A Tale of Two Coordinate Systems: Bridging Civil 3D and Revit Together

Michael Perdue

Project Manager – Technology Initiatives

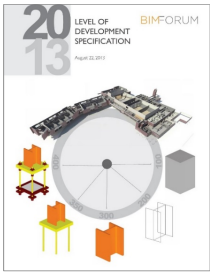
AUTODESK. UNIVERSITY

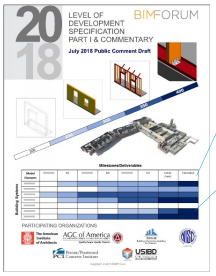
1

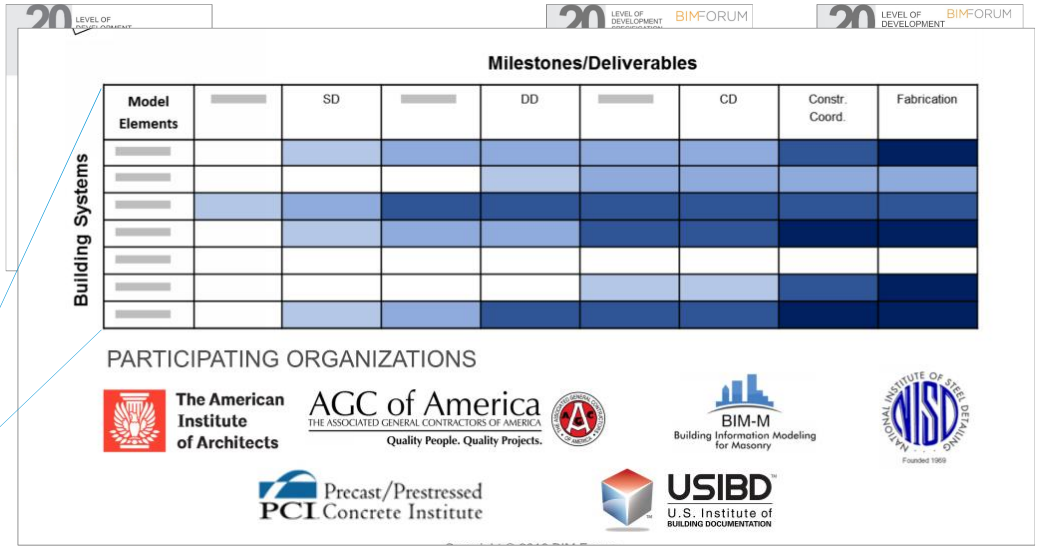
BIMForum Level of Development (LOD) Specification

