University of California San Francisco
Precision Cancer Medicine Building at Mission Bay

Building Information Modeling
Project Execution Plan

Mar 30, 2017

This document is intended only for the participants of the UCSF Precision Cancer Medicine Building at Mission Bay project and the BIM Team members described herein. Use of this document without written authorization from Rudolph and Sletten, Inc., and the University of California San Francisco Medical Center, is prohibited.

RUDOLPH AND SLETTEN
GENERAL AND ENGINEERING CONTRACTORS

Table Contents

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1. Introduction

1. The intent of this document is to share Building Information Modeling (BIM) standards, practices and implementation with internal and external project team members for the UCSF Precision Cancer Medicine Building. The BIM Execution Plan establishes standards and procedures that all shall be adhered to by all BIM team members to support consistent methods and approaches to modeling this project.
2. The BIM Execution Plan is intended to provide the framework to enable the project team to successfully implement BIM tools, techniques and best practices in the most efficient and effective manner. The BIM uses are the foundation of this effort and the purpose of this document is to ensure that all parties are clearly aware of the opportunities, roles and responsibilities associated with the implementation of BIM into the project workflow.
3. In order to achieve that success, UCSF, Rudolph and Sletten, Inc. and the extended Project Team will use the model to develop a digital representation of the physical characteristics of the project. The mutual goals of BIM implementation are to clearly convey the following:

    1.3.1. Assist in design exploration and visualization for the team during design phase
    1.3.2. Coordinate between disciplines during design phase
    1.3.3. Enhance Project Team collaboration
    1.3.4. Improve the quality of construction trade coordination
    1.3.5. Facilitate efficient communication and field construction activities
    1.3.6. As-Built model integration with programs used by Space Management and Facilities.
    1.3.7. Provide as-built documentations that will reflect as-built conditions

4. The 3D model(s) developed for this project will be utilized for multiple purposes including design, documentation, building spatial coordination, clash detection and change management. The trades under Rudolph and Sletten, Inc. will further develop the construction model by coordinating their respective systems in a 3D environment utilizing Autodesk BIM 360 Glue. The resulting coordinated construction model will then be used to develop coordinated 2D drawings for design team review, approval and subsequent trade fabrication and installation. Rudolph and Sletten, Inc. will also analyze the resulting media to perform cost analysis, scheduling, and constructability reviews throughout the project lifecycle. The University of California San Francisco Medical Center will use the as-built model for work order model maintenance.

2. Project Information

1. The BIM Project Execution Plan defines uses for BIM on the project (e.g. design authoring, cost estimating, and design coordination), along with a detailed description of the process for executing BIM throughout the project lifecycle.

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2. The project called UCSF Precision Cancer Medicine Building will be located in Mission Bay San Francisco, California.

2.2.1. FACILITY OWNER: UCSF Medical Center
2.2.2. PROJECT NAME: UCSF Precision Cancer Medicine Building (PCMB)
2.2.3. PROJECT LOCATION: Mission Bay San Francisco, California.
2.2.4. CONTRACT TYPE/DELIVERY METHOD: Design Build
2.2.5. FACILITY TYPE:
2.2.6. BRIEF PROJECT DESCRIPTION: Precision Cancer Medicine Building (PCMB) includes cancer specialty clinics, infusion center, radiation oncology therapy, pharmacy, MRI, LINAC, and laboratory. The building will be six (6) stories and approximately 170,000 GSF. The building will be physically connected to the existing UCSF Ron Conway Family Medical Building. The PCMB utilities will be partly fed from the existing Energy Center, which is under OSHPD jurisdiction.

3. **SECTION A: KEY PROJECT CONTACTS**

RESPONSIBLE PARTIES	FIRM	NAME	ROLE	E_MAIL	PHONE
Owner	UCSF	Fred Whitney	Project Manager	Fred.whitney@ucsf.edu	C: 415-286-6206
Owner	UCSF	Bruce Mace	Facilities Director	Bruce.Mace@ucsf.edu	D: 415-353-7109
Owner	UCSF	Jhoric DeGuzman	Facilities	Jhoric.DeGuzman@ucsf.edu	D: 415-353-1129
Owner	UCSF	Dee Fortune	Facilities BIM Manager	Elizabeth.Fortune@ucsf.edu	C: 415-203-3458
Owner	UCSF	Cliff Massey	Facilities Engineer	Cliff.Massey@ucsf.edu	
Architect	Stantec	Ian Lawler	Project Manager	Ian.lawlor@stantec.com	D: 415-281-5523 C: 415-846-5120
Architect	Stantec	Victor Fong	BIM Manager	victor.fong@stantec.com	D: 415-241-5092
Architect	Stantec	Luis Buenfil	BIM Manager	luis.buenfil@stantec.com	D: 415-882-9500
Structure Consultant	Rutherford + Chekene	Helen Fehr	Project Principal	hfehr@ruthchek.com	D: 415-568-4415
Structure Consultant	Rutherford + Chekene	Francisco Parisi	Project Manager	fparisi@ruthchek.com	D: 415-568-4461
Structure Consultant	Rutherford + Chekene	Amarendra Prasad	Structural Analyst	aprasad@ruthchek.com	D: 415-568-4478
Equipment Consultant	CallisonRTKL	Alan Bergfield	Associate	Alan.Bergfield@callisonrtkl.com	D: 214-468-7548
General Contractor	R&S	Ernie Duran	Project Manager	Ernie.Duran@rsconst.com	C: 408-593-4550
General Contractor	R&S	Bob Johnston	Sr. Superintendent	Bob.Johnston@rsconst.com	C: 916-257-4417
General Contractor	R&S	John Ryan	Project Engineer	John.Ryan@rsconst.com	C: 408-472-1329
General Contractor	R&S	Patrick Krzyzosiak	VDC/BIM Director	Patrick_Krzyzosiak@rsconst.com	D: 650-216-3694 C: 510-524-6893
General Contractor	R&S	Ryan Shilling	BIM Manager	Ryan_shilling@rsconst.com	D: 650-216-3679 C: 559-862-9077
General Contractor	R&S	Jerrud Davis	BIM Coordinator	Jerrud.Davis@rsconst.com	D: 949-223-6844

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General Contractor	R&S	Sean Batzer	Sr. MEP Coordinator	Sean_Batzer@rsconst.com	C: 707-592-7596
General Contractor	R&S	Consuelo Mosberger	MEP Coordinator	Conseulo_Mosberger@rscosnt.com	C: 408-590-4168
Structural Lead					
Fire Protection Lead	Cosco Fire	Darren Tavares	Designer	dtavares@coscofire.com	925-580-1977
Mechanical & Plumbing	Southland Ind.	Ryan Bruggeman	Project Manager	RBruggeman@southlandind.com	D:510-828-0589
Mechanical	Southland Ind.	Joe Sroufe	Lead Detailer	JSroufe@southlandind.com	D:510-376-3202
Plumbing	Southland Ind.	Dave Amason	Lead Detailer	damason@southlandind.com	D:510-299-4315
Electrical	Cupertino	Travis McCray	Project Manager	Travis_McCray@cei.com	D: 415-716-5088
Electrical	Cupertino	Donald Interdonato	BIM Manager	Donald_Interdonato@cei.com	D:408-808-8078 C:408-816-6232
Electrical	Cupertino	Chris Alexander	BIM Production Manager	Chris_Alexander@cei.com	C:408-640-1489
Electrical	Silverman & Light	Greg Meurer	Designer	gregm@silvermanlight.com	C:510-655-1200
A/V					
Controls					
Cold Steel Framing & Drywall Lead					

4. **SECTION B: PROJECT SCHEDULE**

2.4.1. Refer to appendix I for BIM schedule and milestones.

5. **SECTION C: BIM ORGANIZATIONAL ROLES / STAFFING**

CONSTRUCTION PHASE BIM USE	ORGANIZATION	LOCATION(S)	LEAD CONTACT
MANAGE CONSTRUCTION 3D COORDINATION/Model Management	R&S	R&S /Co-location/BIM 360 Glue/ Go-To Meeting	Rudolph & Sletten, Inc.
INDEPENDENT CONSTRUCTION 3D COORDINATION	Lead Detailer/Modeler for each trade	On-site Colocation	Key Trades
MERGED MODEL	R&S	R&S Redwood City, CA	Rudolph & Sletten, Inc.
MODELING	Each Individual Trade	By Trades	Key Trades

6. **SECTION D: COLLABORATION ACTIVITIES**

2.6.1. The success of a BIM project delivery process is highly dependent upon the level at

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which the entire project team can communicate, collaborate and work collectively throughout the duration of the project. Cloud-based collaboration is a recommended strategy for effectively managing this BIM Process. Weekly meetings will occur to review the project's challenges and result in resolution of conflicts in the model. *Please refer to Appendix H – BIM 360 Glue*

2.6.2. A file sharing site (ex: info Exchange, etc..) will be established specifically for the Project and discussed between UCSF and R&S. In addition, Rudolph and Sletten (R&S) is hosting the design and construction coordination using Autodesk BIM 360 Glue. BIM 360 Glue is a cloud-based collaboration platform that will store models from all project participants (Architect, Engineers, consultants, GC, and subcontractors and the University) for securely exchanging BIM project files and data across companies. These models will be accessible to authorized team members for individual coordination purposes on a trade by trade basis.

ACTIVITY TYPE	REQUIRED PER CONTRACT	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
BIM EXECUTION PLAN	YES	Conceptual	ONCE	UCSF/ R&S	On-Site Coordination
DESIGN COORDINATION	YES	Design Development /Construction Design	BI-WEEKLY	Stantec/R&S	On-Site Coordination
DESIGN REVIEW	YES	Design Development /Construction Design	BI-WEEKLY	UCSF/Stantec/R&S	On-Site Coordination
5D COST ESTIMATING (as necessary)	YES	Design Development /Construction Design	SD/DD/CD	R&S	On-Site Coordination
3D CONSTRUCTION COORDINATION	YES	Construction Phase	Daily/Weekly	UCSF/Stantec/ R&S/ Trades	On-Site Coordination
CONSTRUCTION MODEL	YES	Construction Phase	Daily/Weekly	R&S/ Trades	On-Site Coordination
CLOSE-OUT	YES	FINAL	ONCE	UCSF/Stantec/R&S/ Trades	On-Site Coordination

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7. **SECTION E: PROJECT DELIVERABLES:** Include PDF's with all deliverables.

BIM SUBMITTAL ITEM	PHASE	FORMAT(S)	RESPONSIBLE PARTIES	NOTES
BIM Execution Plan (BEP)	Preconstruction	.Docx//PDF	UCSF/R&S/AOR	
BEP Review		.Docx//PDF	UCSF/R&S/AOR	
Schematic Design (SD) model	SD	.RVT/Glue	AOR/EOR/DB	Serves as a tool to evaluate alternatives communicate scope and aid in prototyping the built environment. The current Revit model .rvt will be uploaded to the collaboration site at the conclusion of the BD phase.
Design Development model for review	DD	.RVT/Glue	AOR/EOR/DB	Serves as a tool to evaluate alternatives communicate scope and aid in prototyping the built environment. The current Revit model .rvt will be uploaded to the collaboration site at the conclusion of the DD phase.
Coordinated MEP&F Models	DD/CD	.RVT/Glue	DB /Trades	Accurate representation with shop drawings contains the elements used for fabrication and asset data.
Coordinated Structural Models	DD/CD	.RVT/Glue	EOR	Accurate representation with shop drawings contains the elements used for fabrication and asset data.
Contractor Coordinated Signoff Models	Construction	.RVT/.NWD/ Glue	R&S/ DB /Trades	By levels
As-Constructed Models	Close-out	.RVT/NWD/ Glue	DB /Trades	Reflect the As-Built conditions
As-built Architectural Model	Close-out	.RVT/Glue	AOR	Actual dimensions
As-built MEPF Models	Close-out	.DWG, RVT, NWD, Glue, NWF	DB/Trades	Accurate representation with shop drawings and contains the elements used for fabrication
Construction Model	Construction	Glue/NWD	AOR/EOR/DB /Trades	Accurate representation with shop drawings contains the elements used for fabrication and asset data.
RECORD DOCUMENTS	Close-out	.DWG	AOR/EOR/DB	Coordinated 2D shop drawings, As-Built record documents.
RECORD MODEL	Close-out	DWG, RVT, NWD, Glue	AOR/EOR/DB	See Record model information exchange to ensure that proper information is contained in this model
Equipment ID Tagging	Construction	RVT	MEP&F Trades	Assign ID numbers to all equipment included in the excel spreadsheet per owner requirement.

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Asset Management	Construction	RVT	MEP&F Trades	All reviewed submittals will be uploaded to the file transfer site by the GC using UCSF naming convention
LOD 500 information entry	Construction	RVT	MEP&F Trades	Enter equipment asset data referenced by identification number into the model parameters and per excel spreadsheet owner requirement
Facilities Management	Closeout	RVT	MEP&F Trades	Final LOD 500 model(s) to include information required in Model parameters.

