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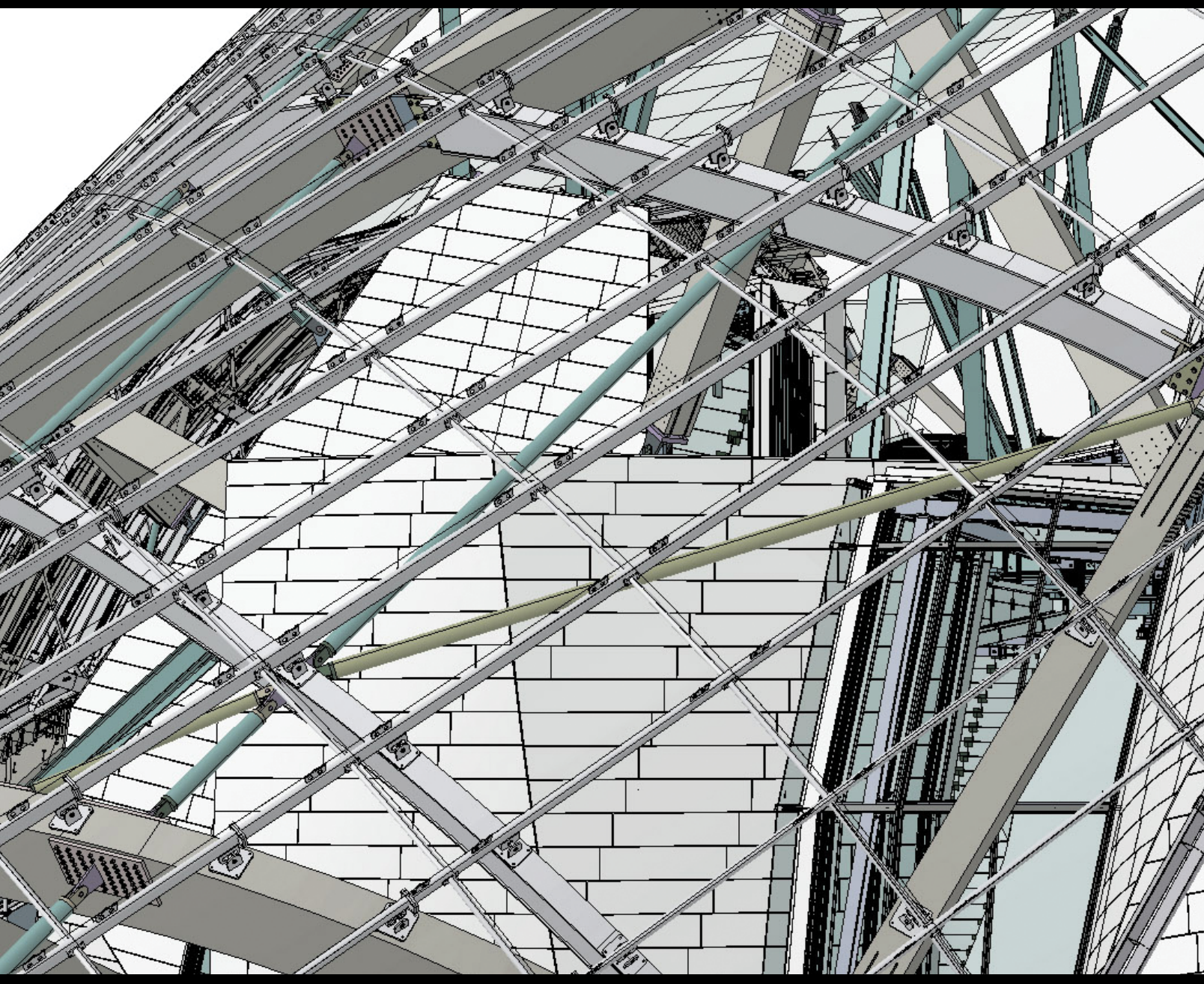

# BIM Really Can Be a Team Sport

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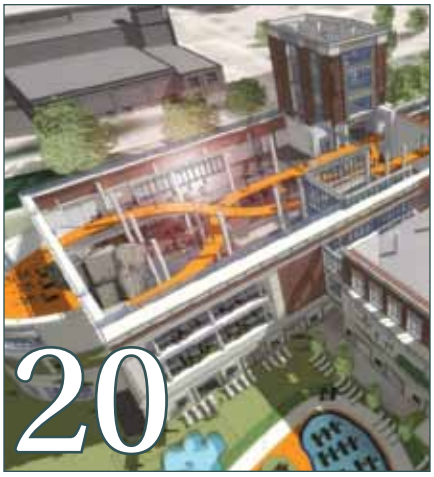


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**On the cover:** The Fondation Louis Vuitton, a new art museum in Paris, is pushing the limits of BIM technology and demonstrates how BIM, enabled by a cloud-based file management and project collaboration platform, can help large distributed teams work together. The 3D cover image, produced by Digital Project™, shows the façade of the Fondation Louis Vuitton.