2

BIM Forum Level of Development



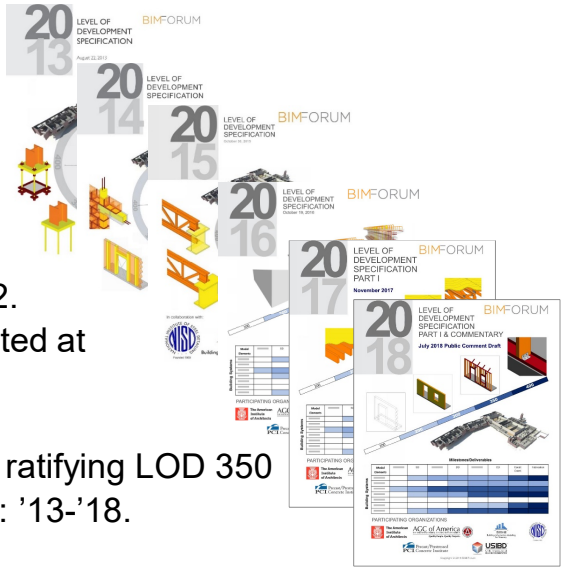




3

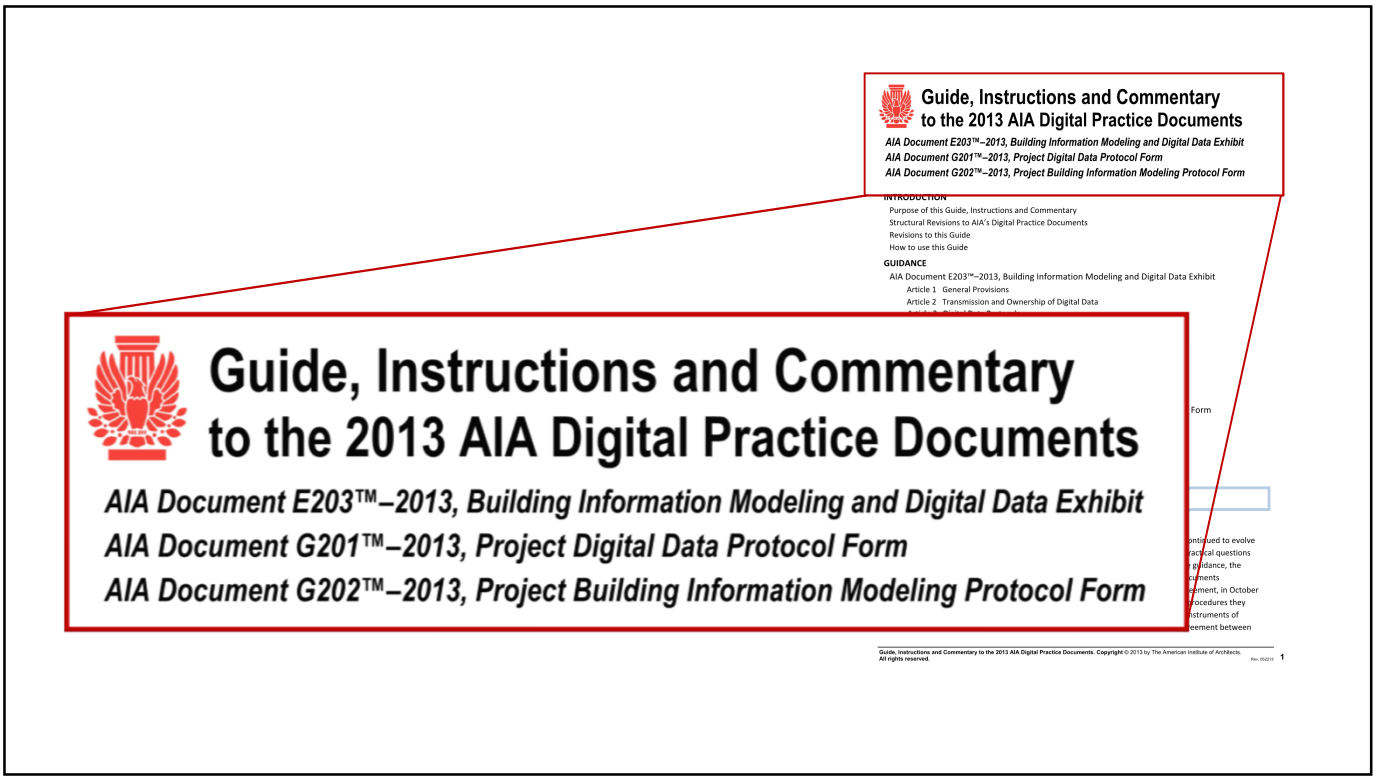
Level of Development Specification

BIMFORUM
The US chapter of buildingSMART International



- Scope cannot address all of BIM
- There is NO LOD of a whole model.
- LOD does not always match design phase.
- **2008** - American Institute of Architects (AIA) First Published definition for 100-400, 2008 E202.
- **2009-10** LOD 350 was authored and first presented at Autodesk University sessions by Ikerd.
- **2011** - BIM Forum LOD Taskforce formed
- **2013** – BIM Forum published the first LOD Spec ratifying LOD 350
- BIM forum LOD Specification is published yearly: ’13-’18.

4



5

LOD 100

BIMFORUM
LOD SPEC. 2019

AIA
G202™-2013

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.

BIMFORUM
LOD SPEC.
2019

BIMForum Interpretation: LOD 100 elements are not geometric representations. Examples are information attached to other model elements or symbols showing the existence of a component but not its shape, size, or precise location. Any information derived from LOD 100 elements must be considered approximate.

6

LOD 200

BIMFORUM
LOD SPEC. 2019

AIA
G202™-2013

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.

BIMFORUM
LOD SPEC.
2019

BIMForum Interpretation: At this LOD elements are generic placeholders. They may be recognizable as the components they represent, or they may be volumes for space reservation. Any information derived from LOD 200 elements must be considered approximate.

7

LOD 300

BIMFORUM
LOD SPEC. 2019

AIA
G202™-2013

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.

BIMFORUM
LOD SPEC.
2019

BIMForum Interpretation: The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs.

8

LOD 350: Detailed Coordination

BIMFORUM
LOD SPEC. 2019

AIA
G202™-2013

The Model Element is graphically represented within the Model as a specific system, object, or assembly in terms of quantity, size, shape, location, orientation, **and interfaces with other building systems**. Non-graphic information may also be attached to the Model Element.

BIMFORUM
LOD SPEC.
2019

BIMForum Interpretation: Parts necessary for coordination of the element with nearby or attached elements are modeled. These parts will include such items as supports and connections. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs.

9

LOD 400: Fabrication Assemblies

BIMFORUM
LOD SPEC. 2019

AIA
G202™-2013

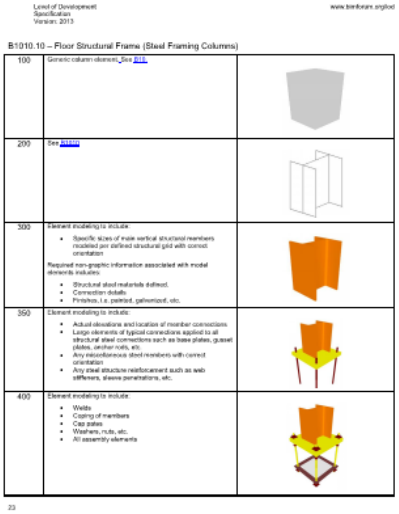
The Model Element is graphically represented within the Model as a specific system, object or assembly in terms of size, shape, location, quantity, and orientation with detailing, **fabrication**, assembly, and installation information. Non-graphic information may also be attached to the Model Element.

BIMFORUM
LOD SPEC.
2019

BIMForum Interpretation: An LOD 400 element is modeled at sufficient detail and accuracy for fabrication of the represented component. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension call-outs.

10

Ex: Steel Column



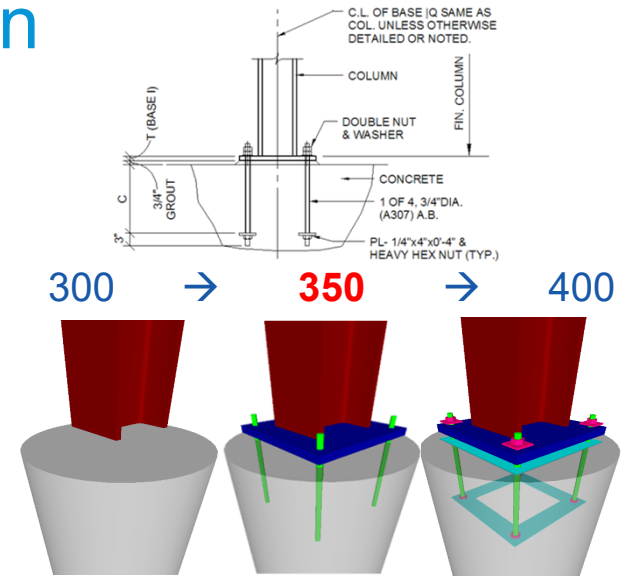
Level of Development Specification Version: 2013

www.bimforum.org/lod

B1010.10 – Floor Structural Frame (Steel Framing Columns)

