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Model Development Specification: Communicating the Exchange of Reliable Models

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FM2397

Learning Objectives

At the end of this class, you will be able to:

- Describe a process for developing model development specifications for firm standards and for projects
- Create the workflow for a project team to manage modeling and metadata using the model development specification
- Identify how the model development specification process improves project team communication
- Evoke changes in the internal processes of the individual stakeholders for the benefit of the whole project team

About the Speaker

Andy Jizba, BIM Program Manager, jizba.andrew@mayo.edu

Andy is the Building Information Management Program Manager at Mayo Clinic in Arizona. As a member of the Facilities Planning and Design group at Mayo Clinic, Andy has led the effort for the creation and implementation of the BIM program for Mayo Clinic. With 18 years in the AECO industry, including 8 years of Architectural modeling experience, and holds a degree in Industrial Technology. Andy has led the implementation of CAFM and PM software for multiple owners, primarily in the healthcare field. His specialty is helping project teams find solutions to coordinate, exchange, and handover projects using the latest technologies. He has spoken at events for the California Society of Healthcare Engineers, Arizona State University, and the Central States Revit Workshop.

David Wilkinson, Solutions Executive, david.wilkinson@autodesk.com

David Wilkinson is an Autodesk Solutions Expert. He helped to create the Model Development Specification process and workshop. He has now run three model development specification workshops for three organizations. David was the lead for the Mayo Clinic Model Development Specification Workshop for Mayo Clinic's PCAP project.

MODEL DEVELOPMENT SPECIFICATION

WORKSHOP GUIDE

(PROJECT NAME)

[*Workshop Date(s)*]

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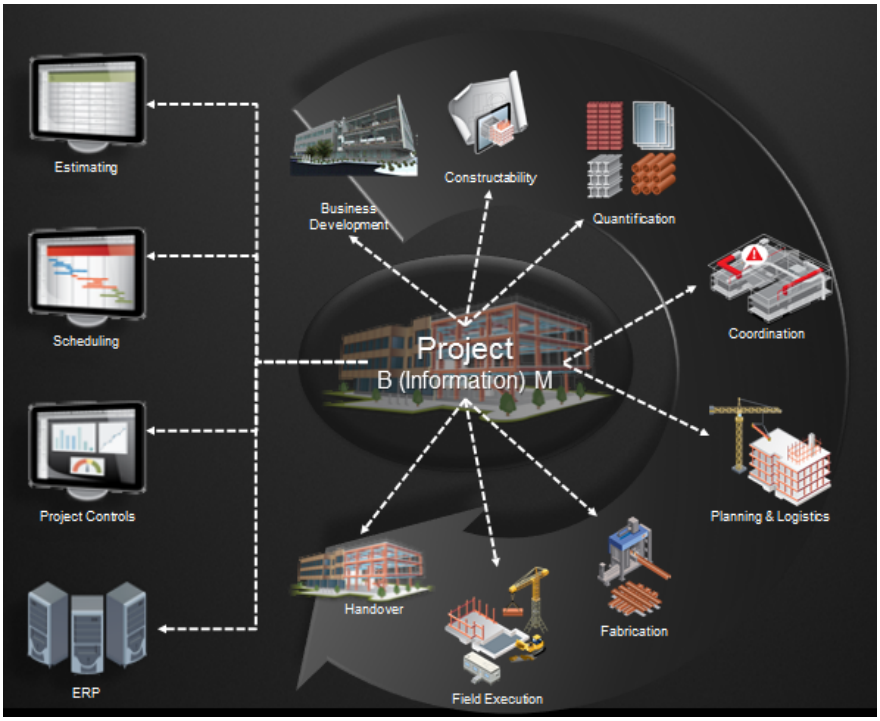
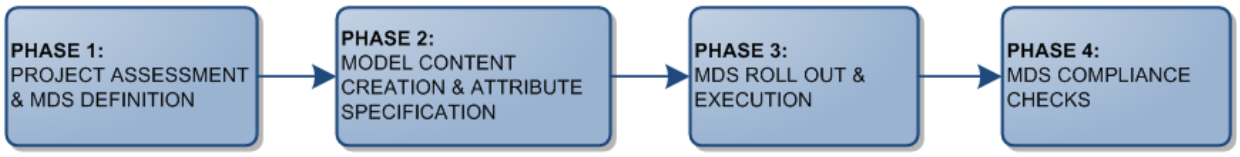
Overview

The purpose of the Model Development Specification (MDS) is to define how Building Information Modeling (BIM) will be implemented and managed on current and future projects. Critical to the development of the BIM is a complete understanding of how the model will be used during the course of the design, construction, and life-cycle management of the building.



[*MDS Lead Organizer*] is committed to building the MDS collaboratively by inviting all of the key stakeholders of the project team to participate in the definition of the project MDS. There are four main Phases with the execution of the MDS. In Phase 1, the most important task deals with the alignment of all the stakeholders BIM expectations early in the project. The Second Phase will focus on the technical delivery and creation of BIM content and custom attribute information that will be required on a Use Case specific basis. The MDS will be rolled out and executed in Phase 3 and lastly, compliance checks will be performed in parallel in Phase 4 to ensure the project delivery team is in compliance with the MDS and on target to meet the project Milestone goals.



