New Zealand BIM Handbook

Appendix C - Levels of Development definitions

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BUILDING AND CONSTRUCTION PRODUCTIVITY PARTNERSHIP building value

Appendix C - LEVELS OF DEVELOPMENT

CONTENTS

1 GENERAL

Level of Development (LOD) is a scale that can be used to show the reliability of content that is expected to be included for specific model elements at different times during model development. The main purpose of LOD when incorporated in LOD tables and BIM Execution Plans is to give clarity to each member of a design/ construction team as to what they are required to author in their models at each stage and to what extent others can rely on them.

- LOD is a means of defining the extent to which a model element has been developed, from conception in the mind of the designer through to its construction and operation.
- The basis for the concept of LOD is recognition that model elements evolve at different rates throughout the design process. It follows that LOD should only be used to describe model elements, not models as a whole.
- LOD represents the extent to which information about an element can be relied on for decision-making purposes at a particular point in time.
- The value of LOD, incorporated in an LOD table, is that it provides a means of communicating expectations about the development of model elements between team members throughout the design and construction process for planning, management and coordination purposes.
- An element has only progressed to a given LOD when all stated requirements have been met. It should also be considered that the requirements are cumulative, i.e., any model element is required to have achieved all the requirements of the previous LOD.
- The resources devoted to developing and maintaining LOD tables should be proportional to the degree that they assist management of the project. They are a tool, not an end in themselves.

2 LEVEL OF DEVELOPMENT VERSUS LEVEL OF DETAIL

LOD is sometimes interpreted as level of detail rather than Level of Development. However, there are important differences. Level of detail is essentially how much detail is included in the model element. Level of Development is the degree to which the element's geometry and attached information has been thought through – the degree to which project team members may rely on the information 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.

3 LOD NOTATIONS

LOD notations are comprised of numbers at intervals of 100 to allow users of the system the flexibility to define intermediate LODs. Defining additional LODs can be crucial in some circumstances, particularly for contractual reasons, e.g., the handover of models from the design team to the construction team.

4 ASPECTS OF LOD

Level of Development as a concept is the sum of different aspects that define the information and geometry of each element, including:

4.1 Level of detail (LOd):

Defines the level of geometric precision relative to the real object. For example, a highly detailed model of a chair may be considered to have a high level of detail. However it may not be the correct size or have any information attached. Due to the graphic detail in the model it appears “complete” or well thought out. Unfortunately, Levels of Development have frequently been defined largely by reference to level of detail (e.g., the BIM Forum LOD Specification). However, this can be a deceptive measure as a very detailed object can be placed into the model, but it may be the wrong object or the wrong size.

4.2 Level of accuracy (LOa):

An object may be highly detailed, but it may be the wrong size, finalising a choice of construction or product as part of the design and, therefore, model development. A highly detailed air conditioning unit could be placed in the model at an early stage; it could represent the approximate likely footprint of the final air conditioning unit, but the same capacity unit could perhaps differ in size by 100mm or more. It is only once a final product selection is made that the accuracy of the object is determined. The issue of tolerances needs to be considered as part of this concept. A plasterboard wall will never be built to the same level of tolerance as a factory assembled piece of laboratory equipment. If this is the case, this should be taken into account in the model. There is little point coordinating something to the nearest millimetre if construction techniques mean it can’t be built this way.

4.3 Level of information (LOi):

Also referred to as level of data. In order to achieve true BIM and allow for use in 4D and Facilities Management, LOD needs to define what information is to be supplied with each element. This information could also relate to costing information at the beginning of the design, or engineering information for further analysis. The only comprehensive standard in this regard is the NATSPEC BOEM, which is highly complex and has not been very widely used in the industry.

4.4 Level of coordination (LOc):

Is not defined as part of the element LOD but refers to the level of coordination with other model elements. A highly detailed door could be placed in an “architectural wall”; the door could contain the correct information for a specific LOD, but it might not be coordinated with the structural opening in the “structural wall”.

	LOD 100	LOD 200	LOD 300	LOD 400	LOD 500
Model content requirements	Overall building massing indicative of area, height, volume, location and orientation may be modelled in three dimensions or represented by a symbol or other data.	Model elements are modelled as generalised systems, objects or assemblies with approximate quantities, size, shape, location and orientation. Non-geometric information may also be attached to model elements.	Model elements are modelled as specific assemblies accurate in terms of quantity, size, shape, location, orientation and interfaces with other building elements. Non-geometric information may also be attached to model elements.	Model elements are modelled as specific assemblies that are accurate in terms of size, shape, location, quantity and orientation with complete fabrication, assembly and detailing information. Non-geometric information may also be attached to model elements.	Model elements are modelled as constructed assemblies (a field verified representation) actual and accurate in terms of size, shape, location, quantity and orientation. Non-geometric information may also be attached to model elements.
AUTHORISED USES					
Construction			Suitable for the generation of traditional construction documents and shop drawings.	Model elements are virtual representations of the proposed elements and are suitable for construction.	
Analysis	The model may be analysed based on volume, area and orientation by application of generalised performance criteria assigned to the representative model elements.	The model may be analysed for performance of selected systems by application of generalised performance criteria assigned to the representative model elements.	The model may be analysed for performance of selected systems by application of specific performance criteria assigned to the representative model elements.	The model may be analysed for performance of approved selected systems based on specific model elements.	
Cost estimating	The model may be used to develop a cost estimate based on current area, volume or similar conceptual estimating techniques (e.g., square feet or floor area, condominium unit, hospital bed, etc.).	The model may be used to develop cost estimates based on the approximate data provided and conceptual estimating techniques (e.g., volume and quantity of elements or type of system selected).	The model may be used to develop cost estimates based on the specific data provided and conceptual estimating techniques.	Costs are based on the actual cost of specific elements at buyout.	

Schedule	The model may be used for project phasing and overall duration.	The model maybe used to show ordered, time-scaled appearance of major elements and systems.	The model may be used to show ordered, time-scaled appearance of detailed elements and systems.	The model may be used to show ordered, time-scaled appearance of detailed specific elements and systems including construction means and methods.	
Other authorised uses	Additional authorised uses of the model developed to a Level 100.	Additional authorised uses of the model developed to a Level 200.	Additional authorised uses of the model developed to a Level 300.	Additional authorised uses of the model developed to a Level 400.	The model may be used for maintaining, altering, and adding to the project.

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