100	Generic column element. See B10	
200	See B1010	
300	Element modeling to include: • Specific sizes of male vertical structural members modeled per defined structural grid with correct orientation Required non-graphic information associated with model elements includes: • Structural steel materials defined. • Connection details • Finishes, i.e. painted, galvanized, etc.	
350	Element modeling to include: • Actual elevations and location of member connections • Large elements of typical connections applied to all structural steel connections such as base plates, gusset plates, anchor rods, etc. • Any miscellaneous steel members with correct orientation • Any steel structure reinforcement such as web stiffeners, sleeve penetrations, etc.	
400	Element modeling to include: • Welds • Coping of members • Cap plates • Washers, nuts, etc. • All assembly elements	

23



Images courtesy of IKERD Consulting, LLC

11

BIMForum BIM Execution Plan Guide

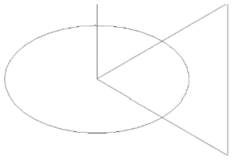
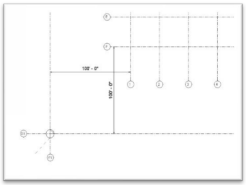
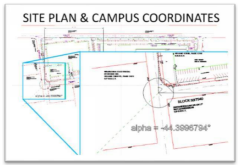
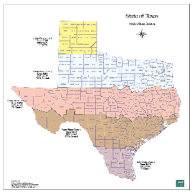
12

BIM Execution Plan (BxP) Guide

The purpose of this guide is to introduce BIM project Execution Plan concepts to teams on small to midsized projects that may have some team members who have never previously used BIM.

13

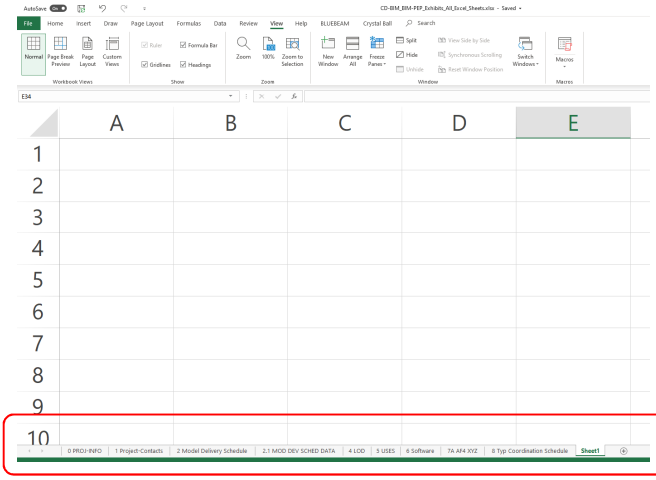
5 Coordinate Systems

Object[1]	Building/Local[1]	Campus/Site[1]	State Plane[2]	GPS
				
Relative system, defines location for assemblies and equipment (e.g. Air Handler)	Relative system, defines location for entire building	Relative system, defines location for a building's site	Absolute system, Northing and Easting used by surveyors and civil engineers	Absolute system, Northing and Easting used by surveyors and civil engineers

1: Image courtesy Ascend Building Knowledge Foundation (AscendBKF.org, CD-BIM.com), 2018. https://creativecommons.org/licenses/by-nc/4.0/
2: Image courtesy of Texas Parks and Wildlife. https://tpwd.texas.gov/gis/maps/images/state-plane-zones/view

14

CD-BIM.com Sample BxP : Spread Sheet Template



15

CD-BIM.com BxP Table 00: Project Information

BxP Table 00: Project Info

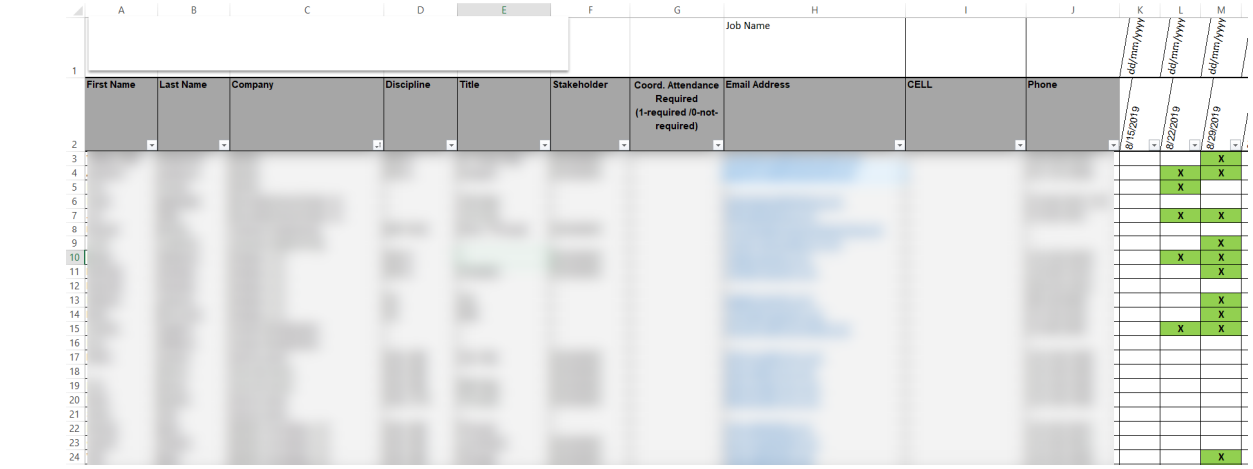
1. Project Name:		Project Phase / Milestone	Estimated Start Date	Estimated Completion Date	Stakeholders Involved
2. Project Address:		Notice to Proceed			All BIM Stakeholders
3. Contract Type/Delivery Method:		A/E GIM Kickoff Meeting			GC, A/E
4. Brief Project Description:		90% CD			GC, A/E
5. General Contractor Project Number:		100% CDs Complete (Building)			GC, A/E
6. BxP Author:		Permit Issued			GC, A/E
		Construction BIM Kickoff Meeting			Electrical, Underground Utilities
		Construction BIM Coordination Start			Electrical, Underground Utilities
		Construction BIM Kickoff Meeting			Above ground trades
		Construction BIM Coordination Start			Above ground trades
		Construction BIM Coordination Complete			All Coordination Team Members
		GC Site Mobilization			All BIM Stakeholders
		GC Construction Complete			All

