Project: *2291 Gavilan College – Library & Student Resource Center*

Location: *Gavilan College, Gilroy CA*

Version # *04*

Project Based Virtual Design and Construction Process Guidelines For Design

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1. Process Overview

a. Project VDC Process expectations

The project team is expected to produce BIM deliverables and be a part of the VDC process on this project to proactively address both design and construction process requirements. The team members are expected to have knowledgeable resources, internal or external, that have participated in a VDC process as part of a project. Team members will participate in the overall VDC project process as further defined by this guide.

i. VDC process requirements

The exact requirements of the VDC process team members shall be clearly defined as part of the Level of Development specification outlined in section 2.e below and required to be filled out as part of the Project BIM execution plan described in section 2.a.

ii. BIM deliverable expectations

1. Design BIM deliverables:
    a. The design team will work with the construction team members as outlined in section 1.b to create the detailed models to be used by the other team as outlined in the LOD specification and model creation requirements defined in section 5.
    b. The design team is expected to update and share their model(s) to reflect material changes that require coordination throughout the project.
2. Construction BIM deliverables:
    a. The construction models shall be used as part of the overall project spatial coordination process as defined under section 6.
    b. The construction models shall be used to create the as contractual required system-based shop drawings as further defined in section 7.
    c. The construction models shall be used in the field as outlined in section 7.
3. Post Construction / Owner based BIM deliverables:
   A list of additional BIM deliverables shall be developed as required for the specific project

iii. Process Goals:

A detailed list of project specific VDC / BIM goals and objectives shall be outlined for the project and included as part of the project BIM execution plan under Section D.1

b. Project VDC Process Team Members

For this project the following team members are expected to be a part of the VDC process. Their expected participation in the modeling and design or construction coordination is represented by an “X” in the corresponding boxes below. The model deliverables expected of each team is further defined in other sections

below. A detailed list of the exact team members will be outlined in the project BIM execution plan Section C as further described in Section 2 below.

Design Consultants	Modeling	Basic/Gross Coordination	Fine Coordination
Architectural	X	X	x
Structural	X	X	x
MEP	X	X	x
Civil (UG Utilities)	X	X	
Special Systems*			
Design-Build Trades	**Modeling**	**Basic/Gross Coordination**	**Fine Coordination**
Concrete			X
Structural Steel	X	X	X
Prefab Metal Framing	X	X	X
Glazing/Ext Skin	TBD	x	x
Ceilings	TBD	x	x
Conveying Systems	TBD	x	x
Mechanical	X	X	X
Plumbing	X	X	X
Electrical	X	X	X
Fire Protection	X	X	X
Tele/Data and Security	X	X	X
Special Systems*			

*Special Systems shall be refined further as individual systems above, i.e. pneumatic tubes, lab fixtures, furnishings, etc.

**Expectation that design consultants are present at coordination meetings once a week – meeting duration ~1HR

c. Process Kickoff Meeting

The project team will hold a VDC process kickoff meeting before the start of the design and then corresponding construction coordination process once the team members as outlined 2.b have been selected. Individuals from the various team members that are responsible for the creation and oversight of their project BIM deliverables and overall field-based services shall attend this kickoff meeting. The goals of this meeting are outlined in the points below:

- Review Flint's Project VDC Process Guideline.
- Creation of the Project Specific Goals and BIM uses list. Items on the goals list will be used to judge the success of the process on the project. The BIM uses list will define the extent to which the BIM deliverables will be used on the project.
- Team will use the meeting to create the design and construction VDC process schedule for the project and include in the Project BIM execution. The team shall come to agreement on the major milestones outlined in

process schedule. The team shall verify that outside data needed for successful creation of the project specific BIM deliverables can be acquired in time to meet the schedule. The process schedule will be included as part of the overall project master schedule. The process for creating the actual VDC process schedule is outlined below in section 3.

- The project team shall review/amend/approve Flint Standard Construction Coordination BIM execution plan which will be amended to the project team member's contracts.
- The project team members that participate in the process kickoff meeting are asked to share best practices from past project experience.
- During the meeting, the project team will determine the BIM uses for the project and record those uses in the Project BIM execution plan.
- The team will also update as needed the Project BIM Level of Development worksheet as defined in section 2.e.

