# The Model Development Specification (MDS)

*A Language and Process for Defining*
*Building Information Model Milestones and Deliverables*

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## 1 Executive Summary

The Model Development Specification is a method for concisely defining the amount, type, and precision of information that is to be included in Building Information Models (BIMs) for specific project milestones and deliverables as the project progresses from concept to closeout. It forms the basis of processes that clearly inform the project team about the content and timing of information required of them and available to them, increasing efficiency and reliability and eliminating unnecessary or redundant work, and thereby significantly reducing the cost and increasing the benefit of the BIM process.

The MDS defines models using a widely accepted language – the Level of Development (LOD)[1] definitions developed by the AIA for its *E202-2008 BIM Protocol Exhibit*. Under an agreement between the AIA and the AGC, the BIMForum, an organization comprising participants from all sectors of the AEC industry, convened an interdisciplinary group to create a *Level of Development Specification* (www.bimforum.org/lod). This document provides standard interpretations of the AIA's LOD definitions for almost 450 building systems and sub-systems, and can be attached to agreements to enable the definition of models.

The MDS can be used stand-alone or together with the *E202,* where the content of the *202*'s Model Element Table is developed through MDS-enabled processes within the context of the project flow, and the *202* provides the means for memorializing the decisions. The MDS is a crucial part of any BIM Execution Plan – once the desired uses for BIM (see Attachment 1) are determined, the MDS is the best way to define the development of BIMs to support them, and to bring clarity and efficiency to the modeling effort.

Some of the benefits the MDS brings to projects:

- The owner is assured of getting the models it needs to support the processes it wants.
- Modeling cost is significantly reduced because the effort can be accurately scoped to include the detail that is necessary and eliminate that which is not.
- Modeling effort can be scoped and priced fairly.
- The design process can be planned and tracked so that the necessary information is available when it's needed.
- Downstream users' reliance on models can be specifically defined and controlled, making the models much more useful than the common "for reference only" disclaimers allow. This is extremely effective in eliminating coordination errors and rework.
- Builders' needs in the models can be concisely defined, allowing design models to be passed on to the builder. This eliminates the need for the builder to re-create models - the savings for this step alone can be in six figures.

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1 The Level of Development language is an outgrowth of the Level of Detail framework, first created by Vico Software (then a division of Graphisoft) and further developed by the AIA California Council IPD Committee. It was evolved into the Level of Development framework by the AIA Contract Documents Committee as the core of its *E202-2008 BIM Protocol Exhibit*.

## 2 Anatomy of the Model Development Spec

The Level of Development (LOD – see 3.1 below) framework at the heart of the MDS describes where a building system, assembly, or component is along the path from concept to final definition. The design of various building elements progresses at different rates and often goes through iterative loops, but in general they progress from concept to generic placeholder to specific assembly to detailed assembly. See Figure 1.

