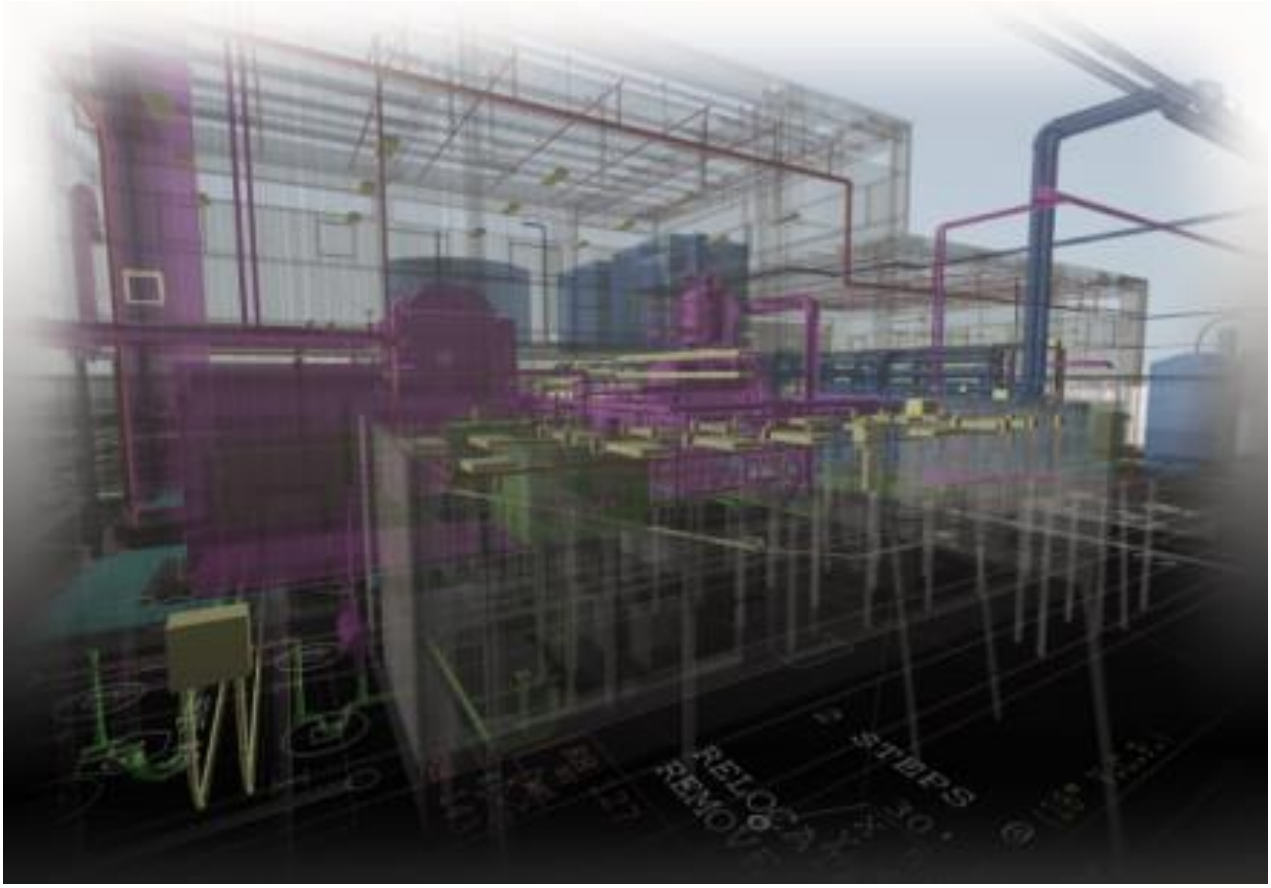
SECTION 3:

ANNEX J

UNC CHARLOTTE ILM IMPLEMENTATION PLAN

(New Section)

UNC CHARLOTTE



INTEGRATED LIFECYCLE MANAGEMENT

IMPLEMENTATION PLAN

Manual for BIM and Lifecycle Data for design and construction projects at UNC Charlotte.

October 2013

ILM helps Owners manage project and post-project related information easier with these four goals: ***Communication***, ***Centralization***, ***Documentation, Standardization*** and ***Automation***.

This document has been provided to assist in the development of Lifecycle Management through BIM and Data Management resources.

To achieve this vision, The University of North Carolina Charlotte (UNC Charlotte) has issued these instructions which will be required as part of the contract for all campus design and construction projects. The Implementation Plan is sponsored by UNC Charlotte in partnership with BRG (Business Resource Group).

If you have any questions about the ILM Plan please contact Nick Patel at UNC Charlotte.

Update Schedule

Release	Date	Brief Update Description
1	10/2013	Initial Public Release

Table of Contents

Integrated Lifecycle Management

1.1 Objectives

Integrated Lifecycle Management (ILM) is a management process by the Owner to improve collaboration and optimize efficiency between the AEC team and Owner through standardization and refinement of business structures and facility practices into a process that collaboratively optimizes efficiency through all phases of design, fabrication, construction and lifecycle management.

This Implementation Plan and its corresponding guidelines are intended to act as the standard for the AEC Team to follow and develop their Project Specific Execution Plans. Project Plans written to execute these guidelines should allow the facility to be compliant with the UNC Charlotte's BIM and Lifecycle Data requirements. All drawings, schedules, simulations, and services required for assessment, review, and construction shall be extractions from the model and support electronic data and metadata. Moving this collected design and construction data into an IWMS is critical to the UNC Charlotte meeting their intended Lifecycle requirement.

UNC Charlotte's Implementation Plan is a living document and will continually be reviewed for applicability with current methods and technology. UNC Charlotte welcomes feedback, receiving information from the AEC Team and internal staff regarding the performance of the ILM process is critical to keeping it relevant.

1.2 BIM Vision

UNC Charlotte understands that Building Information Modeling (BIM) represents both an enhanced technology and a process change for the architecture-engineering-construction-facilities management industry. UNC Charlotte is committed to moving both the organization and its service providers to BIM as effectively and efficiently as possible, and to integrate BIM process methodologies into its delivery requirements. The information model shall include geometry, physical characteristics and product data needed to describe the project, its construction and provide UNC Charlotte with needed Facilities Management Data.

The information model shall include geometry, physical characteristics and product data needed to describe the project, its construction and provide UNC Charlotte with needed Facilities Management Data. All drawings, schedules, simulations, and services required for assessment, review, bidding and construction shall be extractions from this model. The Design and Construction Teams shall follow the guidelines and requirements detailed in this document for BIM related services and deliverable requirements.

UNC Charlotte will describe in this Implementation Plan how the modeling requirements need to be developed and how they can be used by them during and after construction. These requirements are split into categories for model use during design, construction and requirements for model and data use after project completion. Models shall be of a Level of Development, described within, to support an integrated design process that coordinates critical systems for proper building function, performance and IWMS integration.

1.3 Lifecycle Vision

UNC Charlotte's goal is to maximize lifecycle building performance. Just as information has been digitized to greatly improve business and management processes in other areas, electronic building data will improve the design and management across lifecycles. This can now occur from concept design through construction and beyond to operations and eventually to renovations and/or salvage and demolition. Standardized building data available electronically has the potential to help find better ways to design and manage facilities in the future as well.

To achieve this, UNC Charlotte has looked internally to its workflow and processes to strategically align them with a BIM workflow moving forward. Changes have also been made to assets and other electronic information within

their IWMS system to better match BIM processes from the AEC industry. Therefore UNC Charlotte is asking all AEC providers to use compliant BIM authoring tools for all major construction and renovation projects. This guideline shall apply to design and construction by the architects, engineers, other consultants, and contractors hired for UNC Charlotte projects. For smaller projects UNC Charlotte will actively support and encourage the use of ILM where practical, taking into account the size, type of project, and the availability of the BIM skill sets that are needed to accomplish the project.

1.4 General Responsibilities

BIM authoring tools, data integration, and collaborative team workflow environments shall be used to develop and produce project information and documentation as required for completion of construction. Both geometry and data information from BIM is to be used to maximize project reviews, decision support, design analysis, and quality assurance during all phases of the project.

It is the responsibility of all AEC Team members to have or obtain, at their cost, the trained personnel, hardware, and software needed to successfully use BIM and Data Management processes for the project. All technical disciplines shall be responsible for their data integration and data reliability of their work and coordinated models

1.5 Reuse

It is important for UNC Charlotte to own, reuse, and properly manage building data throughout the facility lifecycle. Consequently, UNC Charlotte will place significant importance on the accurate creation, management, and stewardship of building information during project creation, and expects that data created during planning, design and construction to be reused throughout construction and into facility management. Record Model(s) in the authoring software shall be provided at the end of construction and will be used for this purpose.

--- END OF SECTION ---

BIM Execution Planning

UNC Charlotte requires a BIM Execution Plan (BEP) developed to provide a master information/data management plan and assignment of roles and responsibilities for model creation and data integration at project initiation. The BEP shall align the project needs and requirements from this Implementation Plan with the Design and Construction team skills, capabilities, and technology maturity. Through this process, the team members and UNC Charlotte project management team shall jointly agree on how, when, why, to what level, and for which projects BIM will be used and to what extent. If further BEP development information or a template is needed, Penn State's *BIM Project Execution Planning Guide* is a good resource.

For Design-Bid-Build or GMP projects, a separate BEP for Design and Construction shall be developed and submitted to UNC Charlotte with specific attention to model and data handover from the design team to the construction team to Facilities. If a Construction Team is involved during Design and information is available during the design phase, a single BEP can address both Design and Construction activities.

2.1 Design BEP (BEP-D)

The Design Team shall submit to UNC Charlotte their BEP-D before the start of schematic design or within thirty [30] days of contract award. Within fifteen (15) days of submission the BEP-D will be reviewed for approval by UNC Charlotte. BEP-D should identify the entire Design Team including all consulting engineers and specialty consultants. Roles and responsibilities of the team(s) even if that party has not yet been identified should be included in the BEP-D. The BEP-D will be a part of the final contract documents.
At a minimum the BEP-D should contain:

- How BIM during the design phase will support the project delivery method
- Strategy for hosting, transfer, and access of metadata and file exchange between technical disciplines
- Proposed BIM software version to be used by each technical discipline team member
- Energy modeling strategies
- Project schedule aligned to BIM development
- Strategy for updating and coordinating changes during construction into the final model deliverables
- Means for incorporating RFI, Change Order and Clash Changes into the As-Built and/or Record Model(s)
- BIM Leads for all major disciplines (Architect, Civil, MEP, Structural, etc.)
- Documentation of any proposed deviation from UNC Charlotte's BEP

2.2 Construction BEP (BEP-C)

The Construction Team shall submit to UNC Charlotte their BEP-C within thirty [30] days of contract award outlining the strategy and schedule for utilizing BIM Technology to execute construction related activities and project coordination. Within fifteen (15) days of submission the BEP-C will be reviewed for approval by UNC Charlotte. BEP-C should identify the entire Construction Team subcontractors and specialty trades. Roles and responsibilities of the team(s) even if that party has not yet been identified should be included in the BEP-C. The BEP-C will be a part of the final contract documents.

At a minimum the BEP-C should contain:

- How the Construction BIM will support the project delivery activity
- Strategy for the Design BIM reuse
- Process for Co-Modeling or using a Construction Model if Contractor/CM uses BIM authoring software
- Constructability analysis with BIM
- Strategy for software compatibility, file formats, hosting, transfer, and access of data between trades
- Proposed trade coordination strategy and schedule (clash detection)
- Proposed use of digital fabrication and sub-trades using it
- Strategy for updating and coordinating changes during construction into the final model deliverables

- Utilization of 4D scheduling and construction sequencing technology
- Proposed BIM Software to be used by fabrication modelers
- Strategy to assure all trade information is modeled and coordinated
- Integration of construction changes and commissioning data into BIM
- Field BIM integration and data transfer strategy
- Documentation of any proposed deviation from UNC Charlotte's BEP
- Means for incorporating RFI, Change Order and Clash Changes into the As-Built or Record Model(s)

2.3 Information Exchange

UNC Charlotte's Capital Project and Facility Management Exchange is changing beyond the rolls of drawings, DWG electronic files, boxes of specs and basic electronic documents turned over to the Owner at Close-Out. It is evolving into an ongoing information delivery exchange process integral with the entire Team. UNC Charlotte seeks to advance the quality, timeliness and cost- effectiveness of the collection, input and maintenance of that facility information. Further aiding this process is a deliverable standard that produces all design & construction documentation in a consistent format the Owner understands and receives on all projects. This electronic workspace is established for the purpose of efficient and timely exchange of documents, models and database files. The Contractor/CM is to outline this Exchange Structure or Software in the BEP-C and is to store and obtain data from the entire AEC Team trough out construction.

The UNC Charlotte will provide the Contractor/CM with a template folder file structure to populate all Record Documentation for the Owner. This folder structure has a direct relationship to the Digital Management Exchange Guidelines. CLINET will work to develop a process to Exchange this information from the Contractor/CM platform to their Electronic Document Management System (EDMS) .

--- END OF SECTION ---

Process Responsibilities

3.1 General Responsibilities

The AEC Team should involve key personnel, such as the facility managers (FM), head of maintenance, and head of information technology (IT) and telecommunications systems to provide information during design and construction as needed. Their involvement should continue all the way through commissioning & closeout. Feedback from them will be helpful in understanding if the documents and data being developed meet the O&M needs and are compliant.

3.2 VDC/BIM Leads

As part of the execution of the BEP-D and BEP-C, the Design and Construction Team shall assign an individual to the role of Design Team and Construction Team VDC/BIM Manager. The individual shall have sufficient BIM experience for the size and complexity of the project and shall have relevant proficiency in the proposed BIM authoring and coordination software. The individual shall serve as the main point of contact for UNC Charlotte and the Design/Construction Team for BIM related issues.

3.3 Consultant/Sub-trade Leads

All major design consultant/disciplines shall assign an individual to the role of Lead BIM Technician to coordinate their work with the entire Design/Construction Team. These individuals shall have the relevant BIM experience required by the complexity of the project and should have, as a minimum, the following responsibilities for their discipline:

- Coordinate technical discipline BIM development, standards, data requirements as required in the BEPs
- Lead the technical discipline BIM team in its documentation and analysis efforts
- Validates the level of development and controls as defined for the project and trade
- Coordinate the inclusion Lifecycle Operations and Maintenance data for the BIM deliverables
- Coordinate clash detection and resolution activities

3.4 Pre-Design

Design Teams may use any method to begin the Planning and Pre-design process, but should consider moving to BIM authoring model(s) as soon as possible. Provide initial design based on conceptual parameters established by the UNC Charlotte; ensure that code and zoning requirements meet project objectives. A model may or may not take shape during the Pre-Design phase. If a model is created, its role will be to depict the visual concept and general layout of the project.

