Exhibit F – BIM Requirements for Subcontractors
Transbay Transit Center

Webcor/Obayashi Joint Venture

I.   *Introduction*

Webcor/Obayashi Joint Venture is implementing a virtual building process for this project. This process will include building a digital, three-dimensional Building Information Model (BIM) linked to a project cost and labor productivity database, which will provide a platform for collaboration throughout the project's construction. In implementing this virtual building process as further outlined below, the Subcontractors will have the ability to analyze different construction sequences and methods for construction. In turn, the Subcontractor's provision of accurate virtual building data facilitates analysis and mitigation of potential costs and scheduling impacts.

The participants will adhere to the following guidelines in connection with this virtual building process. The costs of all management, administration, software, modeling, drafting, transmission, submittal, meetings, etc. for this process shall be the responsibility of the subcontractor and are included in this Subcontract.

II.   *3D Modeling Requirements*

Subcontractors will be a part of a team that will meet at least bi-weekly, but not more than twice weekly, for coordination meetings to model the building and its systems, coordinate the work, and build the project virtually. The objectives of these meetings include the elimination of as many conflicts and clashes as possible and the development of reliable schedules that allow for efficient workflow and effective production control. The coordination meetings will occur in multiple phases and as described for Target Schedule Development (TSD) in Subsection IV, Item a, below, but shall precede the TSD at each listed phase.

Webcor/Obayashi Joint Venture will manage and lead the coordination process and assist the subcontractors in bringing the individual models together, running clash detection reports, and generally coordinating the process. The individual participants will be partners in this process, model their work, coordinate this with other trades and building components, obtain submittal approvals from the architect and engineers of record, and relocate/modify their systems as necessary when conflicts arise.

The 3D model consists of geometry control models generated and provided by Webcor/Obayashi Joint Venture and/or the Owner's design team from the 3D Database and system models generated and provided by the Subcontractors for their respective scopes of work. The system models, when integrated with the geometry control models, are referred to as the "Federated Model."

The Subcontractor's system models are the Subcontractor's sole responsibility. Prior to commencing any modeling, the Subcontractor must coordinate the initial model orientation with Webcor/Obayashi Joint Venture. All information in the system models shall be consistent with and based on the Contract Documents. The system model shall be maintained throughout the duration of the Project and updated to reflect as-built

conditions. The degree of detail and accuracy of the Subcontractor's system models shall be sufficient to enable accurate and complete clash detection as well as shop drawing extraction. Subcontractors will be required to print their shop drawings directly from the Federated Model, including dimensions, elevations and location of specific trade elements, based off of the building grid and/or coordinates. The printed material shall comply with the submittal requirements noted elsewhere in the contract documents. Lastly, to allow for model quantity extraction for cost and schedule information, the Subcontractor shall coordinate breakdown and classification of systems in the systems model with Webcor/Obayashi Joint Venture.

B…

The Subcontractor's system models shall be fully compatible with **Autodesk BIM 360 Glue,** Autodesk Revit, Tekla, or Graphisoft ArchiCAD in the version contemporaneously current with Subcontractor's initial submission of its system model, or the version immediately preceding the contemporaneously current version. It shall be the responsibility of the Subcontractor to maintain this compatibility at its own expense. If more trade specific software is required for a particular system model, Subcontractor must obtain Webcor/Obayashi Joint Venture's prior consent to utilize such software.

…B

The Subcontractor shall transmit its system model to Webcor/Obayashi Joint Venture's BIM Coordinator who will manage the coordination process. The Subcontractor shall be required to perform clash detections and identify conflicts which shall be communicated to the Project team in a discrepancy report. Subcontractor shall review the identified conflicts as set forth in the discrepancy report and jointly develop conflict solutions and modify their system models accordingly. Trade coordination and model modification shall at all times remain a responsibility of each Subcontractor.

   a. Modeling Schedule

Webcor/Obayashi Joint Venture will develop a Modeling Schedule showing modeling and coordination efforts required by all subcontractors in order to meet the construction and installation performance shown in the Exhibit I Project construction schedule. Subcontractor will be required to maintain its performance to meet the dates shown in the Modeling Schedule Subcontractor shall ensure that it provides adequate modeling and coordination manpower to maintain the modeling/coordination schedule.