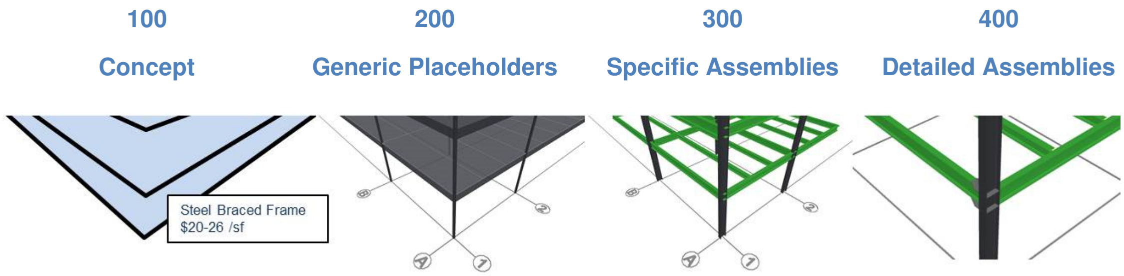
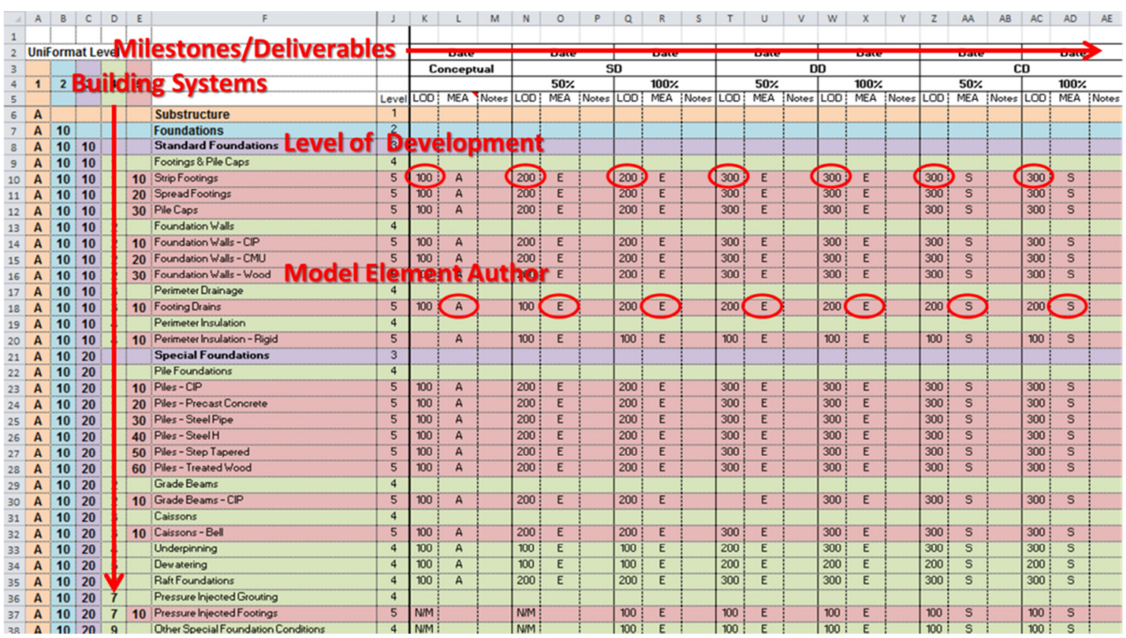



Figure 1 Steel Structure at Increasing LODs

At any point in time a model representing the design will contain elements at various LODs. The MDS is a matrix that breaks down the building system by system, and then assigns an LOD and a Model Element Author (MEA – see 3.2 below) to each system at each milestone or deliverable.