NOTES:

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

16

CD-BIM.com BxP Table 01: Project Contacts

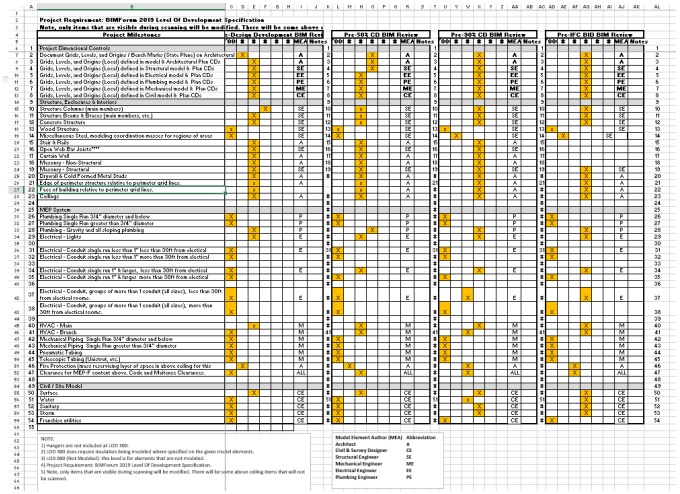


17

CD-BIM.com BxP Table 02: Model Del. Sched.

18

CD-BIM.com BxP Table 04: Level Of Development



NOTE:

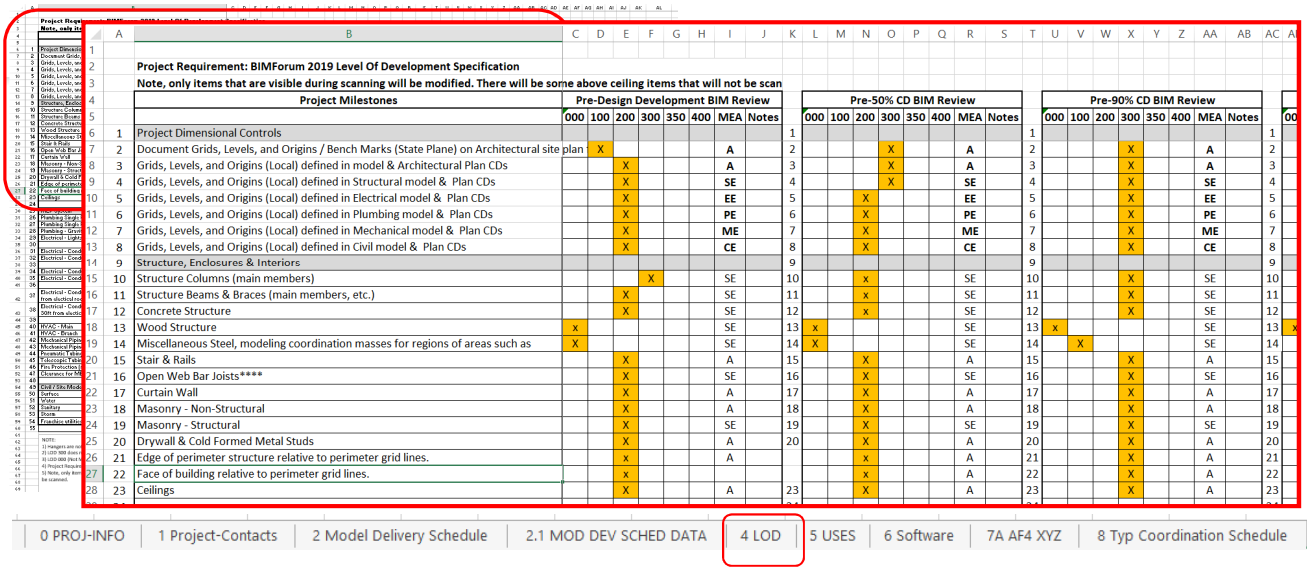
1. Hangers are not included at LOD 300.
2. LOD 300 does require insulation being modeled where specified on the given model elements.
3. LOD 000 (Not Modeled): this level is for elements that are not modeled.
4. Project Requirement: **BIMForum 2019 Level Of Development Specification**.

Model Element Author (MEA)	Abbreviation
Architect	A
Civil & Survey Designer	CE
Structural Engineer	SE
Mechanical Engineer	ME
Electrical Engineer	EE
Plumbing Engineer	PE