The Architect's designated BIM Manager can establish a baseline model with an established 3D reference point to be used as a reference for other models. Also during Pre-Design the BIM Managers can to start establishing the project specific modeling standards and guidelines.

3.5 Schematic Design

UNC Charlotte encourages the Team to take advantage of data exchanges and/or validations with BIM early in Schematic Design, especially when it comes to Program and Space validation. Start providing spatial design based on input from the Pre- Design phase; provide initial design for building system and attributes including architectural, structural, and MEP; identify initial coordination issues among building systems.
All information needed to describe the schematic design should be graphically or alphanumerically included in and derived from BIM by the end of Schematic Design. The Architectural model should show the general design and layout of the building structure and act as the baseline for all other subsystem designs, such as MEP and Structural models. The subsystem designs can be used to show the layout of building components with the combined model showing the spatial relationship of the Architectural model and subsystem design models.

3.6 Design Development

Continued development of the BIM should commence with an increased LOD and building systems. The model should now also include parametric links to enable automatic generation of all plans, sections, elevations, custom details and schedules as well as 3D views. During Design Development, in not before, the UNC Charlotte expects the Design Team to use analysis tools to analyze schedule, cost, constructability and start resolving coordination issues. The Architectural model should continue to act as the baseline for all other subsystem designs. The subsystem designs will be modified accordingly to represent the enhanced design. The combined Design model will continue to show the spatial relationship of the Architectural model and subsystem models. During Design Development and for the remainder of the Design Phase the Design Team is to use BIM for conflict checking and the coordination of individual and specialized Design models. The conflicts report should be developed and show any outstanding coordination issues between the Design Team members.

3.7 Construction Documents

During the Construction Document phase the design should be finalized for the building and all building systems while preparing documentation for code review. All information needed to describe the "Contract Documents" shall be graphically or alphanumerically included in and derived from these models only, except for maybe the Specifications. Any inclusion of electronic specification integration into the model is also welcomed by the UNC Charlotte. At this point no documentation of the models should happen outside of the BIM Authoring software. As described later in this Implementation Plan all model elements mentioned should be modeled and to a minimum LOD of 300.

It is the Design Team's responsibility to conduct and manage an adequate and thorough Clash Detection process so that all major interferences between building components will have been detected and resolved at the completion of Construction Documents. The goal here is to reduce the number of changes during construction due to major building interferences.

3.8 Agency Review

The Architect's BIM Manager will communicate agency comments back to the design team. The Consultants' BIM Managers will revise their design models accordingly and submit them back to the Architect. The Design models will all be revised based on agency feedback and finalized to reflect that feedback.

3.9 Preconstruction

If BIM can or is used during bidding, the use of BIM Standards should be announced and reviewed with potential bidders. The Contractor/CM shall have access to the Design BIM during bidding if needed. The solicitation for bids will define the legal status of the BIM to the bidders by determining the Contract Record Document (the model(s) or the extracted 2D document set). Regardless of whether or not the Design model(s) are the Contract Record Documents, after a contract is awarded for construction the coordinated Design BIM and all native BIM files shall be provided to the appropriate Contractor/CM entities as needed.

3.10 Construction

The Design Team shall continue development of their BIM throughout construction in conjunction with the Contractor/CM based on submittals, RFIs, or owner-directed changes. Maintaining the model based on construction activities and coordinating all updates for the individual and specialized models and databases will insure completeness and accuracy of the overall project model. All information needed to describe the ongoing "detailed design" shall be graphically or alphanumerically included in and derived from these models only. Documentation of the models shall not happen outside of the BIM Authoring software.

By direction from the Design Team Lead the Consulting Engineers' models shall also be revised throughout construction based on submittals, RFIs, or owner-directed changes. The models shall always reflect the revised contract documents. At an agreed upon interval, and outlined in the BEP-C, during construction the updated

design models shall be published in the approved collaboration format and posted for the Contractor/CM's coordination. If native authoring model files are needed by the Contractor/CM, separate copies of each technical disciplines model in the original format shall be provided.

Contractor/CM will have the Design Model(s) available at the start of construction to update and house data as established by the bid documents and specifications as necessary to support construction and UNC Charlotte's facility management objectives. Regardless of the Legal status of the model (Binding, Informational, Reference, Reuse), these electronic files are provided to the Contractor/CM solely for the uses related to this project. In the event of a conflict between the Contract Documents and the Electronic Model Files, the Contract Documents shall control, take precedence over, and govern the Electronic Files unless stated otherwise.

It is the Contractor/CM's responsibility to assure that all major trades are modeled and used for clash detection, construction phasing, and installation coordination. Fabrication models shall be coordinated with the design model and any conflicts need to be made prior to fabrication and construction. Those conflicts shall be reported to the Design Team in the form of a Request for Information (RFI). Clash reports may also be issued by the Contractor/CM as background information for RFI's and submittals. Minor changes that have not been officially executed in the design models and that are considered As-Built changes will be documented by the Contractor/CM during construction. As listed in the BEP-C, those Mark-Ups shall be shared and coordinated with the Design Team so the changes can be incorporated into the Design model(s). All changes in the authoring software shall be published to the Contractor/CMs collaboration model to keep them up to date and accurate.

Methods for recording As-Built information are left to the discretion of the contractor. Potential options include traditional methods, and/or periodic laser scanning of completed or partially completed primary systems coordinated with the sequence of construction, 3D DWF mark-ups that can be opened in the authoring BIM software or traditional hard copy redlines. The UNC Charlotte would prefer that all comments, mark-ups, and suggestions for documentation and design changes be made in a Bluebeam Studio session, setup and emailed out by the Contractor/CM. This session would not require each participant to own a copy of the authoring software, only the Contractor/CM. Updated sheets and information should be made in accordance to the BEP-C and unincorporated mark-ups will be transferred to the latest sheet. This will provide a single source collaborative and accurate way for the AEC Team and Owner to review and resolve changes and milestones.

If the Contractor/CM uses Concurrent Construction Modeling in authoring software they should submit an action plan to the UNC Charlotte and Design Team for review prior to the start of construction that outlines the process for concurrent As-Built documentation and outline this process in the BEP-C.

3.11 Commissioning

Commissioning data including but not limited to design intent, performance criteria and operations data shall be recorded in Electronic form within the described Field Management or compliable application. Unlike traditional paper-based systems, an electronic application for mobile Commissioning can capture systems and equipment information electronically, right in the field, which saves time, reduces errors and develops Real-Time Data Capture. This should reduce the time required for commissioning, improve speed of re-commissioning and validate requirement or deliverables related to equipment issues or documentation. Dynamic reporting can show the statuses of all systems and equipment, enabling commissioning agents and other responsible parties to better manage project status and workflows. Commissioning requirements shall be coordinated with the LEED requirements of the project. It shall be the Contractor/CM's responsibility to coordinate the information sources and integrate this information through the electronic application into a format for transfer at the completion of the project, or before.

If Commissioning is to reside in the Contractor/CM's electronic platform the agents shall provide the Contractor/CM with their traditional documentation that would be used for Commissioning Construction Checklists, Pre-Commissioning, Functional Testing and any other documentation typically used by the agent. The

Construction Manager/Contractor will in turn create that documentation in an electronic version inside their system for Commissioning and Sub-trade coordination.

During the building commissioning processes, O&M staff shall be involved to see how all building systems are designed to function and that they are being installed, balanced and verified to perform as designed. There should be an orientation and training program for all O&M staff to review the contents of the O&M manuals for major systems and equipment, including building mechanical, automation controls, plumbing, electrical, fire detection and protection, security, elevators, systems, etc. Any specialized training in building automation software should not be 'generic training' but should be performed using the actual project building graphics, controls sequences and data.

--- END OF SECTION ---

Coordination & Collaboration

The success of a ILM enabled project is highly dependent upon the level at which the entire Design/Construction Team can communicate and work collaboratively for the duration of the project and with the UNC Charlotte. This section documents collaboration procedures for effectively managing this process.

4.1 Kickoff Orientation

Upon award of the project to the Contractor/CM, they shall facilitate a Project Kickoff Orientation Meeting, which will review all UNC Charlotte BIM and data requirements and answer questions from the Project Team. Both BEP's should be reviewed and coordinated while also reviewing the Primary Systems in BIM.

Primary Architectural Systems include, but may not be limited to:
Partition systems with structure, flooring systems, partition systems with bulkheads, partition systems with expansion control, vertical transportation systems with primary engineering systems, millwork and casework systems with power and data outlets, horizontal ceiling systems with window openings, bulkheads, partitions, lighting, fire protection and HVAC outlet locations, exterior skin systems with window openings, structure, roof edge conditions, parapets, roof penetrations, and equipment locations.

Primary Engineering Systems include, but may not be limited to:
Structural framing, primary HVAC duct runs, primary fire protection main runs, primary electrical conduits (2"+), ceiling grids layouts, primary data, audio visual, security and communication distribution systems (cable trays, etc.).

4.2 Consultants/Sub-trades

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

This collaborative process is to ensure that the deep knowledge and associated efficiencies of the fabricator are embedded into the Construction Model(s). The following construction trades (at a minimum) should provide 3D fabrication models:

- 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
- Additional fabrication models generated by subcontractor

4.3 Clash Issues

Design Teams are required to perform internal coordination between disciplines to assure quality project document delivery. Contractor/CM is required to coordinate models between design team disciplines, subcontractors and specialty trades to perform clash detection in order to assure constructability and help reduce RFI and Change Order submissions before construction begins. Contractor/CM shall require subcontractors, fabricators, suppliers, and manufactures to submit all models to the contractor as outlined in the BEP-C. These model(s) should be updated after each project coordination meeting or as changes occur in the field during construction.

- On a multistory project, the models may need to be split on a level-by-level basis for MEP/F 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.

- The team shall review the model and the Clash Reports in coordination meetings outlined in the BEP-C
- 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 models to the BIM Manager for overall spatial and system coordination.
- 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 UNC Charlotte during project milestone dates, and should be fully resolved before build out.

Collision Reports

Collision reports can be published in a standard XML, HTML, or Text format. These reports shall include the following information at a minimum:

- Description of Collision Report
- Date of Collision Report Run
- List of all Collisions detected their status, and their proposed solution

Contractor/CM shall submit a Collision Report schedule to UNC Charlotte and Design Team as outlined in the BEP-C. Static Coordination Model files should be created at all critical coordination milestones; this model should be archived with the date of the Clash Report at each instance, providing a record document at this point and time during construction.

4.4 Field Management

Field Management applications and their connected web-based workflow for in field point-of-construction data solutions, Issues Tracking and Punchlist are to be utilized by the Contractor/CM in conjunction with the Design Team, Sub-trades and UNC Charlotte for project coordination and data entry. Linked documents, photographs and model data between BIM and the Field Management application can be utilized to collaborate during construction and in preparation for data exchange to UNC Charlotte at handover. Commissioning tests and checks, as-installed data, O&M manuals and start-up procedures are some the items the Field Management application can be used to track, test and validate during construction.

--- END OF SECTION ---

Technology

5.1 Authoring Software

All architects, engineers, and specialty consultants are required to use the following design authoring software. Projects will remain on the same software release throughout the life of the project unless approved by the entire team and University. This should be outlined and coordinated in the BEP-D and BEP-C for the University to reveiw.

- Autodesk Revit Architecture
- Autodesk Revit MEP
- Autodesk Revit Structure
- AutoCAD MEP*

Architectural Models – Autodesk Revit Architecture (.rvt) Model(s) are Revit Architecture Central Files with Worksets enabled. The Revit Architecture Model file (.rvt) contains all architectural features for a building and all state and local codes and laws must be followed. If there will be more than one Architectural and/or Interior models please outline and describe in the BEP-D.

Structural Model – Autodesk Revit Structure (.rvt) Model(s) are Revit Structure central files with Worksets enabled. The Revit Structure (.rvt) model contains all structural features for a building and all state and local codes and laws must be followed.

Mechanical, Electrical, and Plumbing Model – Autodesk Revit MEP (.rvt) Model(s) are Revit MEP Central Files with Worksets enabled. The Revit MEP file (.rvt) contains all MEP features for a building and all state and local codes and laws must be followed.

Life Safety and Fire Protection – Autodesk Revit MEP (.rvt) Model(s) are Revit MEP central files with Worksets enabled. The special Revit MEP (.rvt) model file contains all special system features for a building and all state and local codes and laws must be followed.

*AutoCAD MEP and propriety software add-ons are welcomed to develop, coordinate and fabricate the project. But changes made in these platforms; be it placement, geometry or metadata, must make its way back into the original authoring software model and Record Model.

5.2 Coordination Software

Coordination software shall be used for assembling the various design models to electronically identify, collectively coordinate resolutions, and track and publish interference reports between all disciplines. The technical disciplines shall be responsible for updating their models to reflect the coordinated resolution. All internal and external model coordination and conflict detection are required to use the following software in its native file format in its current version.

- Autodesk Navisworks Manage

5.3 Field Management

A Secure, cloud-based, web and mobile Field Management application that delivers a complete field management solution shall be used. This system will electronically enable workflows for quality, commissioning and document management processes in the field and in the office; proven to reduce rework, delays and eliminate paper. Modules required by the UNC Charlotte on their projects are Issues, Punch-List, Commissioning and Equipment Tracking. BIM 360 Field is an example of a Field Management software that UNC Charlotte currently integrates with their IWMS and would suggest Contractors/CMs use.

- Autodesk BIM 360 Field

5.4 Additional BIM Tools

The Design and Construction Teams are encouraged to explore options to use the BIM and other electronic tools to enhance the project quality and delivery times, including quantity take-offs, cost estimating, overall project scheduling, subcontractor coordination and manpower loading, off-site fabrication, and other widely discussed BIM benefits. UNC Charlotte is interested in fostering and supporting innovation, and encourages bold steps toward trying new ways to improve business process efficiency, design, and project outcomes.

Following are some of the discretionary areas that UNC Charlotte may support for further development and the use of BIM; other ideas may also be proposed by the AEC Teams:

- 5D – Material take-offs & cost estimating
- Integrating information, e.g., electronic specifications that are tied to the BIM
- Achieving automated code checking
- Repeatable pre-fabrication components to speed construction erection time
- Off-site fabrication

Virtual Mockups

The contractor may want to utilize this process in which software is used to design and analyze the construction of a complex building system (e.g. curtain wall, form work, design element, tie-backs, etc.) in order to increase awareness and planning. Any physical mock-ups that need Owner approval can first be developed virtually, but without written approved authorization the Virtual Mockups cannot be supplemented for the Physical Mockups per the specifications.

Energy Requirements

The Design Team shall work with UNC Charlotte to establish project specific energy goals and energy use targets. The Design Team may also establish an energy modeling method including local weather data within the BEP-D that will details how energy modeling will be accomplished for the project.