3. QUALITY CONTROL

1. **Overall Strategy for Quality Control**
   - 3.1.1. The models to be issued will be reviewed by the Discipline BIM Coordinator and BIM Manager.
   - 3.1.2. Should this review process identify too many issues the files will be rejected. Should the coordination exercise proceed with accepted identified issues, the files will be published and identified with the clash detection.
   - 3.1.3. The models published in the agreed formats will then be combined into a federated model in BIM 360 Glue / Navisworks and reviewed by the Lead Consultants BIM Manager. Should this review process identify too many issues the files will be rejected.
2. **Quality Control Checks:** The following checks will be performed on a regular basis and as a minimum prior to any file exchange to assure adherence to the quality goals of the project. Before any submittal, the Discipline BIM Coordinator will coordinate relevant checks to be carried out and will check that no unreasonable issues exist in any file which is published. This check has to include the Quality Control Checks below.
   - 3.2.1. **Visual Check**

     The following potential issues will be captured through visual checks of the models and be resolved before any model publication:
     1. Missing Objects.
     2. Object in wrong place / objects outside building footprint as placeholders for use elsewhere or later on.
     3. Remove all non-required sheets, views (except original floor level views), legends, schedules (except splash page), temporary/unused sections, renders and images.
     4. Remove unused links.
     5. Model lines must be hidden in 3D views to avoid unnecessary conflicts.
     6. Unload all required linked files.
     7. Workset review will be mandatory before each update.
     8. Check object data for population of appropriate parameters.

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9. Check all model objects are exported to necessary file format.
10. Ensure all exporter settings are correct and universally applied.
11. Ensure project base and survey point are located correctly. See sections modeling requirements (page 10) and Modeling Standards - Project Origin.
12. Ensure model objects are assigned to the correct category/assembly.
13. Review federated model clashes and assign tasks to design consultants based upon responsibility for change moving forward through the use of Glue.
14. Overall model compliance check in accordance with the design.
15. Overall model review based on UCSF BIM requirements and detailed rule sets.
16. See Coordination Checklist.

3. **Interference check:** The interference check determines the following issues which will be resolved before construction commences. *Refer to Appendix H – BIM 360 Glue for more information*
   - 3.3.1. Undeclared overlapping objects (objects which have to overlap for modeling purpose have to be declared by the Discipline BIM Coordinator or BIM Manager).
   - 3.3.2. Location of objects within agreed clash tolerances and impeding within other discipline zones.
   - 3.3.3. Model objects within the same zone as others, object duplication.
   - 3.3.4. Clash Detection
   - 3.3.5. The software will analyze the BIM for physical interferences (clashes) between building systems and components. Construction level clash detection results in a reduction of field conflict, RFI's, and change orders. Coordination with off-site prefabricated components is improved. Construction helps avoid budget and schedule conflicts
   - 3.3.6. Clearance Checking
     1. It is accomplished by adding a clearance element, on a separate layer to the model that requires a clearance. Modeling and clashing equipment clearances help identify access, installation and code related clearances for facilities management and maintenance.
     2. This mass will have a unique name and a transparent material.
   - 3.3.7. Clash Resolution
     1. Conflicts found during clash detection need to be resolved within the fabrication BIM authoring platform in order to be incorporated into shop drawings. Virtually solving the issue ahead of time avoids costly errors and revisions as well as schedule impacts and occupancy delays.
4. **Standard Check:** the list of issues below should be checked:
   - 3.4.1. Naming standards are in compliance with Design Coordination Procedure Outline, page 13.
   - 3.4.2. Status and Revisions updated on each sheet.
   - 3.4.3. CSI Master format coding

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1. Assuring the object is accurately recorded to match its CSI code.

3.4.4. Modeling standards
3.4.5. LOD Compliance
3.4.6. Document numbering

5. **Model Maintenance:** Regular project maintenance in line with the BIM Standards for quality assurance and control on the Revit files is required. Before publishing any file, the following should be done to achieve compliance:
   3.5.1. All users to "Save to Central" relinquishing all editing rights.
   3.5.2. Models to be purged (repeat process three times as materials are only removed after the parent object has been removed)
   3.5.3. Review warning messages
   3.5.4. Remove unwanted design options
   3.5.5. Remove unused links
   3.5.6. Unload all required linked files (it is acceptable if they are not unloaded as long as the model links on a workset for linked models.)
   3.5.7. All model elements should be on an appropriate workset.
   3.5.8. Check object data for population of appropriate parameters. *refer to 11.2.11.2 for more information.*
   3.5.9. Check all model objects are exported to necessary file format.
   3.5.10. Ensure all exporter setting are correct and applied universally
   3.5.11. Ensure project base and survey point are located correctly
   3.5.12. Ensure model objects are assigned to correct Assembly code (Default within Autodesk Standard)
   3.5.13. Review federated model clashes and assign tasks to design consultants based upon responsibility for change moving forward
   3.5.14. Overall model compliance check in accordance with the design

CHECKS	DESCRIPTION	RESPONSIBLE PARTIES	SOFTWARE PROGRAM(	FREQUENCY
VISUAL CHECK	All participants are to ensure there are no unintended model components and the design intent has been followed. Ensure BIM requirements have been implemented.	ALL	BIM 360 Glue Native Model	Daily
INTERFERENCE CHECK	R&S to use BIM 360 Glue to create a clash report based on hard clashes and soft clashed based on construction and material clearances. Ensure BIM requirements have been implemented.	ALL	Bim 360 Glue	At Every Submittal

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REVISION AUTHORITY CHECK	BIM models for viewing will be provided on a shared site BIM 360 Glue. BIM models for production will be modified by BIM modelers and BIM managers.	All	All	AT EVERY SUBMITTAL
FIELD TRACKING	BIM models for viewing will be provided through BIM 360 Glue and Field	R&S	BIM 360 Glue / Navisworks	Monthly

4. Design Development Model Management

1. Modeling Manager Responsibilities (Stantec & R&S)
   - 4.1.1. Ensure that modeling requirements and Level of Detail and Development guidelines are being adhered.
   - 4.1.2. Collect and log incoming Models
   - 4.1.3. Validate that files are complete and usable and in compliance with applicable protocols.
   - 4.1.4. Maintain record copy of each file received
   - 4.1.5. Modeling Manager is not responsible for checking models created by others for accuracy. This is the responsibility of the model "Owner"
   - 4.1.6. Coordinate submission and exchange of models
   - 4.1.7. Manage collaborative sessions with/in the models
   - 4.1.8. Perform clash detection in accordance with established protocols and issue periodic clash detection
   - 4.1.9. Compile information from the smaller models of other project members and disseminate in a useful form to other team members

5. Design Development Modeling Guidelines

1. General Requirements
   - 5.1.1. Software Version - All disciplines shall use the Autodesk Revit 2016 platform during Design Development. The project team may elect to upgrade to Revit 2017 at later date during the project.
   - 5.1.2. Origin Point - All models must be in the correct location in 3D space (x,y,z). These coordinates will be set by Stantec and distributed to all Consultants for their use. This includes correct floor elevation (s). The correct insertion point is crucial and ensures that each model will align properly for the master aggregate Model without modification.
   - 5.1.3. Tolerances - Model (s) and Model Elements must be within 1/8" of theoretical dimensions. Tolerances for specific items and systems will be discussed as necessary. Model tolerances are not to be construed as construction tolerances.
   - 5.1.4. Units – imperial units. 1unit in the model equal 0'-1"
   - 5.1.5. Scale – BIM /3D Models need to be correct scale and units. 1unit in the model equal 0'-1"
   - 5.1.6. Recommendations – Geometry from CAD applications such as AutoCAD shall not be imported into the model. Any background information required for coordination

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coming from AutoCAD shall be linked on the proper workset. This link is to be removed from the project as soon as coordination is confirmed. Images files shall not be imported or linked into the model to represent geometry. Revit Warnings should be kept to a minimum (no more than 50 at end of each week per model.

2. VDC/BIM Design Team Meeting
   - 5.2.1. Rudolph and Sletten will hold a VDC/BIM introduction meeting to establish the BIM procedures and organization and setups for all members of the design team. Topics to be included but not limited to:
     1. BIM Execution Plan, LOD
     2. Critical path milestones
     3. Version and Build of Revit to be used
     4. Revit uses for each team
     5. General Requirements / Deliverables
     6. Spatial coordination
     7. Shared Models and areas of responsibilities
     8. Team responsibilities (BIM Manager...)
     9. File Divisions /Organization
     10. Expected Model uses
     11. Procedures for updates. Coordination and communication (BIM 360 Glue, Navis, Bluebeam…)
3. Modeling Requirements
   - 5.3.1. Building model (in plan) shall extend five feet beyond the exterior wall, columns or exit stairs of the building being modeled.
   - 5.3.2. Existing utilities being installed in, or extended, in Ron Conway Outpatient Building and Energy Center, which are directly related to PCMB project, shall be modeled utilizing existing models, provided by UCSF.
   - 5.3.3. On the Z axis, the model shall extend from the lowest extend of the foundations or lowest underground utility up through (and including) the roof of the top most floor or highest overhead utility or adjacent structure.
   - 5.3.4. Modeling existing conditions when directly adjacent to new construction will be determined.
4. Level of Development
   - 5.4.1. Rudolph and Sletten will determine the minimum level of development require for practical uses for design and construction.
   - 5.4.2. See Attachment #1 for level of development (LOD) matrix.
   - 5.4.3. General: The following stipulations must be included in each Model Systems:
     1. Architectural
        - A. All Beams and Columns must be linked in Revit from Structural
        - B. All exterior walls, doors, windows, steps, railings, and roofs will be modeled with the correct type and family.
        - C. All interior walls, partitions, including non-rated walls separating room will be modeled with appropriate metadata. Including:
          - 5.4.3.1.C.1 Fire rating
          - 5.4.3.1.C.2 Sound rating
          - 5.4.3.1.C.3 Occupancy separation
        - D. All walls height to be modeled to correct height as shown in the drawings.
        - E. Sloped floors of 1” or greater must be modeled.

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F. Structural floor slabs and finish floors will be modeled separately.
G. Thickened slabs at slab depressions to be modeled
H. Slab on Grade (SOG) and architectural relevant retaining walls shall be modeled
I. Interior doors and windows will be modeled to the extent that the walls that they are associated with are included in the model.
J. All interior ceiling and soffits will be modeled as the overall thickness including elevation changes and termination points. Overall thickness to be determined by their actual total composite assemblies.
K. All soffit framing should be modeled to bottom of deck
L. Walls with tile finish will include the nominal thickness of the tile and its specified setting bed as part of the total composite assembly and overall wall assembly. Tile height will be modeled accurately.
M. Doors, window leaves and frames will be modeled. Door and window hardware will not be modeled but should be added to metadata.
N. Overall extent stairs will be modeled including railings.
O. Light fixtures will be modeled to the overall height, with, depth and access to any interstitial space.
P. Elevator shaft clear space will be modeled to the worst case clear with, depth and height only from possible vendors: elevator cabs, equipment, others will not be modeled. Nominal elevator cab size, pits and overrun shall be modeled including hoist beam.
Q. Casework will be modeled with sufficient detail to appear in 2D Drawings and to communicate with consultants and trades for cost estimation and coordination.
R. Plumbing fixtures shall be modeled as 3D elements that appear correctly in 2D representation as well as 3D for coordination purposes in Navisworks / and or BIM 360 Glue environment.
S. All items that have room number attributes shall have fields for two room numbers to be updated post occupancy.

2. Civil

A. Grading contours shall be model to within 10 feet of the building perimeter based on civil design to coordinate architectural and underground elements. For coordination purposes, Site Civil, Structural, Electrical, Mechanical, and landscape System models shall include all elements designed by the corresponding Engineer of Record for the project as it relates to each respective site scope of work. Elements shall be modeled as necessary for the BIM deliverables.

3. Structural

A. All Beams and Columns will be copy monitored in Revit for Architecture for design coordination.
B. All Primary and secondary structural steel members will be modeled, including standard steel member sizes, gusset plates, braces, kickers and any other large steel elements that could impact Architectural or coordination with other trades.
C. Metal, Wood, and concrete decks shall be modeled as the overall thickness of the slab. Ribs/flutes in metal decks will not be modeled.

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D. Miscellaneous metals such as elevator hoist beams, rails, and intermediate rail support steel for elevator will be modeled. Any other miscellaneous metals will be modeled including equipment supports above ceiling that could impact Architectural and coordination with other trades.
E. Mark for beam type shall be populated
F. Include all penetrations and openings identified in the construction documents.
G. Architectural team will model stairs. Structural team will provide sizes of main elements such as stringers, edge of landing members and other supports as required for Architectural team to include in model for design, estimation and coordination purposes.