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

19

CD-BIM.com BxP Table 04: LOD Structure



Project Requirement: BIMForum 2019 Level Of Development Specification

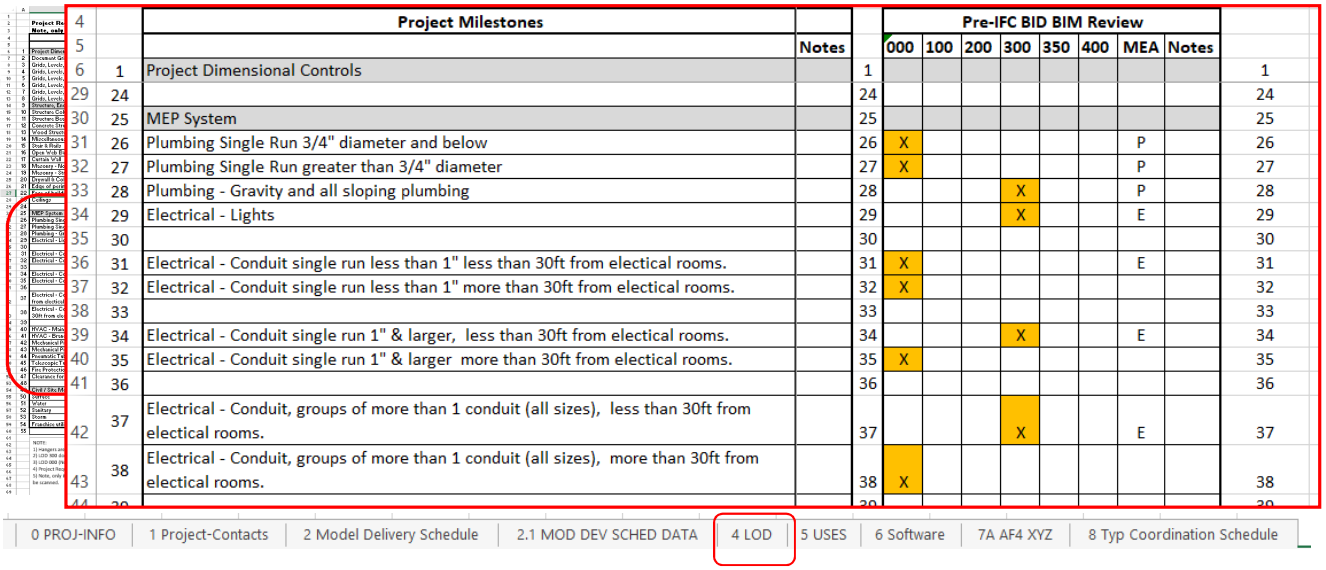
Note, only items that are visible during scanning will be modified. There will be some above ceiling items that will not be scan

	Project Milestones	Pre-Design Development BIM Review								Pre-50% CD BIM Review								Pre-90% CD BIM Review								
		000	100	200	300	350	400	MEA	Notes	000	100	200	300	350	400	MEA	Notes	000	100	200	300	350	400	MEA	Notes	
1	Project Dimensional Controls																									
2	Document Grids, Levels, and Origins / Bench Marks (State Plane) on Architectural site plan	X						A					X			A					X			A		
3	Grids, Levels, and Origins (Local) defined in model & Architectural Plan CDs			X				A					X			A					X			A		
4	Grids, Levels, and Origins (Local) defined in Structural model & Plan CDs			X				SE					X			SE					X			SE		
5	Grids, Levels, and Origins (Local) defined in Electrical model & Plan CDs			X				EE				X				EE					X			EE		
6	Grids, Levels, and Origins (Local) defined in Plumbing model & Plan CDs			X				PE				X				PE					X			PE		
7	Grids, Levels, and Origins (Local) defined in Mechanical model & Plan CDs			X				ME				X				ME					X			ME		
8	Grids, Levels, and Origins (Local) defined in Civil model & Plan CDs			X				CE				X				CE					X			CE		
9	Structure, Enclosures & Interiors																									
10	Structure Columns (main members)				X			SE				x				SE					X			SE		
11	Structure Beams & Braces (main members, etc.)			X				SE				x				SE					X			SE		
12	Concrete Structure			X				SE				x				SE					X			SE		
13	Wood Structure	x						SE		x						SE		x						SE		x
14	Miscellaneous Steel, modeling coordination masses for regions of areas such as	X						SE		X						SE			X					SE		
15	Stair & Rails			X				A				X				A					X			A		
16	Open Web Bar Joists****			X				SE				X				SE					X			SE		
17	Curtain Wall			X				A				X				A					X			A		
18	Masonry - Non-Structural			X				A				X				A					X			A		
19	Masonry - Structural			X				SE				X				SE					X			SE		
20	Drywall & Cold Formed Metal Studs			X				A				X				A					X			A		
21	Edge of perimeter structure relative to perimeter grid lines.			x				A				x				A					X			A		
22	Face of building relative to perimeter grid lines.			x								x				A					X			A		
23	Ceilings			X				A				X				A					X			A		

