tag: AHU
Category	Name of division asset belongs to (Used for reporting purposes) HVAC, PLUM, ELEC or ARCH
Status Code	Indicates if the item is in service (Active) or out of server A = Active N = Not in service (The default will be "A")
Globally Unique Identifier (GUID)	Auto generated unique identifier created by the BIM (Revit created object number)

Manufacturer Name	The name of the manufacturer of the asset
Model Number	Model number provided by the manufacturer
Serial Number	Serial number provided by the manufacture
Installation Date	Date when equipment was installed (Use the date format (month-day-year)
Warranty Period	Manufacturer's warranty period in years or months EXAMPLE: 3 Months or 1 year
* (See USF Location Code Table below)	

NOTE: A full list of USF required BIM Equipment Asset Tags is included in the "USF BIM Equipment Asset Tags (USF-BIM-EA)". The location of this document can be found in the "USF Referenced Documents and Abbreviations" located at the end of this document.

8.3 Equipment Label

Equipment labels are composed of Model Element Attribute Data above, and are used to define a single asset and the system the asset is connected to. The label should include a QR Code/Bar Code and be placed/affixed to each asset in a visible location.

The following format shall be used: "**BBBB_RRRRRRR_AAAAA_ NNNNN_SSSSS_IIIII"**
(Format shown includes the maximum number of characters allowed and shall match the BIM Equipment Model Element Attribute Data limitations. Underscore shall be used as separators between the data elements)

BBBB = Building Number
RRRRRRR = Asset Room Number/Location Code
AAAAA = Asset Tag
NNNNN = Asset Sequential Number
SSSSS = System Tag
IIIII = System Sequential Number

EQUIPMENT LABEL EXAMPLE #1	EQUIPMENT LABEL EXAMPLE #2
	(Format is same as Example #1 except for the additional system info)
0034_0100_CMP_6	**0088_ C0103_VAV_ 1_AHU_4**

Asset Sequential Number
Asset Tag
Room Number/Location Code
Building Number
System Tag
System Sequential Number

8.4 USF Location Code Table

Location codes are used to track attests not located within a room.

USF Location Codes		
Code	**Location**	**Description**
A	Asset Building Cost	Building value
B	*Bleachers*	*Exterior stadium seating*
C	*Corridor*	*Interior corridor*
D	Dock	Boat dock etc.
E	*Elevator*	*Building elevator*
F	Field	Recreation/band field etc.
G	In Ground	Below ground, Manhole or vault's etc. (below ground)

M	*Mechanical Rooms/ Chases*	*Interior building mechanical rooms and chases*
P	*Partition*	*Landscape partition wall (Cubicles)*
R	Roof	On the roof of a building
S	*Stairs*	*Interior or exterior stairs of a building*
T	Trail	Exercise or jogging trail
U	Outside	Outside of building and above ground
W	In Water	Within a body of water
X	*External Circulation*	*Roofed walkways or covered areas etc. (Non-conditioned space)*
Z	Entry Features /Signage	Main Entrances and campus wide improvements
H, I ,J, K, L, N, O, Q, V & Y	(Currently Not Used)	

(Items shown in *Italic* are for reference only, these codes are used in room numbers)

Location codes use the same format as a room number, the code is used as an alpha character prefix before the 4 digits of a room number. Use 4 0's in the place of the numeric portion of the room number.

Equipment Label Example Showing Use Of Location Code
0088_ R0000_EXHF_1 _CFH_4
This would be the label for an Exhaust Fan with Asset Sequential Number 1 that is located on the roof of the CPR building that is part of a Chemical Fume Hood with System Sequential Number 4.

8.5 Model Element Specifications

Parametric links shall be maintained within the BIMs to enable automatic generation of all plans, sections, elevations, custom details and schedules as well as 3D views.. All information needed to describe the "Detailed Design" shall be graphically or alphanumerically included in and derived from the BIMs only, except for the specifications. This section includes, at a minimum, model elements required, although it is not an exhaustive list and the Design Team is expected to add appropriate elements that will help meet all BIM requirements and expectations.