| | A | B | C | D | E | F | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | AA | AB | AC | AD | AE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | UniFormat Level | | | | | | | Date | | | Date | | | Date | | | Date | | | Date | | | Date | | | Date | | |
| 3 | | | | | | | | Conceptual | | | SD | | | | | | DD | | | | | | CD | | | | | |
| 4 | 1 | 2 | | | | | | | | | 50% | | | 100% | | | 50% | | | 100% | | | 50% | | | 100% | | |
| 5 | | | | | | | Level | LOD | MEA | Notes | LOD | MEA | Notes | LOD | MEA | Notes | LOD | MEA | Notes | LOD | MEA | Notes | LOD | MEA | Notes | LOD | MEA | Notes |
| 6 | A | | | | | Substructure | 1 | | | | | | | | | | | | | | | | | | | | | |
| 7 | A | 10 | | | | Foundations | 2 | | | | | | | | | | | | | | | | | | | | | |
| 8 | A | 10 | 10 | | | Standard Foundations | 3 | | | | | | | | | | | | | | | | | | | | | |
| 9 | A | 10 | 10 | | | Footings & Pile Caps | 4 | | | | | | | | | | | | | | | | | | | | | |
| 10 | A | 10 | 10 | | 10 | Strip Footings | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 11 | A | 10 | 10 | | 20 | Spread Footings | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 12 | A | 10 | 10 | | 30 | Pile Caps | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 13 | A | 10 | 10 | | | Foundation Walls | 4 | | | | | | | | | | | | | | | | | | | | | |
| 14 | A | 10 | 10 | | 10 | Foundation Walls - CIP | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 15 | A | 10 | 10 | | 20 | Foundation Walls - CMU | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 16 | A | 10 | 10 | | 30 | Foundation Walls - Wood | 5 | [illegible] | [illegible] | | [illegible] | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 17 | A | 10 | 10 | | | Perimeter Drainage | 4 | | | | | | | | | | | | | | | | | | | | | |
| 18 | A | 10 | 10 | | 10 | Footing Drains | 5 | 100 | A | | 100 | E | | 200 | E | | 200 | E | | 200 | E | | 200 | S | | 200 | S | |
| 19 | A | 10 | 10 | | | Perimeter Insulation | 4 | | | | | | | | | | | | | | | | | | | | | |
| 20 | A | 10 | 10 | | 10 | Perimeter Insulation - Rigid | 5 | | A | | 100 | E | | 100 | E | | 100 | E | | 100 | E | | 100 | S | | 100 | S | |
| 21 | A | 10 | 20 | | | Special Foundations | 3 | | | | | | | | | | | | | | | | | | | | | |
| 22 | A | 10 | 20 | | | Pile Foundations | 4 | | | | | | | | | | | | | | | | | | | | | |
| 23 | A | 10 | 20 | | 10 | Piles - CIP | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 24 | A | 10 | 20 | | 20 | Piles - Precast Concrete | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 25 | A | 10 | 20 | | 30 | Piles - Steel Pipe | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 26 | A | 10 | 20 | | 40 | Piles - Steel H | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 27 | A | 10 | 20 | | 50 | Piles - Step Tapered | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 28 | A | 10 | 20 | | 60 | Piles - Treated Wood | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 29 | A | 10 | 20 | | | Grade Beams | 4 | | | | | | | | | | | | | | | | | | | | | |
| 30 | A | 10 | 20 | | 10 | Grade Beams - CIP | 5 | 100 | A | | 200 | E | | 200 | E | | | E | | 300 | E | | 300 | S | | 300 | S | |
| 31 | A | 10 | 20 | | | Caissons | 4 | | | | | | | | | | | | | | | | | | | | | |
| 32 | A | 10 | 20 | | 10 | Caissons - Bell | 5 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 33 | A | 10 | 20 | | | Underpinning | 4 | 100 | A | | 100 | E | | 100 | E | | 200 | E | | 300 | E | | 300 | S | | 300 | S | |
| 34 | A | 10 | 20 | | | Dewatering | 4 | 100 | A | | 100 | E | | 100 | E | | 200 | E | | 200 | E | | 200 | S | | 200 | S | |
| 35 | A | 10 | 20 | | | Raft Foundations | 4 | 100 | A | | 200 | E | | 200 | E | | 300 | E | | 300 | E | | 300 | S | | 300 | S | |
| 36 | A | 10 | 20 | 7 | | Pressure Injected Grouting | 4 | | | | | | | | | | | | | | | | | | | | | |
| 37 | A | 10 | 20 | 7 | 10 | Pressure Injected Footings | 5 | N/M | | | N/M | | | 100 | E | | 100 | E | | 100 | E | | 100 | S | | 100 | S | |
| 38 | A | 10 | 20 | 9 | | Other Special Foundation Conditions | 4 | N/M | | | N/M | | | 100 | E | | 100 | E | | 100 | E | | 100 | S | | 100 | S | |

Figure 2 Fragment of a Sample Model Development Spec

### 2.1 Breakdown structure

Each row of the matrix is a building system (there are several standard breakdown structures that can be used – CSI's Uniformat is shown in Figure 2). Systems can be further broken down or rolled up to provide more or less granularity depending on project needs.

## 2.2 Milestones and Deliverables

There are two types of these:

Standard Milestones define normal workflow – they are usually the architect's definitions for standard design phases, as in Figure 1. These form a starting point for developing a project MDS.

Use-case Milestones and deliverables define models for significant points in specific uses of the model (see Attachment 1) - price check points, permit submittals, procurement events such as steel mill orders, etc.

In the matrix each group of three columns defines a milestone or deliverable. At each milestone or deliverable each system is given an LOD to define the precision and reliability of the system model elements, an MEA to indicate who is controlling the system's representation in the model, and a space for additional notes if needed.

# 3 Definitions

## 3.1 Level of Development (LOD)

The Levels of Development describe the progress of the design of a building system, assembly, or component from vague concept to precise definition. They define not only the content of the representative model elements but also the degree of precision for which users can rely on them. The LOD definitions[2] shown here differ somewhat from those in the AIA *E202-2008*, having been revised according to both the AIA's updating of its Digital Practice Documents and the efforts of the joint AIA/AGC LOD working group.

100 Conceptual 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.

200 Generic Placeholders 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.

300 Specific Assemblies 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.

350 Detailed Assemblies 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 and potential interferences with other building systems. Non-graphic information may also be attached to the Model Element

400 Fabrication Details The Model Element is graphically represented within the Model as a specific system, object or assembly that is accurate 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.