   b. Modeling Coordination Meetings

Subcontractor shall participate in BIM coordination and review meetings with Webcor/Obayashi Joint Venture. Subcontractors can expect these meetings to occur at least weekly or biweekly depending on the projects schedule needs. As a result of the information exchanged at such meetings, both the system model and the Work depicted

Webcor/Obayashi Joint Venture

in the Subcontractor's system model may be required to be changed by the Subcontractor to achieve coordination with other elements of the Project being provided by others. In accordance with General Conditions subsection 1.03.G, Subcontractor will be compensated for the associated BIM coordination efforts under the provisions for Change Orders of Article 6. Subcontractor acknowledges that BIM coordination and review meetings will require attendance of personnel that are familiar with both the data entry aspects of the BIM as well as an understanding of the Work to be performed and its relation to other elements of the Project, and the Subcontractor therefore agrees that personnel conversant in both shall attend all such meetings.

_B..._

III.   **DELETED** *Cost and Productivity Data*

~~In addition to the 3-D modeling requirements set forth above, all Subcontractors shall provide accurate cost and productivity information to be imported into a project data base in order to facilitate 4-D (time dimension) and 5-D (cost dimension) modeling. This information shall be broken down such that line items describe work activities for each building system included in Subcontractor's scope of work.~~

    a. ~~Scheduling Information. Subcontractor shall provide detailed scheduling information including, but not limited to, the following:~~
        i. ~~Provide a list of tasks which identify continuous activities that can be performed with other trades.~~
        ii. ~~Provide a list of predecessor tasks for each above-defined task that needs to be complete before Subcontractor can start the subject task.~~
        iii. ~~Provide a list of preferred minimum work areas breakdown. This breakdown shall be based on the minimum work areas that will be necessary for the Subcontractor to work efficiently.~~
        iv. ~~Provide task and specific location-based activity assignments for each item in Subcontractor Submittal Register when submitted in accordance with Exhibit F, Item III.A.12.~~
        v. ~~All information noted within this Item 'a.' shall be provided within 15 days of Subcontract award.~~

_...B_

A

    b. DELETED

A

IV.   *Project Scheduling and Production Control Phase Planning*

Project Schedule, is a critical path method (CPM) schedule that shows the initial plan to construct the project. This schedule sets forth certain dates for performance and a

Webcor/Obayashi Joint Venture

general sequence of construction that is subject to change based on project requirements and as set forth in Section G of the Instructions to Bidders.
Because the BIM requirements contained in this exhibit provide an opportunity to develop a schedule that is optimized for subcontractor performance efficiencies, it is the intent of the Project Team to employ production control techniques to manage the day-to-day construction of the Project. This process will proceed generally in the following manner and is affirmatively acknowledged by Subcontractor as follows:

a. Subcontractor agrees to participate in phased Target Schedule Development (TSD) at completion of each of the following stages of Consolidated Model Development:
    i. TSD#1 – Foundation & Substructure
    ii. TSD#2 – Superstructure & Exterior Envelope
    iii. TSD#3 – Mechanical, Electrical, Plumbing, Sprinkler (Fire) [MEPS]
    iv. TSD#4 – Interior Finishes
    v. TSD#5 – Commissioning
b. Phased Target Schedule Development (TSD) requirements:
    i. Subcontractor agrees that durations for Subcontractor's tasks at each location will be calculated based on quantities at each location divided by the Subcontractor's crew production rate
    ii. Subcontractor agrees to assist with optimization of the overall performance schedule for all trades, working from visualization(s) of labor flow using a Flowline chart (a modified Line of Balance schedule), to:
        i. Balance the number of crews to improve flow
        ii. Remove labor or material spikes to increase manageability and reduce site conflicts
    iii. Use risk analysis to determine buffer placement points and durations required to minimize risk
c. Subcontractor agrees to participate in Mid-Phase Re-optimization Development at least one (1) additional time following each of the TSD for phases of Consolidated Model Development described in Item A, above:
    i. Mid-Phase Re-optimization Development (MRD) requirements:
        i. Subcontractor agrees that durations for Subcontractor's tasks at each location will be calculated based on quantities at each location divided by the Subcontractor's crew production rate.
        ii. Subcontractor agrees to assist with optimization of the overall performance schedule for all trades, working from visualization(s) of labor flow using a Flowline chart (a modified Line of Balance schedule), to enable the following:
            i. Balance the number of crews to improve flow
            ii. Remove labor or material spikes to increase manageability and reduce site conflicts
            iii. Use risk analysis to determine buffer placement points and durations required to minimize risk