It is important to understand that the MDS is a performance specification that establishes key milestones and requisite Levels of Development (LoD), however, it enables the participants to determine the best methods to achieve the project target milestones.

Lastly, the successful implementation of a MDS on a project can be broken down further into 7 major Steps:

Step 1: Stakeholder Introduction to MDS - Workshhop (4 Hours)

Step 2: Discovery & Preliminary Definition of the MDS - Pre-Workshop Discovery & MDS Homework

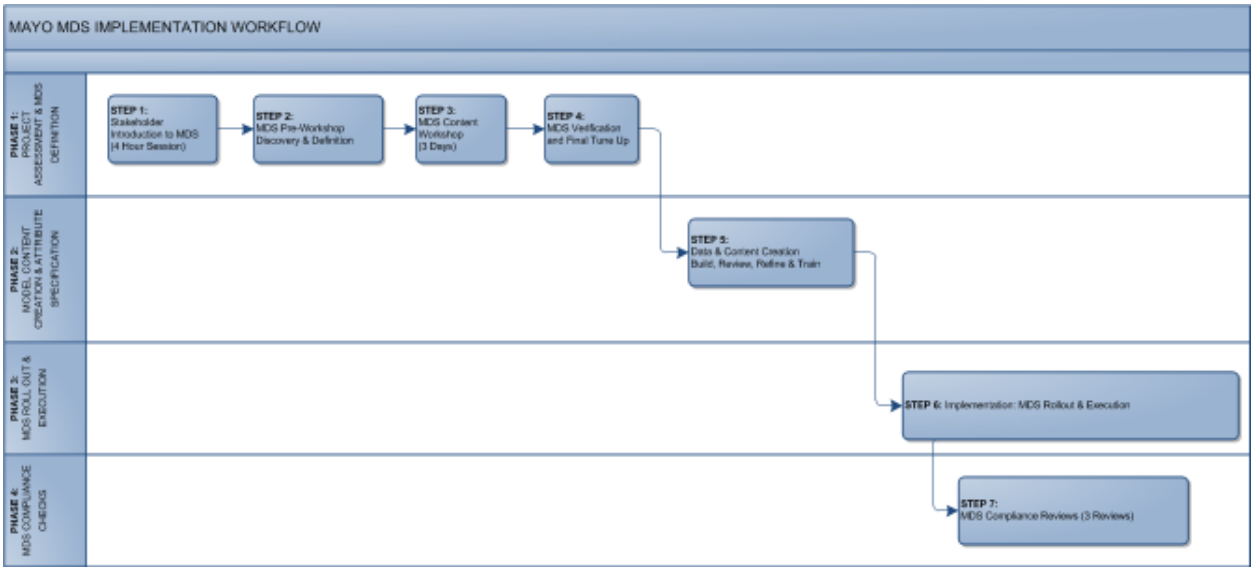
Step 3: Stakeholder MDS Content Defintion Workshop (3 Days)

Step 4: MDS Verification: Revisions & Refinement

Step 5: Model Data & Content Creation - Build, Review, Refine & Train

Step 6: MDS Implementation - Rollout & Execution

Step 7: MDS Compliance- Compliance Reviews (3 Reviews)



The content contained in this guide pertains to all Stakeholders and relates only to the MDS Content Defintion Workshop phase of the MDS implementation workflow (designated as Step 3 above).

Step 3 Stakeholder MDS Content Definition Workshop

Step 3.0 MDS Workshop Agenda

Required Attendees:

- Owner
- A/E
- GC
- On-boarded Subcontractors

***A Project Manager and a VDC/BIM staff member from each stakeholder will be required to attend each of the sessions. Depending on the Use Case session, please send additional supporting staff members as required.**

Workshop Day 1

9:00 -11:00 ***All**	**Kickoff : ALL** *Baseline knowledge and understanding of the MDS for all participating personnel in the*

Participating Personnel	*workshop.* o Goals for the MDS (*presenter*) o MDS general review (*presenter*)
11:00 -3:00 *All Participating Personnel	Session 1: **Use Case 1 – 2D Drawing Generation / Permit Submittals** *Review, Define & Agree on the following* • Discussion Topics o LOD's o MEA's o Classes o Milestones
3:00 - 5:00 *All Participating Personnel	Session 2: **Use Case 2 - Maintenance Management** *Review, Define & Agree on the following* • Discussion Topics o LOD's o MEA's o Classes o Milestones

Workshop Day 2

9:00 -11:00 *All Participating Personnel	Session 3: **Use Case 2 - Maintenance Management** *Review, Define & Agree on the following* • Discussion Topics o LOD's o MEA's o Classes o Milestones
11:00 -5:00 *All Participating	Session 4: **Use Case 3 - TBD** *Review & Define & Agree on the following* • Discussion Topics