6. Design Development Coordination Procedure Outline

1. Architectural Design team (Stantec), Structural Consultant, MEP&FP consultants will create a BIM model for this project and produce Construction Documents using Revit 2016. The Revit files shall be 100% Revit and shall not contain any imported AutoCad and limited number of linked AutoCad files for reference.
2. Revit model transmitted shall be named per the following format:
   Date_Phase_Project_Building_Revit Version_Discipline. Extension.
   6.2.1. Example: 20160719_SD_PCMB_B1_Arch.rvt

7. Design Development Model Management

1. Design consultants shall provide updates /maintenance of digital data / 3D models throughout construction to reflect changes design which include:
   7.1.1. Incorporation of RFI

8. Design Development Coordination

1. Spatial design coordination will be managed between by the Prime Architect as it relates to Architecture, Structure, Mechanical, Electrical, Plumbing fire protection during design model phase.

9. Design Development Model Updates

1. The Design Team will continue to develop and update the architectural design models throughout the entire construction process. For any design changes that have a direct and immediate effect on construction coordination, the Architect must update and re-upload their design models to the designated server within 3 work days. This include:
   9.1.1. Any ASI, MSI,SSI or any other question or RFI that is answered by the Design Team that requires a design change.
   9.1.2. A change order that affects construction coordination.
2. The Design Team shall publish a monthly bulletin summarizing all questions, resolutions and model changes/updates and all decisions for design or for value engineering that have been

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made and will post the bulletins to the server as a non-editable file along with the updated models.

3. The Structural Engineer is required to continue to update the design model in parallel with the steel fabricator or until the fabrication model has reached a sufficient level of development for construction coordination. The Designer's structural model may be the only model used throughout design and construction.

10. Construction Roles and Responsibilities

1. **Roles**

10.1.1. **BIM Manager:** BIM Manager for Rudolph and Sletten, Inc.

1. Management and implementation of the BIM Coordination process.
2. Administer access to BIM and the tools used to facilitate the coordination process.
3. Identify major coordination issues through the use of clash detection.
4. Provide markups of the model within the coordination tool.
5. Facilitate team in resolving issues by offering solutions to conflicts.
6. Assist the team with clashes that could not be resolved in trade-to-trade coordination.
7. Create sign-off files and narratives.
8. Provide extensive support as it relates to software and workflow.

10.1.2. **Trade Coordinator:** Each trade shall have a lead contact and decision maker who will be required to attend coordination meetings.

1. Make decisions for movements in coordination to resolve clashes.
2. Verify that components are modeled to the correct Level of Detail (LOD) and match submittal data.
3. Run independent clash detection within the collaborative software chosen by Rudolph and Sletten, Inc. after each daily update.
4. Create markups to be reviewed during coordination meetings, and communicate with other trades in an attempt to resolve the markups.
5. Evaluate constructability, sequencing, installation requirements, and means and methods of systems that are considered and incorporated in the model effort during coordination.
6. Ultimately responsible for making sure models are being uploaded on time and are complete.
7. Ensure uploads are completed on time, as requested by BIM Manager.
8. Provide shop drawings for sign off of each phase of BIM.
9. Provide equipment submittals and/or cut sheets when requested.
10. Ensure that the standards listed in this document are met before each upload.

10.1.3. **Trade Modeler:** Main modeler for each respective trade (responsibilities may be merged with Trade Coordinator).

1. Modeling of trade systems and components.
2. Required to attend coordination meetings as needed.
3. Coordinate adjustments to the model to resolve clashes.
4. Upload models daily and when requested by BIM Manager or Trade Coordinator
5. Provide quality control of responsible models to be used in BIM.

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11. Construction Models and Development

This BIM is known as the "Construction Model". It includes models provided by of the AOR and subcontractors, which will be managed and kept current by Rudolph and Sletten Inc. through the lifecycle of the project with all resolved constructability issues, Change Orders and RFI's for the record set. The construction models are to be developed with fabrication software. There should not be a conversion process from design to fabrication unless agreed upon with Rudolph and Sletten Inc. This is to avoid problems with the conversion as well as identify constructability issues within the design during the population process of each model.

1. **Naming Convention**

11.1.1. File Naming

1. Typical Syntax (for projects with one package of contract documents): *ProjectName-Discipline-Level.filetype*

A. All caps, single dashes, no underscores, no spaces, no dates, no project numbers.

B. The internal file name is the same name uploaded to BIM 360 Glue. Refer to Appendix H - BIM 360 Glue.

2. *Example PCMB-PL-L1=PCMB – Plumbing – Level 1*

11.1.2. Layer or Workset Naming

1. Layers should be descriptive of the elements they contain:

A. For Example: PL-DCW-Valves = Plumbing – Domestic Cold Water – Valves

B. For Example: PL-DCW-Valves-Clear = Plumbing – Domestic Cold Water – Valves – Clearances

11.1.3. Object naming

1. Any element or component name within a model shall reflect the component or system installed
2. For Example: A block modeled to represent an AHU should have the AHU number associated with it in the naming convention (AHU1).

2. **Modeling Standards**

11.2.1. Project Origin

1. The civil Engineer will provide Control Points to be used by the Design team as a reference for developing the project gridlines and setting the survey point and base point in Revit for the project.
2. The project origin (X,Y,Z) will be defined in the Architectural Model. Usually, this will be located at one corner of the property line boundary.
3. It is the Architect responsibility to verify the accuracy of the coordinates and to provide a grid intersection at 0,0,0 for all other team members.

11.2.2. Worksets / Layers

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1. All Revit models will be “shared projects” (worksets enabled).
2. An existing model shall be an exception to this standard.

11.2.3. **Levels & Grids**

1. All Levels and Grids must be “Copy-Monitored” from the architectural model, and remain “Monitored” throughout the project.
2. All Levels and Grids must be located on the “Shared Levels and Grids” workset / layers. This allows other project participants to easily hide the grids from linked models.

11.2.4. **Model Sharing**

1. Tool

A. The project will be using BIM 360 Glue to facilitate and coordinate the models produced.

B. BIM 360 Glue will host all of the most current and design models from each participating discipline.

2. Folder Structure and models

A. See appendix “A” for file folder structure

B. The naming of the models uploaded to the corresponding discipline folder shall stay consistent

C. The location shall be verified after each upload. See appendix “H” for upload workflow

11.2.5. **Reference Levels**

1. All objects should be placed on the correct reference level or floor level
2. If objects are elevated above reference levels, they should be referenced from the proper elevation callout. This ensures proper collaboration and integration of the BIM with the project team and their respected software.

11.2.6. **Object Heights**

1. All objects modeled should fall within the proper reference levels. For example walls, both exterior and interior functioning should be modeled to begin at floor height and continue only to the elevation reference line directly above.

11.2.7. **DO NOT MODEL OBJECTS TWICE**

1. One exception may be when a vertical pipe is passing floor to floor, it is beneficial to verify that the location below matches the location above

11.2.8. **Analytical Objects**

1. All referenced objects that do not pertain to the model it is located within should be excluded from uploads
2. Use Xref’s or links to eliminate having to clean the model at every point of upload

11.2.9. **Purging Models**

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1. When uploading or sharing a model, there should not be any of the following:

A. floating objects

B. objects that do not pertain to the model

C. layers that do not contain any components

11.2.10. **Object Types**

1. Floors

A. All floors should be modeled at the right reference plane to ensure proper dimensioning and takeoff.

B. Shafts and vertical opening should be used to cut voids through horizontal planes. Editing the face of each wall should be discouraged unless reasoning dictates the cut should be made.

C. Floor thickness should reflect the slab and deck total thickness

2. Walls

A. Types

11.2.10.2.A.1 Basic Walls - used to define architecture scope of interior and exterior walls. Structural Walls - used by the structural team to define shear walls and structural bearing walls.

11.2.10.2.A.2 Curtain Wall Systems - exterior wall systems used to define assemblies that extend in heights above 9’-0”.

11.2.10.2.A.3 Exterior Glazed Wall Systems - glass wall assembly systems

11.2.10.2.A.4 Storefront Systems - glass wall assembly systems that are between 7’-0” to 9’-0”.

11.2.10.2.A.5 Window Systems – glass window assembly systems that are between 7’-0” or less.

11.2.10.2.A.6 Fire Rated Walls – used to define the fire barrier within the wall

11.2.10.2.A.7 Shaft Walls – Used to define the shaft wall condition

11.2.10.2.A.8 By choosing the proper wall type, the team can ensure that all assembly codes and data information attached to each object will be correct.

11.2.10.2.A.9 All objects modeled should fall within the proper reference levels. Walls, both exterior and interior functioning, should be modeled to begin at floor height and continue only to the elevation reference line directly above.

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11.2.10.2.A.10 Wall and Openings by Face should be utilized to cut voids through the vertical faces of wall assemblies. An “edit profile” command can be used if necessary, or if the “Wall Openings” and “Openings by Face” commands cannot create the desired object effect.

B. Object Description vs. Modeling/Drawings

C. All descriptions given to the object must match the objects parameters/ data

D. Example: a description of a column footing will say “F7” to indicate a 7’-0” x 7’-0” x 3’-6” footing; the footing must be drawn/modeled to the description. This will ensure that all objects are correct in the BIM and be able to help the project team coordinate other systems that may run close to said objects.

E. Example: a description of a partition wall that terminates 6” above the ceiling plane. The wall should be drawn to terminate above the ceiling plane (wall height will be determined by Design Project Team).

11.2.11. **Object Information Input**

1. Object Function

A. Choose the function of the wall from the following categories using Uniformed codes: Interior

11.2.11.1.A.1 Exterior

11.2.11.1.A.2 Foundation

11.2.11.1.A.3 Retaining

11.2.11.1.A.4 Core-Shaft

11.2.11.1.A.5 Soffit

B. Choose the proper category for equipment such as

11.2.11.1.B.1 Mechanical Equipment

11.2.11.1.B.2 Electrical Equipment

11.2.11.1.B.3 Fire Protection Equipment

11.2.11.1.B.4 Plumbing Equipment

11.2.11.1.B.5 Plumbing Fixtures

11.2.11.1.B.6 Electrical Fixtures

2. Data Integration

A. At a minimum, all information found on the stamped Record Set of 2D drawings is to be integrated. These fields are to include all information commonly found as (but not limited to): Notes, Schedules*, Type Mark, Description, Detail, Nameplate Data, Key Notes, Sheet Notes, SOO, Specific Nameplate Data.

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11.2.11.2.A.1 Fully Developed Schedules* to include, but not limited to this sample set:

11.2.11.2.A.1.1 Lighting

11.2.11.2.A.1.2 Doors – full detail and ratings, assembly

11.2.11.2.A.1.3 Equipment – nameplate data set

11.2.11.2.A.1.4 Fire Alarm

11.2.11.2.A.1.5 Flow and control diagrams – locations, control points, notes

11.2.11.2.A.1.6 HVAC

11.2.11.2.A.1.7 Plumbing fixture schedule - associated data fields, notes

11.2.11.2.A.1.8 Plumbing systems components schedule DWV – detail, notes

11.2.11.2.A.1.9 Mechanical ventilation compliance CMC – room name, number, type designation, air balance, ACH, exhaust, supply, volume, transfer, ceiling height, balance to corridor, etc.

11.2.11.2.A.1.10 Electrical Distribution

11.2.11.2.A.1.11 Panel schedules – panel full detail, system branch, isolation, service locations, load, feeder, voltage, etc.

11.2.11.2.A.1.12 Partition, Area Separation, and similar Rated Assemblies

B. All equipment (pumps, AHU, FCU, boilers, etc.) must include manufacturer specific information, within the model, and field verified for accurate representation in the model. Refer to LOD matrix Attachment #1 for more information.

C. All systems that are non-accessible must be field verified for location.

D. COBIE Data extraction will be conducted from all models. Refer to attachment #2 BIM2FM Asset Class for the required data parameters to be applied to the associated geometry within the model.

E. All items that have room number attributes shall have place holder for a second room number.

F. Refer to Attachment #4 Sample Model Parameters for a detailed example of what types of parameters will be required within the model.

11.2.12. **Logistics**

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1. All BIM Team members involved in the BIM coordination process shall cooperate and compromise with one another to develop combined solutions that achieve the project's goals and overall design intent.
2. As previously mentioned, the architectural, Structural and MEP design work will be made available with Revit Architecture, Revit Structures, and Revit MEP, respectively, and/or other details provided in 2D format. These backgrounds / models can be utilized by the subcontractors in the 2D and/or 3D environment. These models are the basis of design and will be further detailed by the responsible subcontractors.
3. While populating, each trade should be in conversation with the trades around them.
4. Coordination outside of the BIM meetings will be required for items such as, but not limited to, housekeeping pads, IT equipment, and small conflicts between 2 trades.

11.2.13.**Scheduling**

1. Rudolph and Sletten, Inc. will develop a modeling/Coordination schedule that will align with the overall construction schedule. Participants will be required to maintain this schedule so that the modeling/coordination schedule and the overall construction schedule are maintained. See Appendix "I".