[2] The Level of Development Definitions are produced by the AIA and have been used here by permission. Copyright © 2011. The American Institute of Architects. All rights reserved

## 3.2 Model Element Author (MEA)

The Model Element Author is responsible for the actual modeling of a given system, and is usually designated as one of the firms participating in the project (architect, engineer, subcontractor, etc.). Note that the MEA is not necessarily responsible for the content of the model element, as when a subcontractor is actually modeling a system but an engineer is still responsible for the design. Rather, the MEA coordinates any changes necessary with whoever is responsible for the design of the system and with other systems

## 3.3 Use Case

A use case is the use of modeling to support a specific design or construction function - Attachment 1 lists almost 50 of these. Each function has specific needs for information from a model, and the MDS enables these needs to be clearly defined and planned for.

# 4 Putting the MDS to Work

The MDS enables effective and accurate planning and tracking of many aspects of the project delivery process.

## 4.1 Software Implementation

At this writing both Assemble Systems and Autodesk are implementing functionality to facilitate project and model management processes using the MDS. Both implementations streamline the process of importing LOD information into models, and enable the user to see, in a semi-transparent model, LOD information on selected sets of elements. Views can be set up, for example, to show all elements in selected systems that are currently at various LODs, all elements in the model whose LODs are behind the required LOD for the next milestone, etc.

## 4.2 Processes

Below is a sampling of processes that are greatly streamlined and made more rigorous and predictable through the use of the MDS:

### 4.2.1 Mapping Firm Standards

This is a process of defining a firm's standards in the MDS format. This definition provides the clarity necessary to ensure that project teams develop model elements to the detail that's required without wasting effort on detailing that's not needed. For firms without existing standards the MDS provides clarity that greatly facilitates standards development.

Some examples:

- **Owner:** standard cost checkpoints, model needs for facilities management
- **Architect:** mid- and end-points of standard design phases
- **Contractor:** standards for construction models to support various use cases

Development of a project MDS begins with one or more of these standards as a baseline.

### 4.2.2 Scoping Modeling Effort

The completed MDS provides a clear basis for determining the effort needed to develop the required model(s). When additional modeling functionality is contemplated, comparison with the baseline enables accurate and transparent determination of the cost and time needed to develop it.

### 4.2.3 Developing a Baseline Design Schedule

This is done by defining standard milestones using one or more of the firm standards mapped out as described in 4.2.1 above, and then assigning dates to them. Often the starting point is the architect's standard, since it's the architect that's responsible for overall coordination. Once the baseline is laid out any changes needed for the specific project can be clearly identified.

### 4.2.4 Defining Use-Case Milestones

Modeling use in supporting a specific function will usually have several associated milestones. For example, the estimating function may have several budget check points specified by the owner as well as project delivery estimates such as a GMP, bidding documents, or an IPD target cost. The LODs for use-case milestones are set according to the precision needed to generate the information required for the milestone.

### 4.2.5 Setting Milestone Dates Based on Standard Workflow

If the team wishes to stay with the standard workflow as defined by the baseline schedule, use-case milestones can be compared to the baseline, and dates for these milestones can be set according to when the necessary LODs will be available.

### 4.2.6 Determining Workflow Based on Milestone Dates

If certain use-case milestones have critical dates, they can be inserted into the baseline according to those dates. This will clearly indicate any systems whose development will need to be accelerated in order to meet the milestone dates.

### 4.2.7 Defining a Design/Build Bridging Package

In this form of project delivery the "bridging" can happen at a range of points – often at the end of Design Development, but in some cases as early as partial Schematic Design. Defining the bridging package through an MDS enables the owner and the preliminary designer to be clear on both the scope of the preliminary design effort and the level of completeness of the information the owner will have to pass on to the design-builder.

### 4.2.8 Defining a Design Architect – Executive Architect Transfer Package

On projects where these are separate entities clearly defining the transfer package through an MDS can eliminate unnecessary uncertainties in the design as well as much redundant work.

### 4.2.9 Passing a Model from Design to Construction

It is still common practice for contractors to re-create a model from scratch, at significant cost, for use in construction tasks such as estimating, system coordination, and layout, even when the design team has already created a detailed model. However, on many current projects the teams are able to avoid much of this cost by passing the design model on to the construction phase, the contractor adding the necessary construction detail to the existing model rather than building a new one.

The MDS enables this handoff by clearly stating, at each defined milestone, both the allowable uses and the precision of model elements representing various components of the building.

This process works best if the architect and contractor agree on MDS milestone definitions at the beginning of the modeling effort. Alternatively, the contractor can define its own needs in models to support various use cases as firm standards. Then if the contractor comes on to a project after modeling is underway, its standards can be compared to the project MDS. This comparison will show the gap between what is available and what is necessary, and the effort needed to fill the gap can be scoped and fairly priced.