Webcor/Obayashi Joint Venture

V.   *Miscellaneous Provisions*

   a. Model Ownership: In accordance with Article 2, subsection 2.07A, BIM files, and other computer files created for the Project shall be made and remain the property of the TJPA, including all intellectual property rights to all documents or materials.

   b. Protection of Intellectual Property or Proprietary Information: Subcontractors who provide intellectual property and/or proprietary information which is incorporated into their models shall provide notification of the confidentiality of the information.

   c. Other Subcontract Requirements: Subcontractor agrees that neither the BIM nor the use of the BIM is in lieu of nor intended to relieve the Subcontractor of its responsibilities under the Subcontract, including, without limitation, to (i) coordinate its Work with the work of others involved in the Project and (ii) strictly comply with the other requirements of the Subcontract Agreement and the Contract Documents. It is expressly understood and agreed that, notwithstanding the requirement for submittals in connection with the BIM, other submissions shall be required of Subcontractor as required by the Contract Documents.

   d. BIM Liability: Subcontractor acknowledges and agrees that the TJPA and Webcor/Obayashi Joint Venture shall incur no responsibility or liability with respect to the BIM or the use thereof, including that resulting from errors, omissions or deficiencies in the BIM. In the event that Subcontractor provides deficient information or data that does not represent the Work it will ultimately be providing, or that is corrupted in that the information transmitted contains a virus, and/or that otherwise damages the BIM, Subcontractor shall bear all costs associated with reconstructing the BIM and to otherwise remediate such deficiencies and their effects. In the event Subcontractor discovers an apparent error, inconsistency or omission in its information or submissions it shall notify Webcor/Obayashi Joint Venture within 72 hours and via written correspondence. In the event Subcontractor discovers an apparent error, inconsistency or omission in the information or submissions provided by others Subcontractor shall promptly request clarification of the same from Webcor/Obayashi Joint Venture, with a written Request for Information per General Conditions Article 6.03.

VI.   *Modeling Specification*
      B…
      a. The goal, through 3D coordination, is to create fully coordinated shop drawings derived from using the Models produced and coordinated by each discipline. ~~These models would then be used for scheduling (4D) and cost management (5D) purposes.~~ This section describes the **Degree of Detail (DOD)** to which

Webcor/Obayashi Joint Venture

each system will be modeled and whether the system should fall under the standard or high level category.

...B

i. <u>DOD 1 indicates</u> standard degree of detail where elements match the approximate space and shape the element occupies or the space required to access equipment for maintenance. Accurate geometry of components with rectangular cross sectional geometry. Components of complex cross sectional geometry are approximated with simplified cross sections and modeled with accurate enveloping geometry. Composite structures are modeled with solids. Symbolic representation of fixtures, equipment, furniture and like.