2. Process Execution and Management Plan

a. BIM Project Execution Plan

The BIM Project Execution Plan is to be created by the project team. This plan will guide the team through the creation of the project BIM and corresponding VDC process requirements. All team members involved in creating and managing the Project VDC process shall be involved in the creation of the BIM Project Execution Plan.

b. VDC Model Workflow

As part of this BIM Process Guide and as a basis for the Process Schedule, the team members will develop a detailed workflow using the attached VDC Model Workflow chart as a guide. The agreed upon workflow will be incorporated into this document as an addendum.

c. Flint Model Manager/Coordinator

A member(s) of Flint's team will act as the model manager/coordinator for the project. The model manager / coordination lead may be an appointed individual or company outside of Flint. This individual / company will be responsible for coordinating the overall modeling efforts on this project. The coordination of these efforts will be based upon the VDC process schedule that is tied to the overall project master schedule.

d. Project Team Member Roles and Responsibilities

The BIM Project Execution Plan shall include a list of all the major team members that will be involved in the project VDC process and their responsibilities within the process. The list will be defined as part of the Project BIM execution plan. This list should include the name of the individual that will lead the process for each team. The individual listed shall have an advanced knowledge of BIM and VDC and have past experience on projects similar to this specific project. The individual selected is recommended to have past experience being a team leader through a collaborative VDC process. This

person will be the point of contact between Flint's model manager/coordinator and the team member's BIM authors. The team member leader will be responsible for making sure that their team adheres to these guidelines and the Project BIM execution plan. They will also be responsible to participate in the coordination meetings as outlined in Section 5. They should be able to act as a representative of their company and address the issues and questions raised during the meetings directly or bring the team member(s) to the meeting that can.

e. BIM Use Matrix

A BIM Use matrix shall be completed by the project team members as part of the Project BIM execution plan. The BIM Uses matrix shall be filled out to match the overall VDC process goals as outlined by the project team. For those team members not familiar with all the possible BIM uses and how to fill out the worksheet, they may find additional information by visiting the BIM Project Execution Planning website that is part of the Computer Integrated Construction Research Program at Penn State. The site can be found at the following web address. http://bim.psu.edu/

f. Level of Development / Information Exchange

i. BIMForum Level of Development (LOD) Specification

The LOD Specification worksheet included in the appendix of this guide will be used to outline the expectations of the project 3D models and other BIM deliverables needed for the project.

1. The LOD worksheet will be used as a guide for all the BIM based project information and delivery dates. LOD is defined as follows based on the definitions contained in the Level of Development Specification version 2019 as released by the BIMForum

LOD 100

The Model Element may be graphically represented in the Model with a symbol or other generic representation but does not satisfy the requirements for LOD 200. Information related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be derived from other Model Elements.

BIMForum Interpretation: LOD 100 elements are not geometric representations. Examples are information attached to other model elements or symbols showing the existence of a component but not its shape, size, or precise location. Any information derived from LOD 100 elements must be considered approximate.

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 Element.

BIMForum interpretation: At this LOD elements are generic placeholders. They may be recognizable as the components they represent, or they may be volumes for space reservation. Any information derived from LOD 200 elements must be considered approximate.

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.

BIMForum interpretation: The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension callouts. The project origin is defined, and the element is located accurately with respect to the project origin.

LOD 350

The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, orientation, and interfaces with other building systems. Non-graphic information may also be attached to the Model Element.

BIMForum interpretation: Parts necessary for coordination of the element with nearby or attached elements are modeled. These parts will include such items as supports and connections. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension callouts.

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.

BIMForum interpretation: An LOD 400 element is modeled at sufficient detail and accuracy for fabrication of the represented component. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension callouts.

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.

BIMForum interpretation: Since LOD 500 relates to field verification and is not an indication of progression to a higher level of model element geometry or non-graphic information, this Specification does not define or illustrate it.

2. Responsibility for the project model/drawing elements will be assigned to project team members for each of the various LOD stages. The project team for the creation of the model/drawings will include the prime designer as well as consultants and include Flint as the prime contractor and major trade contractors outlined in section 1.b. Element creation assignments will be unique to the project based on the experience of the project team members and the contractual responsibility of the team members.
3. A LOD worksheet for this project based on Flint's expectations of the various process team members is included in the appendix of this guideline. Team members involved in the VDC process for this project shall meet at a minimum the model level of development in the attached LOD worksheet. This LOD

worksheet shall be reviewed during the project process kickoff meeting for acceptance by the various team members.