Potential software to perform the energy modeling for the project may be:

- Green Building Studios
- Ecotect
- eQuest

Photographic Exact-Built Documentation

A Photographic Exact-Built Documentation system creates a comprehensive, time-indexed permanent record of the entire construction project, from ground-breaking through completion and may be utilized by UNC Charlotte on this project. The Exact-Built System utilizes interactive drawings; state-of-the-art indexing and navigation; inspection-grade high-resolution photography; and remote access via the internet to create a comprehensive and innovative form of construction risk management. A final set of MEP Exact Built documentation may be incorporated into the Record Model. This shall include wall and ceiling locations that contain Primary Engineering Systems or areas of heavily consolidate MEP systems.

--- END OF SECTION ---

Model Format & Data Collection

The models shall consist of objects and elements that represent the actual dimensions of the building elements and the building equipment that will be installed on the project. Before modeling begins, the BIM Manager 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 UNC Charlotte so that the models can be reconstructed at a later date. BIM coordination requires the following model structure and features:

- The BIM Manager shall establish the floor elevation protocol so that the Technical Discipline/Trade BIMs will be modeled at the correct elevation.
- Clearance Reservations: All models shall include required clearances for all mechanical equipment for repair, maintenance, and replacement, light fixture access, overhead cable tray access, etc.
- All 3D model files submitted for clash detection shall be "clean;" all extraneous 2D references and/or 3d elements must be stripped from the model files.
- Revit deliverables should not have imported or linked 2D AutoCAD files associated with them.

6.1 General Requirement

6.1.1 Origin Point

All models must be in the correct location in 3D Space (x, y, and z coordinates). Models should be inserted by Auto-Origin to Origin. All models should contain their own grids and levels as a QC method to assure correct location. The correct insertion point is critical and ensures that each model will align properly without modification when linking and coordinating.

6.1.2 Tolerances

Model(s) must be within construction tolerances of the element in question – use 1/16" if unsure. Tolerances for specific items and systems will be determined as necessary. Set precision to 1/256". Globally set the precision to 1/256" and look for odd dimensions, the intent is to model at the highest accuracy as not to start out with errors built in.

6.2 Model Structure

All elements of the building must be coordinated into one file and should be modeled by their specific trade.

Examples:

- Architectural models should not include any of the structural elements contained in the structural model.
- Lights should be modeled by the electrical engineer, and not be the architect
- Plumbing Fixtures should be modeled by the plumbing engineer, and not the architect
- Architectural ceilings should contain information for openings for lights, registers, etc. as required by design
- All models should include 3D representations of required clearances and/or access requirements for equipment

Models will be separated by the following disciplines for design and construction coordination by all project participants throughout the construction process.

- Architectural -Deliverable-
- Mechanical -Deliverable- (This may coordinated into a single MEP model)
- Electrical -Deliverable- (This may coordinated into a single MEP model)
- Plumbing -Deliverable- (This may coordinated into a single MEP model)
- Structural -Deliverable-

- Construction Based on Contractor/CM authoring capabilities
- Coordination Required during Construction, only Clash Reports are a required deliverable.
- As-Built -Deliverable-
- Record -Deliverable-

6.3 File Naming

Model deliverables should have a file name that consists of three [3] distinct sections delineated by the following format: Facility ID _Discipline _Published Date.xxx

Provide a Copy after each Design Phase:

Architectural Design Model(s)	Facility ID_ARCH_YYYYMMDD.rvt
Interiors/Furniture Design Model(s)	Facility ID_FURN or INTR_YYYYMMDD.rvt
MEP Design Model(s)	Facility ID _MEP or [DISCIPLINE]_YYYYMMDD.rvt
Structural Design Model(s)	Facility ID_STRL_YYYYMMDD.rvt

Final As-Built Model:

As-Built	Facility ID _AsBuilt_YYYYMMDD.nwd

Final Record Model:

Architectural Model(s)	Facility ID_ARCH_YYYYMMDD.rvt
Interiors/Furniture Model(s)	Facility ID_FURN or INTR_YYYYMMDD.rvt
MEP Model(s)	Facility ID _MEP or [DISCIPLINE]_YYYYMMDD.rvt
Structural Model(s)	Facility ID_STRL_YYYYMMDD.rvt

6.4 Data Modeling Requirements

6.4.1 Room Name & Numbers

Use the Room Numbering convention provided by the UNC Charlotte for all new construction projects, coordinate existing Room Numbers with UNC Charlotte for renovation projects. This system provides a consistent method for identifying and managing building space and shall be adhered to unless approval is documented in writing by the UNC Charlotte. Workstations in Open Office areas need to have a Room Number associated with them, do not tag the Workstation with a Furniture Tag. Use the Room Separation Line Rectangle tool to create the Rooms based on the inside faces of the Workstation. Coordinate the Areas in the Schedule to confirm all Workstations of the same size have the same Area.

The Room Numbers shall be assigned to the Room Number Parameter in Revit for each individual Room or Space. This process gives the space a Unique Identifier understood by the UNC Charlotte while also allowing the developed space to be connected to complex space standards and regulations inside the UNC Charlotte's IWMS once connected. This serves as the Primary Connecter for Room Data between Revit and the IWMS. Every building is unique so if questions arise about Room Numbers, i.e. when Corridors should change name, review these areas with the Facilities Team to coordinate their current process for the IWMS.

6.4.2 Room Category

All Rooms are assigned a Room Category per the University, you can find these listed in *Exhibit 1-Room Assets*. An additional Shared Parameter of Room Category will be assigned to Rooms and will be available once transferring the Project Standards from the *UNCC ARCHIBUS Shared Parameters File Template*. Populate this field when placing a Room with the Category assigned to that Room Type per the Exhibit provided in this document.

6.4.3 Occupancy

UNC Charlotte has two fields relating to Occupancy they would like populated. The first one being the Standard

Room field of "Occupancy" which is the maximum number allowed per code. Second is the additional "Fixed Occupancy" field for those spaces that have fixed seating or built in work stations within the space.

6.4.4 Area Calculation

UNC Charlotte has a fundamental method of measuring Room Square Footage that synchronizes in a practical way with their IWMS. The Area bound by the inside faces of surrounding walls, minus the area bound by the outside faces of contained full height columns will be the net area of a space. Revit should automatically delineate this based on the footprint of surrounding walls.

6.4.5 Equipment Naming

Asset Management during Design & Construction aids the CLEINT in more efficient maintenance and operation procedures of a facility. By having data in the model early, it allows the FM team to start planning for building start up and tracking of building operations instead of spending time doing data entry or trying to find O&M documentation.

Each individual piece of building equipment shall include the following attributes and be maintained throughout Design and Construction. The Mark field in Revit is to be coordinated with the UNC Charlotte's Equipment Standard so that those names and their associated equipment tags in the plan view and on the documents have a relationship. The Equipment Code serves as the Primary Connecter for Equipment Data between Revit and their IWMS and is to be authored in the model during Design when the equipment is placed. Those Equipment Codes can be found in one of the attached Exhibits.

6.4.6 Equipment Code and Standard

All Equipment in the MEP Design Model is to be assigned an Equipment Code per the University, you can find these listed in *Exhibit 2-Equipment Assets*. An additional Shared Parameter for Equipment Code will be assigned to MEP Equipment and will be available once transferring the Project Standards from the *UNCC ARCHIBUS Shared Parameters File Template*. Populate these fields when placing a piece of Equipment in the Design Model with the Standards provided in the attached Exhibit.

6.4.7 MasterFormat Numbering

All Equipment in the MEP Design Model is to be assigned its equivalent MasterFormat Level 3, and when available Lever 4, CSI Number. An additional Shared Parameters of CSI Number will be assigned to MEP Equipment and will be available once transferring the Project Standards from the *UNCC ARCHIBUS Shared Parameters File Template*. Populate these fields when placing a piece of Equipment in the Design Model with the appropriate number.

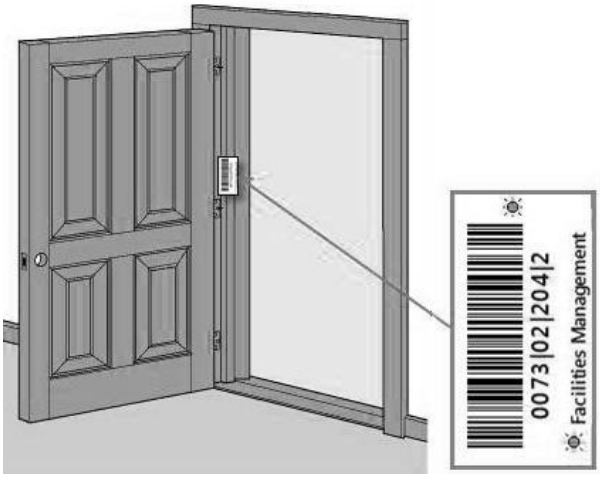
6.4.8 Doors

Door types are to be created to accurately reflect each kind of door in regards to type, size and information. The door symbol is a result of the view that is created from the model. Because of this, 3-D doors shall be used throughout the construction documents process and be built into the door schedule and parameters. Each door is also to receive a barcode over the second (middle) hinge of each door frame.

Door Details Tracked in Model During Design

- Door Number (Mark)
- Door Width
- Door Height
- Door Thickness
- Door Hand (Shared Parameter)
- Door Material
- Frame Material

- Frame Type
- Fire Rating
- Hardware Code (Shared Parameter)



Door Details Tracked During Construction

- Lock Brand
- Lock Design
- Lock Finish
- Lock Back Set
- Cylinder Brand
- Cylinder Part Number
- Cylinder Material
- Cylinder Finish

Barcode information:

- Example barcode ID: 0055|02|232|A
- ID Breakdown: Building ID|Floor ID|Room ID|Door ID
- Barcodes are to face the door they are associated with.
- Doors are associated with Rooms by the following rules:
    - The lock faces opposite of the room that the door is associated with. Example: When you unlock a room 120 from hallway 100, the door is associated to room 120.
    - If panic hardware is installed on a door then the direction the panic hardware is facing is the room the door is associated to.
    - In the instance of a corridor where both doors swing in either direction, it's the discretion of the installer to decide which room the doors are associated with.

6.4.9 Wall Partitions

A different Partition type is to be created for each type of wall used in the project per UNC Charlotte approval and constructed in 3-dimensional form. These will based on Universtiy standards opposed to project standards. The Fire Rating, Fire Rating UL# and STC Rating # all need to be Parameters associated with each Partition type.

Partition Type Mark/Tag Example: G5a

G=Partition Type
5=Sequence Number
a=Fire/Smoke Rating

Partition Types: C = Concrete
E = Exterior
S = Shaft
F = Furring
G = Gypsum
D = Demountable

Fire Ratings: G5 = No Rating
G5a = Smoke Rated
G5b = 1 Hour Fire Rating
G5c = 1 Hour Fire and Smoke Rated
G5d = 2 Hour Fire Rated
*Continue progression as needed above 2 hours+.

6.4.10 Additional Room Data

Room Finishes shall be assigned to the room areas through the room properties, with Parameters defining finish assignments. Finishes assigned to the room properties shall be formatted into a Room Finish Schedule to be placed on a drawing sheet. Material Codes in the Room Finish Schedule that were entered in the room properties are identified in a Finish Legend. Product information is entered into the established parameters to specify finishes. Finish codes and their description shall be associated with the room properties.

Coordinate with the UNC Charlotte on specific finish nomenclatures as these should be unique University as well as the project. For example, the UNC Charlotte most likely already has a P1 for Paint, WC1 for Wall Covering, etc. and does not want those repeated on every project.

The basic Room Finish Parameters should be populated: Wall, Base, Floor and Ceiling

6.5 Types of Model Elements

Model elements should be derived from inherent Parameters and specific Shared Parameters for Room and Equipment. The Spared Parameters will be issued by the UNC Charlotte via a Revit Template file so those Instance Parameters can be transferred to the Design and Construction models. Facilities Data will need to be entered into these fields during Design and Construction and eventually be passed to the Record Model. These Shared Parameters will exist at the Instance Level, not the Family Level. So if data requested by the UNC Charlotte exist at the Family Level for the Manufacture's Elements or Custom Elements, that metadata will have to be duplicated at the Instance Level as well. Please refer to the attached Exhibits for the Shared Parameter fields being added.

- Manufacturer's Model Elements - elements created by and acquired from manufacturers often have more information than is prudent to keep in the model; the *appropriate* level of detail should be retained for the design element. However, embedded performance data shall remain for analysis and specification purposes.
- Custom Created Model Elements - custom model elements that are created must utilize appropriate BIM Authoring tool templates to create custom elements. Custom models components need to be assigned as a part and part of a family or group.

6.6 Model Systems and Components

- BIM shall be used for all building systems design, development, and analysis, including but not limited to architectural, structural, mechanical, electrical, plumbing, and fire suppression, etc.
- During Concepts, SD and DD Phases, BIM technology shall be used to develop and establish building performance and the basis of design in accordance with UNC Charlotte standards.
- Elements, objects and equipment shall be tagged with unique identifiers (GUIDs).

6.6.1 Architectural Systems

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

- Architectural Site plan
- Exterior wall systems
- Interior wall systems
- Fire rated walls
- Architectural floor slabs
- Roofing systems
- Equipment including owner provided equipment
- Reflected ceiling plans
- Vertical circulation – including elevators, stairs, escalators, and railings
- Doors and door frames

- Glazing – windows, interior glazing, curtain wall, and storefront
- Millwork and casework
- Finishes – Including all room paint codes, flooring codes, and other finish items
- Toilets and accessories
- Toilet Partitions
- Specialties
- Must meet BOMA Standards
- Furnishings, fixtures, and equipment if not provided by others and integrated into the architectural model for coordination and document generation.
- Specialty equipment (food service, etc)
- Clearance zones for access, door swings, service space requirements, gauge reading, and other operational clearance must be modeled and checked for conflicts with other elements. These clearance zones should be modeled as invisible solids within the object.

6.6.2 Structural Systems

Model the following structural elements.

- Foundations, including foundation walls
- Columns, beams, and joists
- Column grid
- Load bearing structural walls
- Brace frames and shear walls
- Structural slab
- Specialties
- Misc. structural components.
- Miscellaneous Steel
  - Angles for openings, deck bearing, etc.
  - Channels for mechanical units coordinating between mechanical
  - Lintels (unless considered a major member)
- These items may be modeled at the Design Team's option:
  - Steel reinforcing in concrete
  - Embeds in concrete

6.6.3 HVAC Systems

Model the following HVAC elements at a minimum.

- Equipment
  - Fans, VAV's, compressors, chillers, cooling towers, air handlers etc.
- 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
- Pipes sized at and over 2" diameter, include any insulation in model
- 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. These clearance zones should be modeled as invisible solids within the object.