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

20

CD-BIM.com BxP Table 04: LOD Plumb & Elec

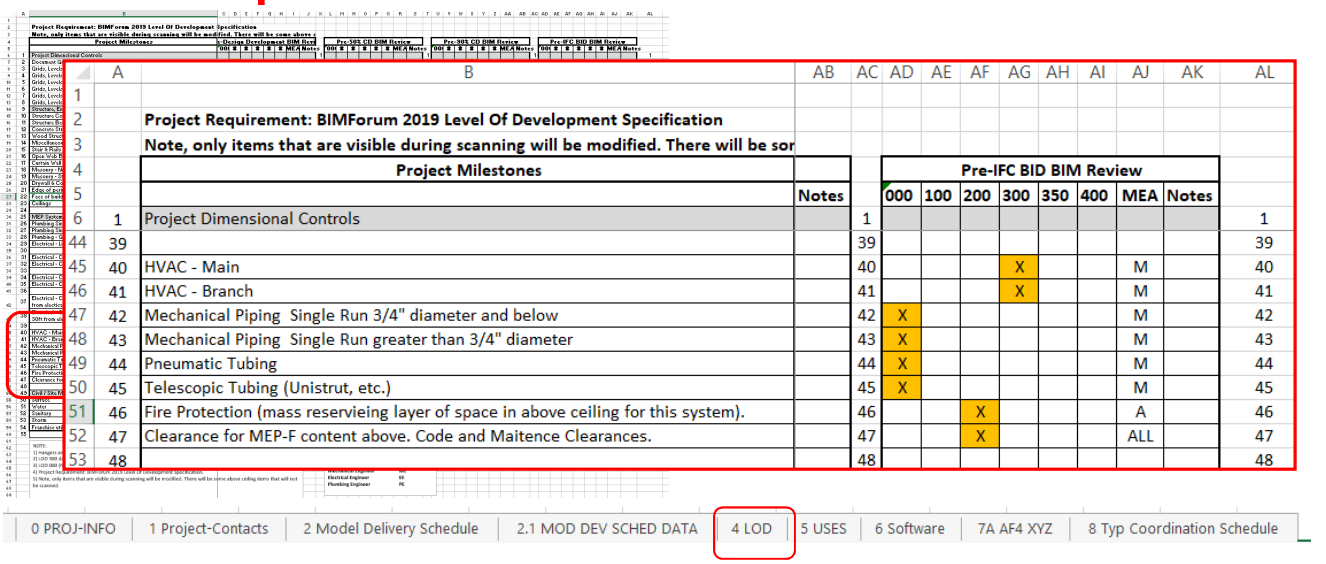


		Project Milestones	Notes		Pre-IFC BID BIM Review								
					000	100	200	300	350	400	MEA	Notes	
6	1	Project Dimensional Controls		1									1
29	24			24									24
30	25	MEP System		25									25
31	26	Plumbing Single Run 3/4" diameter and below		26	X						P		26
32	27	Plumbing Single Run greater than 3/4" diameter		27	X						P		27
33	28	Plumbing - Gravity and all sloping plumbing		28				X			P		28
34	29	Electrical - Lights		29				X			E		29
35	30			30									30
36	31	Electrical - Conduit single run less than 1" less than 30ft from electical rooms.		31	X						E		31
37	32	Electrical - Conduit single run less than 1" more than 30ft from electical rooms.		32	X								32
38	33			33									33
39	34	Electrical - Conduit single run 1" & larger, less than 30ft from electical rooms.		34				X			E		34
40	35	Electrical - Conduit single run 1" & larger more than 30ft from electical rooms.		35	X								35
41	36			36									36
42	37	Electrical - Conduit, groups of more than 1 conduit (all sizes), less than 30ft from electical rooms.		37				X			E		37
43	38	Electrical - Conduit, groups of more than 1 conduit (all sizes), more than 30ft from electical rooms.		38	X								38

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

21

CD-BIM.com BxP Table 04: Level Of Development



	A	B	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1													
2		Project Requirement: BIMForum 2019 Level Of Development Specification											
3		Note, only items that are visible during scanning will be modified. There will be sor											
4		Project Milestones			Pre-IFC BID BIM Review								
5			Notes		000	100	200	300	350	400	MEA	Notes	
6	1	Project Dimensional Controls		1									1
44	39			39									39
45	40	HVAC - Main		40				X			M		40
46	41	HVAC - Branch		41				X			M		41
47	42	Mechanical Piping Single Run 3/4" diameter and below		42	X						M		42
48	43	Mechanical Piping Single Run greater than 3/4" diameter		43	X						M		43
49	44	Pneumatic Tubing		44	X						M		44
50	45	Telescopic Tubing (Unistrut, etc.)		45	X						M		45
51	46	Fire Protection (mass reservieing layer of space in above ceiling for this system).		46			X				A		46
52	47	Clearance for MEP-F content above. Code and Maitence Clearances.		47			X				ALL		47
53	48			48									48

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

22

CD-BIM.com BxP Table 05: Model Uses

BxP Table 05: Uses

NOTE:
1) This table of BIM Uses is adapted from Kreider, John Messner, and Craig Dubler's Uses of BIM.The design building operate phase are adapted from the Penn State Project Execution Planning Guide, V2.1, 2011.

2) This scope is limited to a design modeling online.

	USES	Design	Build	Operate
1	3D Coordination	X		
2	Design Reviews	X		
3	Design Authoring	X		
4	Design Communications	X		
5	Construction System Design		x	
6	Existing Conditions Modeling			
7	3D Control and Planning	X		
8	4D Scheduling	x	x	
9	5D Estimating	x	x	
10	6D Owner Information			x
11	Programming			

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

23

CD-BIM.com BxP Table 06: Software

Document Control Software							
	All						
		BIM Process	**Discipline**	**Software**	**Version**	**Primary Coordaintion File Format**	**Secondary Coordaintion File Format**
		Document Control (Final documents only)	All	Autodesk BIM360	2019		
		Document Control (Commissioning)	GC, Subs	TBD	2019		
		Document Control (All 3D model files)	All	Autodesk BIM360	2019		
		3D Coordiantion, Navisworks Progress Reviews	ALL	DES w/ Navisworks	2019		
		Document Control (Native Design Models)	All	Autodesk BIM360	2019		
		PDF Viewer/Editor (All 2D PDF)	GC, Subs	BlueBeam Revu	11 & up		
Authoring and Collaboration Software							
	Design						
	Design	**BIM Process**	**Discipline**	**Software**	**Version**		
	Design	3D Authoring Models	Architect	REVIT	2019		
	Design	3D Authoring Models	Structural	REVIT	2019		
	Design	3D Authoring Models	Mechanical	REVIT	2018		
	Design	3D Authoring Models	Plumbing	REVIT	2018		
	Design	3D Authoring Models	Electrical	REVIT	2018		
	Design	3D Authoring Models	Technology	REVIT	2018		
	Design	3D Authoring Models	Special Equipment	REVIT	2018		
	Design	3D Authoring Models	Civil [Sitework & Utilities]	Civil 3D	2019		
	Design	3D Model Coordination	All	Navisworks Manage	Most Current		
	Construction						
		BIM Process	**Discipline**	**Software**	**Version**		
		3D Authoring Models	Mechanical and Plumbing	[SOFTWARE NAME]	2018	3D CAD - Solid	
		3D Authoring Models	Electrical	[SOFTWARE NAME]	2018	3D CAD - Solid	
		3D Authoring Models	Structural Steel	[SOFTWARE NAME]	2018	3D CAD - Solid	
		3D Authoring Models	Fire Protection	[SOFTWARE NAME]	2018	3D CAD - Solid	
		3D Viewing Only	All	[SOFTWARE NAME]	2018	Free Federated Model File	
		3D Model Coordination	GC, Subs	[SOFTWARE NAME]	2018		
		3D Field Validation	GC, Subs	[SOFTWARE NAME]	2018		
		3D Model As-Builts	GC, Subs	[SOFTWARE NAME]	2018		
		3D Record Model	GC, Subs	[SOFTWARE NAME]	2018		
		4D Simulation	GC	[SOFTWARE NAME]	2018		
		5D Simulation + Cost	GC	[SOFTWARE NAME]	2018		
		Point Coordinates	All	[SOFTWARE NAME]	2018	CAD	TXT
		6D Facilites Management	All	[SOFTWARE NAME]	2018		

0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

24

CD-BIM.com BxP Table 07: Origin

BxP Table 07A: X, Y, Z ORIGIN - AF4

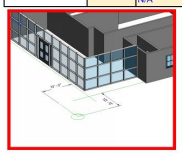
IKERD *People | Building | Clarity*
www.IKERD.com

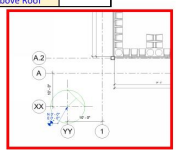
DENTAL CLINIC
Load the project .DWG coordinate location file (TBD) into your BIM software by inserting it at the origin of your application (Global X, Y, Z COORDINATE = 0,0,0). This file shall be located on the project's FTP site.