Architectural Model

a. **Architectural Systems**
Model the following architectural elements to a level that defines the design intent and accurately represents the design solution.

a1. **Architectural Site plan:** (Also see Civil Engineering section below)
- Paving, grades, sidewalks, curbs, gutters, site amenities and other elements typically included on enlarged scale site drawings in vicinity of building.

a2. **New interior and exterior walls including:**
- Doors, windows, openings,
- Veneers, insulation and other vertical elements thicker than ½" (May be part of a composite element or assembly)
- Interior and exterior soffits, overhangs, sun control elements
- Parapets, screening elements
- Architectural precast

a3. **Floor, ceiling and roof systems including:**
- Appropriate structural items listed below if not provided by the structural engineer and integrated into the architectural model for coordination and document generation.
- Insulation, ceiling systems, floor tiles and other horizontal elements ½" or thicker (May be part of a composite element or assembly)

- Roof, floor and ceiling slopes, if needed, shall be modeled

a4. **Elevators, stairs, ramps including railing systems**

a5. **Casework, shelving, fireplaces and other interior architectural elements**

a6. **Furnishings, fixtures and equipment if not provided by others and integrated into the architectural model for coordination and document generation.**
- Furniture (Permanently affixed)
- Specialty equipment (Food service, medical, etc.)
- Model mechanical, electrical and plumbing items that require architectural space (Toilets/sinks/etc.), require color/finish selection (Louvers, diffusers, etc.) or affect 3D visualization (Lighting fixtures) unless provided by engineers.

a7. **Clearance zones for handicap access, door swings, service space requirements, gauge reading, and other operational clearance must be modeled as part of all equipment and checked for conflicts with other elements.**

a8. **These items may be modeled at A/E option:**
- Exterior and interior wall trim
- Sheet metal or other thin elements
- Hardware
- Finishes unless stated above

Structural Model

b. **Structural Engineering**
Model the following structural elements:

b1. **Foundations such as:**
- Spread Foundations
- Caisson Foundations
- Pile Foundations
- Mat Foundations
- Load-bearing Wall Foundations

b2. **Framing such as:**
- Steel Columns (With correct shape and size)
- Steel Floor C-Joists
- Open Web Joists (Include webs for visual purposes, but need not be accurate)
- Joist Girders (Model webs for visual purposes, but need not be accurate)
- Steel Beams (with correct shape and size)
- Precast Concrete Elements (Hollow Core Plank may be modeled as a slab)
- Cast-In-Place Concrete Elements (Chamfers and embeds may or may not be modeled)
- Floors including overall extents and openings (Cast-In-Place, Precast, Wood)
- Model overall thickness of wood floor systems (framing members need not be modeled)
- Wood Posts/Column
- TJI Joists
- Wood Trusses (include webs for visual purposes, but need not be accurate)
- Solid Wood or Laminated Beams

b3. **Wall Types including openings:**
- Load Bearing Walls (Masonry, Concrete, Cold-Formed Steel, Wood). Model overall thickness of Cold-Formed Steel and Wood Stud walls (Individual members may be modeled at A/E option)

- Structural Foundation Walls including brick ledges

b4. **These items may be modeled at A/E option:**
- Steel reinforcing in concrete
- Embeds in concrete
- Connection steel (Gusset plates, bolts, clip angles, etc.)
- Miscellaneous Steel, Angles for openings, deck bearing, etc. channels for mechanical units lintels (Unless considered a major member)

b5. **Miscellaneous Wood:**
- King studs
- Headers (Unless considered a major member)

MEP Model

c. **HVAC Systems:**
Model the following HVAC elements:

c1. **Equipment:**
- Fans, VAV's, compressors, etc.

c2. **Distribution:**
- Supply, return, exhaust, relief and outside air ductwork modeled to outside face dimension or duct insulation (Whichever is greater)
- Duct Joints
- Diffusers, grilles, louvers, hoods, radiant panels, perimeter units, wall units

c3. **Pipes sized at and over 2" OD, include any insulation in model**

c4. **Clearance zones for access, door swings, service space requirements, gauge reading, and other operational clearance must be modeled as part of the HVAC equipment and checked for conflicts with other elements.**

c5. **Exclusions:**
- Pipe Fittings and connections

d. **Electrical Systems:**
Model the following electrical elements

d1. **Power:**
- Interior and exterior transformers and other equipment
- Main and distribution panels and switchgear including access clearances
- Feeders and conduit over 2"OD
- Outlets, switches, junction boxes

d2. **Lighting:**
- Permanently mounted lighting fixtures (Moveable, plug-in fixtures need not be modeled as part of the electrical package)

d3. **Clearance zones for access, door swings, service space requirements, gauge reading, valve clearances and other operational clearance must be modeled as part of the electrical equipment for collision checking.**

e. **Plumbing and Fire Protection:**
Model the following plumbing and fire protection elements

e1. **Waste and Vent:**
- Piping sized at and over 2" OD, include any insulation in model