### 4.2.10 Defining an As-Built Model

At the end of the project the owner often has a need for field verification of specific items, and these elements might be modeled at any LOD – the need for field verification does not necessarily imply that the LOD needs to be increased. The MDS enables clear definition of these items by providing for a suffix of

"FV" appended to an LOD. This definition ensures that the owner will get the information it needs without paying for information it doesn't.

#### 4.2.11 Defining Facilities Management Models

Facilities management includes many functions (see Attachment 1), with widely varying needs from a model. For example, support of remodeling and repurposing of a building requires a complete construction model, some of it field verified. Space and asset management, on the other hand, usually doesn't require more from a model than the visible geometry of the spaces as a base for CAFM information. In order for the owner to be assured of getting the model(s) it needs without paying for non value-add effort, the FM functions to be supported are selected, and then one or more supporting models are defined via the MDS.

#### 4.2.12 Facilities Management Data Collection

When the owner wants a model populated with building component information such as model or serial numbers of specific equipment, the effort needed to gather the information can be significant. Using the software functionality mentioned above personnel can quickly see not only what information still needs to be collected, but also exactly where in the building to find it.

## 5 Conclusion

The MDS allows both interim and final models to be fully and clearly defined, an endeavor that until now has been vague at best. For any BIM effort this enables the generation of higher value deliverables, avoidance of unnecessary modeling effort, vastly improved planning and tracking, accurate, fair, and transparent scoping and pricing of modeling effort, more reliable models, and the ability to leverage models for more purposes, all leading to improved efficiency and significant cost savings.

| *Interactions: As a project develops, functions may be added or deleted, and interactions might vary based on capabilities of the parties and whether or not a specific consultant is on board for a particular function. In an IPD setting functions of parties are often blurred - i.e., any party might use or support any function. The notations here refer to the most prevalent interactions.<br>**Lead:** Primary author. Note that some functions have multiple leads - this can be different leads for different aspects (e.g., 2D Drawing Generation) or a collaboration (e.g., Design Decision Support).<br>**Support:** Provide input to the Lead.<br>**Use:** Extract output from the model for input to one's own work. | **Phase** | | | | | | | | **Interaction with Model*** L=Lead, S=Support, U=Use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conceptualization | Criteria Design | Detailed Design | Implementation Docs | Final Buyout | Agency Review | Construction | Closeout | Owner | Architect | Engineers | GC | Subcontractors |
| **1. Visualization** | | | | | | | | | | | | | |
| 1.1. Design decision support | ■ | ■ | ■ | | ■ | | | | S | L/U | L/U | S | S |
| 1.2. Rendering | | ■ | ■ | | ■ | | | | U | L/U | | | |
| 1.3. 2D Drawing generation | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | L/U | L/U | U | L/U |
| **2. Space or Program Planning** | | | | | | | | | | | | | |
| 2.1. Programming | ■ | | | | | | | | S | L | | | |
| 2.2. Safety and security | | ■ | ■ | | | | | ■ | S | L/U | | | |
| 2.3. Disaster planning | | ■ | ■ | | | | | ■ | S | L | | | |
| 2.4. Code compliance, ADA | ■ | ■ | ■ | | | | | | | L/U | | | |
| 2.5. Operation simulation | | ■ | ■ | | | | | ■ | S/U | L/U | S | | S |
| **3. Analysis** | | | | | | | | | | | | | |
| 3.1. Structural analysis | | ■ | ■ | | | | | | | S | L/U | | S |
| 3.2. Sun path and climate studies | ■ | ■ | | | | | | | | L/U | L/U | | |
| 3.3. Comfort studies | | ■ | ■ | | | | | | U | L/U | L/U | | |
| 3.4. Ventilation (natural and artificial) | | ■ | ■ | | | | | | | S/U | L/U | | |
| 3.5. HVAC sizing and configuration | | ■ | ■ | | | | | | | S/U | L/U | | L/U |
| 3.6. CFD (computational fluid | | | ■ | | | | | | | S/U | L/U | | U |
| 3.7. Lighting (natural and artificial) | | ■ | ■ | | | | | | S | S/U | L/U | | |
| 3.8. Energy consumption | | ■ | ■ | | | | | | | S/U | L/U | | S |
| 3.9. Fire safety | | ■ | ■ | | | | | | | S/U | L/U | | |
| 3.10. Acoustics | | ■ | ■ | | | | | | S | S/U | L/U | | |
| 3.11. Code review | | ■ | ■ | ■ | | ■ | ■ | ■ | | L | | | |
| **4. Sustainability Measures** | | | | | | | | | | | | | |
| 4.1. Design for credits (LEED, other) | | ■ | ■ | | ■ | | | | S | S/U | S | L | S |
| 4.2. Design for carbon footprint | | ■ | ■ | | ■ | | | | S | S/U | S | L | S |
| 4.3. Design for renewable energy | | ■ | ■ | | ■ | | | | S | L/U | L/U | S | S |
| 4.4. Sustainability metric tracking | | | | | ■ | | ■ | ■ | | U | | L | S |
| **5. 4D Scheduling** | | | | | | | | | | | | | |
| 5.1. Sequencing | | ■ | ■ | | ■ | | | | U | S | S | L | S |
| 5.2. Logistics planning | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | L | S/U |
| 5.3. Location-based scheduling | | | ■ | ■ | ■ | ■ | ■ | | U | S | S | L | S |
| 5.4. Schedule animation | | ■ | ■ | ■ | ■ | ■ | ■ | | U | | | L | S |