ii. <u>DOD 2 indicates</u> a high degree of detail dimensionally accurate, and where applicable, manufacturer specific element (does not require manufacturing/fabrication detail – exterior envelope is required) Accurate geometry of components with rectangular and complex cross sectional geometry. The individual layers of composites are broken down to smaller components and built up piece by piece. Exact representation of fixtures, equipment, furniture and like. The model will include secondary components that may influence coordination, such as gusset plates, secondary steel members, hangers, braces etc.
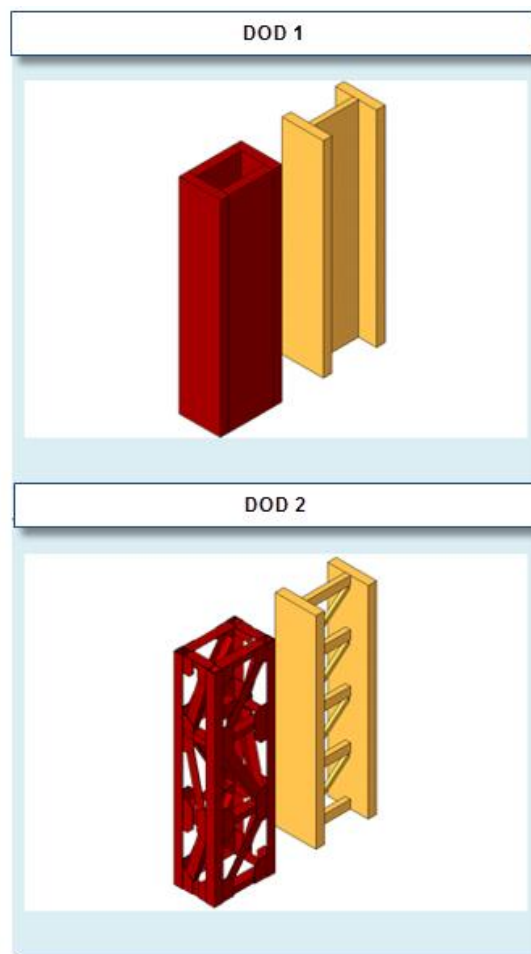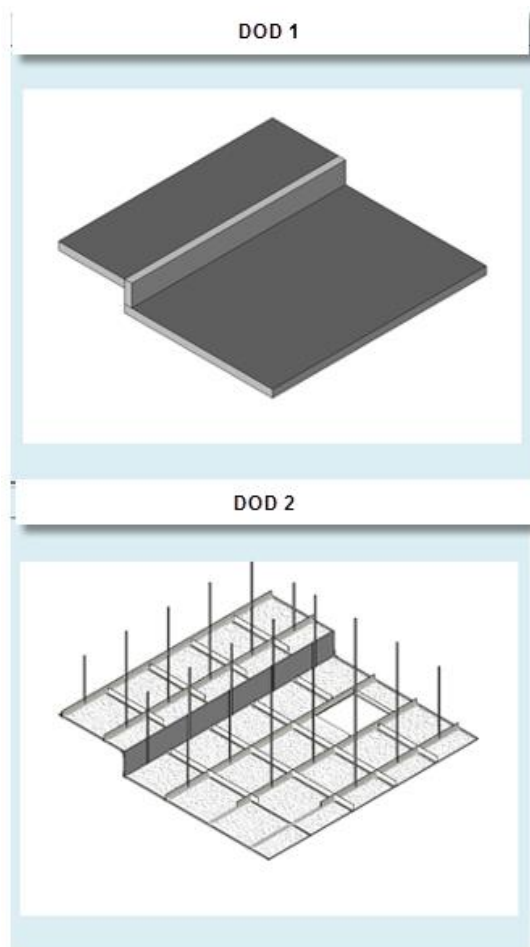
Please refer to the Trade Specific BIM Requirements below for the list of systems that are required to be modeled.

VII.   Change Management

Subcontractor will maintain its system model throughout the project duration, incorporating all changes that impact its Work. Subcontractor will update its Work as required through participation in the 3D coordination process outlined above. Subcontract may be required to re-extract shop drawings and prepare updated submittals to incorporate changes to its Work.

After each model update for a change package (e.g. ASI), Subcontractor shall archive a copy of its model before incorporation of further changes. Using versions of its system model, Subcontractor shall publish quantity deltas per system between models. Subcontractor will apply it's bought out unit rate for a particular changed system to the quantity delta to calculate

Webcor/Obayashi Joint Venture

the value of the change per the original contract. This value will serve as a baseline to enable change orders negotiations.

Exhibit F - Trade Specific BIM Requirements

Trade	*System*	*As-Built Delivery DOD*
Electrical (TG10.4)	Equipment	2
	Conduit under 1"Ø in High Density Locations	2
	Conduit 1"Ø and Over - Electrical Feeders	2
	Flex conduit	2
	High - Voltage	2
	Medium - Voltage	2
	Low Voltage - Security, IT, Phone, Sound and Video	1
	Lighting - Interior / Exterior	2
	Fixtures - Interior / Exterior	2
	Cable Trays	2
	Racks	2
	Access Panels	2
	Hangers and Support	1
	Raceways	2
	Sleeves	2
	Blockouts	2
	Temporary Power	2
	Equipment Pads	2
	Access and Installation Clearances	1
	Meter and Submeters	1
	Curbs	2
	Backing and Blocking	1
	Panel Boards	1
	Security and Lighting Pylon	1
	Switch Gear and Transformers	2
	Pull Boxes	1
	Display Panels/LCD Panels and associated Wall Mounts	1
	Signage	1
	Buss Ducts	2
	Light Switches	2
	Receptacles	2
	Fire Alarm System Devices, i.e. control panel(s), strobes, horns, etc.	1
	Security Systems, i.e. Control Panel(s), Speakers and Cameras	1