- Roof and floor drains, leaders, sumps, grease interceptors, tanks, water treatments and other major items.

e2. **Supply:**

- Piping sized at and over 2” OD, include any insulation in model

e3. **Fixtures: sinks, toilet fixtures, water tanks, floor sinks**

e4. **Fire protections:**

- Sprinkler lines over 2” OD
- Sprinkler heads,
- Stand pipes, wall hydrants, fire department connections, risers, including valve clearances

e5. **Clearance zones for access, service space requirements, gauge reading, valve clearances and other operational clearance must be modeled as part of the plumbing**

Civil Model

f. **Civil Engineering:**
Model the following civil engineering elements at a minimum

f1. **Topography:**
3D terrain of all site work as designed, including retaining walls. This model should include the site and surrounding areas that contribute to the site’s drainage system or otherwise impact on the site. In most cases, this shall require that adjacent roadways be modeled.

f2. **Landscaping Elements:**
Planting areas, such as raised planting beds and berms, parking islands, pools/ponds/other water features, terraces and other items not included elsewhere in the model.

f3. **Utilities and Fixtures:**
Model all structures pump stations, fueling systems, manholes and other major items that impact the overall project understanding or which may become project design constraints. All items must be geo-referenced such that all elements can be viewed as an overlay in the building information model.

- Power
- Lighting (Poles, structures, etc.)
- Data
- Communications
- Water Service (Potable water, fire protection, hydrants, etc.)
- Stormwater System
- Sanitary/Waste Water System
- Gas
- Mechanical Systems (Hot and chill water)

GLOSSARY

TERM	DEFINITION
3D/4D/5D	Descriptions of BIM implementation with increasing 'richness' of associated information.
A/E	**Architect and/or Engineer --** Collective acronym for professions working in the creation/maintenance of the built environment.
ASF	**Assignable Square Feet (Assignable Areas) --** The sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or specific use. (Includes: classrooms, labs, offices, study facilities, special use, general use, support, health care, residential, and unclassified – that are used to accomplish the institution's mission) Note: ASF calculations do not include wall thickness or space that is open to below. Also referred to as **Net Assignable Square Feet (Net Assignable Area) NASF**.
ASI	**Architect's Supplemental Instruction --** The process used to resolve minor issues in the construction documents so long as they do not affect contract time or money.
BOD	**Basis of Design --** The design parameters and subsequent design systems and materials incorporated into the project model(s). The BOD is owner provided functional requirements for the facility with expectations of use and operation. It may include project and design goals, budgets, limitations, schedules, owner directives and supporting information.
BEP	**BIM Execution Plan --** Written plan to integrate the BIM tasks and information with all stakeholders and processes.
BIMs	**Building Information Model(s) - Product --** An object-based digital representation of the physical and functional characteristics of a facility. The Building Information Model or Models serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its lifecycle from inception onward.
BIM	**Building Information Modelling - Process --** A collection of defined model uses, workflows, and modeling methods used to achieve specific, repeatable, and reliable information results from the model. Modeling methods affect the quality of the information generated from the model.
BMP	**Best Management Practice --** Is a method or technique that has consistently shown results superior to those achieved with other means, and that is used as a benchmark. In addition, a "best" practice can evolve to become better as improvements are discovered.
BIM Authoring Tools / Software	The software or tool used to create the models. (Design applications such as Autodesk Revit)
CAD	**Computer Aided Design --** (Also known as 2D Drawings) A geometric/symbol based computer drawing system that replicated hand drawing techniques. The production of CAD documents are to be completely derived from the BIM model(s).
CAFM	**Computer-Aided Facilities Management --** Includes the creation and utilization of Information Technology (IT)-based systems in the built environment. A typical CAFM system is defined as a combination of Computer-Aided Design (CAD) and/or relational database software with specific abilities for Facilities Management.
Clash detection	Process of identifying conflicts and issues using 3D collaboration and coordination software tools.
CMMS	**Computerized Maintenance Management Systems --** A software package that maintains a computer database of information about an organization's maintenance operations, enabling the facility manager to track the status of maintenance work on their assets and the associated costs and manpower related to that work.
COBie	**Construction Operations Building Information Exchange --** Information exchange standard/protocol for BIM projects - generally spreadsheet based progressively developed through construction process passed to building operator. The model and facility data for the commission, operations, and maintenance of the project expected from BIM for facility handover in formats suitable for integration into current and future CAFM systems.
Construction Team	A group of professionals working together for a common goal in utilizing techniques and industry involved in the assembly and erection of structures.
Contracting Entity	Is the party or company who enters into a binding agreement with the owner as the primary responsible entity that is awarded the contract.
Design Team	A group of design professionals, working together for a common goal or purpose. It is made up of different individuals with different skills or talents. It may consist of architects, engineers, artists etc.
Design/ Construction Team	The term use when both the Design Team and Construction Team is referenced. (See Design Team, Construction Team)