3. Process Schedule

a. Process Schedule Integration with Project Master Schedule

Flint and its project team partners will come together to create a VDC milestone schedule during the kickoff meeting. The schedule will be approved after the completion of the process kickoff for official inclusion in the process execution plan. This schedule should be generated by the project team using a schedule charrette type process. A charrette process allows for each project team member to place their milestones where they see them. Then the entire team creates the sequenced schedule which reflects the dependent needs of each milestone. It is recommended that the team use a pull scheduling type process for sequencing the milestone tasks. Pull scheduling starts with the last task in an activity, and then works back to the start of the schedule, inserting tasks based on dependent activities which must be accomplished before the next task can begin

b. Design Model Handoffs

The VDC schedule will include a model handoff schedule to occur through a staggered approach based on individual disciplines. This schedule will reflect the previously agreed upon VDC Workflow Guide Addendum (ref section 2.b.).

c. VDC Process Schedule

Beyond the VDC milestones, the team should also place schedule tasks for the construction coordination meetings. When possible, the coordination sessions should be given a description based on the area / system / and component of the project that they will be reviewed during that meeting. The coordination meetings should be seen as intermediate, model deliverable, deadlines that are creating the day to day VDC process which will help the team to assure timely completion of the milestone task. The coordination process for a project is outlined in section 5, which also includes a description of the actual coordination meetings and frequency.

i. Submittals

The Submittal Schedule for the project should be reviewed by the VDC process team members during the creation of the Project Specific VDC Process Schedule. In order to effectively model and coordinate the exact systems to be built on the project, submittals needing approval for the purchase of a system/equipment must be reviewed and approved prior to the element being modeled or virtually coordinated. The time needed to review and approve these various submittals, which are directly related to model systems, should be included as in the VDC process schedule with the Approve by Date noted as a milestone on the schedule. The Approve by Date is the last date possible for approval of the

submittal before it will impact the overall modeling/coordination process, and the purchasing/delivery/installation dates of the system.

ii. **Prefabrication Requirements**

Prefabrication elements should be discussed during the process kickoff meeting. The delivery date of the major system / equipment prefabrication items should be included on the VDC Schedule. Prefabrication relies on detailed coordination, not only of the prefab system, but also all the systems around it. So unique prefab coordination milestones might need to be created to assure the successful delivery of the prefab element on time, and that the area of installation is clear to accept the item. During the creation of the design team's VDC Schedule, they should create place holders for these prefab coordination meetings and prefab milestones for review and confirmation by the construction team.

4. Model Standards

a. Modeling/Coordination Programs

Flint uses the following programs as part of its Virtual Construction efforts. All models need to be created so that they can be read in at least one of the programs below.

i. Revit – 2021 or Newer
ii. Autodesk Construction Cloud – Cloud Based
iii. Navisworks – 2021 or Newer
iv. AutoCAD – 2021 or Newer
v. AutoCAD Civil 3D – 2019, 2020, 2021, 2022, 2023
vi. Revizto – Cloud Based
vii. Plannerly – Cloud Based

b. Model Naming Structure

The Project BIM execution plan details the specific file naming and model structure requirements for the project. These naming and model structure requirements shall be followed during the design and construction process stages.

c. Orientation Point

Project specific model orientation expectations shall be outlined in the Project BIM execution plan. Below are the general global and local orientation expectations for the project.

i. Globally

During the initial Process Kickoff Meeting, the project team shall review and determine the global reference location for the project model(s). This spatial reference point shall be based on a geo-reference location. Flint's model manager/coordinator shall establish the geo-reference for the project team to use based on the projects specific GIS information and

standards if they exist for the project. This point shall be used to globally locate both building models and site models.

ii. Locally

1. During the initial process kickoff meeting, the team will also establish a project specific model orientation point to be used by the team in their individual model authoring programs. This point should be a spatial reference location that is tied back to the Global reference point
2. At the start of the modeling efforts, the project team will agree upon the location of the project origin.
3. This point typically should be an intersection of two major grid lines at the top of the first floor slab.
4. The X, Y & Z axis for this point will be documented for all project team members.
5. Once established, this origin will be used for all future project information including 2D drawings and any 3D Models.

d. Model Sharing

i. A collaborative data site will be set up for the project team to transfer BIM deliverables and other project information back and forth and will be defined in the Project BIM execution plan.

ii. This site shall be set-up and managed by Flint, unless otherwise designated.

e. Layer Naming

i. Standardized Structure – Uniformat System

Flint uses a standardized model layer naming structure around the Uniformat convention of system-based numbering for its models. Design and construction team members should also use the Uniformat convention of naming to establish their model layers / worksets / etc. The layer name should be either a Uniformat 3rd or 4th level numbering.

f. Model Data

i. Element Naming Structure

Each model element should have a unique name based on its system or individual component / equipment. This name should be based when possible around the manufacturers name for the finished system / component / equipment. As well as the unique name given to the model element in the authoring program, each element should also have a global unique identifier (GUID) tag that the program creates.

ii. Integration of Data with Model Element

Data about a model element should be attached to that element when possible for the project owner's use after project completion and as outlined in the LOD worksheet. This data may include specification information, warranty information, operational information, and manufacturer product cut sheets, etc. Each project team member is responsible for updating the

model element with the outside data that is created during their phase of the VDC process as outlined in the LOD worksheet.