11.2.14.**Coordination Concept**

1. Construction Coordination

A. Clash Detection

11.2.14.1.A.1 Software will analyze the BIM for physical interferences (clashes) between building systems and components. Construction level clash detection results in a reduction of field conflict, RFI's, and change orders. Coordination with off-site prefabricated components is improved. Construction helps avoid budget and schedule conflicts

B. Clearance Checking

11.2.14.1.B.1 It is accomplished by adding a clearance element, on a separate layer, to the model that requires a clearance. Modeling and clashing equipment clearances helps identify access, installation and code related clearances for facilities management and maintenance.

C. Clash Resolution

11.2.14.1.C.1 Conflicts found during clash detection need to be resolved within the fabrication BIM authoring platform in order to be incorporated into shop drawings. Virtually solving the issue ahead of time avoids costly errors and revisions as well as schedule impacts and occupancy delays.

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D. Coordination Sign-Off

11.2.14.1.D.1 After construction coordination is complete, a set of 2D and 3D coordination drawings are to be created within the BIM for construction team sign-off and Design Team (AOR) submittal review.

11.2.15. **Modeling Requirements**

1. **General Requirements**

A. Model clearance requirements - Areas which must remain clear for code or service consideration including but not limited to insulation, monokote, equipment, access clearance around piping or other systems requiring a code specific clearance. All in-wall system equipment and devices to be modeled.

B. Model wall and ceiling access doors where required.

C. Model working area around J-boxes, panels, etc.

D. Model working area around A/V equipment.

E. Model swing area around panel doors.

F. Elevated access zones are to be modeled from the top of the eqp. to the floor below.

G. Pre-fabrication - anything that will be pre-fabricated should be included in the BIM. This will ensure proper spacing and connections.

H. Supports/ seismic braces will be required in the BIM.

I. Model all in wall or surface mounted devices and or equipment

J. Attachment #5 Maximo Class Attribute (Uniformat) Sample for an example of what the expectation for model extracted information entails.

2. **Architectural Model**

A. Wall thickness and height - required for routing main utilities, locating VAV boxes, identifying priority wall framing, wall penetrations, fire stopping.

B. Walls, slabs, Doors, Interior Windows, and signage.

C. Hard ceilings and soffits - required for identifying structural integration and clearances, HVAC diffuser locations, electrical fixture locations, and routing of utilities.

D. Suspended acoustical ceilings - required for identifying structural integration and clearances, HVAC diffuser locations, electrical fixture locations, and routing of utilities.

E. Exterior walls and storefronts - required for identifying the location of rain water leaders.

F. Shaft/Chase walls - required for identifying the correct locations of plumbing vents and HVAC shafts.

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G. Architectural features requiring utilities - required for mechanical routing.

H. Architectural features in mechanical spaces - required for mechanical routing.

3. **Cold Steel Framing Model**

A. Top and bottom track, kickers, and zclips to be used for coordination.

B. Framing/block-outs for MEP trades as needed.

C. Door framing and headers.

D. Head of wall conditions.

E. Any no-fly zones required for installation or representation of an object.

4. **Structural Model**

A. Beams and columns - required for coordinating above ceiling MEP/FP utilities.

B. Braces and gusset plates - required for coordinating above ceiling MEP/FP utilities.

C. Miscellaneous supports - required for coordinating above ceiling MEP/FP utilities.

D. External wall framing connections - required for coordinating with MEP/FP and Architectural trades.

E. Beams penetrations - required for coordinating above ceiling MEP/FP utilities.

F. Decking layout, Bent plates, and deck closures.

G. Base isolators with required clearances and access paths for removal

H. Lateral dampers along with required clearances.

5. **HVAC Model**

A. CAV's/VAV's/Phoenix Valves/FCU's/Humidifiers/AHU's or any other mechanical equipment and the associated access or code related clearance.

B. Valve train components and associated access or code related clearance.

C. Medium pressure duct and SMACNA required reinforcement and supports - required for coordination and routing of other trades.

D. Low-pressure duct and SMACNA required reinforcement and supports - required for coordination and routing of other trades.

E. Shaft locations and supports- required for coordination and routing of other trades and for locating smoke dampers, etc.

F. Fire smoke dampers - required in coordination, especially if walls are also provided in the model.

G. Flex ducts - required for showing how low-pressure ducts connect to the diffusers.

H. Diffuser locations and sizes - required for coordination of finish utilities with the other fixtures in a room (like electrical fixtures, etc.).

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I. SMACNA required reinforcement and supports - Hangers and seismic bracing - required for coordination and routing of other trades and for inserting the deck correctly before installation begins.

J. HVAC piping to VAV and CAV boxes - required for coordination and routing of other trades.

K. All equipment and clearance plus access zones- required for coordination and routing of other trades (can be drawn as 3D blocks with accurate connection points).

L. CAV & VAV Boxes including all access zones required for maintenance.

M. Motors and access to motors/thermal resets, disconnect switches, and Damper access doors.

N. Insulations

O. Structural equipment pads

P. Access zones, no Fly zone (Radiant tubing areas).

Q. Wall and ceiling access doors (access zones shown above and below).

6. **Mechanical Piping**

A. All ½" piping required for building system function

B. All insulation required

C. All equipment and housekeeping pads

D. All Valves

E. High point vents, drains, low point valves, etc.

F. Hangers and seismic bracing - required for coordination and routing of other trades and for inserting the deck correctly before installation begins.

G. Seismic joints and movement clearances

H. Access and clearance zones required

I. Wall and ceiling access doors (access zones shown above and below).

7. **Electrical Model—include under slab electrical and low voltage**

A. All Conduit or bundles of wiring adding up to 1 1/2" in diameter and above are to be modeled. All homerun conduits from panel to homerun junction box will be modeled.

B. Feeder conduit - required for coordination with other trades.

C. Junction boxes associated with modeled devices or conduit homeruns- required for coordination with other trades.

D. Lighting fixtures - required for coordination with other trades and finish utilities like ceiling grid, sprinkler heads, HVAC diffusers and specialty lighting.

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E. Lighting supports and seismic required for architectural lighting that exceeds 20lbs. - required for routing and coordination of other trades.

F. Cable trays and supports - required for coordination with other trades.

G. Trapeze pathways for home runs - required for coordination.

H. Outlets and switch locations in rooms - Architectural model determines locations.

I. Hangers and seismic bracing associated with conduit home runs, large feeder runs, or trapeze pathways- required for coordination with other trades and for inserting the deck.

J. Equipment panels - required for coordinating with wall framing to determine backing, etc.

K. Electrical rooms - required for coordination with wall framing and other trades.

L. Fire alarm devices and equipment only - required for coordination with other trades.

M. Wall devices that could impact in-wall coordination.

N. Structural equipment pads

O. Access zones

P. Wall and ceiling access doors (access zones shown above and below).

8. **Plumbing Model—including under slab plumbing.**

A. All piping ½" and greater along with any valves are to be modeled.

B. Plumbing fixtures including trap primers- required for coordination with other trades.

C. Graded cast iron pipe lines - required for coordination with other trades.

D. Waste and vent lines - required for coordination with other trades and with architectural walls and shafts.

E. Cold and hot water piping including valves- required for coordination with other trades.

F. Medical gas piping and gas mains including valves, ZVB's, headwalls, etc. - required for coordination with other trades.

G. SCW/ICW to associated equipment

H. Hangers and seismic bracing -required for coordination with other trades and for inserting before installation.

I. Boiler and other equipment -required for coordination (can be drawn as 3d blocks with accurate connection points).

J. Specialty piping -required for coordination with other trades.

K. Structural equipment pads

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L. Insulation

M. Access zones

N. Wall and ceiling access doors (access zones shown above and below).

9. **Sprinkler Model**

A. All piping ½" and associated valves or equipment greater are to be modeled.

B. Sprinkler mains and branches - required for coordination with other trades.

C. Sprinkler head drops –required for coordination with finish utilities like electrical lighting, diffusers, etc. Avoid using elements that are non-manipulatable for connection to heads.

D. Sprinkler pipes - required for coordination with other trades.

E. Hangers -required for coordination with other trades.

F. Seismic bracing.

G. Clearance zones.

H. Access zones.

I. Wall and ceiling access doors (access zones shown above and below).

10. **A/V Model**

A. All Conduit or bundles of wiring adding up to 1" in diameter and above are to be modeled

B. Rough-in of ceiling support locations

C. Project light paths - useful to ensure proper viewing of projector image.

D. Cable tray -required if an extra tray is used for A/V.

11. **Controls**

A. Wall mounted panels, terminal cabinets, in-line devices and other equipment including all clearances and access zones

B. All conduit required for coordination

12. **Site Utilities**

A. All systems 3/4" and greater

B. All fittings, valves, reinforcements, manholes, pumps or other eqp.

C. All clearances and access zones

13. **Medical Equipment**

A. All Equipment that may affect the design or dimensions of a room

B. All point of connections

C. Access zones

D. Seismic bracing

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11.2.16.**Coordination Prioritization**

1. The Construction coordination process will not interfere with the construction schedule. This Construction Coordination timing is critical so the team can receive approvals required prior to the first construction deck insert activity.

A. HVAC and Plumbing contractors will need to procure pipe anchor embeds to meet early concrete work as indicated in the schedule.

B. HVAC and Plumbing contractors will need to obtain approval on the seismic joints early in order to model the final locations correctly that correlate with the anchor locations. M&P contractors will drive anchor wall heights depending on routing and seismic joint elevation limitations.

C. Early approvals of major AHU and FCU equipment to ensure model connection points of the approved product and included in model

D. It is critical to the coordination process that the trades that will require seismic engineering, engage their preferred engineer as early as award. It is suggested that the project team utilize the same engineer to avoid unnecessary conflicts and engage in a more efficient seismic layout.

11.2.17.**BIM Team Scopes**

1. During BIM Construction coordination, modeling scopes will be prioritized and executed by Rudolph and Sletten, Inc. per Section 6.3 of this document and the Rudolph and Sletten, Inc. Coordination Schedule.
2. Subcontractors shall develop 3D fabrication model for coordination with sufficient level of detail for accurate coordination.
3. Shop drawings shall be produced from the models used for construction coordination.
4. In general, all work in scope shall be modeled in the 3D environment unless specifically agreed to with Rudolph and Sletten, Inc.'s VDC Director and BIM Manager.

11.2.18.**Model Ownership**

1. During construction, major ownership is held by Stantec and Rudolph & Sletten, Inc., who hold the prime owner contracts and contracts with all model authors (i.e.: subcontractors, consultants, etc.). The model authors are individually responsible for the content and outcome from the use of their model in the BIM.
2. At project completion, the ownership is transferred to UCSF.
3. See Appendix C – Model Ownership Diagram.

11.2.19.**Infrastructure**

1. Common Platform

A. The primary collaboration platform is BIM 360 Glue. Access to BIM 360 Glue will be provided to each participating party by Rudolph and Sletten, Inc. Subcontractors may consider Navisworks as alternatives for those additional

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users if appropriate. Access to software must not impact the performance of any team members.

2. BIM File Sharing

A. BIM 360 Glue will be used for collaboration and file sharing, with access rights provided by Rudolph and Sletten, Inc. and file sharing for miscellaneous use by the subcontractors.

3. Hardware / Equipment

A. All participants will be expected to provide all necessary computers, software, and peripherals with sufficient capacity to ensure a reliable work flow.

11.2.20.**Process**

1. Model Flow Summary

A. Model flow is an iterative process involving the Model Authors, Model Managers, and the common model communication platform is BIM 360 Glue for this project.

B. The model flow begins with a Model Author and the design intent which it is derived from (plans, specifications, and RFI responses, etc.). The Model Authors predominantly communicate directly with the common platform, calling on any other model which they need to coordinate with, review, or back check. They also speak through the Model Managers for the following reasons:

11.2.20.1.B.1 Issues requiring contractor Input

11.2.20.1.B.2 Cumbersome coordination items / multi-trade

11.2.20.1.B.3 Model QA / QC by management

11.2.20.1.B.4 See Appendix B – Model Flow Summary Diagram.

2. Design changes and RFI's

A. As RFI's and CO's are distributed, it is each trades responsibility to review and implement the response into their model. A log that documents this implementation will be kept and maintained by each trade and provided to R&S upon request.

B. Distribution of this log will be required prior to any BIM coordination meeting.

11.2.21.**Model Collaboration**

1. The Model Ownership Diagram (Appendix C) and Model Collaboration Diagram (Appendix D) are depicted in a similar fashion. Collaboration crosses through the ownership dividing line as shown in the Ownership diagram. Each of the contractor disciplines has communications through Rudolph & Sletten, Inc. with their relevant AOR or EOR.

2. Rudolph and Sletten, Inc. will assist the project team in determining when their model / plans need to change due to coordination results. Rudolph and Sletten, Inc. and STANTEC, will be able to manage these communications by receiving a

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copy of any email, file transfer, or other means to satisfy open communications and keeping managers "in the loop."