Orient the model to the following information that is in the DXF file:

Plan North:	Y	Axis	
	FT		Grid
X-Axis =	-10.0000	West of Grid	1
Y-Axis =	-10.0000	South of Grid	A
Z-Axis =	100.0000	Below FF	

Zone	Low	High	Note	Delta
	(FT)	(FT)		(FT)
L00	N/A	100.0000	Suberade	
L01	100.0000	115.0000		15.0000
L02 (ROOF)	115.0000	0.0000		-115.0000
L03		0.0000	Above Roof	0.0000
		0.0000		0.0000
		N/A	Above Roof	

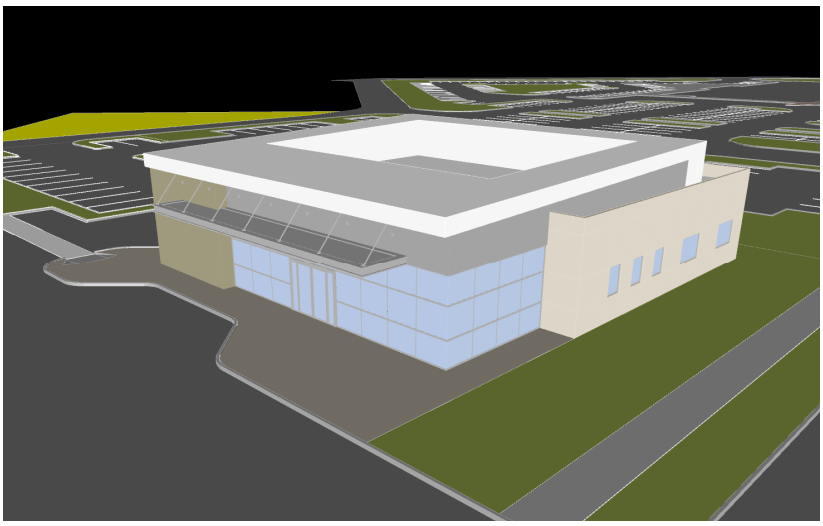


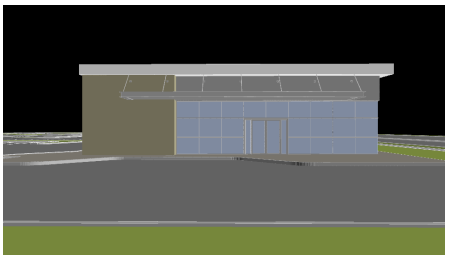


0 PROJ-INFO | 1 Project-Contacts | 2 Model Delivery Schedule | 2.1 MOD DEV SCHED DATA | 4 LOD | 5 USES | 6 Software | 7A AF4 XYZ | 8 Typ Coordination Schedule