5. Model Creation

Team members shall deliver their models based on the VDC Schedule and to the expected detail outlined in the LOD worksheet. The information below outlines the general model and system specific expectations for all models created by the project design team. The requirements outlined below are the minimum expected VDC process and BIM deliverable expectation for this project and this list shall be included in the Project BIM execution plan and further developed as need by the project team as part of that plan. The minimum requirements are expected regardless of each system's level of detail as outlined in the LOD worksheet.

a. General Modeling Guidelines

Models shall be created in a format that can best be used by each of the individual project partners based on their specific scope of work. Each model needs to have the ability to be used by other project partners that will be adding information or coordinating around a design model. (Model flow: Design-Fabrication-Installation-Facility Management).

i. All models will be supplied to Flint in their native file format as well as an ifc format if requested. The ifc format shall be the latest standardized version as outlined by BuildingSMART International. Currently the latest ifc file format that the project team should use is an ifc 2x3 or higher. Models may be requested to be supplied in alternative formats based on the modeling programs that Flint currently uses.

ii. All elements of the project are to be created in 3D with real world information including material/product sizing and project specific location coordinates to match what is shown on the 2D contractual documents. Specifically, all elements shall be modeled to their overall height, width and depth and to a level of development as outlined in the attached LOD worksheet.

iii. All materials assigned to model elements shall be identified in accordance with the project design. The elements shall best represent the expected final product.

iv. Elements that are being provided by a specific manufacturer or based on a specific system shall be modeled using a model when available directly from the manufacturer. This model shall include relevant product specific information. Examples include: MEP Equipment, Doors, and Windows…

v. Any element that needs specific clearance space around it shall have that space modeled as a semi-translucent element clearly labeled as to what it's for. This clearance element needs to be contained in a separate layer from the element which it is required for. Example: Work areas, both install and maintenance, around electrical panels, mechanical equipment.

vi. Anything that is not intended to be seen in a model shall be removed or hidden prior to the model being shared.

vii. Use only standard fonts in the model or any accompanying 2D drawings.
viii. Xrefs – 2D Xrefs may be requested by project team members to be used as a background file during their modeling efforts. Please do not bind Xrefs files to any model that is being shared with the project team.
ix. Worksets/Layers – All model elements should be drawn on unique worksets/layers that relate to that specific element or system. Text for a model element should be on its own separate layer. i.e. fire rated walls, standard partitions, etc…
x. All project specific model worksets/layers need to be on/visible when the model is shared.

b. Site Elements

i. Site topography
ii. All underground utilities within 5'-0" of a building
iii. All bundled conduit or piping with a cross sectional area of 36" or larger
iv. All vaults, manholes, tanks, and underground storage containers
v. All ductbanks
vi. Light poles, light pole bases, and bollards
vii. Sidewalks, curb, gutter, asphalt and concrete paving
viii. Hardscape areas not mentioned above
ix. All backwash preventers and control valves
x. All site structures not included in the building architectural package

c. Architectural Systems

i. All elements shall be modeled as they are to be built. i.e. walls from top of slab to bottom of the slab above.
ii. Model all openings in slabs and walls,
iii. All slabs and floors not included in the structural model. Slab should include all materials required for their assembly.
iv. All walls both exterior and interior not included in the structural model. Walls need to include all materials required for their assembly and assembly ratings and be labeled in the model to match the labeling shown in the contract documents. Cuts through the walls should clearly show the various elements that make-up the overall wall assembly. *Walls can be drawn as different elements and uniquely labeled based on their assembly. i.e. metal studs, gyp. board, insulation…this is not a standard project requirement and shall be discussed by the team during the process kick-off.*
v. Non-structural wall modeling in preparation for pre-fabrication
    1. Interior walls shall have an identifier indicating the orientation of the inside and outside of the wall, i.e. outside layer of gyp. to be colored differently from the inside layer.
    2. All windows and doors in their respective families
    3. Window and door datums must be in the center of the opening
    4. Window and door families; rough width and rough height must be equal to the door/window size