6.6.4 Electrical systems

Model the following electrical elements at a minimum.

- Power and Telecommunications
  - Interior and exterior transformers, emergency generators, and other equipment
  - Main and distribution panels and switchgear including access clearances
  - Main IDF's

  - Feeders and conduit at and over 2”diameter, and all large conduit bundles
  - Outlets, Switches, Junction Boxes
- Light Fixtures
- Lighting Controls
- Fire Alarm and Security Systems
  - Input devices
  - Notification devices
  - Associated equipment and access clearances
  - Permanently mounted fixtures
- Building Controls
- 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. These clearance zones should be modeled as invisible solids within the object.

6.6.5 Plumbing and Fire Protection Systems

- Model the following plumbing and fire protection elements at a minimum.
- Waste and Vent Piping sized at and over 2” diameter, includes any insulation in model
- Roof and floor drains, leaders, sumps, grease interceptors, tanks, water treatments and other major items.
- Supply Piping sized at and over 1½“diameter, includes any insulation in model.
- Domestic Booster Pumps
- Fixtures (sinks, toilet fixtures, water tanks, floor sinks, etc.)
- Fire protection Sprinkler lines at and over 1”diameter
- Sprinkler heads, Fire Protection Pumps
- Stand pipes, wall hydrants, fire department connections, risers, including valve clearances
- Clearance zones for access, service space requirements, gauge reading, valve clearances and other operational clearance must be modeled as part of the plumbing and fire protections system and checked for conflicts with other elements. These clearance zones should be modeled as invisible solids within the object.

6.6.6 Specialty Consultants

- Specified or provided equipment by consultants should be outlined in the BEP-C.
- If questionable, pose to UNC Charlotte for further direction.

6.6.7 Civil & Site

- Grading, contours (proposed and existing), site structures to nominal dimensions, all new utilities will be modeled.
- Existing utilities and points of connection, only as applicable and available from existing owner as-built information. Include all structures and utilities to be demolished.
- Pads and other accommodations for buildings will be modeled. Floor slabs, decks and other structural surfaces will be modeled by the architecture team.
- Landscape items, benches, etc. will be modeled by the architecture team to the extent that they are required for overall project coordination.

6.7 Construction Modeling

6.7.1 Construction Model

Objective: Construction Models are the models being developed during construction in an authoring software package by the Contractor/CM and/or Sub-trades. Depending on the Contractor/CM and the BEP-C, model authoring by the Contractor/CM may not occur, but is required by the Sub-trades for coordination. Any Construction Modeling should reflect the exact geometric properties of the materials and/or systems being submitted. In addition to the items mentioned in Section 7 these models could include fabrication, shop drawing and other models for coordination. Once federated

with all the Design, Construction, Sub-trade, etc. models this is to be referred to as the Coordination Model.

Responsibilities: The Contractor/CM's BIM Manager will work with the Design Team and Sub-trades to answer the RFIs and submittals and adjust the Construction Models accordingly while also using it for constructability analysis. If so determined in the BEP-C the Contractor/CM's Construction Model may replace the Architect's Design model during construction and within the Coordination Model. Sub-trade models are to be analyzed based on the Design and be incorporated into the Coordination Model.

6.7.2 Coordination (Federated) Model

Objectives: Update Coordination based on submittals, RFIs, or owner-directed changes; maintaining the model during construction based on construction activities and developed to reflect the actual fabrication of the building. These models are to include fabrication, shop drawing and other models developed during coordination. The model is to always reflect the revised contract documents and can be used for scheduling analysis, construction sequencing is so desired.

Responsibilities: The Architect's BIM Manager will work with the Architect's Consultants to answer the RFIs and submittals and adjust the Design model accordingly. The Contractor's BIM Manager will update the Construction model and will work with the suppliers and subcontractors to eventually make this the As-Built model.

6.7.3 As-Built (Federated) Model

Objectives: The As-Built model serves as the final model based on updated Coordination models including all field changes and data requirements and represents the actual assembly of the building. This will be issued at the close of construction as a Naviworks NWD file.

Responsibilities: The Contractor/CM's BIM Manager will work with all Consultants and Sub-trades to finalize this Coordination Model into an As-Built model. The success of an As-Built BIM is highly dependent upon the level at which the entire Design/Construction Team communicate, share and work collaboratively for the duration of construction.

6.7.4 Record Model

Objective: Model in the original authoring software format containing all Contractual and As-Built conditions used to depict an accurate representation of the physical conditions, environment, and assets of a facility. The Record Model contains information relating to the main architectural, structural, and MEP elements, coordinated to match that of the As-Built model conditions as well as the Sub-trade models. It is the culmination of the BIM process for the project; including Operation, Maintenance, Asset Data and As-Built conditions back into the Authoring Software Platform for use by the Owner and Facility Management Team.

Responsibilities: The Contractor/CM is responsible for providing UNC Charlotte this Record Model. The Facilities Management Team will update the model and data based on ongoing operations. These models will be issued at the close of construction as Revit RVT files.

6.8 Level of Development

UNC Charlotte intends to make final deliverable building information models available for integration into a Lifecycle Management solution. In order to meet that objective, it is important that the UNC Charlotte's model deliverable meets their LOD (Level of Development).

UNC Charlotte' welcomes the use of the Level of Development for BIM deliverables as defined by the AIA

document E202–2008 Model Progression Specification (MPS) or the 2013 Level of Development Specification by BIM Forum. As UNC Charlotte specific information will be added to the Design and Construction Models, the Record Model LOD will be 350. This number refers to a LOD 300 for model geometry which should be provided at the end of Construction Documents. The 50 represents the more specific supplemental equipment and facilities data and As-Built construction changes in the Record Model. Supplemental data during construction may be authored directly into the model or via data integration through the Field Management application to the IWMS. UNC Charlotte and the Contractor/CM will coordinate that process in the BEP-C.

During Construction and Coordination modeling the Contractor/CM and Sub-trades may use LOD 400 and 500 and which are acceptable in the Final As-Built Model to UNC Charlotte.

6.9 Model Quality

Discussions regarding processes and best practices to ensure Quality should be reviewed at the Kickoff Orientation as a project team. At project milestones and at agreed-upon intervals, the model and metadata should be reviewed to confirm that each model and its corresponding metadata/documents are being developed in accordance with the UNC Charlotte's intended use. The goal is to support each team member and verify that the processes are being followed throughout the timeline of the project, that there are no unresolved issues during construction and that there are no issues that may result in a significant loss of metadata upon exchange of information.

The Team shall establish and use in-house modeling quality control guidelines and exchange protocols. Good BIM practices may include but are not limited to:

- Use of element and component objects that embed the best practices of the firm.
- Maintenance of parametric linkages within the model at all times.
- Dynamic Search Sets as opposed to Static Selection Sets
- Use of UNC Charlotte defined nomenclature from the Equipment Standards Matrix.
- Use appropriate and interoperable viewing, checking, and output file formats.
- Review of a random 15% of model components, metadata and documentation for compliance.

--- END OF SECTION ---

7.1 Integrated Workplace Management System (IWMS)

An IWMS is characterized as an enterprise-class software platform that integrates five key components of functionality, operated from a single technology platform and database repository: real estate management, project management, facilities and space management, maintenance management, and environmental sustainability.

The CAFM portion of the application helps UNC Charlotte improve space efficiency and evaluate the true costs associated with space usage. The reports resulting from a space management analysis will reveal how each square foot of space is being allocated which can enable a highly granular chargeback process. This can, in turn, improve reimbursement rates from third parties who require accurate and defensible space allocation and occupancy reports. With Space Management, organizations can easily satisfy these needs and better plan for current and future space needs across the organization.

The CMMS portion of the application allows them to cost-effectively manage on demand or preventive maintenance (PM), improve internal and outsourced service provider performance, and simplifies forecasting and budgeting. Building Operations Management puts all of those capabilities—and more—easily within reach so the organization may gain more control over their workload instead of allowing it to manage them.

The interchange of information in an IWMS solution helps the Owner's team better understand, operate and manage the facility. BIM has enabled a richly detailed and collaborative approach to the way buildings are designed and constructed. What has been lacking is a way to easily scale the information to the portfolio level to connect with Facilities Operations. To address that need, quick and direct access to the enterprise data needed for the IWMS. The task of the VDC-FM Consultant is to assist and use available tools and mapping protocols to transfer that enterprise data from BIM or other AEC Tools to the Owners IWMS.

UNC Charlotte intends to integrate the final deliverable Record Model into a Lifecycle Management solution. In order to meet that objective, it is important that the data guidelines presented in this document be followed so they can be validated by the Owners IWMS. The integration of the Record BIM data into an IWMS is critical to UNC Charlotte's O&M procedures. Electronic data already in the model allows the FM team to start planning for building start up and tracking building operations; instead of spending time "catching-up" with data entry after taking control of the building. Any additional BIM advice or data collection opportunities that the AEC Team might be aware of or can be provided during the process are welcomed.

7.1.1 Equipment (Assets)

As an example, at minimum this will allow UNC Charlotte to:

- Store operations, maintenance owner user manuals, and equipment specifications.
- Perform and analyze facility and equipment condition assessments
- Maintain up-to-date facility and equipment data including, but not limited to, maintenance schedules, warranties, cost data, upgrades, replacements, damages/deterioration, maintenance records, manufacturer's data, equipment functionality, and others required by owner.
- Produce accurate inventory of current company assets which aids in financial reporting, bidding, and estimating the future cost implications of upgrades or replacements of a particular asset.
- Allow for future updates of the Record Model to show current building asset information after upgrades, replacements, or maintenance by tracking changes

7.1.2 Space

As an example, at a minimum this will allow UNC Charlotte to:

- Identify and allocate space for appropriate building use

- Track current use of space
- Insure optimum use of the facility's space resources
- Assist in planning future space needs for the facility

7.2 IWMS Construction Data Collection

Field Management applications enable users to leverage Equipment and their attributes (i.e. name, type, manufacturer) as well as UNC Charlotte driven attributes. Using a mobile device in the field or web-based application attributes are dynamically updated as work and operations progress. End users do not even need to see the BIM while entering data as part of this workflow. Information can be bi-directionally data synced and stored in the Coordination Model, extending BIM so its objects can be used to access other data, documents and stored in the cloud.

Equipment related information is to be uploaded to the Field Application as soon as possible so the information can be reviewed by the AEC Team, Cx Team Members and the Owner's Facilities Maintenance team. The purpose is to create a more collaborative team approach and to collect equipment data and documentation throughout construction, not just at the end of the project. Metadata within the application is to be utilized to manage equipment during construction in preparation for Lifecycle Management. These documents and metadata inside the Field Application can then be mapped to the UNC Charlotte's IWMS for Lifecycle Management and Operations and Maintenance creating a Real-Time Data Collection Process.

Tracking of the materials and equipment are identified with an attached Exhibit, these assets have components and metadata to be tracked across all stages of the construction process. The Contractor/CM will be responsible for coordinating with the Owner and the VDC-FM Consultant to ensure all custom metadata fields needed for Facilities O&M data are produced in the application. It will be the VDC-FM Consultant's responsibility to map that metadata to UNC Charlotte's IWMS systems and the attached asset documentation to the EDMS.

Tracking electronic information by bar-coding is part of UNC Charlotte's business and usual process and they are now extending that to the Construction and ILM process as well. Using Owner supplied barcodes the AEC Team can track materials and assets with the Field Management application throughout installation and is required. By attaching barcodes to the Equipment Assets, the team can track and update the progress and metadata of these components and directly access information about the asset. This process further prepares the BIM database for Lifecycle Management tracking for the UNC Charlotte.

On a bi-monthly basis, at minimum, the Contractor/CM shall include UNC Charlotte and all BIM Managers in a coordination established for the purpose of assessing and/or executing FM data reviews/transfers from the construction process. Data transfers shall be coordinated with the Owner representative and the BIM Managers (when feasible) and be based on the FM objectives as defined. The Contractor/CM will be responsible for coordinating with the Owner and the VDC-FM Consultant to ensure all custom metadata fields needed for Facilities O&M data are produced in the application. It will be the VDC-FM Consultant's responsibility to integrate systems so that metadata is transferred to UNC Charlotte's IWMS and the attached asset documentation to the EDMS.

7.3 Enterprise Document Management System (EDMS)

An EDMS delivers solutions that strategically leverage engineering content to enhance, automate and streamline business processes in organizations throughout the information lifecycle. It is important for people and organizations to communicate with each other and share the information across that organization. UNC Charlotte's EDMS will provide a platform for people across the organization to collaboratively work on engineering projects, regardless of involvement in engineering, design, construction or building and facility maintenance. A single point of information with accurate engineering content enables people to work simultaneously on multiple projects; increasing efficiency and quality in their engineering-driven organization.

--- END OF SECTION ---

Digital Management Exchange

A Digital Management Exchange shall be established for the purpose of efficient and timely transfer of model, metadata and document files into an electronic process. Capital Projects handover is changing beyond the roll of plans, box of specs and basic electronic documents turned over to the Owner at close-out, and more into a Facility Management exchange. This evolution is more of an ongoing information delivery process integral with the entire facility development that remains part of the lifecycle management process. UNC Charlotte seeks to advance the quality, timeliness and cost- effectiveness of the collection, input and maintenance of the facility information. Further aiding this process is a deliverable standard that produces all design & construction documentation in a consistent format the Owner understands and receives on all projects. This electronic workspace is established for the purpose of efficient and timely transfer of model and database files. It produces a standard structure where the BIM files, coordination files, fully coordinated submittals, specifications and OMSI files to reside. The Contractor/CM is to obtain, file and store this data from the entire AEC Team based on UNC Charlotte's giving structure. UNC Charlotte will provide the Contractor/CM with a template folder file structure for the document exchange process. This folder structure has a direct relationship to the Digital Management Exchange Guidelines and should be exchanged with UNC Charlotte at the close of the project based on the process agreed on by the Contractor/CM and Owner outlined in the BEP-C.

2D Printed documents for the purposes of assembling a printed set shall be derived from the models. All BIM information shall be fully parametric so that all applicable information regarding fixtures and/or elements can be generated for the schedules. Also refer to *Exhibit 6-Digital Management Exchange*.