***Interactions**: As a project develops, functions may be added or deleted, and interactions might vary based on capabilities of the parties and whether or not a specific consultant is on board for a particular function. In an IPD setting functions of parties are often blurred - i.e., any party might use or support any function. The notations here refer to the most prevalent interactions.

**Lead:** Primary author. Note that some functions have multiple leads - this can be different leads for different aspects (e.g., 2D Drawing Generation) or a collaboration (e.g., Design Decision Support).

**Support:** Provide input to the Lead.

**Use:** Extract output from the model for input to one's own work.

| | **Phase** | | | | | | | | **Interaction with Model*** L=Lead, S=Support, U=Use | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conceptualization | Criteria Design | Detailed Design | Implementation Docs | Final Buyout | Agency Review | Construction | Closeout | Owner | Architect | Engineers | GC | Subcontractors |
| **6. Cost Estimating** | | | | | | | | | | | | | |
| 6.1. Value Engineering | ■ | ■ | ■ | | ■ | | | | S/U | S/U | S/U | L | S/U |
| 6.2. Target Value Design (TVD) | ■ | ■ | ■ | | ■ | | | | S/U | L/U | S | L | S |
| 6.3. Detailed estimating | | ■ | ■ | ■ | ■ | | ■ | | U | S | S | L | S |
| **7. Construction Coordination** | | | | | | | | | | | | | |
| 7.1. Safety planning and reporting | | | | ■ | ■ | ■ | ■ | | | | | L | L/S/ |
| 7.2. Prefabrication | | ■ | ■ | ■ | ■ | ■ | ■ | | | S | S | SU | L |
| 7.3. Constructability review | | ■ | ■ | | ■ | | ■ | | | U | S | L | S |
| 7.4. Building system coordination | | | ■ | | | | ■ | | | | | L | S/U |
| 7.5. Automated fabrication | | | | ■ | ■ | | ■ | | | S/U | S/U | S/U | L/U |
| 7.6. Shop drawing generation | | | | ■ | ■ | ■ | ■ | | | S/U | | U | L/U |
| 7.7. Permit submittals | | | | ■ | | ■ | ■ | | | L/U | S | S | S |
| 7.8. Laser scanning | | ■ | ■ | ■ | | | ■ | ■ | | U | | L/U | U |
| 7.9. Laser survey - precision | | | | | | | ■ | ■ | | U | | L/U | U |
| 7.10. Laser survey - precision layout | | | | | | | ■ | | | S | S | L/U | S/U |
| 7.11. Record model | | | | | | | ■ | | | U | | L | S |
| 7.12. As-built model | | | | | | | ■ | ■ | U | U | | L | S |
| **8. Closeout** | | | | | | | | | | | | | |
| 8.1. Punch list | | | | | | | | ■ | | S/U | | L/U | S/U |
| **9. Facilities Management** | | | | | | | | | | | | | |
| 9.1. Space and asset management | | | | | | | | ■ | S/U | L | S | S | S |
| 9.2. Maintenance management | | | | | | | | ■ | S/U | L | S | S | S |
| 9.3. Remodeling/repurposing | | | | | | | | ■ | S/U | L | S | S | S |
| 9.4. Wayfinding and mapping | | | | | | | | ■ | S/U | L | S | S | S |
| 9.5. Energy mgt. / BAS integration | | | | | | | | ■ | S/U | L | S | S | S |
| 9.6. Security | | | | | | | | ■ | S/U | L | S | S | S |