5. No generic model types

vi. All columns not included in the structural model.

vii. Furring as required for walls and columns included in the structural model as part of the component assembly, not individual members.

viii. All doors including their door frame and their material properties. Hardware should be included as a note in the model element or in the naming of the element but does not need to be included as a 3D element as part of the door.

ix. All exterior systems including but not limited to: masonry, precast, plaster, punched windows, curtain wall and storefront systems.

x. Ceilings and soffits. Ceilings shall include both hard and suspended acoustical ceilings.

xi. Stairs and railings

xii. Casework

xiii. Floor and wall coverings as outlined in the LOD worksheet.

xiv. Roofing System

xv. Scuppers and drains not included in the MEP model

xvi. Equipment and fixtures not included in the MEP model

d. Structural Systems

i. All elements shall be modeled as they are to be built. i.e. model individual slabs per the way they are to be poured

ii. All foundations, caissons, and grade beams based on their actual sizes and shown at the correct top and bottom elevation based on the project origin.

iii. All structural walls

iv. All structural columns

v. All structural decks, beams and joists. Joists shall be modeled when possible as outlined in the project LOD worksheet using model elements provided by the project joist supplier. Joist openings shall match the fabricated locations for use in the coordination process.

vi. All lateral and diagonal bracing

vii. All openings in structural walls and decks

viii. Structural concrete and steel stairs including their related components

e. MEPF Systems

i. General

1. All systems listed below are examples of Flint's standards. Reference Section 6 for LOD requirements at different project stages

2. All elements are to be correctly allocated to a discipline and systems.
3. All elements that are identified in Appendix C, Section 2.3 as 'Defined Managed Assets' are to be tagged using the Managed Asset Naming Convention and populated with asset data.

4. All model elements are to be allocated to the correct Level parameter within the model.
5. Duct, piping, cable tray and similar items are to be identified by size – element geometry and in the metadata.
6. Piping to be modelled at the appropriate Outside Diameter including any lagging and be tagged in element metadata with the Nominal Diameter. Lagging to be modelled as a semi-transparent mass.
7. Duct, pipe, cable tray, etc. supports/hangers are to be modelled as required for the purposes of coordination.
8. All access requirements, insulation, lagging and/or linings are to be included in services models.
9. All concrete equipment pads, inertia pads, etc. to be modelled.
10. All acoustic and fire rated collars, dampers, etc. to be modelled.
11. Seismic bracing/restraints to be modelled.
12. All elements are to be identifiable by type as parameters. Subcontractors are to model elements that align to the specification of installed (or to be installed) elements. Key data associated with elements to include any size/dimension/type, etc.
13. Models from supplier's to be used in all possible instances throughout the Project.
14. All model elements are to be modelled using the appropriate category or element type e.g. an eccentric ductwork transition must belong to the 'Duct Fitting' category, and not as a mass element.
15. Clearance Installation / maintenance zones for access, service space requirements, and other operational clearance must be modelled (as a semitransparent element within the same group / family) for all equipment as part of the services equipment and checked for conflicts with other elements.
16. Equipment access doors and panels including access zones in front, above and below shall be modelled and comply with accessibility requirements per relevant code/maintenance requirements.
17. All elements shall include necessary information to enable scheduling as required for the discipline in a complete and accurate manner – including quantities, asset registers, etc.
18. All Elements, **regardless of size**, if residing in a prefabricated wall panel shall be modeled. This includes, but is not limited to, conduit, piping, MEPF stub-ups, etc.
19. All stubs through concrete into wall panels shall be modelled with 2" clearance zone around the stub.

ii. Mechanical Systems

1. All supply, return, exhaust, relief and outside air ductwork to be modelled, including any insulation modelled to the outside face

dimension or duct insulation (whichever is greater). Insulation to be indicated as a separate model element as a semi-transparent element wrapping the duct/pipework.