3. BIM 360 Glue – Online Cloud-Based Collaboration tool.
4. It is strongly recommended to Glue on a regular basis (daily). Each participant does their own work and asked to share and correct their own model. It also recommended to visually inspecting each upload for quality that could impact other trades. BIM 360 Glue will automatically notify other parties and R&S BIM Manager.
5. Through BIM 360 Glue, R&S BIM manager will be able to regularly (daily) monitor the coordination activities from each participant and how the activities were performed.

11.2.22. **Process Flow**

1. This narrative is in reference to Appendix E – Process Flow Diagram.

A. Detailing: The process begins after a periodic benchmark posting date by a Design Author to be used as an electronic reference.

11.2.22.1.A.1 Areas/zones for priority coordination are established by the Team and scheduled by Rudolph and Sletten, Inc. The schedule will direct the Team's focus on a week-by-week basis.

11.2.22.1.A.2 The subcontractor references the applicable 2D and 3D data to conduct its modeling.

B. Coordination & Clash Detection Process

11.2.22.1.B.1 The subcontractor produces a fabrication model based on the information provided and uploads their own model to BIM 360 Glue for collaboration and clash detection.

11.2.22.1.B.2 Each subcontractor will be responsible for resolving clashes of their trade by collaborating and communicating outside of Clash detection meetings in order to reduce the amount of conflict prior to these meetings.

11.2.22.1.B.3 The first clash detection and resolution meeting is hosted by R&S who has reviewed the unresolved model clashes and saved each as a viewpoint prior to the meeting. Through the meeting, resolutions are assigned and recorded among the trades (see Appendix A of this document for further information).

11.2.22.1.B.4 This process is repeated, requiring trades to review updated models and coordinate around any newly-discovered clashes caused by their work, other subcontractors' work, and/or vendors until a given area is fully coordinated.

2. **Coordination Expectations and Recommendations**

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A. It is expected that the trade contractors will perform QC checks for their discipline for completeness and design intent.

B. Each subcontractor shall be responsible for updating backgrounds and models with all approved Change Orders affecting them, constructability review items, and any RFI responses throughout the project. They shall also raise to the attention of Rudolph and Sletten, Inc. any previous construction model issues not updated within the current construction model.

C. The BIM process is suited to improve coordination of the design and construction process, as well as deliver improved information for facility management. Required files and documents will be uploaded to Rudolph and Sletten designated collaboration site. Design Professionals, Rudolph, and Sletten, Sub-contractors are required to coordinate models between disciplines to verify clearance, analyze conflicts/clashes and deliver quality documentation to reduce RFI and Change order submissions.

D. The subcontractor is required to understand and coordinate with the work of all other trades in the development of the 3D model. The subcontractor shall check and provide quality control over the work of their detailers, preferably by a foreman, so that their 3D model accurately represent the design intent as it will be exactly installed in the field to operate properly in a fully-integrated system that meets all building codes and the requirements of other jurisdictions and local agencies over this project (Fire Marshall, ADA,). Any deviation during installation should be notified by the trade responsible and approved by Rudolph and Sletten, Inc. and AOR.

E. If the subcontractor lacks the in-house modeling, hardware and/or software to accurately generate the 3D Model, it may outsource this modeling effort to a 3rd party.

F. It is recommended that the geometry from the BIM should be exported to total station or equal for an accurate, coordinated construction layout. This will increase efficiency in the layout of systems, reduce overall margin of error and ultimately preserve design intent during construction.

G. Project Drawings and schedules required for owner review, biddings, and construction will be extracted from this model. The final “As-built” model is what will be integrated to UCSF lifecycle programs.

H. Background creation for coordination must be produced by the trade that is in need of another trades background. This can be done by downloading said revit model and exporting the necessary backgrounds or through model links.

3. **FM Data Review**

A. UCSF will review the COBIE data that is extracted from the model at specific milestones. Those milestones are as follows:

11.2.22.3.A.1 100% DD

11.2.22.3.A.2 50% CD

11.2.22.3.A.3 100% CD

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B. This review will help identify the missing data that is required for Maximo integration.

12. Model Authors

1. Their internal modeling process for each trade is not described in the scope of this manual, but the collaboration process is as follows:
2. Rudolph and Sletten, Inc. assigns action items to project team members during the subcontractor clash resolution meetings, and the viewpoints are sent to the relevant Model Author. PDF pen markups are also useful. A coordination meeting is held with the BIM Team members in the days following, where the issues are viewed and resolved.
3. The Model Authors shall arrive at the meeting with an idea of how each of their clashes can be resolved. Each clash is discussed collaboratively and action items are assigned and recorded.
4. The Model Author (or subcontractor(s) if assigned) makes the changes to their model and back checks against any newly-discovered clashes caused by this work or other changes that may be concurrent.
5. The model file is posted to BIM 360 Glue daily and clashed daily.
6. BIM 360 Glue will automatically update the facilitated model with the model and it is the responsibility of the model author to review their model against the facilitated model for new or resolved clashes.
7. Responsible for providing the required information of all access requests of the model for BIM 360 Glue.

13. Data Management

1. Purpose

13.1.1. The objective of the data management guidelines is to establish the framework for the successful capture and management of normalized facility data on UCSF projects in order to ensure an efficient migration into systems used for facilities management (FM).

13.1.2. Construction documentation correctly reflects AEC consultant deliverables per milestone.

13.1.3. Data is properly normalized (no redundancies) to ensure efficient transition at handover to facility management.

13.1.4. As-builts are accurate and available in a file format that can support change management.

2. Key Software Applications

13.2.1. BIM Applications (Revit, BIM 360 Glue, Navisworks)

13.2.2. Design coordination software (Navisworks, BIM360 Glue)

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13.2.3. Project Management software (Prolog)

13.2.4. Data management Software (Maximo)

3. A project designated as a "BIM Project" typically includes deliverables produced both in BIM and non-BIM Applications. For example, the architectural model may be produced in Revit, while mechanical and electrical models are produced in CAD based software. It is critical to set up proper data management procedures before the project is started to enable appropriate data collection and exchange regardless of how many applications are being used by the project delivery team.

4. The Project Team (including trades) will follow the (J) BEP to perform continuous collecting, entering, validating, updating and exporting design, construction and commissioning data from/into BIM and other data sources. Various parties (i.e. Design/Construction Team, FM team/Owner, etc.) at specific times will be responsible for predefined actions and these responsibilities for data gathering. The Project Team should focus on how they will apply the following objectives of the data management process to ensure process efficiencies.

   13.4.1. Capture data as it is created-eliminate redundant data collection efforts where possible;

   13.4.2. Implement objective measure for quality control-provide transparent methods to review progress against deliverable requirements

5. The Process Data Management overview starts with UCSF providing a set of standard naming conventions for equipment, space designation/ zone naming policies, and a minimum set of required attributes for equipment, systems and zones to the design team. The design team uses the provided standards from the beginning to avoid renaming BIM objects or searching for missing attributes later in the project. It is required that the design team uses BIM applications for data assignments (not CAD) for all disciplines due to the data oriented nature of BIM applications.

6. UCSF Design and Construction/FM team sets up one or more milestones during design and construction to check data for accuracy. The required information to be checked at those milestones will be provided by the AEC Team in advance. A data commissioning agent or UCSF internal personnel reviews the provided models for data accuracy. If there are issues with the data, the model is returned to the design team for corrections.

7. When the design team reports that the BIM is ready for construction and the model matches the requirements, it is submitted to the construction team. The Construction Team uses the design BIM to create The Construction BIM (shop drawings). The construction team can use the design model for reference but does not have to rely on it, except for maintain the naming conventions and space assignments for objects. For example, if there is an object in the BIM with an Instance Name fields value equal to "FSD 25" and its Room Number field is equal to "2311" in the design model, then the construction model should also have an object with an instance Name equal to "FSD 25" and its Room Number equal to "2311", unless the object is moved or deleted. Even though the data will be extracted from the models maintained by the Design Team, having the construction team maintain proper naming conventions in their models will simplify data updates by the Design Team.

8. Data Management and integration – Additional data related information. *Refer to Attachment #2 BIM2FM Asset Class, Attachment #3 Sample COBIE Format UCSF Facilities,*

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Attachment #4 Sample Model Parameters, and Attachment #5 Maximo Class Attribute (Uniformat) Sample for more information.

13.8.1. For the purposes of using the model for maintenance management, if there are several MEP spaces in the same room (i.e. above ceiling, below floor), those spaces will be classified as one room, unless there is a plenum.

13.8.2. Plenums are defined as a separate space.

13.8.3. Rooms identified in the model, should have Room objects assigned to it.

13.8.4. Room boundaries should be properly connected. All spaces must be bounded by walls and floors.

13.8.5. The MEP model should have spaces mapped to the architectural model and all lifecycle-targeted MEP equipment should be assigned to spaces.

13.8.6. Zones (Revit areas) should be defined and each zone consists of spaces.

13.8.7. Every space has a name and a room number, including the roof if there is rooftop equipment.

13.8.8. All mechanical systems are defined (every element belongs to a system)-I.e. chilled water, hot water, etc…

13.8.9. All data parameters required for Maximo integration will be exported to the defined COBIE format in attachment #3 Sample COBIE Format UCSF Facilities.

14. Deliverables

1. The 2D conversion takes place after, or during, the process described in this document. The result of the collaborative, 3D-based construction coordination process is one with input and buy-in from many project participants. Each of the deliverables listed below shall have undergone review by each trade foreman and/or project manager for the following

14.1.1. Conformance with Project Drawings and Specifications.

14.1.2. 2D CAD, PDF, and native Revit (.rvt) files are required

1. Revit files will include the information that will be extracted for integration into Maximo.

2. The final products include:

14.2.1. Coordinated P.O.S. (Penetrations, Openings, & Sleeve) drawings which contain locations of any penetrating system through the slab, deck, roof or concrete wall.

14.2.2. Coordinated shaft drawings which contain dimensions of all deck openings as well as locations of all systems and equipment located with a shaft including supports and insulation.

14.2.3. Coordinated insert and point load drawings

14.2.4. Coordinated priority wall drawings

14.2.5. Coordinated equipment pad and layout drawings

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14.2.6. Coordinated composite reflected ceiling plan which accurately shows all ceiling mounted devices and equipment.

14.2.7. Coordinated shop drawings

14.2.8. Reviewed and approved by the AOR, MEOR, and EOR.

14.2.9. Coordinated native 3D models for construction fabrication and field installation.

14.2.10. Models of the project and set of drawings in PDF format showing locations of all concealed conditions, and the actual dimensions of all architectural, structural, mechanical, electrical, plumbing, security and fire protections elements, components, and systems.

14.2.11. Delivery of a model that locates construction elements to a reasonable proximity. Changes made during construction of more than a few inches from the design should be reflected in the model.

PHASE	DISCIPLINE	TOLERANCE
Design Documents	Architecture/Structure	Accurate to +/-1" of Actual Size and Location
Construction Drawings	Contractor/Sub-contractors	Accurate to +/-1" of Actual Size and Location for all concealed/hidden components
Design	Civil	Accurate to +/-1" of Actual Size and Location

15. Model Maintenance

1. Each model author is responsible for maintaining their models through the construction coordination phase. For example: when RFI's and Change Orders are issued impacting the location of walls and ceilings the Architect should issue an updated model for use by the whole team. RFI's and changes impacting Finishes would not be issued as a model file. Any RFI's and Change Orders affecting subcontractors require the model authors to update. All as built changes are also required to be updated.
2. Model maintenance also includes data filing for the Team. The guidelines for uploading files must be followed in order to prevent re-filing and to ensure archiving is preserved.
3. During the coordination periods, all participant of this process should make best efforts to keep their models up to date with all changes. These latest models will be distributed to the MEP/FP, Exterior Envelope, drywall subcontractors daily unless a more frequent update is needed.

16. Construction and the Model

1. Through the Construction Coordination phase, the BIM Team has determined the most effective scopes of the project to be modeled and the level of detail therein. All systems are fully coordinated as agreed to by the BIM Team. When this detailed preplanning translates into the physical construction, any arising issues are resolved by using the model in the field.

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However, when discrepancies exist between the 2D and the model, 2D documents take precedence with consideration of the approved federated model.

2. Once an area, floor, or the entire project has been modeled and coordinated, the BIM Leader will publish a Protected Navisworks file (.NWD) and distribute to the BIM Team. Each BIM team member will also plot their drawings for "sign-off" by all trades. By the act of signature and submittal, each subcontractor acknowledges their coordinated portion of the work for installation with all other trades, not limited to mechanical, electrical, architectural, and structural, fire protection and framing contractors. The Navisworks (protected file) will take precedence over the 2D sign-off drawings when clashes occur and there is a dispute over the accuracy of signed drawings to the 3D Model. Rudolph and Sletten, Inc. will use these documents to resolve field conflicts that may occur.