TERM	DEFINITION
Fabrication	The act or process of manufacturing, to make, build, or construct in reference to building systems or components. Usually means off site fabrication done within a controlled environment resulting in improved accuracy and efficiencies.
FM	**Facilities Management --** The University department that manages building design and construction. Each USF System's institution has a Facilities Department. FM Tampa provides oversight for the entire USF System.
Geo-reference	To associate something with locations in physical space. The term is commonly used in geographic information systems to describe the process of association to spatial locations. Establishes control points, coordinate system and other projection parameters.
GSF	**Gross Area Square Feet --** The sum of all areas on all floors of a building included within the outside faces of its exterior walls. Includes: exterior covered areas, and all vertical penetration areas, for circulation and shaft areas that connect one floor to another. Note: GSF calculations do not include space that is open to below.
HVAC	**Heating, ventilation, and air conditioning --** The system used to provide heating and cooling services to building
Information model	Another name or reference to the Building Information Model.
IPD	**Integrated Project Delivery --** Contractual form relevant to the BIM design and construction process. Not widely used outside of the USA at present.
LEED	**Leadership in Energy and Environmental Design --** Is a green building certification program that recognizes best-in-class building strategies and practices. To receive LEED certification, building projects satisfy prerequisites and earn points to achieve different levels of certification.
LOD	**Level of development --** Scales applied to provide a common understanding of information requirements at different stages of a project (A scale developed by the American Institute of Architects).
MEP	**Mechanical, Electrical and Plumbing --** The professional engineers designing the building systems for Mechanical, Electrical and Plumbing disciplines.
Model	General term used to refer to the computer file or files that may contain BIM data.
NASF	**Net Assignable Square Feet (Net Assignable Area) --** The sum of all areas on all floors of a building assigned to, or available for assignment to, an occupant or specific use. Excluding: public corridors, elevators, stairwells, and all types of mechanical rooms, public bathrooms, custodial rooms, and shaft spaces. Note: NASF calculations do not include wall thickness or space that is open to below.
Non-ASF	**Non Assignable Square Feet --** The sum of all areas on all floors of a building not available for assignment to an occupant or for a specific use, but necessary for the general operation of a building. (Includes: building services, circulation, and mechanical that are used to support the building's general operation) Note: Non-ASF calculations do not include wall thickness or space that is open to below.
NSF	**Net Square Feet** -- The total square footage of all the rooms/areas on a floor. This includes assignable and non-assignable rooms. Note: NSF calculations do not include wall thickness or space that is open to below. Also referred to as **Net Usable Area (Net Usable Square Feet) NUSF**
O&M	**Operations & Maintenance --** Encompasses a broad spectrum of services required to assure that the built environment will perform the functions for which a facility was designed and constructed.
Parametric	A digital description of a physical object using parameters. Characteristics of components and the interactions between them. It maintains consistent relationships between elements as the model is manipulated.
PFD	**Program for Design --** The development of a comprehensive and purposeful system or plan to achieve a specific goal.
RFI	**Request for Information --** The process of requesting additional information, directive or clarification from the architect or client.
USF	**University of South Florida --** Identity or name of project owner.

USF REFERENCE DOCUMENTS AND ABBREVIATIONS

DOCUMENT TITLE	DOCUMENT ABBREVIATION	LOCATION
USF CAD Guidelines and Standards	**USF-CAD**	All documents can be found on the http://www.usf.edu/fm web site.
USF BIM Guidelines and Standards	**USF-BIM**	
USF BIM Project Execution Plan (Template)	**USF-BIM-EP**	
USF BIM Equipment Asset Tags	**USF-BIM-EA**	
USF Layer Guidelines	**USF-LG**	