2. All ductwork and pipework (≥20mm) to be modelled as fabricated lengths and incorporate flanges, joints, other connectors, etc.
3. All mechanical equipment under the subcontractor's scope of works to be modelled (e.g. fans, VAV's. compressors, chillers, cooling towers, AHU's, pumps, tanks, sensors, dampers, etc.)
4. All valves, gauges and control valves to be modelled.
5. Diffusers, registers, louvres, grilles, high/low point drains, starters, etc. to be modelled.
6. All controls devices are to be modelled.
7. All Elements, **regardless of size**, if residing in a prefabricated wall panel shall be modeled. This includes, but is not limited to, conduit, piping, MEPF stub-ups, etc.

iii. Hydraulic Systems

1. All piping systems (≥20mm in diameter) to be modelled. All required insulation to be modelled as a separate semi-transparent thickness around the pipework.
2. All equipment including any elements associated with Domestic Cold Water, Chilled Water, Steam, pumps, tanks, water heaters, in-wall carriers, in-wall plumbing equipment, etc. to be modelled.
3. All fixtures to be modelled e.g. sinks, toilet fixtures, water tanks, etc.
4. All valves, gauges, control valves and clean-outs to be modelled.
5. All Elements, **regardless of size**, if residing in a prefabricated wall panel shall be modeled. This includes, but is not limited to, conduit, piping, MEPF stub-ups, etc.

iv. Electrical, Comm, Network and Security Services

1. All electrical/communications/network/security systems, equipment and devices/receptacles are to be modelled to the correct overall height, width and depth.
2. All cable containment and fittings (cable tray/ladder/ducting) are to be modelled.
3. All equipment including panels, transformers, switch/paralleling gear, generators, sensors, etc. to be modelled.
4. All light fixtures, exit signs, fire alarm components and devices, speakers, AV equipment and devices, recessed electrical devices etc. are to be modelled and coordinated with ceilings and walls.
5. Individual cables are not required to be modelled.
6. All conduits ≥1"in diameter, or bundles of conduits ≥4" in diameter are to be modelled.

7. All elements are to be included in panel schedules within the authoring platform.
8. All electrical components are to be assigned to an electrical switchboard.
9. All Elements, **regardless of size**, if residing in a prefabricated wall panel shall be modeled. This includes, but is not limited to, conduit, piping, MEPF stub-ups, etc.

v. Fire Protection/Fire Alarm

1. All risers, main and branch piping including sprinkler lines and heads to be modelled.
2. All pumps, controls, detectors, alarms (components and devices), public address systems and all other equipment are to be modelled.
3. All Elements, **regardless of size**, if residing in a prefabricated wall panel shall be modeled. This includes, but is not limited to, conduit, piping, MEPF stub-ups, etc.

f. Miscellaneous Systems

The following is a list of some of the additional systems that may or may not be required to be modeled on a project based on the project specific LOD worksheet. Incorporation of these elements will be determined at the VDC Process Kickoff meeting.

- **i.** Raised access floor system including under floor air distribution that's not been modeled as part of the overall mechanical system
- **ii.** Furniture system as outlined in the LOD worksheet
- **iii.** Water Features including fountains and pools
- **iv.** Security systems including devices and conduit larger than 1-1/2"
- **v.** Pneumatic tube systems

g. As-Built (Project Record) Modeling (If Required)

The construction model shall be updated by the project team during the construction phase to include the actual conditions of the final constructed systems / components. The LOD worksheet will outline which team members are responsible to update the various model systems to their as-built condition. The project team shall outline a written plan for creating a final as-built model upon completion of the project and include it in the BIM Project Execution Plan. This Plan may include the team's use of digital as-built collection tools such as 3D laser scanning and model based total station surveying systems.

6. Coordination Process

The goal of Flint's coordination process is to achieve an LOD 350 model at time of submission to the AHJ. This requires three (3) distinct phases of coordination which are listed below. Project specific collaboration procedures are further defined in section H of the Project BIM execution plan.

a. Basic and Gross Coordination (Award through DD)

i. Basic coordination will be completed through the schematic design process. The goal for this phase is to have all teams complete their models to an LOD of 200 and submit those in tandem with milestone drawings.
ii. Gross coordination will be completed through the design development phase. The goal for this phase is to have all teams complete their models to an LOD of 300 and submit those in tandem with milestone drawings.
iii. Flint's Coordination Manager shall work with the various design team members Coordination leads to further detail the VDC process schedule to create coordination stages that match the needs of the design deliverable schedule.
iv. Flint's Coordination Manager will act as lead representative for the construction team during the design stage of the project and will be responsible for making sure the construction teams requests and requirements are accurately relayed to the design team.
v. Should construction team members outside of Flint be needed to help make design decisions and resolve project coordination issues then the coordination manager will be the lead to arrange for those team members to attend the design coordination meetings.
vi. Each team's coordination manager shall be responsible for reviewing the accuracy of the model deliverables at the various stages of the project as outlined in the LOD worksheet.