3. R&S shall not take responsibility for any and all coordination drawings created by subcontractors for backgrounds, elevations, dimensions, routing paths, sizes, and service access areas. Rudolph and Sletten, Inc.'s role during these coordination times and meetings is to guide the process of coordination along for scheduling and installation and to assist with any conflicts that may arise during coordination among the subcontractors. R&S will not sign off on coordination drawings.

4. BIM to field tolerance's

16.4.1. All elements are to be installed per the coordinated BIM. This is typically achieved through the use of point layout, prefabrication, layout drawings, and inserts. It is expected that there may still be deviation from these methods. This will be a maximum tolerance of +/- 2".

16.4.2. For all items that are not able to be installed through the use of these methods, there are specific tolerances required. With reference to a model, those items are categorized below:

1. If an item cannot be installed per the above expectation, they are subject to the following tolerances:
   A. LOD 500 will be a maximum tolerance of +/- 6"
   B. LOD 450 will be a maximum tolerance of +/- 12"
   C. LOD 400 and below will have a maximum tolerance of +/- 24"
2. Concealed items within a wall or chase will have a maximum tolerance of +/- 6". Those systems are:
   A. Medical gas
   B. Plumbing
   C. Hydronic
3. The Point of Connection to and LOD 500 equipment, would adopt the LOD 500 requirement. This adopted LOD ends at the Point of Connection and does not apply to the entire system.
   A. Receptacles are not considered a Point of Connection.

16.4.3. The model will be used as a tool to assist in the resolution of any conflict created in the field. All items not modeled are to be coordinated around the model.

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17. Conforming vs. Non-Conforming Work:

1. Any work performed or installed that differs from the BIM and/or AOR -Approved documents shall be considered Non-Conforming Work.
2. Any work performed or installed that is not modeled and/or coordinated as previously agreed with Rudolph and Sletten, Inc. will be considered Non-Conforming Work.
3. No work including work based on Change Orders will be performed without the completed 3D model and signed coordination shop drawings, any such work will be considered Non-Conforming Work.
4. Non-Conforming Work includes any and all seismic and anchorage points not shown on signed coordination drawings.
5. Conforming Work is work that has been modeled and clearly shown on signed shop drawings with proper elevations, dimensions, routing paths, service access areas and has been fully coordinated and signed off by all trades for acceptance.
6. Non-Conforming Work that conflicts with Conforming Work will, therefore, have to be moved by the installing Non-Conforming Work contractor at no additional cost to the Owner or R&S, this includes any schedule impacts.
7. In the event that Conforming Work may have to be moved or modified to correct the conflict, the installing contractor with the Non-Conforming Work shall be liable for the cost incurred by those BIM Team members in order to accommodate installation of all Non-Conforming Work.
8. Non-Conforming Work will not have precedent over Conforming Work.
9. In the event that “Conforming Work” conflicts with “Conforming Work”, meaning conflicts missed during the coordination process, trades that are in conflict will have to re-coordinate the conflict either in the field or by 3D modeling and Navisworks. At no time will this re-coordination, re-work installation, or schedule impacts become a cost to the Owner or R&S.
10. Any work shall be considered ‘Non-conforming’ if the trade has not modeled per specific plan details as required even though what is modeled may be clash free as this will show up as potential conflicts or access issues during construction.

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Appendix A - BIM Protocols

A. File naming conventions
   1. Design
      a. Live File:Project -Trade-Phase-level.
      b. Archive File:Project-Company-Discipline-Subproject-YYYYMODA
   2. Construction
      a. Live File:Project -Trade-Level

B. Element identifying Information – As per Contract Requirements
   1. Specification & subsections
   2. Equipment Name Plate Data, [i.e. manufacturer, model number, ratings (i.e. flow, pressure, electrical power, Horsepower)]
   3. Pipe, Duct, Material, and size

C. Model structure
   1. Revit views or 3D Models should be created on a floor by floor basis from the bottom of the slab to bottom of the slab. We will keep a separate facilitated models for each for distribution and record.

D. Accuracy
   1. To within:
      a. Model: 1/8”
   2. Tolerances will not be added within BIM 360 Glue. Each trade is required to model tolerances.

E. Common reference point
   E.1. Each trade must use the same reference point or global coordinate system. The Revit files should be linked “Origin-to-Origin” for proper alignment.
   E.2. There will be a 2D grid available for each building on the Common server.

F. Elevations
   1. Top of Slab - All elements must be modeled at the correct elevation so that when all levels are composited together, every trade will be at the correct elevation relative to project 0.
   2. Zoning - Zones that have been established by the design and or BIM Team on the contract documents will be verified and adjusted to meet actual installation and coordination requirements. These zones may have to be re-established if the design does not accommodate the actual space needed.

G. Exports/Posting
   1. Files exported for Team use are .dwg, dwf, .ifc, .nwc, .nwd, .rvt.
   2. Posting to BIM 360 will provide access to those who accept the BIM 360 invitation within the project.
   3. Folders and sub-folder will be set-up for the appropriate trades.

H. Purged models
   H.1. The 3D model submitted should contain only relevant 3D data and no extraneous 2D data unless requested by the Team. All x-refs must be detached.
   H.2. The Revit model should have views created specifically for the BIM 360 Glue updates. This should be provided by the AOR.

I. Object Enablers
   I.1. Object Enablers must be provided by the subcontractors as necessary.

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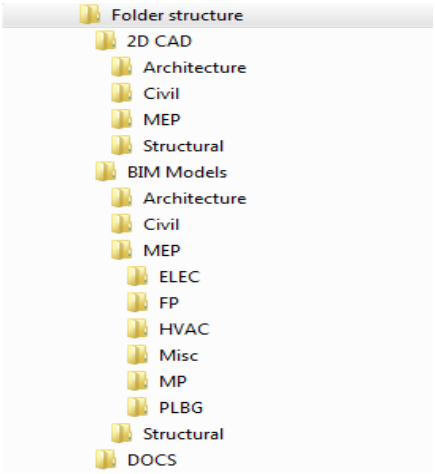
J. File folder structure



K. Navisworks / BIM 360 Glue Global Options and Workspace Settings

K.1. Recommended Global Options and Workspace will be provided.

L. Viewpoints

1. Design
    a. Folder naming: Company generating viewpoint
    b. Sub Folder naming: Grouping by discipline, or other specific coordination description
    c. Viewpoint naming: Level. - Company generating viewpoint. item number + (action by) initials + 'x' when complete or 'a' if approved by team as-is
2. Construction
    a. Main Folder naming: Company responsible for viewpoint
    b. Sub Folder naming (based on Clash Batch Names)

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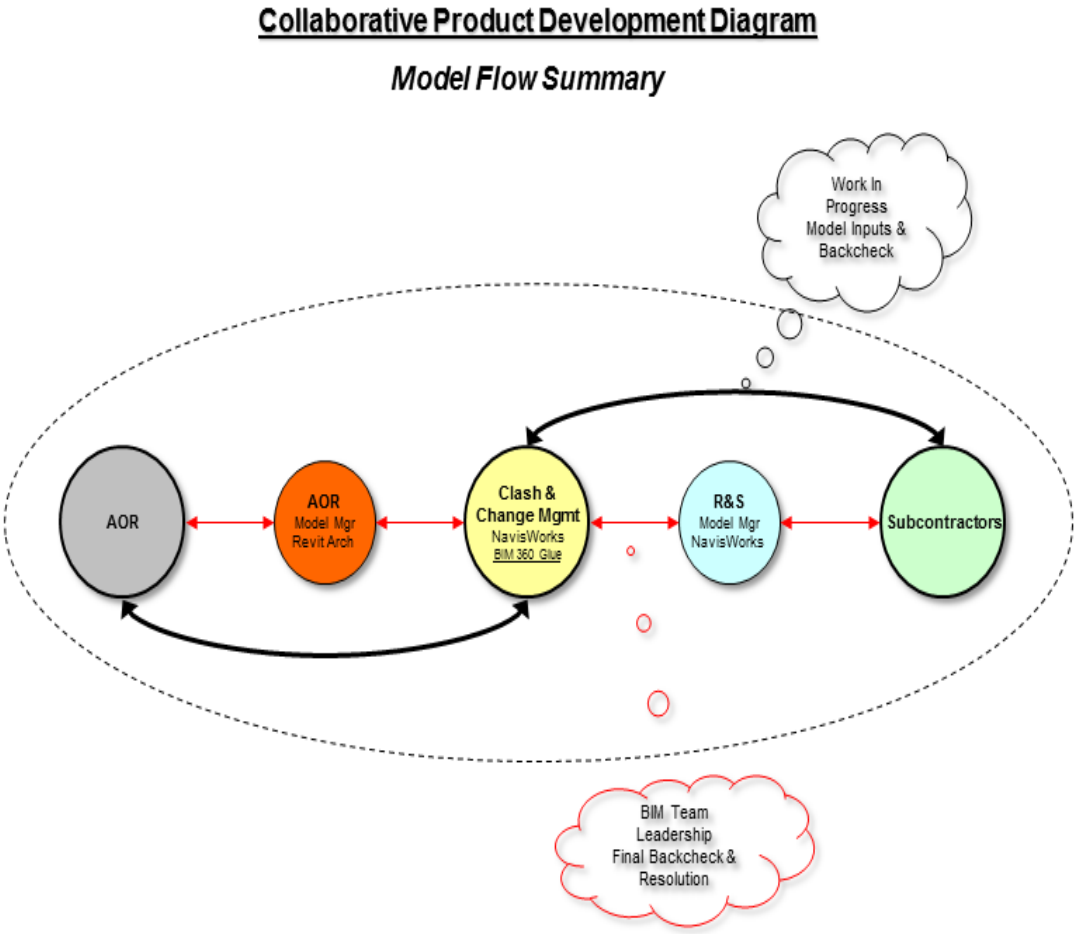
Appendix B - Model Flow Summary Diagram



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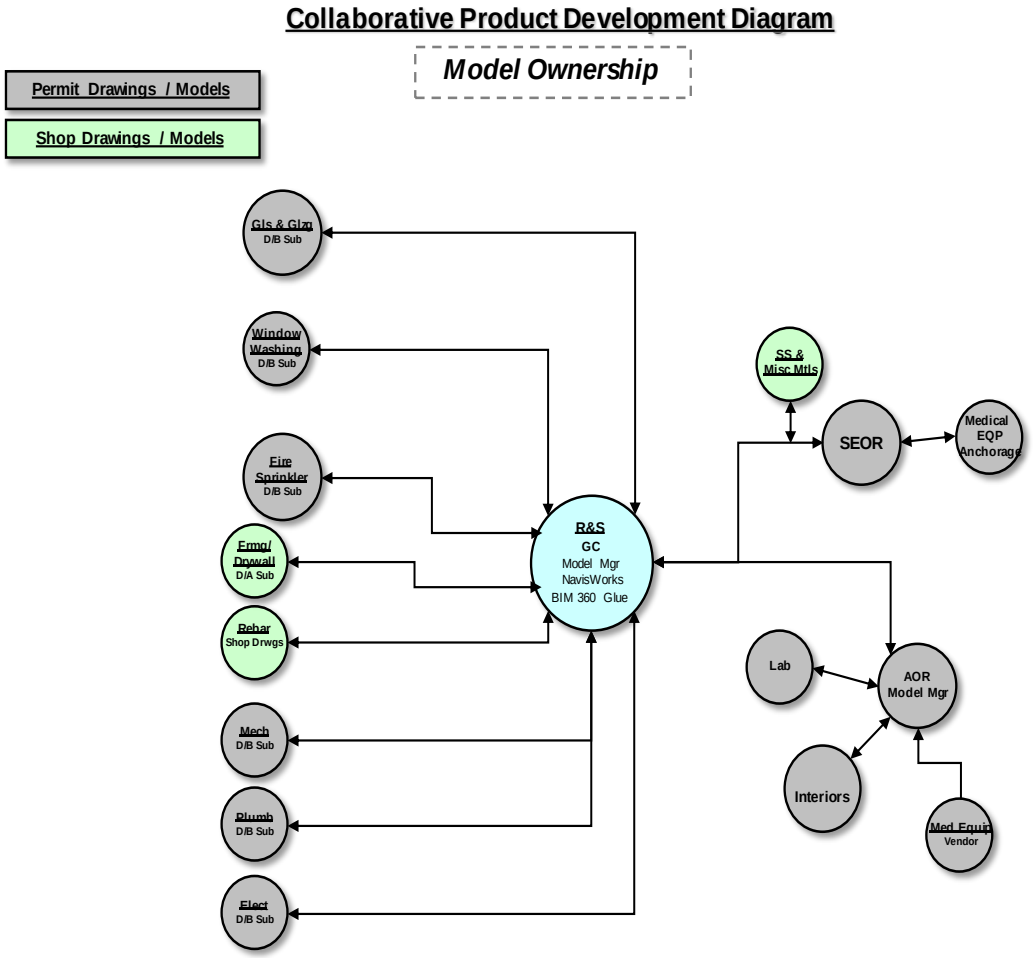
Appendix C - Model Ownership Diagram