8.1 Programing & Pre-Design

- BEP-D (within 30 days after contract execution)
- Programs and Spaces and Validation
- Massing/Volume/Area Sketches or Models
- Relationships/Functions
- Responsibility Matrix
- AIA E202 Refinements (if necessary)

8.2 Schematic Design

- Preliminary Energy Model
- Programs and Spaces and Validation
- Massing/Volume/Area Sketches or Models
- Concept Systems Model - Structural, MEP, Civil or other systems required by the project.
- Outline Specifications
- Coordination Report

8.3 Design Development

- Architectural Model
- Structural Model
- MEP Model(s)
- Site/Civil Model
- Energy Model
- DD Document Set (Single File PDF bookmarked at each discipline)
- Preliminary Specifications
- Cost Analysis
- Preliminary Coordination Report

8.4 Construction Documents

- Architectural Model
- Structural Model

- MEP Model
- Site/Civil Model
- Specialty Consultant Models
- Energy Model
- Project Manual
- Contract Document Drawing Set (PDF Single Sheet Files)
- Cost Analysis
- Detailed Coordination Report

8.5 Construction

- Static Coordination Model (based on Clash Report)
- Clash Collision Reports

8.6 Close Out Deliverables

The Contractor/CM shall be responsible for providing UNC Charlotte all information outlined in the Digital Management Exchange Exhibit per the listed file type and location.

--- END OF SECTION ---

Waivers

Situations could arise where adherence to this standard may be problematic. If such a situation arises, the party creating the data must request a waiver. UNC Charlotte is not opposed to such requests, but the request must identify the specific standard for which the waiver is requested, the reason for the waiver, the resulting impacts on the use of the data for the purposes UNC Charlotte intends, and any alternative approaches that should be considered.

Models and facility data developed for the project are the property of UNC Charlotte. UNC Charlotte may make use of this data as allowed under the [Owner/Architect Agreement, AIA-B141] and [Owner/Contractor Agreement, AIA-A101] and [General Conditions of the Contract for Construction, AIA-201].

- The A/E or Consultant, as applicable, may retain copies, including reproducible copies of such Drawings, Specifications and other documents for information and reference.
- Drawings, Specifications, or other documents, including the Electronic Files used to create them, may be used by UNC Charlotte or others employed by UNC Charlotte for reference in any remodeling, renovation, alteration, modification of, or addition to, the Project, without prior approval of, or compensation to, the A/E or its Consultants.
- Drawings, Specifications or other documents, including the Electronic Files used to create them, shall not be used by UNC Charlotte, or be given or sold by UNC Charlotte to be used by others, on other projects, except by prior written agreement with, including mutually acceptable compensation to, the A/E or Consultant, as applicable.

--- END OF SECTION ---

Glossary

AEC
Architectural/Engineering/Construction

ARCHIBUS
IWMS used for Space Planning and Facilities Maintenance

As-Built Documents
As-built documents are the collection of 2D hard copy documents and/or electronic drawing files from the Contractor/CM that contain mark-ups, annotations, and comments about changes that have been made to the Contract Documents during the construction phase.

As-Built Model
This is a collection of models that have been collected and updated throughout the construction process by the Construction Manager/Contractor. These changes and updates have been communicated from the Contractor and Sub-Contractors through comments, annotations, mark-ups and design changes; model showing how a building is actually assembled and delivered. (Also see Section 7.6.3)

Building Information Modeling (BIM)
An integrated process aimed at providing coordinated, reliable information about a building project throughout different project phases—from design through construction and into operations. BIM gives architects, engineers, builders, and owners a clear overall vision of the project—to help them make better decisions faster, improve quality, and increase profitability of the project.

BIM Execution Plan (BEP)
The BEP helps to define the BIM roles and responsibilities for the Design and Construction Team during the project.

Clash Detection
The process of checking for clashes and interferences in one or more BIM models. May also be referred to as model coordination.

Construction Documents
The Construction Documents are a set of Drawings, that along with the Specifications, Addenda, Construction Change Directives, Change Orders or other written amendment or orders make up the set of documents that includes all pertinent information required for the contractor to price and build the project.

Construction Model
The model used during construction to simulate and analyze the construction of a building for constructability, pricing, etc. within an authoring software. (Also see Section 7.6.1)

Coordination Model
A federated model created from two or more models, used to show the relationship of multiple building disciplines such as architectural, civil, structural, and MEP (mechanical, electrical, and plumbing) for constructability and coordination. (Also see Section 7.6.2)

Core Collaboration Team
The group of people—which should include someone from each party working on the project, such as the owner, architect, contractor, consultants and trade contractors—responsible for completing a BIM and BES, creating the document management file folder structure and permission levels in the collaborative project management

system, and enforcing the action plan set out in that document throughout design and construction of the project.

Design Team
The Design Team is considered to be the Architect and all of the consultants that provide design services for a project. These design services can be rendered at any time during the project.

Design Model
The model used to communicate the design intent of a building.

.DWF
.DWF is a file type that was developed by Autodesk to be locked file for drawing sheets and model data. It can be used as a file transfer for estimating data, markups, and other third party software. It can be a combination of 3D and 2D information within the same file.

Integrated Lifecycle Management (ILM)
A management process that improves collaboration and optimizes efficiency between the AEC team and Owner through standardization and refinement of business structures and facility practices into a process that collaboratively optimizes efficiency through all phases of design, fabrication, construction and lifecycle management.

LEED
The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a suite of standards for environmentally sustainable construction. Based on a point system, a building can achieve different ratings based on the performance of the design, construction, and operation of the building.

MEP
Mechanical, Electrical and Plumbing. MEP/FP is Mechanical, Electrical, Plumbing and Fire Protection

Metadata
The term refers to "data about data". For this document it refers to individual instances of application data, the data content, or “content about content". This content can be authored in a field, stored and managed in one database and transfer to yet another database.

Model Manager
The project team member(s) responsible for managing the collaboration and sharing of electronic files during the project. Model managers are also responsible for maintaining the integrity of BIM models, which can include gathering, linking, and uploading updated models.

Navisworks
Navisworks is software that allows for the viewing of multiple model formats. This ability to “view” these files also allows for Navisworks to simulate the interaction between model files. That includes collision reporting, time lining, and coordination.

NWC
This file is a Cache File that is used by Navisworks to quickly read many other file types.
These files can only be read in Navisworks and Navisworks cannot export out or be saved as a NWC. NWC is the format that is typically created (exported) from products like Revit and AutoCAD, and also is created automatically when Navisworks opens up a DWG directly.

NWD
This is the equivalent of a DWF or PDF. Typically the project file NWF is published to NWD which removes all links

and keeps everything in the NWD. This allows the ability to share a project with someone externally without having to send all of the linked/appended files. A NWD can be opened with any Navisworks program, specifically Freedom Viewer.

NWF
This is the project file. The NWF contains all of the Navisworks data and pointers to the files that are loaded. The content that is saved in an NWF are things like redlines, saved viewpoints, materials, etc. Project/working file used daily to update info and reload updates from the linked/appended files.

O&M
Operations and Maintenance

OMSI
Operations and Maintenance Support Information

Parametric
The relationships among and between all elements of a model that enable coordination and change management. These relationships are created either automatically by the software or manually by users as they work.

Record Drawings
The capturing of As-Built Document's annotation, comments, and mark-ups into an updated drawing set. This is a collection of 2D hard copy documents and/or electronic drawing files from team member assigned to producing and providing the documentation to the Owner.

Record Model
Model containing all Contractual and As-Built conditions used to depict an accurate representation of the physical conditions, environment, and assets of a facility within an authoring software. (Also see Section 7.6.3)

.RVT
An .RVT file is a Revit native file type. It is also the deliverable file format for all projects. This includes all of the Design Team's models.

Single Line Diagrams
A 2D simplified diagram illustrating the inter-relationship of pieces of a system or other elements. These are not to scale.

Schematics
Similar to a Single Line Diagram, a Schematic Diagram illustrates the inter-relationship of components, but incorporates more of a spatial context of the elements, i.e. locations. Generally these are not to scale.

Appendix

Exhibit 1 - Space Mapping Matrix
Exhibit 2 - Space Assets
Exhibit 3 - Equipment Mapping Matrix
Exhibit 4 - Equipment Assets
Exhibit 5 - Equipment Asset Details
Exhibit 6 - Digital Management Exchange
Exhibit 7 - Revit Shared Parameters File

Exhibit 1-Space Mapping Matrix

The following Parameter should be tracked for each Space/Room Asset and will be mapped to the Rooms Table in the IWMS. The associated mapping along with the Author and Authoring Software is listed. See ***Exhibit 7-Revit Shared Parameters File*** on how to use the Revit .rte file to transfer Project Standards from the Template File to the Design Model.

Information Category	Space Details	IWMS	Model	Who Enters Data	Data Authoring Software	ARCHIBUS Field	Revit Field
Building	Site Code	X		Owner	ARCHIBUS	site_id	N/A
Building	Building Code	X		Owner	ARCHIBUS	bl_id	N/A
Spatial Location	Floor Code	X		Owner	ARCHIBUS	fl_id	Level†
Spatial Location	Floor Name	X		Owner	ARCHIBUS	name	N/A
Room Program	Room Name	X	X	Designer	Revit	rm_name	Room Name†
Room Program	Room Code	X	X	Designer	Revit	rm_id	Room Number†
Room Program	Room Standard	X	X	Owner	ARCHIBUS	rm_std	Room Standard*
Room Program	Room Category	X	X	Designer	Revit	rm_cat	Room Category*
Room Program	Room Type	X	X	Owner	ARCHIBUS	rm_type	Room Type*
Room Program	Room Use	X	X	Owner	ARCHIBUS	rm_use	Room Use^{z}
Physical Properties	Area	X	X	Auto	Revit	area	Auto Fill
Physical Properties	Perimeter	X	X	Auto	Revit	length	Auto Fill
Physical Properties	Condition	X	X	Owner	ARCHIBUS	rm_condition	Room Condition
Program Compliance	Division	X	X	Owner	ARCHIBUS	dp_id	Division*
Program Compliance	Department	X	X	Owner	ARCHIBUS	dp_id	Department*
Program Compliance	Occupancy	X	X	Designer	Revit	occ_num	Occupancy†
Program Compliance	Stations	X	X	Designer	Revit	stations	Fixed Occupancy†

†Existing Revit Field
*Parameter Created by ARCHIBUS
^{z}Shared Parameter File

Exhibit 2-Space Assets

The following Parameter of Room Category is to be tracked for each Room in the Architectural Design Model. A Revit a Template will be provided to assign this Shared Parameter to Rooms. See ***Exhibit 7-Revit Shared Parameters File*** on how to use the Revit .rte file to transfer Project Standards from the Template File to the Design Model.

Room Description	**Room Category** for Revit
Toilet or Bath	**919**
Media Prod. Srvc	**535**
Trash Room	**X04**
Lobby	**W05**
Athletic/Phys. Ed.	**520**
Toilet or Bath Mobility Impaired	**919X**
Mechanical Area	**YYY**
Animal Quarters	**570**
Building Service Area	**XXX**
Athletic/Phys. Ed. Srvc	**525**
FACILITY SERVICES	**X05**
Assembly Srvc	**615**
Research/Non-Class Lab Srvc	**255**
Open-Stack Study Rm	**430**
Lounge Srvc	**655**
Merchandising Srvc	**665**
Recreation	**670**
Recreation Srvc	**675**
Meeting Room Srvc	**685**
Shop Srvc	**725**
Central Storage Srvc	**735**
Central Service Supp.	**755**
Hazardous Material	**760**
Hazardous Material Srvc	**765**
Patient Bath	**820**
Nurse Station	**830**
Nurse Station Srvc	**835**
Treatment/Exam Srvc	**855**
Diag. Srvc Lab.	**860**
Central Supplies	**870**
Public Waiting	**880**
Sleep/Study No Bath - Designed for Mobility Impaired	**910X**
Sleep/Study with Toilet or Bath	**920**
Sleep/Study Service	**935**

Apartment	**950**
Apartment - Designed for Mobility Impaired	**950X**
Apartment Service	**955**
Circulation Area	**WWW**
Bridge/Tunnel	**W01**
Escalator	**W03**
Loading Dock	**W04**
Janitor Room	**X02**
Electrical Room	**Y24?**
Stairway	**W07**
Shaft	**Y03**
Custodial Supply Closet	**X01**
FACILITY SERVICES	**Y24**
Mechanical Room	**Y14**
Telecomm Room	**Y34**
ELEC/TELECOMM	**Y44**
MECH/ELEC/TELECOMM	**Y54**
MECH/ELEC	**Y65**
ELEC/HSKPG	**Y74**
Public Corridor	**W06**
COMMON SPACE	**W08**
Office Service	**315**
Men's Restroom ADA	**011**
Women's Restroom ADA	**012**
Unisex Restroom Equipped for Mobility Impaired	**013**
Classroom	**110**
Class Labs	**210**
Office	**310**
Assembly	**610**
Central Storage	**730**
Sleep/Study No Bath	**910**
Elevator - Passenger	**010**
Utility/Mechanical Space	**Y04**
Vertical Penetration	**ZZZ**
Treatment/Exam	**850**
Central Service	**750**
Shop	**720**
Exhibition	**620**
Vehicle Storage	**740**
Conf. Room	**350**
Central Computer/TC Srvc	**715**
Study Room	**410**

Central Computer/Telecom	**710**
Lounge	**650**
Meeting Room	**680**
Classroom Service	**115**
Research/Non-Class Lab	**250**
Merchandising	**660**
Stack	**420**
House	**970**
Class Lab Srvc	**215**
Media Production	**530**
Inactive Area (available but unassigned)	**050**
Public Restroom	**X03**
Open Lab	**220**
Food Facility	**630**
Alteration or Conversion Area	**060**
Unfinished Area	**070**
Open Lab Srvc	**225**
Conf. Room Srvc	**355**
Processing Room	**440**
Study Service	**455**
Animal Quarters Srvc	**575**
Greenhouse	**580**
Greenhouse Srvc	**585**
Exhibition Service	**625**
Food Facility Srvc	**635**
Support Facilities General	**700**
Building Roof	**ROOF**
Athletic Facilities Spectator Seating	**523**
Vehicle Storage Srvc	**745**

Exhibit 3-Equipment Mapping Matrix

The following Parameter should be tracked for each Equipment Asset and will be mapped to the Equipment Table in the IWMS. The associated mapping along with the Author and Authoring Software is listed below. See ***Exhibit 7-Revit Shared Parameters File*** on how to use the Revit .rte file to transfer Project Standards from the Template File to the Design Model.