# Aligning LOD, LoD and OEM into a Project Collaboration Framework

**By Jim Bedrick, FAIA, LEED-AP and Dianne Davis, CSI**

ARCHITECTS (AIA), BIMFORUM AND buildingSMART alliance™ (bSa) are working together to create a content and context-rich framework for building information modeling (BIM) collaboration. This framework merges level of development (LOD), level of detail (LoD), a refinement of an object's specification and the object/element matrix (OEM)[1], defining data requirements at an object level by BIM purpose or use case **(TABLE 1)**. This combination integrates the three definitions of BIM: **BIM**ODEL (product), **BIM**ODELING (process) and **BIM**ANAGEMENT (the data) into a repeatable strategy needed for BIM-based project collaboration, communication and execution.

## BACKGROUND

The AIA's Level of Development (LOD)[2] framework was created to address several issues that arise when a BIM is used as a communication, collaboration or decision support tool (for example, when someone other than the author extracts information from it).

- During the design process, building systems and components progress from a vague conceptual idea to a precise description. In the past, there has been no simple way to designate where an element is along this path.
- It's easy to misinterpret the precision at which an element is modeled. Hand drawings range from pen strokes on a napkin to hard lines with dimensions called out. In a model, a specific component located precisely can look exactly the same as a generic component placed approximately, so we need something besides appearance to tell the difference.
- In a collaborative environment, where people other than the model author are depending on information from the model in order to move their own work forward, the design work plan takes on high importance. It is necessary for the model users to know when information will be available in order to plan their work.
- Object/element information is not uniform through the modeling process. There is no uniform level model corresponding to project phases. The detail and data varies according to the model purpose or use case required to make project decisions and move work forward

The point is that a concise method is needed to denote where a model element is along its path, from vague idea to precise description. To make these connections, a multi-disciplinary group met regularly to redefine and align these BIM concepts. Thus, the following LODs have been defined. They have been numbered in the hundreds in order to allow for definition of intermediate levels where necessary. This feature should be used sparingly, though. It is recognized that there are often dozens of steps in a component's progress from concept to installation—it is neither feasible nor necessary to label all of them with an LOD number.

Brief descriptions can be found in **TABLE 2.**

**TABLE 1: BIM PROJECT COLLABORATION**

| LOD | LoD | OEM (Object/Element Matrix) |
|---|---|---|
| Level of Development | Level of Detail | Definition of Use |

## FURTHER EXPLANATION

LOD 100, then, corresponds to a conceptual level. For example, in a massing

**TABLE 2: LEVELS OF DEVELOPMENT**

| LOD 100 | LOD 200 | LOD 300 | LOD 400 | LOD 500 |
|---|---|---|---|---|
| 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 (for example, cost per square foot or tonnage of HVAC) can be derived from other model elements. | 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. | The model element is graphically represented within the model as a specific system, object or assembly, accurate in terms of quantity, size, shape, location and orientation. Non-graphic information may also be attached to the model eement. | 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. | The model element is a field-verified representation, accurate in terms of size, shape, location, quantity and orientation. Non-graphic information may also be attached to the model elements.[3] |

model, the interior walls may not yet be modeled but we can have an idea of the cost per square foot of floor area for interior construction. Thus, the walls are at LOD 100—they're not modeled but information about them can be inferred from elements that are modeled (the floors), coupled with other information (square foot cost tables).

To continue with the wall example, a floor plan is often first laid out using generic walls. The walls can now be measured directly but the specific wall assembly isn't known and the quantity, thickness and location measurements will be approximate. The walls are now at LOD 200. To step back to the massing model, if the exterior wall area can be measured directly, it is actually at LOD 200, even though there is no detail.

At LOD 300, the wall element is modeled as a specific wall type, with information about its framing, wallboard and insulation, if any. The element is modeled at the thickness of the actual wall type and is located accurately within the model. Note that non-geometric information may be attached. This means that it's not necessary to model every component of the wall assembly—a solid model element with accurate thickness, location and with the information usually included in a wall type definition attached qualifies as LOD 300.

At LOD 400, details are included. For the wall example, this might include such things as seismic bracing and head conditions. LOD 400 can be thought of as similar to the kind of information usually found in shop drawings.

At LOD 500, the model element has been updated to reflect any differences between the as-designed condition and the as-built condition. Note again, that there is no strict correspondence between LODs and design phases. Systems will progress at different rates through the design process. At 100 percent schematic design (SD), the model will include many elements at LOD 200 but will also include many at LOD 100, as well as some at 300 and possibly even 400, depending on the use cases being developed for decision support.

Similarly, there is no such thing as an LOD model. Models will invariably contain elements at various LODs.

> In a model, a specific component located precisely can look exactly the same as a generic component placed approximately, so we need something besides appearance to tell the difference.

As a final note, some designers have been reluctant to adopt this framework because they are concerned that tagging an element with LOD 300 meant that it was set in stone. The LODs should be viewed with some flexibility and they should be thought of as the designer's best professional judgment rather than unchangeable truth.

The AIA, BIMForum and bSa have formed a working group comprised of practitioners from across the spectrum of design and construction disciplines to develop a catalog of examples of building systems, components and assemblies modeled at different LODs. The catalog will serve as a reference to aid project teams in defining BIM needs.

The first step was for the group to specifically interpret the LOD definitions for all building systems. A by-product of this effort was that the LOD framework was put to some rigid testing and the logic held up well.

The next phase of work for the committee is to merge the LOD with the OEM so that a clear understanding of data requirements by use case is aligned with the LOD definitions. This work will be submitted to bSa for inclusion in the *National BIM Standard-United States™*, Version 3. ■

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*A full list of references for this article is available upon request. Please email ssavory@matrixgroupinc.net.*