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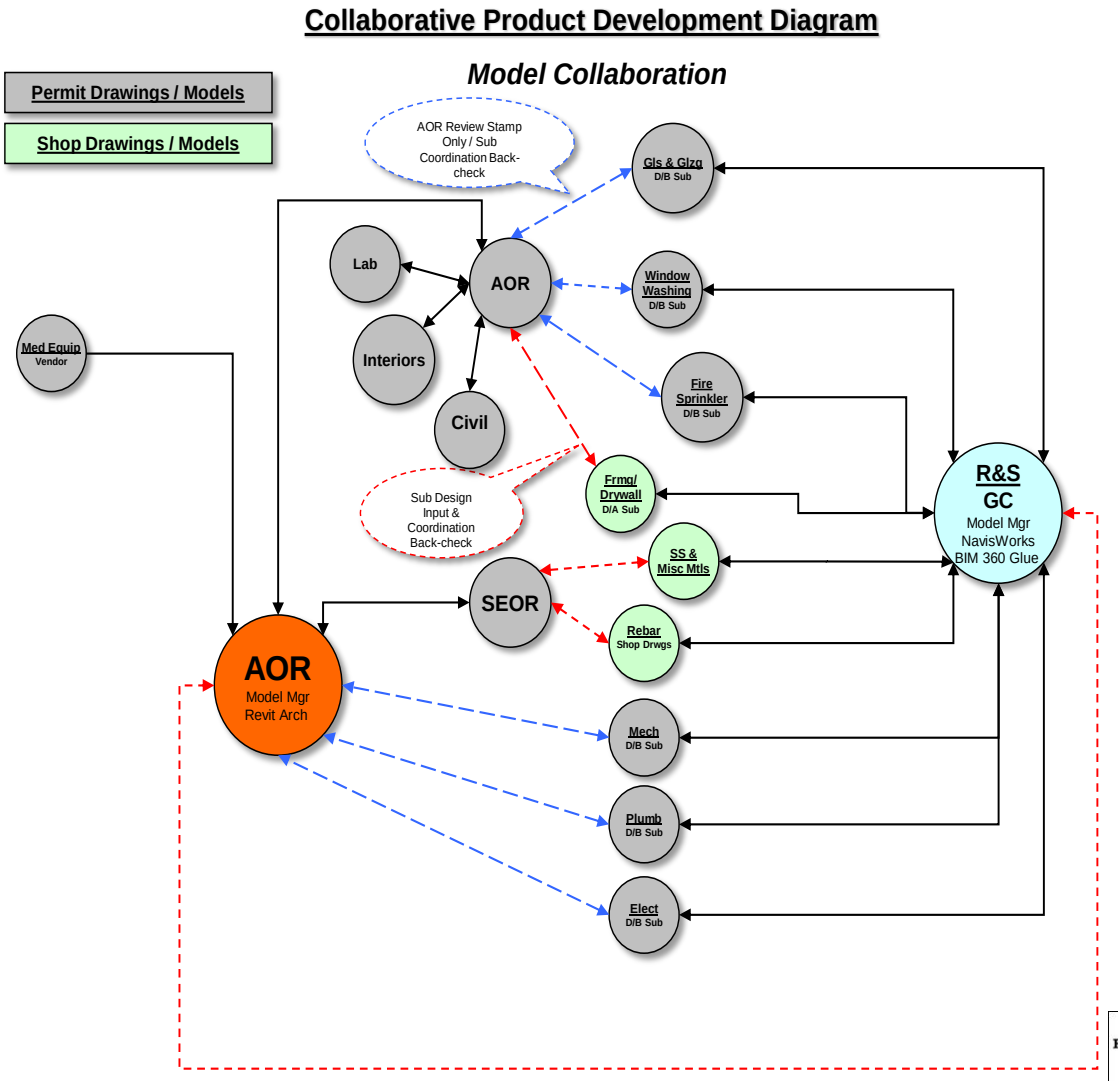
Appendix D - Model Collaboration Diagram



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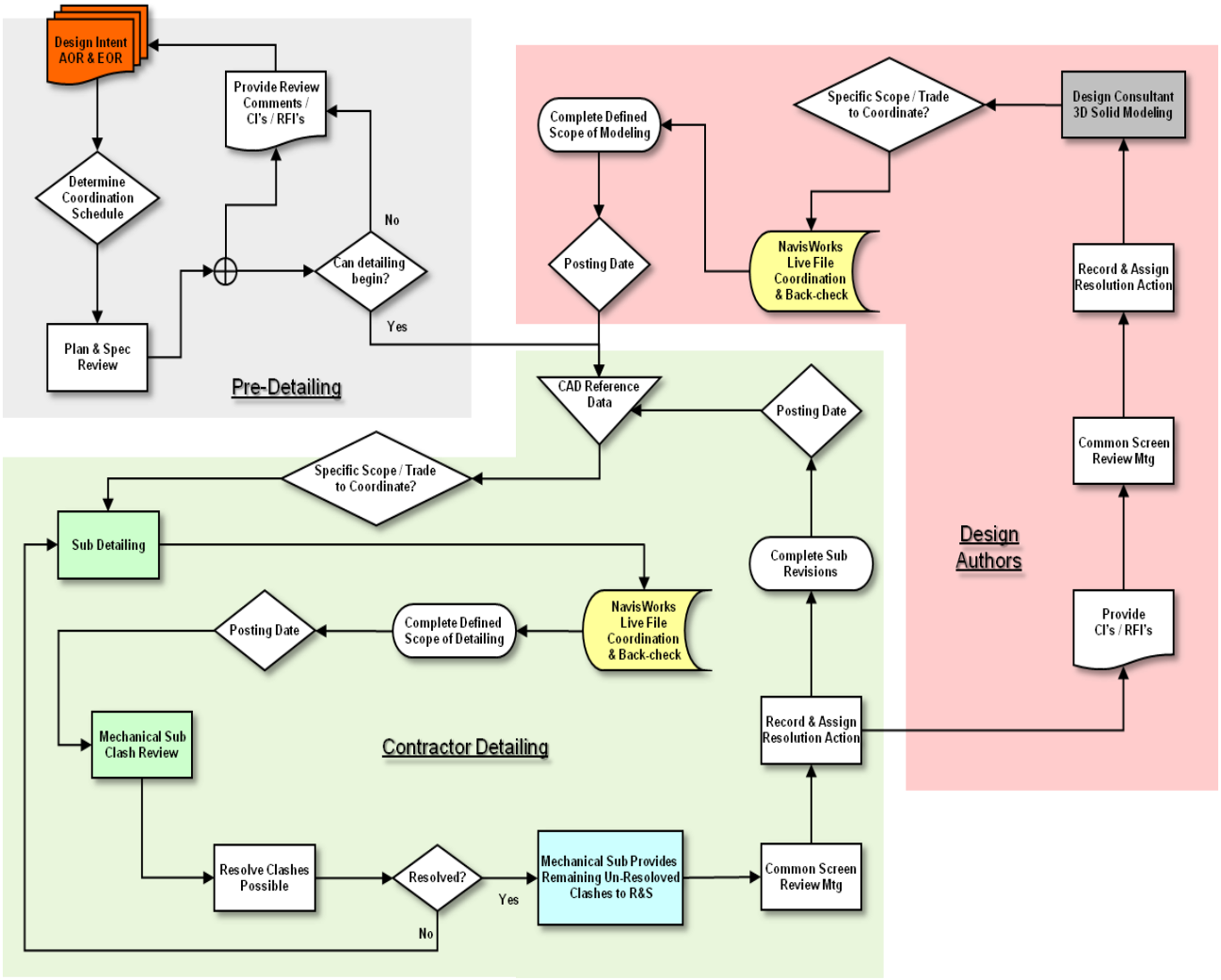
Appendix E - Process Flow Chart



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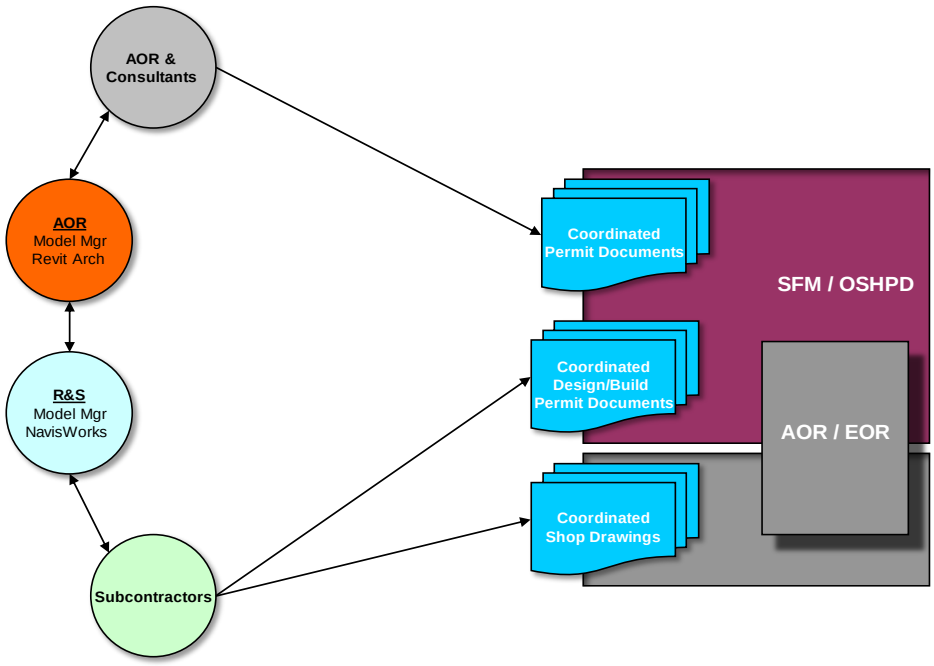
Appendix F - 2D Deliverables Diagram

Collaborative Product Development Diagram

2D Deliverables



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Appendix G – Navisworks Clash Detection Procedures

Navisworks will not be used for clash detection unless otherwise stated by the BIM Manager

Appendix H – BIM 360 Glue

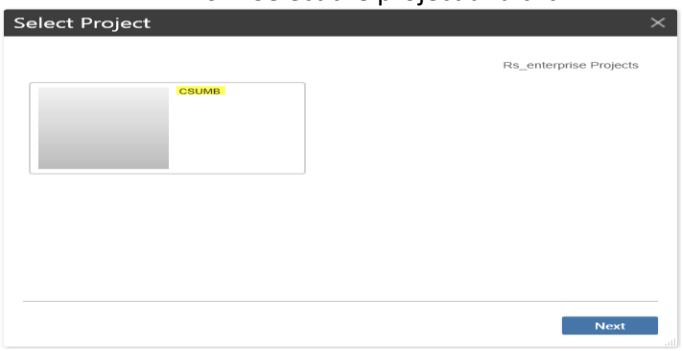
Requirements: BIM 360 Glue add-in Located HERE, Access to the project

A. "Glue the model"

This workflow applies to Revit and AutoCAD users Revit users must upload using the following routine.

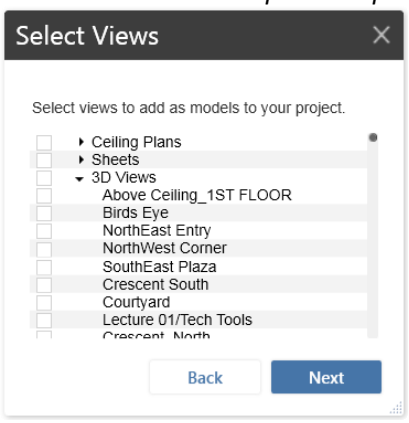
1. Open the working file
2. Make sure to be in a 3D View
3. Navigate to the "add-Ins" tab
4. Select the "Glue" Add-In

5. Login using the Autodesk ID linked to the email provided to the BIM manager of the project. If the email of the model author has not been provided, please notify the BIM Manager.
6. Select the project and click NEXT



7. Select the view to be uploaded

For non-Revit users skip this step



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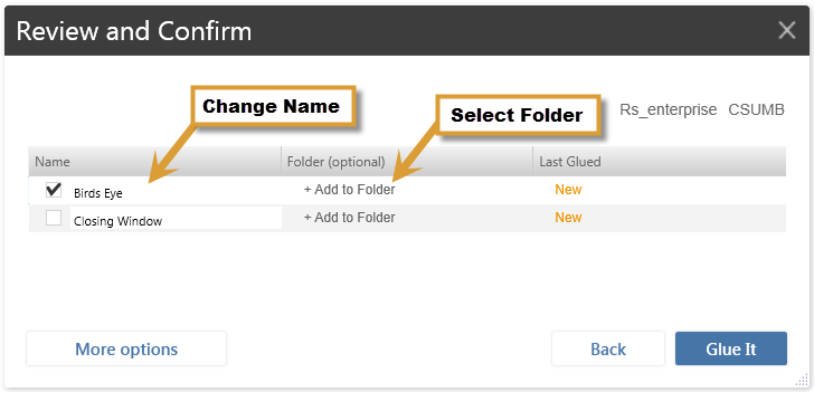
GENERAL AND ENGINEERING CONTRACTORS

8. Check the name and location of the model to be uploaded. After uploading the model once, name and location of all future uploads of the same model identical to the original. Archiving of files is automated through glue.