Information Category	Equipment Details	IWMS	Model	Who Enters Data	Data Authoring Software	ARCHIBUS Field	Revit Field
Spatial Location	Room Code	X	X	Designer or Contractor	Revit or 360 Field	rm_id	Space Number†
Asset Properties	Mark (Revit Unique Identifier)*	X	X	Designer	Revit	mep_code	Mark†/Name
Asset Properties	Equipment Code (FM Unique Identifier)	X	X	Designer	Revit	eq_id	Equipment Code²
Asset Properties	CSI ID (CSI Masterformat Number)	X	X	Designer	Revit	csi_id	CSI Number²
Asset Properties	Asset ID (Asset Barcode Tag)	X	X	Contractor	360 Field	asset_id	Barcode²
Asset Properties	Equipment Category	X	X	Based on Type	360 Field	N/A	N/A
Asset Properties	Equipment Type	X	X	Contractor	360 Field	eq_type	Equipment Type²
Manufacture Information	Manufacturer	X	X	Contractor	360 Field	model_name	Manufacturer²
Manufacture Information	Model Number	X	X	Contractor	360 Field	model_num	Model Number²
Manufacture Information	Serial Number	X	X	Contractor	360 Field	num_serial	Serial Number²
Cost Requirements	Purchase Cost	X		Contractor	360 Field	cost_purchase	N/A
Cost Requirements	Cost of Replacement	X		Contractor	360 Field	cost_replace	N/A
Facility Management	Date Purchased	X		Contractor	360 Field	date_purchased	N/A
Facility Management	Install Date	X	X	Contractor	360 Field	date_installed	Install Date²
Facility Management	Date In Service	X	X	Contractor	360 Field	date_in_service	In Service Date²
Facility Management	Life Expectancy	X	X	Contractor	360 Field	eq_life_expct	Life Expectancy²
Facility Management	Warranty Start Date (Manufacturer)	X		Contractor	360 Field	warranty_start_date	N/A
Facility Management	Warranty Length (Manufacturer)	X		Contractor	360 Field	warranty_length	N/A
Facility Management	Warranty End Date (Manufacturer)	X	X	Contractor	360 Field	warranty_end_date	Warranty End Date
Facility Management	Parent Code (Child to Parent)	X	X	Contractor	360 Field	parent_id	Parent ID²
Facility Management	Condition²	X	X	Owner	ARCHIBUS	condition	Condition²

†Existing Revit Field
*Parameter Created by ARCHIBUS
²Shared Parameter File

Exhibit 4-Equipment Assets

Parameter fields and documentation listed in the ***Exhibit 5-Equipment Asset Details*** are to be collected on all the Equipment Assets listed here. Individual metadata fields listed in ***Exhibit 5-Equipment Asset Details*** will be tracked and authored in either Revit by the Design Team or the Field Management Application by the Contractor/CM and/or Sub-trades. Refer to the ***Exhibit 3-Equipment Mapping Matrix*** for authoring party and software.

This is a comprehensive list of Equipment Assets for UNC Charlotte. If items mentioned below are not being modeled in the Revit MEP outline those in the BEP for approval. If there are other pieces of Equipment that the AEC Team may consider 'Major HVAC, Electrical or Plumbing Equipment' or are Equipment being scheduled on the project please inform UNC Charlotte of those items as well.

Equipment Cat orgies:

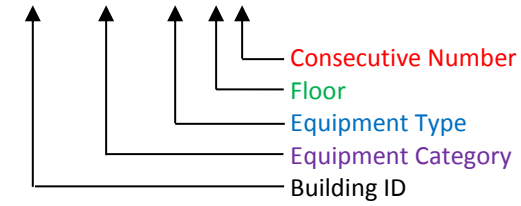
HVAC - HVAC
PLBG - Plumbing
ELEC - Electrical
COMM - Communication
LFSF – Life Safety
GENR - General
KITC - Kitchen

Equipment Code Format:

Building ID-Equipment Category-Equipment Type-Floor and Consecutive Number

Populate in Revit when Equipment is placed in the model.
Example:

0080-HVAC-VAV-101



Mark Format: (Would also serve as the UNCC MEP-Code)

Equipment Type-Consecutive Number

Populate in Revit when Equipment is placed in the model.
Example:

VAV-01

Equipment Standard Format:

Equipment Type-Manufacture-Model	AHU-Trane-059943
or Equipment Category-Equipment Type	HVAC-AHU
or just the Equipment Type Description	Air Handling Unit

Equipment Category - HVAC: HVAC			
Description	**Type**	**Mark** for Revit	**Code** for Revit
AC Unit	ACU	**ACU-#**	**BLD ID-HVAC-ACU-#**
Air Flow Unit	AFU	**AFU-#**	**BLD ID-HVAC-AFU-#**
Air Handler	AH	**AH-#**	**BLD ID-HVAC-AH-#**
Air Handling Unit	AHU	**AHU-#**	**BLD ID-HVAC-AHU-#**
Boiler	BOIL	**BLR-#**	**BLD ID-HVAC-BLR-#**
Ceiling Return Diffuser	CGRD	**CGRD-#**	**BLD ID-HVAC-CGRD-#**
Ceiling Supply Diffuser	CGSD	**CGSD-#**	**BLD ID-HVAC-CGSD-#**
Chemical Pump	CHMP	**CHMP-#**	**BLD ID-HVAC-CHMP-#**
Chilled Water Loop	CWL	**CWL-#**	**BLD ID-HVAC-CWL-#**
Chilled Water Pump	CWP	**CWP-#**	**BLD ID-HVAC-CWP-#**
Chiller	CHIL	**CLR-#**	**BLD ID-HVAC-CLR-#**
Cooling Tower	COTR	**CT-#**	**BLD ID-HVAC-CT-#**
Compressor Pump	COMP	**COMP-#**	**BLD ID-HVAC- COMP-#**
Compressor	CPSR	**CPSR-#**	**BLD ID-HVAC-CPSR-#**
Condensate Pump	CP	**CP-#**	**BLD ID-HVAC-CP-#**
Condenser Pump	CONDP	**CONDP-#**	**BLD ID-HVAC-CONDP-#**
Condenser	COND	**COND-#**	**BLD ID-HVAC-COND-#**
Constant Air Volume Box	CAVB	**CAVB-#**	**BLD ID-HVAC-CAVB-#**
Control Valve	CV	**CV-#**	**BLD ID-HVAC-CV-#**
Controls	CNT	**CNT-#**	**BLD ID-HVAC-CNT-#**
Compute Room AC	CRAC	**CRAC-#**	**BLD ID-HVAC-CRAC-#**
Damper	DMPR	**DMPR-#**	**BLD ID-HVAC-DMPR-#**
Dedicated Outside Air Unit	DOAU	**DOAU-#**	**BLD ID-HVAC-DOAU-#**
Dehumidifier	DHUM	**DHUM-#**	**BLD ID-HVAC-DHUM-#**
Dry Cooler	DC	**DC-#**	**BLD ID-HVAC-DC-#**
Duct Silencer	DSIL	**DSIL-#**	**BLD ID-HVAC-DSIL-#**
Energy Wheel	EGRW	**EGRW-#**	**BLD ID-HVAC-EGRW-#**
Exhaust Fan	EXHF	**EF-#**	**BLD ID-HVAC-EF-#**
Fan Coil Unit	FCU	**FCU-#**	**BLD ID-HVAC-FCU-#**
Fan Powered VAV	FPVAV	**FPVAV-#**	**BLD ID-HVAC-FPVAV-#**
Fan	FAN	**FAN-#**	**BLD ID-HVAC-FAN-#**
Filter	HVAF	**FLTR-#**	**BLD ID-HVAC-FLTR-#**
Freeze Protection Pump	FPP	**FPP-#**	**BLD ID-HVAC-FPP-#**
Fuel Oil Pump	FUOP	**FUOP-#**	**BLD ID-HVAC-FUOP-#**
Fuel Pump	FP	**FP-#**	**BLD ID-HVAC-FP-#**
Fuel Storage Tank	FUST	**FUST-#**	**BLD ID-HVAC-FUST-#**
Fume Hood	FH	**FH-#**	**BLD ID-HVAC-FH-#**
Furnace	FURN	**FURN-#**	**BLD ID-HVAC-FURN-#**
Glycol Make Up Unit	GMU	**GMU-#**	**BLD ID-HVAC-GMU-#**

Grill	GRIL	**GRIL-#**	**BLD ID-HVAC-GRIL-#**
Heat Exchanger	HEX	**HX-#**	**BLD ID-HVAC-HX-#**
Heat Pump	HP	**HP-#**	**BLD ID-HVAC-HP-#**
Hot Water Loop	HWL	**HWL-#**	**BLD ID-HVAC-HWL-#**
Hot Water Pump	HWP	**HWP-#**	**BLD ID-HVAC-HWP-#**
Humidifier	HUMR	**HUM-#**	**BLD ID-HVAC-HUM-#**
Outlet Vent			
Linear Supply Diffuser	LSD	**LSD-#**	**BLD ID-HVAC-LSD-#**
Louver	LVR	**LVR-#**	**BLD ID-HVAC-LVR-#**
Make-Up Air Handling Unit	MAHU	**MAHU-#**	**BLD ID-HVAC-MAHU-#**
Modular Cooling Unit	MCU	**MCU-#**	**BLD ID-HVAC-MCU-#**
Motor	MTR	**MTR-#**	**BLD ID-HVAC-MTR-#**
Outside Air Fan	OAF	**OAF-#**	**BLD ID-HVAC-OAF-#**
Pressure Cage	PG	**PG-#**	**BLD ID-HVAC-PG-#**
Pump	PUMP	**PUMP-#**	**BLD ID-HVAC-PUMP-#**
Radiator	RAD	**RAD-#**	**BLD ID-HVAC-RAD-#**
Refrigerant Compressor	REFRCP	**REFRCP-#**	**BLD ID-HVAC-REFRCP-#**
Refrigerant Condenser	REFRCD	**REFRCD-#**	**BLD ID-HVAC-REFRCD-#**
Register	REG	**REG-#**	**BLD ID-HVAC-REG-#**
Relief Fan	RELF	**RELF-#**	**BLD ID-HVAC-RELF-#**
Return Air Fan	RAF	**RAF-#**	**BLD ID-HVAC-RAF-#**
Return Air Silencer	RAS	**RAS-#**	**BLD ID-HVAC-RAS-#**
Roof Top Unit	RTU	**RTU-#**	**BLD ID-HVAC-RTU-#**
Smoke Damper	SMKD	**SMKD-#**	**BLD ID-HVAC-SMKD-#**
Sound Attenuator	SA	**SA-#**	**BLD ID-HVAC-SA-#**
Split Unit	SU	**SU-#**	**BLD ID-HVAC-SU-#**
Static Pressure Sensor	SPS	**SPS-#**	**BLD ID-HVAC-SPS-#**
Steam Trap	STRAP	**STRAP-#**	**BLD ID-HVAC-STRAP-#**
Supply Air Fan	SUPF	**SAF-#**	**BLD ID-HVAC-SAF-#**
Supply Air Silencer	SAS	**SAS-#**	**BLD ID-HVAC-SAS-#**
Thermostat	TH	**TH-#**	**BLD ID-HVAC-TH-#**
Transformer	TFMR	**TFMR-#**	**BLD ID-HVAC-TFMR-#**
Unit Heater	UH	**UH-#**	**BLD ID-HVAC-UH-#**
Variable Frequency Drive	VIBA	**VFD-#**	**BLD ID-HVAC-UH-#**
Variable Air Volume	VAV	**VAV-#**	**BLD ID-HVAC-VAV-#**
Wall Return Diffuser	WRD	**WRD-#**	**BLD ID-HVAC-WRD-#**
Wall Supply Diffuser	WSD	**WSD-#**	**BLD ID-HVAC-WSD-#**
Window Unit	WU	**WU-#**	**BLD ID-HVAC-WU-#**

Equipment Category - Plumbing: PLBG			
Description	**Type**	**Mark** for Revit	**Code** for Revit
Area Drain	AD	**AD-#**	**BLD ID-PLBG-AD-#**
Back Flow Preventer	BFPR	**BFP-#**	**BLD ID-PLBG-BFP-#**
Back Flow Unit	BFU	**BFU-#**	**BLD ID-PLBG-BFU-#**
Boiler Feed Water Pump	BFPR	**BFPR-#**	**BLD ID-PLBG-BFPR-#**
Circulator Pump	CRP	**CRP-#**	**BLD ID-PLBG-CRP-#**
Chemical Water Treatment Pump	CHEP	**CHEP-#**	**BLD ID-PLBG-CHEP-#**
Domestic Water Pump	DOWP	**DOWP-#**	**BLD ID-PLBG-DOWP-#**
Emergency Shower	ES	**ES-#**	**BLD ID-PLBG-ES-#**
Eye Wash Station	EWS	**EWS-#**	**BLD ID-PLBG-EWS-#**
Floor Drain	FD	**FD-#**	**BLD ID-PLBG-FD-#**
Floor Sink	FSNK	**FSNK-#**	**BLD ID-PLBG-FSNK-#**
Flow Meter	FLM	**FLM-#**	**BLD ID-PLBG-FLM-#**
Grease Trap	GP	**GP-#**	**BLD ID-PLBG-GP-#**
Hose Bib	HB	**HB-#**	**BLD ID-PLBG-HB-#**
Hot Water Pump	HWFP	**HWP-#**	**BLD ID-PLBG-HWP-#**
Hot Water Circulation Pump	HWCP	**HWCP-#**	**BLD ID-PLBG- HWCP-#**
Hot Water Storage Pump	HWST	**HWST-#**	**BLD ID-PLBG-HWST-#**
Lavatories	LAV	**LAV-#**	**BLD ID-PLBG-LAV-#**
Mop Receptor	MOPR	**MOPR-#**	**BLD ID-PLBG-MOPR-#**
Overflow Roof Drain	ORD	**ORD-#**	**BLD ID-PLBG-ORD-#**
Pressure Gage	PG	**PG-#**	**BLD ID-PLBG-PG-#**
Pump	PUMP	**PUMP-#**	**BLD ID-PLBG-PUMP-#**
Rain Water Leaders	RWL	**RWL-#**	**BLD ID-PLBG-RWL-#**
Roof Drain	RD	**RD-#**	**BLD ID-PLBG-RD-#**
Sand Filter	SF	**SF-#**	**BLD ID-PLBG-SF-#**
Sanitary Sewage Pumps	SSP	**SSP-#**	**BLD ID-PLBG-SSP-#**
Servery Sink	SVSK	**SVSK-#**	**BLD ID-PLBG-SVSK-#**
Service Sink	SSNK	**SSNK-#**	**BLD ID-PLBG-SSNK-#**
Sewer Pump	SWP	**SWP-#**	**BLD ID-PLBG-SWP-#**
Shower	SH	**SH-#**	**BLD ID-PLBG-SH-#**
Shut-Off Valve	SOV	**SOV-#**	**BLD ID-PLBG-SOV-#**
Sink	SNK	**SNK-#**	**BLD ID-PLBG-SNK-#**
Solar System Circulation Pump	SSCP	**SSCP-#**	**BLD ID-PLBG- SSCP-#**
Solar Thermal Panel	STP	**STP-#**	**BLD ID-PLBG-STP-#**
Sound Attenuator	SATU	**SATU-#**	**BLD ID-PLBG-SATU-#**
Steam Trap	STAP	**STRP-#**	**BLD ID-PLBG-STRP-#**
Storm Water Ejectror Pump	SWEP	**SWEP-#**	**BLD ID-PLBG-SWEP-#**
Sump Pump	SUMP	**SMP-#**	**BLD ID-PLBG-SMP-#**
Trench Drain	TDR	**TDR-#**	**BLD ID-PLBG-TDR-#**