25

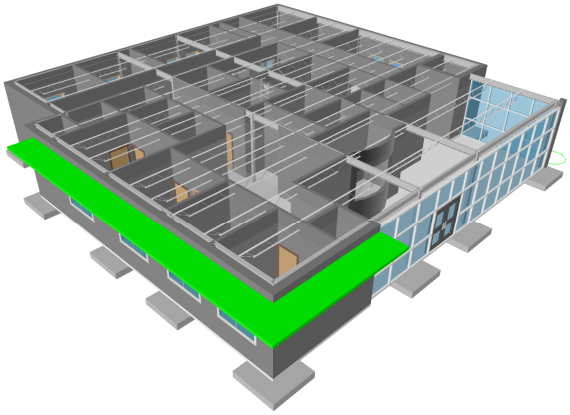
Upcoming LOD Sample Model

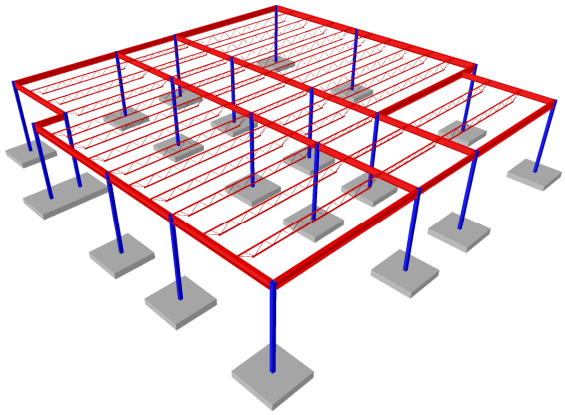




26

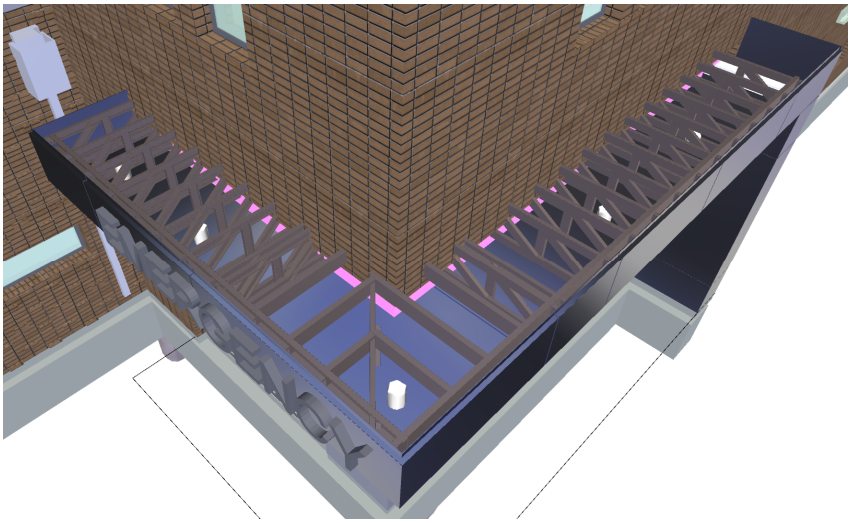
Upcoming LOD Sample Model

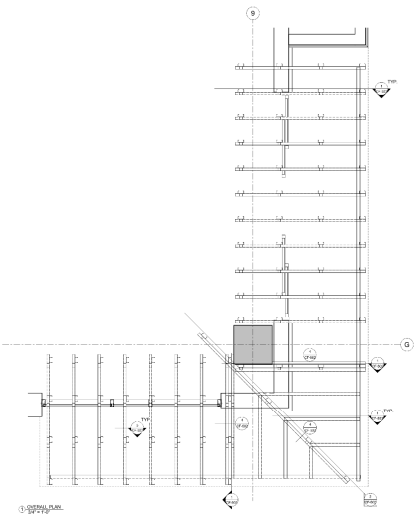




27

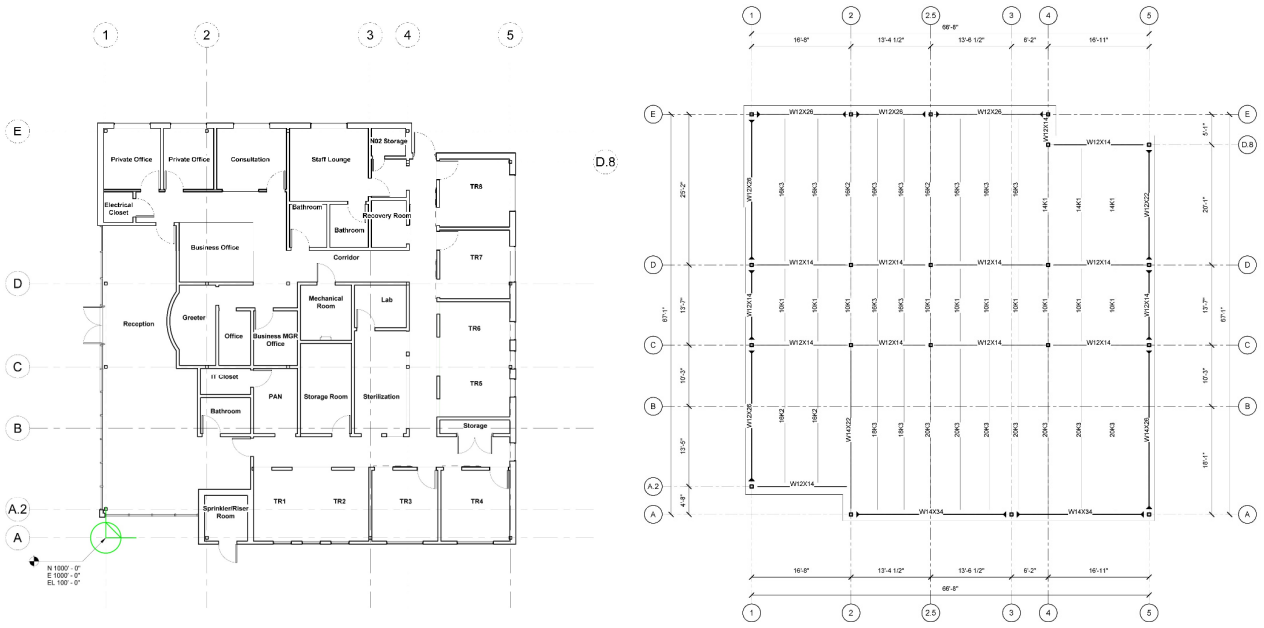
Upcoming LOD Sample Model





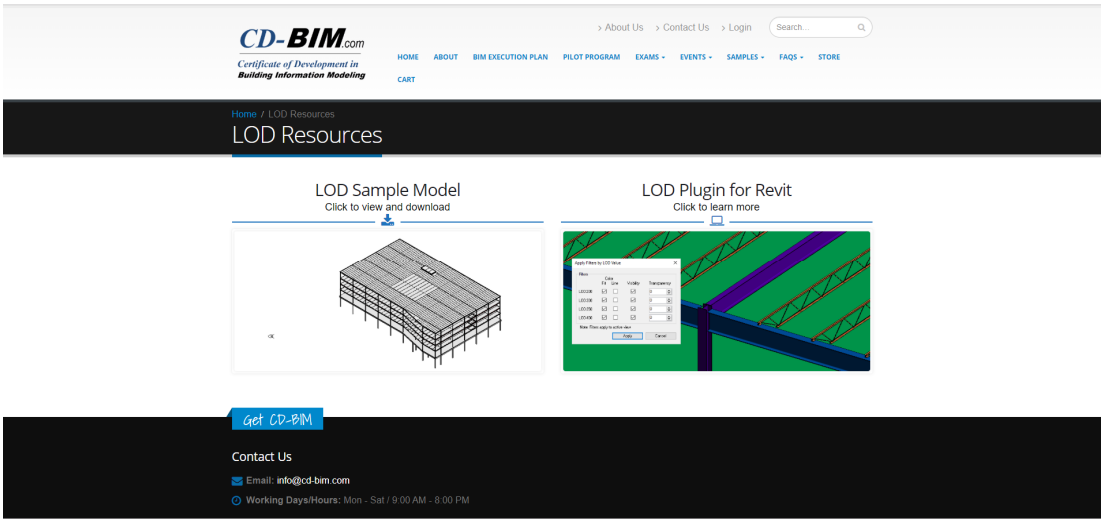
28

Upcoming LOD Sample Model



29

CD-BIM.com



30

31