I.E.: BIM/MECH/ECH-HVAC-LVL01



B. Clash Detection

It is required for all trades that are coordinating during this process, to be able to use the provided clash detection tool within BIM 360 Glue and the ad-ins linking the trade model with the facilitated model.

1) Each trade is responsible for the setup of the initial clash sets for their trade.
    a. The naming of each clash set will be distributed by the BIM Manager
    b. The BIM Manager will use a batch clash set as well.
2) In order to speed up the clash detection process, an order of responsibility will be established within the clash detection set name.
    a. For example: *ELEC & HVAC*= Electrical trade to research their move first. If a move is required by both trades then the Electrical trade would contact the HVAC detailer to discuss their solution.
    b. This guide will be enforced to ensure that a correction isn't made by both trades at the same time and eliminate new clashes from a proposed resolution.
    c. The minimum required clashes to be created by trade is as follows:
        i. HVAC &
            1. Structure
            2. Ceiling
            3. Framing
            4. FP Mains
            5. Lighting
            6. Top & Bottom Track
            7. Frames of windows, doors, and other trades
        ii. FP Branches &
            1. Structure
            2. Ceiling
            3. Framing
            4. Lighting

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5. Top & Bottom Track
6. Frames of windows, doors, and other trades
7. Fire Proofing
8. HVAC

iii. PL &

1. Structure
2. Ceiling
3. Framing
4. HVAC
5. FP
6. Lighting
7. Top & Bottom Track
8. Frames of windows, doors, and other trades
9. Fire Proofing

iv. MP &

1. Structure
2. Ceiling
3. Framing
4. HVAC
5. FP
6. PL
7. Lighting
8. Top & Bottom Track
9. Frames of windows, doors, and other trades
10. Fire Proofing

v. ELEC &

1. Structure
2. Ceiling
3. Framing
4. HVAC
5. FP
6. PL
7. MP
8. Top & Bottom Track
9. Frames of windows, doors, and other trades
10. Fire Proofing

vi. Framing &

1. HVAC
2. FP
3. PL
4. MP
5. Lighting
6. Top & Bottom Track
7. Frames of windows, doors, and other trades
8. Fire Proofing

vii. PT &

1. Structure

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2. Ceiling
3. Framing
4. HVAC
5. FP
6. PL
7. MP
8. ELEC
9. Top & Bottom Track
10. Frames of windows, doors, and other trades
11. Fire Proofing

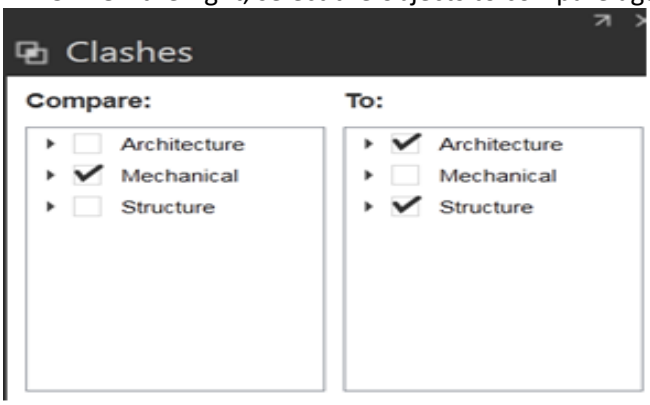
3) Each week there will be a coordination meeting which will be used to resolve any issues about "who should move where". The BIM Manager from Rudolph & Sletten will host and mediate these meetings.

To Run Clashes

1. In a model view, in the BIM 360 toolbar, click Clashes.
2. Click the Update Your Models Now link to enable the latest clash review features. This step is not always required and the link may not be available. If the link does not appear, proceed to step

Depending on the size and number of models, this one-time update process may take some time. When models are updated, any existing comments and notifications are overwritten. After the model updates are complete, all clash results, comments, notifications, and markups persist going forward.
Note: While the model updates are in progress, click Refresh to see a status update.

3. In the Clashes module, click Find Clashes. After the first use, click New.
4. In the list on the left, select the first set of objects or models to compare.
5. On the right, select the objects to compare against the first set.



6. Set the tolerance.
7. Name the Result Set.
8. Click Find Clashes.

One of the recommended tools to use during the resolution of clashes is "Clash Pinpoint". This can be found inside the Ad-in provided by Autodesk alongside the "Glue" Ad-in. It is used to pin point the clash found in the BIM 360 Glue model, directly into the detailers live model.

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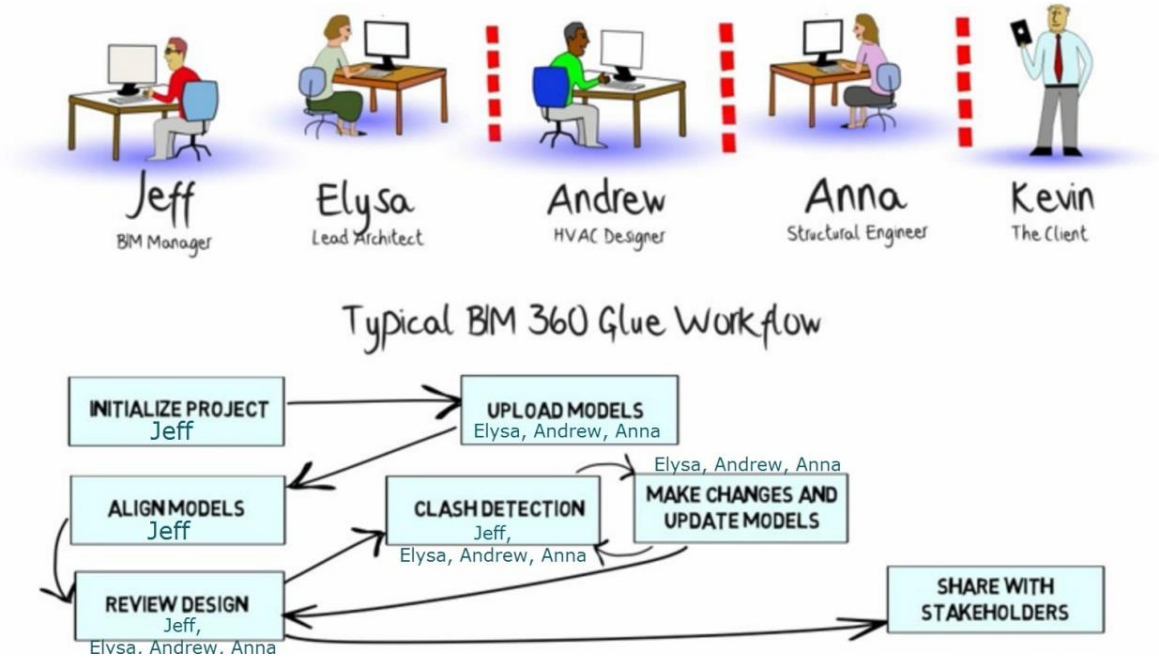
C. Workflow



Appendix I – Deliverables and Milestones

A. Refer to the project schedule for a detailed coordination schedule.

Appendix J – Software Interoperability

Autodesk Navisworks 2016 and BIM 360 Glue will be used to facilitate all models produced by design and/ or fabrication software. It may be necessary to export a model to another format for interoperability.

A. File types that may be requested
   a. DWG – An Autocad native format
   b. DWF – Used when uploading from Revit
   c. IFC – Used primarily by the Framing contractor and necessary for openings
   d. NWC – An export available in most Autodesk applications. It is also created when appending a file to Navisworks.
   e. NWD – A model saved as a Navisworks document
   f. RVT – A Revit native format

B. It is in the best interest of all parties involved to:
   a. Provide the requested materials to the team in an efficient manner.
   b. Communicate through the use of BIM 360 Glue or email.
   c. Use markups to discuss an issue or document a change

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Appendix K – BIM Acronyms, Terms & Definitions

1. Terms
   - 1.1.1. BIM "Building Information Modeling" - A Building Information Model (Model) is a digital representation of the physical and functional characteristics of a facility. As such, it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life cycle from inception onward.- *National Institute of Building Sciences*
   - 1.1.2. Level of Development or Detail - The Level(s) of Development / Detail (LOD) describes the level of completeness to which a Model Element is developed.
   - 1.1.3. Model Element - A Model Element is a component of a model representing an item, system or assembly within a building or building site. For purposes of this BIM Protocol Manual, Model Elements may be:
   1. Existing Component: Any element within the project boundary that is to remain during construction.
   2. Substructures: including foundations.
   3. Shell: including superstructures for floor and roof construction; exterior enclosure for exterior walls, exterior windows, exterior doors; roof covering and roof openings.
   4. Interiors: including interior construction for partitions, interior doors, fittings; stair construction and finishes; interior finishes for walls, floors, and ceilings.
   5. Services: including conveying systems (elevators); plumbing systems; HVAC systems; fire protection systems; electrical systems for service and distribution, lighting and branch wiring, communications & security, controls, fire alarm and other electrical systems.
   6. Equipment & Furnishings, (as appropriate to the Project): audio visual equipment, kitchen equipment, owner furnished contractor installed equipment (OFCI); owner furnished owner installed equipment (OFOI).
   7. Building point of connections: 5feet out to the building and verify Point of connection (POC) as provided by the site utilities: mechanical utilities, site electrical utilities and other site utilities such as vaults and existing site utilities.
   - 1.1.4. Model Author - The model author is the discipline responsible for developing the content of a specific model to the LOD required, while maintaining and updating said model.
   - 1.1.5. Model User - The model user refers to any individual or entity authorized to use and/or reference the model.
   - 1.1.6. Construction Model - The construction model is the coordinated BIM and is to be used as a guide during the installation and construction of the project.
2. Definitions
   - 1.2.1. Background files: 2d files from the design build team, used in coordination by the trades in their model files as an external reference.
   - 1.2.2. BIM 360 Glue: The software used for collaboration between systems.
     1. Glue It: Add in used in modeling software that assists in uploading the working model to BIM 360 Glue. See Exhibit "H".
     2. Clash Point: An add on used in modeling software that pinpoints the referenced clash point from BIM 360 Glue back to the active model
   - 1.2.3. DWG: Most common file format (AutoCAD).

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1.2.4. DXF: "Drawing Exchange Format" and is used for exchanging components between CAD software applications
1.2.5. IFC: "Industry Foundation Class" is a neutral and open specification that is not controlled by a single vendor or group of vendors. It is an object-based file format.
1.2.6. LOD: "Level of development" or "Level of detail" is used to define the process or progress of the models contents. The LOD can change as the project progresses.
1.2.7. LOD 200- The Model Element is graphically represented within the model as a generic system object, or assembly with approximate quantities, size, shape, location, and orientation. Non-Graphic information may also be attached to the Model Elements.
1.2.8. LOD 300- The model element is graphically represented within the model as a specific system, object or assembly in terms of quantity, size, shape, location, and orientation. Non-graphic information may also be attached to the model element.
1.2.9. LOD 350- The model element is graphically represented within the model as a specific system, object or assembly in terms of quantity, size, shape, orientation and interfaces with other building systems. Non graphic information may also be attached to the model element.
1.2.10. LOD 400- The model element is graphically represented within the model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, fabrication, assembly, and installation information. Non graphic information may also be attached to the model element.
1.2.11. LOD 500- The model element is a field verified representation in terms of size, shape, location, quantity, and orientation. Non graphic information may also be attached to the model elements.
1.2.12. NWF, NWD, NWC: Navisworks file formats
1.2.13. Object enabler(s): Application or file in AutoCAD or Navisworks which allows special objects to be seen in those programs. Usually, these objects are produced in special fabrication and detailing programs with in AutoCAD.
1.2.14. P.O.S.: Penetrations, Openings, & Sleeve drawings, these drawings are a composite of all trade files that have Penetrations, Openings, & Sleeves in slabs.
1.2.15. Pre-Fabrication: The process of developing and fabricating components in office and not onsite.
1.2.16. R.C.P.: Reflected Ceiling Plan. A Coordinated reflected ceiling plan will be one of the results of this coordination process. All ceiling mounted equipment will be included.
1.2.17. Shop Drawing(s): Shop Drawings are produced from the coordinated models of each trade and include all dimension and labeling. Usually done at a 1/4"=1'-0" and submitted for approval by R&S team. These drawings are then used in the field for fabrication and erection.
1.2.18. Signoff Model: A Coordinated model that is clear of all clashes, unresolved or unclear design elements. Exceptions can be made provided the consent of Rudolph and Sletten, Inc.

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