Urinal	UR	**UR-#**	**BLD ID-PLBG-UR-#**
Water Closet	WC	**WC-#**	**BLD ID-PLBG-WC-#**
Water Filter	WFFL	**WF-#**	**BLD ID-PLBG-WF-#**
Water Filtration Device	WFLD	**WFLD-#**	**BLD ID-PLBG-WFLD-#**
Water Flow Meter	WMTR	**WMTR-#**	**BLD ID-PLBG-WMTR-#**
Water Fountain	WFTN	**WF-#**	**BLD ID-PLBG-WF-#**
Water Hammer Arrestor	WHR	**WHR-#**	**BLD ID-PLBG-WHR-#**
Water Heater	WHTR	**WHTR-#**	**BLD ID-PLBG-WHTR-#**
Water Meter	WM	**WM-#**	**BLD ID-PLBG-WM-#**
Water Softener	WS	**WS-#**	**BLD ID-PLBG-WS-#**

Equipment Category - Electrical: ELEC			
Description	**Type**	**Mark** for Revit	**Code** for Revit
AC Motor	AMTR	**AMTR-#**	**BLD ID-ELEC-AMTR-#**
Battery	BATT	**BATT-#**	**BLD ID-ELEC-BATT-#**
Breaker	BKR	**BKR-#**	**BLD ID-ELEC-BKR-#**
Ceiling Light Fixture	CLGLT	**CLGLT-#**	**BLD ID-ELEC-CLGLT-#**
Ceiling Outlet	CLGEO	**CLGEO-#**	**BLD ID-ELEC-CLGEO-#**
Daylight System	DS	**DS-#**	**BLD ID-ELEC-DS-#**
Disconnect Box	DCNB	**DCNB-#**	**BLD ID-ELEC-DCNB-#**
Disconnect Switch	DCNS	**DCNS-#**	**BLD ID-ELEC-DCNS-#**
Distribution Panelboard	DPLBD	**DPLBD-#**	**BLD ID-ELEC-DPLBD-#**
Electric Meter	ELM	**ELM-#**	**BLD ID-ELEC-ELM-#**
Electrical Closet	ELCT	**ELCT-#**	**BLD ID-ELEC-ELCT-#**
Electrical Transformer	ELTR	**ELTR-#**	**BLD ID-ELEC-ELTR-#**
Emergency Lighting Control Panel	ELCP	**ELCP-#**	**BLD ID-ELEC-ELCP-#**
Emergency Panelboard	EPLBD	**EPLBD-#**	**BLD ID-ELEC-EPLBD-#**
Emergency Transformer	ETFMR	**ETFMR-#**	**BLD ID-ELEC-ETFMR-#**
Exterior Lighting	EXLT	**EXLT-#**	**BLD ID-ELEC-EXLT-#**
Floor Outlet	FEO	**FEO-#**	**BLD ID-ELEC-FEO-#**
Generator	GEN	**GEN-#**	**BLD ID-ELEC-GEN-#**
Heater	HTR	**HTR-#**	**BLD ID-ELEC-HTR-#**
High Voltage Switch	HVSW	**HVSW-#**	**BLD ID-ELEC-HVSW-#**
Inverter	IVTR	**IVTR-#**	**BLD ID-ELEC-IVTR-#**
Junction Box	JB	**JB-#**	**BLD ID-ELEC-JB-#**
Legally Required Panelboard	RPLBD	**RPLBD-#**	**BLD ID-ELEC-RPLBD-#**
Light	LGHT	**LGHT-#**	**BLD ID-ELEC-LGHT-#**
Lighting Control Panel	LCP	**LCP-#**	**BLD ID-ELEC-LCP-#**
Lighting Panelboard	LPLBD	**LPLBD-#**	**BLD ID-ELEC-LPLBD-#**
Main Switch Board	MSB	**MSB-#**	**BLD ID-ELEC-MSB-#**
Motion Sensor	MS	**MS-#**	**BLD ID-ELEC-MS-#**
Occupancy Sensor	OS	**OS-#**	**BLD ID-ELEC-OS-#**
Pad Mounted Transformer	PDTR	**PDTR-#**	**BLD ID-ELEC- PDTR-#**
Panelboard	PLBD	**PLBD-#**	**BLD ID-ELEC-PLBD-#**
PDU	PDU	**PDU-#**	**BLD ID-ELEC-PDU-#**
Photo Cell	PCELL	**PCEL-#**	**BLD ID-ELEC-PCEL-#**
Power Panelboard	PPLBD	**PPLBD-#**	**BLD ID-ELEC-PPLBD-#**
PV Panels	PVP	**PVP-#**	**BLD ID-ELEC-PVP-#**
Standby Panelboard	SPLBD	**SPLBD-#**	**BLD ID-ELEC-SPLBD-#**
Standby Transformer	STFMR	**STFMR-#**	**BLD ID-ELEC-STFMR-#**
Surge Arrester	SA	**SA-#**	**BLD ID-ELEC-SA-#**
Switchgear	SGER	**SGER-#**	**BLD ID-ELEC-SGER-#**

Timer	TM	**TM-#**	**BLD ID-ELEC-TM-#**
Toilet Exhaust Fan	TEF	**TEF-#**	**BLD ID-ELEC-TEF-#**
Track Lighting	TLT	**TLT-#**	**BLD ID-ELEC-TLT-#**
Transformer	TFMR	**TFMR-#**	**BLD ID-ELEC-TFMR-#**
Transfer Switch	TNSW	**TNSW-#**	**BLD ID-ELEC-TNSW-#**
UPS	UPS	**UPS-#**	**BLD ID-ELEC-UPS-#**
Wall Light Fixture	WLT	**WLT-#**	**BLD ID-ELEC-WLT-#**
Wall Outlet	WEO	**WEO-#**	**BLD ID-ELEC-WEO-#**

Equipment Category - Communication: **COMM**			
Description	**Type**	**Mark** for Revit	**Code** for Revit
Access Control	ACC	**ACC-#**	**BLD ID-COMM-ACC-#**
Alarm	ALM	**ALM-#**	**BLD ID-COMM- ALM-#**
Building Automation System	BAS	**BAS-#**	**BLD ID-COMM- BAS-#**
Ceiling Data Port	CGDP	**CGDP-#**	**BLD ID-COMM-CGDP-#**
Ceiling Speaker	CGSP	**CGSP-#**	**BLD ID-COMM-CGSP-#**
Clock	CLK	**CLK-#**	**BLD ID-COMM-CLK-#**
Call Station	CS	**CS-#**	**BLD ID-COMM-CS-#**
Cable Tray	CT	**CT-#**	**BLD ID-COMM-CT-#**
Projector	GP	**GP-#**	**BLD ID-COMM-GP-#**
Marker Board	MBD	**MBD-#**	**BLD ID-COMM-MBD-#**
Monitor	MTR	**MTR-#**	**BLD ID-COMM-MTR-#**
PA System	PAS	**PAS-#**	**BLD ID-COMM-PAS-#**
Projector Lift	PL	**PL-#**	**BLD ID-COMM-PL-#**
Projector Mount	PM	**PM-#**	**BLD ID-COMM-PM-#**
Polycom	POLY	**POLY-#**	**BLD ID-COMM-PM-#**
Projection Screen	PROS	**PROS-#**	**BLD ID-COMM-PROS-#**
Security Access Panel	SPNL	**SPNL-#**	**BLD ID-COMM-SPNL-#**
Security Camera	SC	**SC-#**	**BLD ID-COMM-SC-#**
Security Card Reader	SCR	**SCR-#**	**BLD ID-COMM- SCR-#**
Sound Masking System	SMS	**SMS-#**	**BLD ID-COMM-SMS-#**
TV	TV	**TV-#**	**BLD ID-COMM-TV-#**
TV Mount	TVM	**TVM-#**	**BLD ID-COMM-TVM-#**
TV Port	TVP	**TVP-#**	**BLD ID-COMM-TVP-#**
Video Camera	VDC	**VDC-#**	**BLD ID-COMM-VDC-#**
Wall Data Port	WDP	**WDP-#**	**BLD ID-COMM-WDP-#**
Wall Speaker	WSP	**WSP-#**	**BLD ID-COMM-WSP-#**
Wireless Transceiver	WT	**WT-#**	**BLD ID-COMM-WT-#**

Equipment Category - Life Safety: LFSF			
Description	**Type**	**Mark** for Revit	**Code** for Revit
Alarm Check Valve	ACV	**ACV-#**	**BLD ID-LFSF-ACV-#**
Backdraft Damper	BDD	**BDD-#**	**BLD ID-LFSF-BDD-#**
Clean Agent System	CAS	**CAS-#**	**BLD ID-LFSF-CAS-#**
Call Box	CB	**CB-#**	**BLD ID-LFSF-CB-#**
Double Check Valve	DCV	**DCV-#**	**BLD ID-LFSF-DCV-#**
Duct Detector	DD	**DD-#**	**BLD ID-LFSF-DD-#**
Emergency Light	EL	**EL-#**	**BLD ID-LFSF-EL-#**
Emergency Mgnt System	EMS	**EMS-#**	**BLD ID-LFSF-EMS-#**
Emergency Elev Telephone	EMPE	**EMPE-#**	**BLD ID-LFSF-EMPE-#**
Emergency Shower	EMEW	**EMEW-#**	**BLD ID-LFSF-EMEW-#**
Emergency Telephone	EMTP	**EMTP-#**	**BLD ID-LFSF-EMTP-#**
Emergency Exit Light Sign	EELS	**EELS-#**	**BLD ID-LFSF-EELS-#**
Fire Alarm Strobe	FAS	**FAS-#**	**BLD ID-LFSF-FAS-#**
Fire Alarm Strobe Speaker	FASS	**FASS-#**	**BLD ID-LFSF-FASS-#**
Fire Control Panel	FCP	**FCP-#**	**BLD ID-LFSF-FCP-#**
Fire Damper	FD	**FD-#**	**BLD ID-LFSF-FD-#**
Fire Department Valve	FDV	**FDV-#**	**BLD ID-LFSF-FDV-#**
Fire Extinguisher	FEXT	**FE-#**	**BLD ID-LFSF-FE-#**
Fire Extinguisher Cabinet	FEC	**FEC-#**	**BLD ID-LFSF-FEC-#**
Fire Hose Cabinet	FHS	**FHS-#**	**BLD ID-LFSF-FHS-#**
Fire Hose Valve	FHV	**FHV-#**	**BLD ID-LFSF-FHV-#**
Fire Pump	FIRP	**FP-#**	**BLD ID-LFSF-FP-#**
Fire Protection Floor Control	FPFC	**FPFC-#**	**BLD ID-LFSF-FPFC-#**
Fire Smoke Exhaust Fan	FSEF	**SEF-#**	**BLD ID-LFSF-SEF-#**
Flow Switch	FS	**FS-#**	**BLD ID-LFSF-FS-#**
Fire Sprinkler System	FSS	**FSS-#**	**BLD ID-LFSF-FSS-#**
Fire Suppression System	FSUP	**FSS-#**	**BLD ID-LFSF-FSS-#**
Flow & Tamper Switch	FTSW	**FTSW-#**	**BLD ID-LFSF-FTSW-#**
Heat Detector	HD	**HD-#**	**BLD ID-LFSF-HD-#**
Leak Detector	LD	**LD-#**	**BLD ID-LFSF-LD-#**
Pre-Action System	PASY	**PASY-#**	**BLD ID-LFSF-PASY-#**
Panic Button	PB	**PB-#**	**BLD ID-LFSF-PB-#**
Pull Station	PS	**PS-#**	**BLD ID-LFSF-PS-#**
Radiation Detector	RAD	**RAD-#**	**BLD ID-LFSF-RAD-#**
Smoke Detector	SD	**SD-#**	**BLD ID-LFSF-SD-#**
Sprinkler Head	SPKH	**SPKH-#**	**BLD ID-LFSF-SPKH-#**
Standpipe	SPIPE	**SPIPE-#**	**BLD ID-LFSF-SPIPE-#**
Exit Sign	EXIT	**EXIT-#**	**BLD ID-LFSF-EXIT-#**

Equipment Category - General: GENR			
Description	**Type**	**Mark** for Revit	**Code** for Revit
Access Floor	ACFL	**ACFL-#**	**BLD ID-GENR-ACFL-#**
Automatic Door	AUDR	**AUDR-#**	**BLD ID-GENR-AUDR-#**
Bleachers	BLER	**BLER-#**	**BLD ID-GENR-BLER-#**
Clock	CLK	**CLK-#**	**BLD ID-GENR-CLK-#**
Clothes Dryer Machine	CDRM	**CDRM-#**	**BLD ID-GENR-CDRM-#**
Cloths Washing Machine	CWAM	**CWAM-#**	**BLD ID-GENR-CWAM-#**
Dock Leveler	DL	**DL-#**	**BLD ID-GENR-DL-#**
Door	DOOR	**# (Door Number)**	**BLD ID-GENR-DOOR-#**
Dumbwaiter	DW	**DW-#**	**BLD ID-GENR-DW-#**
Elevator	ELEV	**ELEV-#**	**BLD ID-GENR-ELEV-#**
Escalator	ESC	**ESC-#**	**BLD ID-GENR-ESC-#**
Motorized Shades	MWT	**MWT-#**	**BLD ID-GENR-MWT-#**
Restroom Accessories	RA	**RA-#**	**BLD ID-GENR-RA-#**
Storage Tank	SRT	**SRT-#**	**BLD ID-GENR-SRT-#**
Roof	Roof	**ROOF-#**	**BLD ID-GENR-ROOF-#**

Equipment Category - Kitchen: KITC			
Description	**Type**	**Mark** for Revit	**Code** for Revit
Coffee Machine	COFM	**COFM-#**	**BLD ID-KITC-COFM-#**
Cooler	COLR	**COLR-#**	**BLD ID-KITC-COLR-#**
Cooling Pan	CP	**CP-#**	**BLD ID-KITC-CP-#**
Compactor	CPT	**CPT-#**	**BLD ID-KITC-CPT-#**
Dryer	DRY	**DRY-#**	**BLD ID-KITC-DRY-#**
Dishwasher	DSHW	**DW-#**	**BLD ID-KITC-DW-#**
Dishwasher Exhaust Fan	DEXH	**DEXH-#**	**BLD ID-KITC-DEXH-#**
Disposal	DISP	**DISP-#**	**BLD ID-KITC- DISP-#**
Exhaust Fan	EXF	**DRY-#**	**BLD ID-KITC-DRY-#**
Exhaust Hood	KEXH	**EXH-#**	**BLD ID-KITC-EXH-#**
Food Warner	WRMR	**WRMR-#**	**BLD ID-KITC-WRMR-#**
Ice Machine	ICEM	**ICEM-#**	**BLD ID-KITC-ICEM-#**
Induction Unit	IU	**IU-#**	**BLD ID-KITC-IU-#**
Microwave	MW	**MW-#**	**BLD ID-KITC-MW-#**
Oven	OVEN	**OVEN-#**	**BLD ID-KITC-OVEN-#**
Refrigerator	REFR	**REFR-#**	**BLD ID-KITC-REFR-#**
Toaster	TOS	**TOS-#**	**BLD ID-KITC-TOS-#**
Walk-In Cooler	WINC	**WINC-#**	**BLD ID-KITC-WINC-#**
Walk-In Freezer	WINF	**WINF-#**	**BLD ID-KITC-WINF-#**

Exhibit 5-Equipment Asset Details

Parameters shown below should be collected/tracked for each Asset listed in ***Exhibit 4-Equipment Assets*** and also include the listed attachments. Attachments are to be filed via the ***Exhibit 6-Digital Management Exchange Guidelines*** and/or in the Field Management Application as needed. Individual fields listed in this Exhibit document will be created in the Field Management Application and will be collected by the Contractor/CM and/or Sub-trades. These metadata fields will be mapped directly from the Field Management Application into the Owners IWMS.