b. Fine Coordination (CD's)

i. Flint's Coordination Manager will be responsible for leading the model coordination process. This will include dividing the project up into specific model coordination areas for review.
ii. Fine coordination is defined as the coordination phase throughout CD's which is intended to resolve issues to achieve an LOD 350+ model by the time of submission to the AHJ.
iii. For design consultants (non-design build trades), all elements must be modelled and coordinated to an LOD of 300 or higher in this phase. Any changes made in coordination shall be reflected on the construction documents.
iv. For design-build trade consultants, all elements must be modelled and coordinated to an LOD of 350 or higher in this phase. Any changes made in coordination shall be reflected on the construction documents.
v. Additional coordination may be required after AHJ submission due to AHJ comments and/or additional constructability reviews. There will be a small time frame after AHJ approval to incorporate these changes and coordinate these items.
vi. A coordination schedule will be created with the project team to outline the model coordination area sequence. This schedule will tie into the overall project schedule that is established during the initial process schedule charrette session.

1. Below is an **example** of Flint's Fine coordination workflow/schedule
    a. A typical coordination schedule would be for all models of a specific area to be turned over to Flint on the end of the day Tuesday.
    b. Then Flint would internally review them on Wednesday and load them in to the model coordination review software.
    c. The actual coordination of the specific model areas would occur as a team on Thursday during a live meeting either face-to-face or via a web meeting service.
    d. Friday-Tuesday would be used for team members to update models based on coordination meeting deliverables.

vii. Once a Fine Coordination area has been reviewed by the project team and is deemed to be substantially coordinated, each contributor will update their portion of the model, and a sign-off set will be published of that area. This sign-off set will be based on the exact model files used to create the final coordinated review model. The set will include an initial block for the various team members involved in that coordination area on each of the for-construction shop drawings. Also, a sequencing schedule for the work to be performed by the subcontractor, as represented on the sign-off documents, will be included on the cover sheet. By signing the drawings, the various trades agree to install the system as the model/drawings indicate.

viii. The coordinated model/models shall be aligned to the contract documents. If changes are required due to the Fine Coordination process, these shall be incorporated into the drawings or into the project documents via RFI. In the event of material discrepancies between sign-off models/drawings and contract documents, contract documents shall govern. The responsible authoring party, however, shall be responsible for updating the model to an as-designed condition.

ix. Project team members that are involved in the modeling process will be required to attend the coordination meetings. The meetings shall be attended by individuals representing their companies that can approve the sign-off documents.

x. Model color schemes are a recommendation and are subject to adjustment at the time of Construction Coordination Kickoff and in the project specific BIM Execution Plan.

c. Model Hierarchy/System Prioritization

i. For the purposes of model coordination/clash detection the following hierarchy shall be used as a guideline. Specific Hierarchy and prioritization with respect to design and construction models will be determined by the agreed upon BIM execution plan.

1. Structural Elements

2. Architectural Elements
3. Main and medium pressure duct runs
4. Main plumbing waste lines and vents
5. Fire sprinkler mains and branches
6. Hot and cold water mains and branches
7. Plumbing fixtures
8. Lighting fixtures
9. Flexible ducts and smaller supply/return ducts
10. Domestic cold and hot water supply lines

ii. This hierarchy may be adjusted based on the specific system requirements on the project. If the standard hierarchy as described below is to be changed for a project, then all team members must agree to the changes. Those changes shall be detailed in the Project BIM execution plan.

d. Pre-Fabrication

The Design Consultant's shall develop the BIM up to LOD 300 throughout the design process. The Design Consultant provided BIM shall be used only for LOD 300 intended purposes per the BIM use matrix (i.e. layout, and coordination). The Design Consultant shall not be responsible for the accuracy of the BIM beyond LOD 300 as defined and interpreted in section 2.F.1 above. For pre-fabricated elements, the Design-Builder shall be responsible for additional LOD required (400+) for prefabrication such as walls, utilities, and finishes.

e. Model Based Shop Drawings

Shop drawings shall be created directly from the construction models used during the design or construction coordination process. As outlined above during the construction coordination process, the subcontractors involved are responsible for creating model-based shop drawings that are to be approved by other team members involved in the process as well. The designated design consultants shall review these shop drawings for final approval and use in the field during construction. The Shop drawings mentioned in this section are intended to represent the output from LOD 350 models and are not intended to include the level of detail required for use as fabrication documents.