Personnel	o LOD's o MEA's o Classes o Milestones

Workshop Day 3

8:00 -11:00 *All Participating Personnel	Session 5: **Master MDS** *Master MDS: Agree on the following* o *Introduction to Master MDS* o Identify Areas of Conflicts between Design Schedule Milestones and Use Case Milestones o Adjust LOD's as necessary o Adjust MEA's as necessary
11:00-12:30 *All Participating Personnel	Session 6: **"Speak now or forever hold your peace"** *Review, Define & Agree on the following* o Final Milestones
12:30-2:00 *All Participating Personnel	Individual Lunch/Work Break
2:00-3:00 *All Participating Personnel	Session 7: **Implementation Overview** *Preliminary overview discussion about the next steps and the implementation of the MDS.*
3:00-4:00 *All Participating Personnel	Session 8: **Compliance** *Overview discussion around compliance of the MDS for the PCAP Project*

Step 3.1 MDS Definitions

Use Case: A design or construction function which Virtual Design and Construction (VDC) is being used to support. Examples include cost estimating, building system coordination, energy consumption, etc.

Standard Milestones: A defined state of information development for a significant point in the overall progress of the project often set at industry standard points such as SD, DD, CD, etc. In the MDS process, the state of information is defined.

Use Case Milestones: A defined state of information development for a significant point in a specific Use Case. E.g. the owner will often have standard budgeting checkpoints during design – these are set as milestones in the cost estimating Use Case, and as with Standard Milestones are defined by stating Levels of Development (LODs) for specific systems.

Level of Development (LOD): See below white paper by Jim Bedrick, *Levels of Development*.

Model Element Author: The person or entity coordinating the overall development of the element, often the person or entity actually generating and manipulating the model element. Note that this is not necessarily the person responsible for the design of the element – that is controlled by licensing. An example is a subcontractor creating a model of the HVAC ducting – in this case the sub is the MEA, but the engineer of record is still responsible for the design of the ductwork. The MEA can be thought of as a gatekeeper – if someone needs an element changed, it is the MEA's responsibility to coordinate the change with all concerned parties.

Use Case Classes: These define the precision of information for a specific use case that is attached to an element.

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Step 3.2 LOD Definitions

Levels of Development

The Level of Development (LOD) framework was created by an industry group including software companies, AEC firms, and the AIA, and is currently being refined by a joint AIA / AGC BIMForum effort. Its purpose is to address several issues that arise when a Building Information Model (BIM) is used as a communication or collaboration tool, i.e. 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. The author knows, but others often don't.
- 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, and it's easy to infer the precision of the drawing from its appearance. In a model though, 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.

The LOD Framework addresses these issues by providing an industry-developed standard language to describe, system by system, the state of development of a BIM. This language drives consistency in communication and execution by enabling the detailed definition of BIM milestones and deliverables.

It is important to understand the difference between Level of Detail, a term used in some commercial applications and services, and Level of Development, the concept as refined by the AIA for use in the *E202-2008 Building Information Modeling Protocol*. Level of Detail is essentially how *much* detail is included in the model element. Level of Development is the degree to which the information attached to the element has been thought through – what project team members may rely on the information for when using the model. In essence, Level of Detail can be thought of as input to the element, while Level of Development is reliable output.

The following Levels of Development[1] have been defined. They have been numbered in the hundreds in order to allow for definition of intermediate levels where necessary.

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.

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.

LOD 300 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 Element.

LOD 400 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.

LOD 500 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.

[1] The Level of Development Definitions are produced by the AIA and have been used here by permission.

LOD 100, then, corresponds to a conceptual level. For example, in a massing 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, insulation if any, etc. 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 and location and with the information usually included in a wall type definition attached qualifies as LOD 300. A good example of the difference between Level of Detail and Level of Development can be seen here. A library object denoting a specific wall type might be placed in a model at an early stage in the design when the wall type and location is not yet fully determined. In this case the element may look like LOD 300, but is actually LOD 200 in terms of the information that can be reliably extracted from it.

At LOD 400 details are included. For the wall example, this might include such things as seismic bracing, head conditions, etc. 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 that there is no strict correspondence between LOD's and design phases. Systems progress at different rates through the design process – for example, design of the structural system is usually ahead of the design of interior construction. At 100% 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.

Similarly, there is no such thing as an "LOD XXX model". Models will invariably contain elements at various LOD's.

As a final note, some designers have been reluctant to adopt this framework because they were concerned that tagging an element with LOD 300 meant that it was set in stone – everyone on the project would assume that LOD 300 was a promise from the designer that the element would not change or move. It is well known that design is a process of iteration – often a previous decision has to be revisited as its effects on the rest of the project become better known. The LOD's should be viewed with some flexibility – they should be thought of as the responsible person's best professional judgment rather than unchangeable truth.

Jim Bedrick, FAIA, LEED AP
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