Metadata Fields for ALL Equipment			
Field	**Definition**	**Format**	**Data Format**
Name	Name of the equipment on the drawings, should match the Revit Mark.	Text	See Exhibit 4-Equipment Assets
Location	Physical location of the piece of equipment.	Drop-Down	Based on application standard and Owner's Room Numbering Standard.
Status	Position of progress on a piece of equipment in relation to the project schedule.	Text	Contractor/CM discretion
Type	Specific piece organized under categories	Text	See Exhibit 4-Equipment Assets
Description	Brief description of the equipment as needed	Text	In 140 characters or less add any description or special instructions.
Barcode	Number on Owners supplied tag.	Numeric	Scan or enter as shown on tag.
Expected Life	Estimated life in years	Numeric	Number of years
Install Date	Date equipment was installed in the building	Date	mm/dd/yyyy
Purchase Date	Date the equipment was purchased	Date	mm/dd/yyyy
Serial Number	Equipment Serial Number	Text	Serial number, if exceeding 32 characters inform Owner.
Submittal	Project submittal number	Text	
Warranty End Date	Manufacturer's warranty end date	Date	mm/dd/yyyy
----------Custom Fields----------			
Equipment Code	Unique FM Identifier associated to the equipment in the model.	Text	See Exhibit 4-Equipment Assets
Manufacture	Equipment Manufacturer name	Text	Name of Manufacture, if exceeding 32 characters inform Owner.
Model Number	Equipment Model Number	Text	Model number, if exceeding 32 characters inform Owner.
Purchase Cost	Cost of Equipment only	Numeric	
Cost of Replacement	Cost of Equipment only	Numeric	If value is over 8 characters please inform owner, and no use of special characters or commas.
Date in Service	Date of functional testing and put into use	Date	mm/dd/yyyy
Warranty Start Date	Should equal the Substantial Completion Date	Date	mm/dd/yyyy
Warranty Length	Manufacturer's warranty length.	Date	mm/dd/yyyy
Subcomponent Of	Track the Parent-Child relationship of equipment	Text	Enter the Equipment Code of the Parent piece of equipment, should not exceed 20 characters.
Classification Code	CSI number, Per CSI MasterFormat standards	Numeric	Number should not exceed 9 digits; 8 numbers and one decimal is the max.
Equipment Location	Short description of the equipment location within the space	Text	In 140 characters or less description of where the equipment is located in the room or building.

Lock Brand	Door specific field to list the Lock Brand/Manuf.	Text	Name of Manufacture, if exceeding 32 characters inform Owner.
Lock Design	Lock type, i.e. Lever, Knob, Panic, Deadbolt.	Drop-Down	Options will be listed in a Drop-Down menu option.
Lock Finish	Door specific field to list the Lock Finish	Drop-Down	Options will be listed in a Drop-Down menu option.
Lock Back Set	Distance from the vertical centerline of the door edge to the centerline of the lock cylinder.	Text	Measured Inches in decimal format.
Cylinder Brand	Door specific field to list the Cylinder Brand/Manuf.	Text	Name of Manufacture, if exceeding 32 characters inform Owner.
Cylinder Part Number	Door specific field to list the Cylinder Part Number	Text	Enter Part Number, if exceeding 16 characters inform Owner.
Cylinder Material	Door specific field to list the Cylinder Material	Drop-Down	Options will be listed in a Drop-Down menu option.
Cylinder Finish	Door specific field to list the Cylinder Finish	Drop-Down	Options will be listed in a Drop-Down menu option.
Attachments for all Equipment, also listed in Digital Exchange Guidelines: Product Data, O&M Manuals, Installation Guide, Installation Guide, Warranty Documents, Submittal Information, Commissioning Reports, Start Up & Shut Down Procedures and any Additional Equipment Testing Documents.			

2013

Exhibit 6-Digital Management Exchange (Close Out Deliverables)

This Digital Management Exchange was developed for efficient and timely transfer of model, metadata and document files electronically at Project Close Out into the Owners EDMS.

Architectural/Engineering and Construction Documents			
Required Information	**Required By**	**Format**	**Filing Location**
Final Punch List	Design Team	Completed in 360 Filed, exported to PDF at completion of project.	TBD
Building Cost Report	Design Team	PDF and/or Excel Documents	TBD
Photographs & Videos	Contractor	JPEG, MP4, WAV in date taken folder	TBD
O&M Manuals	Contractor	See OMSI Scope of Work & BIM-C Execution Plan	TBD
Record Drawings & Model	Design Team	See BIM Close Out Deliverables Scope of Work	TBD
Inspection & Certification	Contractor	PDF	TBD
Certificate of Substantial Completion	Contractor	PDF	TBD
Submittals Index Log	Contractor	PDF	TBD
Submittal Files	Contractor	PDF in folder w/ Submittal Number	TBD
As-Built Drawings & Model	Contractor	See BIM Specific Deliverables Scope of Work	TBD
Design & Construction Specifications	Design Team & Contractor	PDF in CSI formatted folders	TBD
Close Out Letter	Design Team	PDF	TBD
Certificate of Substation Completion	Contractor	PDF	TBD
Payment Applications	Design Team	PDF of Signed Documents	TBD
Commissioning Documents	Multiple Parties	See Commissioning Documents Scope of Work	TBD
LEED Documents	Multiple Parties	See Commissioning Documents Scope of Work	TBD

BIM Specific Deliverables			
Required Information	**Required By**	**Format**	**Filing Location**
Design Models	Design Team	Revit RVT file	TBD
Record Construction Drawings	Design Team	Individual PDF Sheets	TBD
Constructability Model	Contractor	Revit RVT file	TBD
Coordination Model	Contractor	Navisworks NWF file	TBD
Sub-trade Models	Contractor	Native File Format	TBD
As-Built Model	Contractor	Navisworks NWD file	TBD
As-Built Drawings	Contractor	Individual PDF Sheets	TBD
Record Model	Design Team	Revit RVT file	TBD
Record Drawings	Design Team	Individual PDF Sheets	TBD
Database Files	Design Team & Contractor	Native File Format	TBD

Commissioning Documents Scope of Work			
Required Information	**Required By**	**Format**	**Filing Location**
Executive Summary	Cx	In Commissioning Report but filed as an individual PDF	TBD
Report Summary	Cx	In Commissioning Report but filed as an individual PDF	TBD
Cx Plan	Cx	In Commissioning Report but filed as an individual PDF	TBD
Cx Design Review Comments	Cx	In Commissioning Report but filed as an individual PDF	TBD
Correspondence	Cx	In Commissioning Report but filed as an individual PDF	TBD
Cx Issue Log	Cx	In Commissioning Report but filed as an individual PDF	TBD
Submittal Review Log/Comments	Cx	In Commissioning Report but filed as an individual PDF	TBD
Construction Verification Forms	Cx	In Commissioning Report but filed as an individual PDF	TBD
Functional Testing Forms	Cx	In Commissioning Report but filed as an individual PDF	TBD
Trending Plan	Cx	In Commissioning Report but filed as an individual PDF	TBD
Tending Logs	Cx	In Commissioning Report but filed as an individual PDF	TBD
Test & Balance Report	Cx	In Commissioning Report but filed as an individual PDF	TBD
System Setpoints	Cx	In Commissioning Report but filed as an individual PDF	TBD
Training Sign-In Log	Cx	In Commissioning Report but filed as an individual PDF	TBD

Commissioning Documents Scope of Work			
Required Information	**Required By**	**Format**	**Filing Location**
Scorecard	Design Team	Excel or PDF	TBD
OPR	Cx	In Commissioning Report but filed as an individual PDF	TBD
BOD	Cx	In Commissioning Report but filed as an individual PDF	TBD
Credit Documents	LEED Admin	PDF	TBD
Building Energy Model	Design Engineer	Original files and output documents	TBD
IAQ Plans	Contractor	PDF	TBD
M&V Plan(s)	Cx or Design Engineer	PDF	TBD

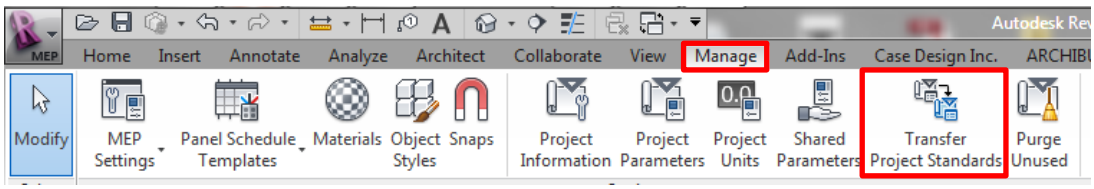
Operations & Maintenance Support Information (OMSI) Scope of Work			
Required Information	**Description**	**Format**	**Filing Location**
Manufactures' Literature	Identifying manuals, cut sheets, etc., from equipment manufacturers that amplify information provided within the system-level O&M manual. Manufacturers' literature generally provides procedures to operate, maintain, troubleshoot, and repair specific items at the equipment level. This information is contained in a separate volume of binders, identified by facility/system, for easy reference. Specific material or complete documents can also be electronically scanned for its 'on-line' use, such as linking from the system-level manual.	PDF files	TBD
Certified Tests & Reports	Equipment and System Tests	PDF files	TBD
Maintenance Charts	Maintenance charts including maintenance frequency checklists, maintenance summary, lamp replacement data sheet, equipment data sheets, recommended maintenance and service contacts, and recommended work order form.	PDF files	TBD
Start-Up, Shut Down and Operating Procedures	Controls/Startup/Shutdown/Emergency Over-Ride/Seasonal Changeover: Include equipment configurations for each mode of operation	PDF files	TBD
Equipment Troubleshooting Problems & Solutions Info	Controls/Startup/Shutdown/Emergency Over-Ride/Seasonal Changeover: Include equipment configurations for each mode of operation	PDF files	TBD
Installation Guides	For Equipment or Component Parts of Equipment put into service during construction.	PDF files	TBD
Preventive Maintenance	Equipment and System-level table guide maintenance, via fault tree analysis, in a sequential, step-by-step isolation of a system problem to identify faulty equipment. Typical malfunctions, tests or inspections, and corrective actions or recommendations to correct malfunctions are included	PDF files	TBD
Warranty & Bond Documents	For Systems, Equipment or Component Parts of Equipment put into service during construction.	PDF files	TBD
Safety Data	Safety hazards commonly associated with the operation of system/equipment applicable to the facility	PDF files	TBD

Exhibit 7- Revit Shared Parameters Files

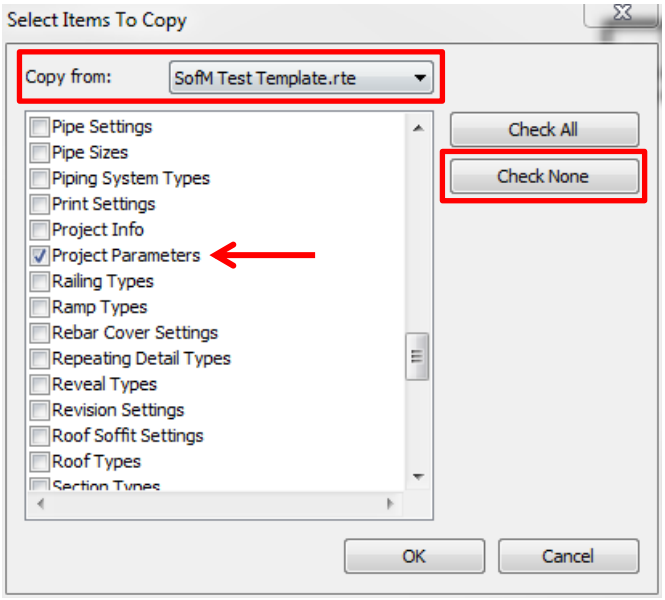
- This is an electronic file named *UNCC ARCHIBUS Shared Parameters File Template*.
- Use this Revit .rte file to transfer Project Standards from the Template File to the Revit Design Models, both Revit Architecture & MEP.
- This will create the Instance Parameter fields for metadata requested by the the University of North Carolina Charlotte for Rooms & Equipment .
- Author the requested information into these fields.

Process:

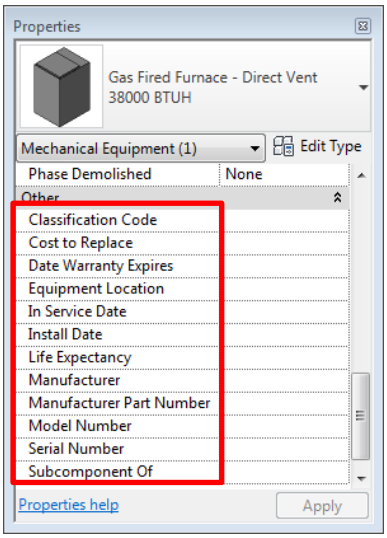
1. Open the *State of Minnesota ARCHIBUS Shared Parameters File Template* while also having one of the MEP files listed above open.
2. Using the model file as the active and open window, go the 'Mange' tab and select 'Transfer Project Standards'.



3. The following 'Select Items to Copy' window will pop up. In the 'Copy from:' drop down select the *State of Minnesota ARCHIBUS Shared Parameters File Template*.
4. Then select the 'Check None' button to deselect all the checked items in the window.
5. Find the 'Project Parameters' field and re-select it.
6. Then click the 'OK' button.



Transfer of Shared Parameters from the Template file to the active model



7. At the Instance Level in Revit you will now find these Shared Parameters for MEP Equipment on the project so that metadata required by the State of Minnesota can be authored into these fields.