7. Construction Process Integration

a. Subcontractor Field Installation Process

i. The subcontractor is responsible for coordinating the field installation of their systems to match that agreed to during the model coordination process and documented on the sign-off drawings.

ii. The subcontractor shall be responsible for any cost incurred by other members of the project team due to a deviation from the sign-off drawings.

iii. Any deviation from the sign-off drawings shall be recorded by the subcontractor and used to update the model that was the basis for those drawings.

iv. Installation shall be layed out via total station or similar system.
v. Flint reserves the right as part of its overall quality control process to spot check installed systems.
vi. Items which are not specifically contained within the BIM are to be coordinated in the field against the BIM and the Contract Documents by the installing trade partner. Any cost incurred from failure to coordinate against the BIM and Contract Documents is the responsibility of the installing trade partner.

b. Field BIM

i. Coordination models may be used on the project directly in the field as communication tools to help in the installation of various systems.
ii. Coordination models may also be attached to material tracking software to monitor the flow of material from fabrication to installation on the project.
    1. If this is an elected option on a project, the subcontractor will be responsible for working with an agreed upon tracking system to install tracking devices on their materials to facilitate this process.
    2. Flint will be responsible to supply the subcontractor with the tracking devices necessary for the process. (i.e. RFID tags, barcode tags)

8. Building Management and Operations Integration (If Required)

a. Model Based O&M Data

b. Asset Tagging

9. Model Deliverables

a. Model Transfer / Deliverable

After the completion of the VDC coordination process for the project, the facility owner will be given a federated / coordinated model in an ifc and nwd format for viewing in their modeling software. The project owner will also be given all native model files that created that final model deliverable. All of design and construction models at the completion of the project should be transferred to Flint through the project collaboration site.

b. Data Transfer

i. Electronic Data Files (PDFs)

All data files attached to model elements as outlined in the LOD worksheet shall be delivered to Flint in a PDF format at the time of the model deliverables as outlined above. If the file has more information on it than that associated directly to a model element, then information that pertains to the project/element should be clearly highlighted. A spreadsheet listing the name and description of the electronic file and its associated model element should be created by the team and delivered

to the Flint. This spreadsheet should be created in an excel format for easy future modifications by the Flint as needed.

ii. **Model Based Drawings**

All model-based drawings shall be delivered to Flint in both a hard copy and pdf format. Model based drawings shall be delivered as required by the process schedule.

10. Glossary of Terms

Building Information Modeling (BIM) – A building information model (BIM) is a digital representation of 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 lifecycle.

BuildingSMART Alliance – Organization established to coordinate the profound constructive changes coming to the fragmented real property industry in North America. The organization's collective goal is to establish open interoperability and full lifecycle implementation of building information models. http://www.buildingsmartalliance.org/

Charrette – An intensive process that involves the collaboration of all project stakeholders at the beginning of a project to develop a comprehensive plan or design.

GIS – Geographic Information System – integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.

Industry Foundation Class (IFC) – IFCs are data elements that represent the parts of buildings, or elements of the process, and contain the relevant information about those parts. IFCs are used to assemble a computer-readable model of the facility that contains all the information of the parts and their relationships. The project model constitutes an object-oriented database of the information which continues to grow as the project goes through design, construction, and operation. The International Alliance for Interoperability (IAI) has created this IFC data exchange format. The IFC format is now controlled by the BuildingSMART International Alliance. IFC format allows models to be used/shared in other modeling software without losing element specific information.

Sign-off Drawings – These are drawings created by project team members to guide in the fabrication and installation of project systems/elements. The drawings are produced from models used by team members during the coordination process. Sign-off drawings may also be known as Shop Drawings and contractually are viewed as the same document.

Virtual Design and Construction (VDC) – Virtual Design and Construction is the use of multi-disciplinary performance models of design-construction projects, including the product

(facilities information), work processes and organization of the design-construction-operation team in order to support business objectives.

VDC Process Goals – These are goals that are defined by the project team to outline the overall VDC objectives for the project. The goals include metrics for tracking and measuring the successful completion of the goals. The goals define the levels of BIM to be used on the project.

VDC Schedule – The VDC Schedule is created by the project team to outline the day-to-day and VDC milestones that lead to the creation of the design, construction and as-built BIM. VDC coordination meetings that are held by the team during both the design and construction phases of the project are also included in this schedule.

VDC Milestone – A VDC Milestone marks either the start of or completion/sign-off of a BIM area/system/element.

11. Appendices

12. Addenda